ARDUINO IO SIMULATOR DRAG & DRAW

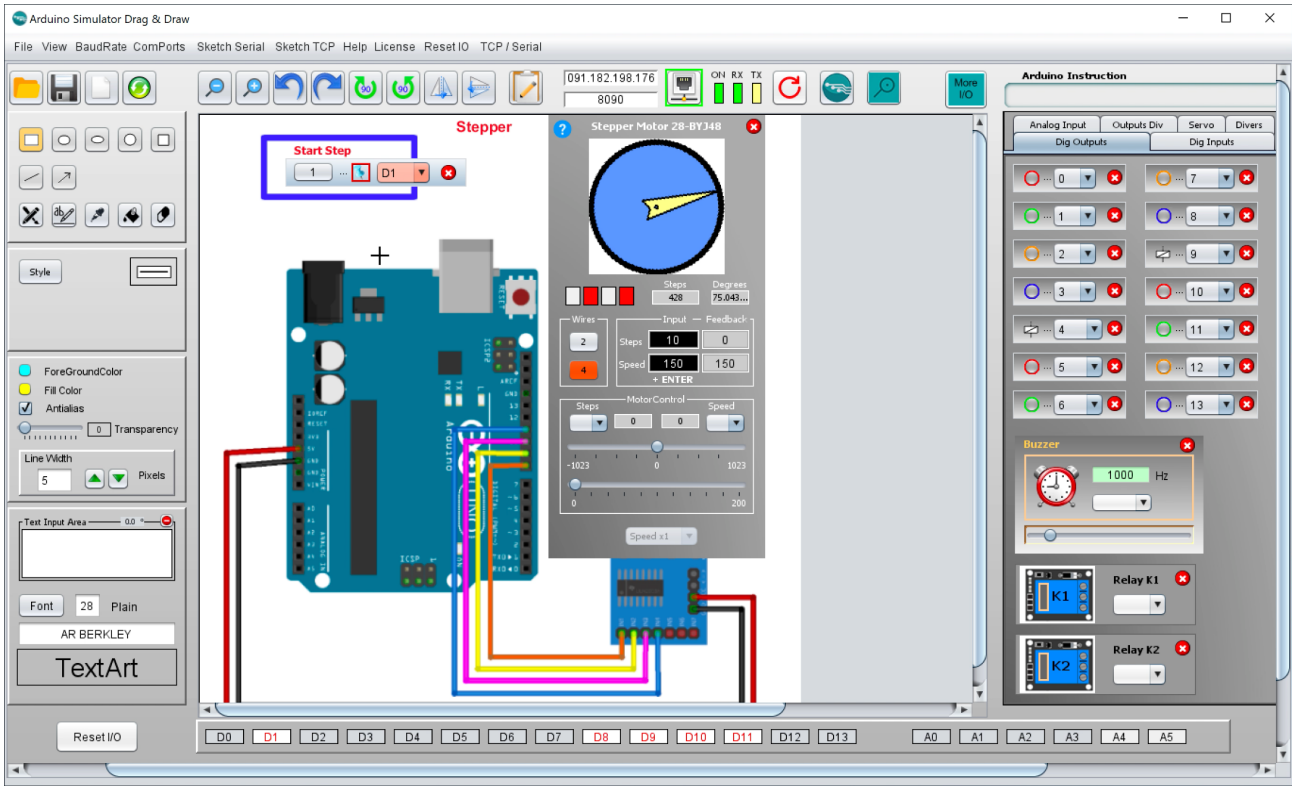
USER MANUAL

XEVRO

Version 1.5.5

Louis D'Hont & Marc Van Den Berge

This manual describes all features and capabilities of the Arduino IO Simulator.



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ARDUINO IO SIMULATOR

The Arduino IO Simulator gives you the tools and components you need to simulate your Arduino IO. It's made for quick tests and small projects, there is still further developed to obtain the widest possible IO functions.

This Arduino IO Simulator is designed to test an Arduino program quickly with the Arduino board without really having connections to external IO (buttons, potentiometers, LEDs, LCD displays, ...). Add a nice custom drawing around it to get a better simulation experience. The simulator only requires the simulator software and an Arduino board. The simulator has a library that is used in your Arduino code, the Arduino (with simulator library) will communicate through the serial communication when the board is connected to the simulator.

To use the simulator, we need 3 programs:

- Java JRE
- The Arduino simulation program
- The Arduino IDE

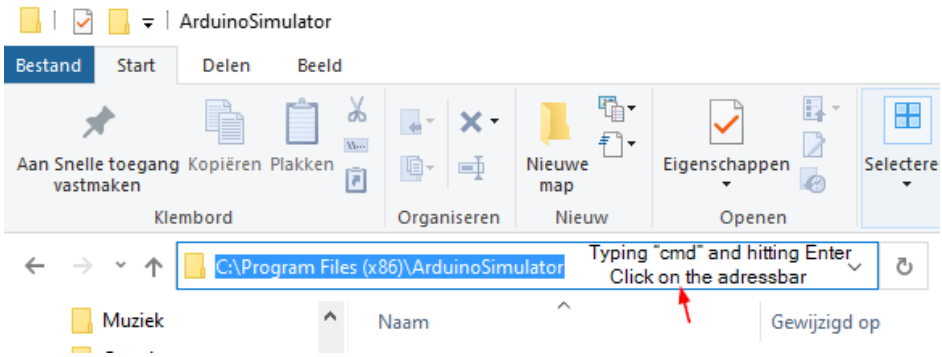
To use the simulator, we need to download the Java JRE on our computer, you can find the download link on the website of Xevro or go to Java where you can find the latest version.

ARDUINO IDE

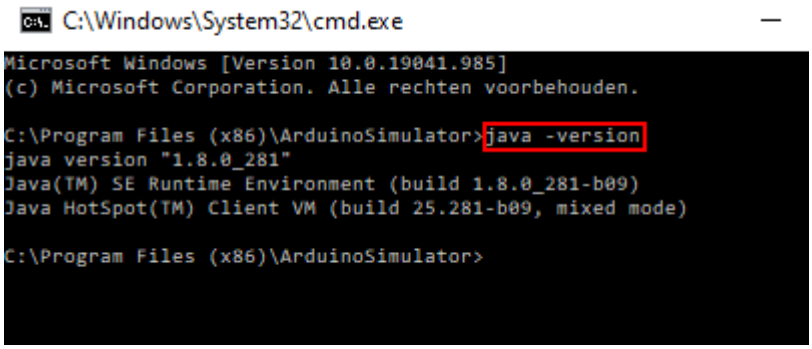
For we start using the Arduino IO Simulator we need the Arduino software, it is also free available on the Arduino website: http://arduino.cc/en/Main/Software

HOW TO START THE SIMULATOR FROM A COMMAND PROMPT

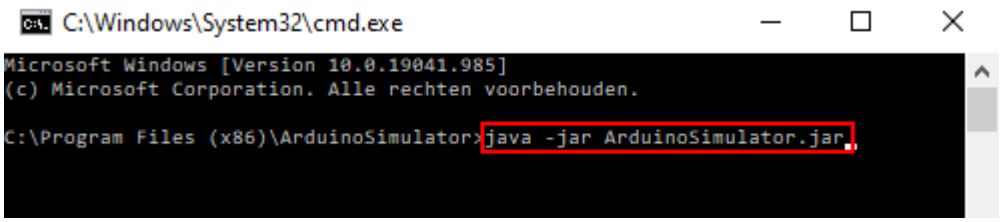
You can open Command Prompt directly from inside a Windows Explorer window. Taking you directly to that folder location!
If you click on this address bar, you can type in text. By typing "cmd" and hitting Enter, you'll open the command prompt at that location.
Go to the directory C:\Program Files (x86)\ArduinoSimulator



Check java version command: **java -version + ENTER**



Start simulator command: **java –jar ArduinoSimulator.jar + ENTER**

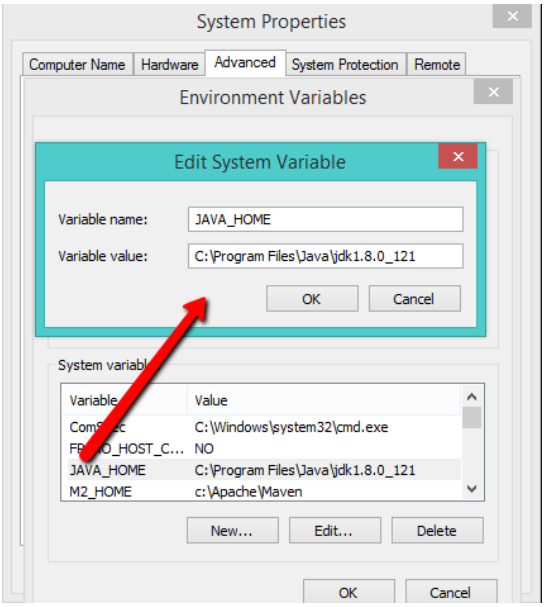


IF JAVA VERSION NOT WORK IN COMMAND PROMPT

Press simultaneously the "windows" and "pause" buttons on your keyboard, this will bring up the System Preferences dialog. In the Advanced tab, find Environment Variables.
Then, in the User (upper) section, create or update the following two variables:

- JAVA_HOME = where you put your JDK, eg. C:/Java/SDK
- PATH = %JAVA_HOME%/bin

Close the dialogs.
Then, in a new command-line console, try "java -version" and see if it's detected. It's important that you use a new console because environment variables are read only when the console is launched.

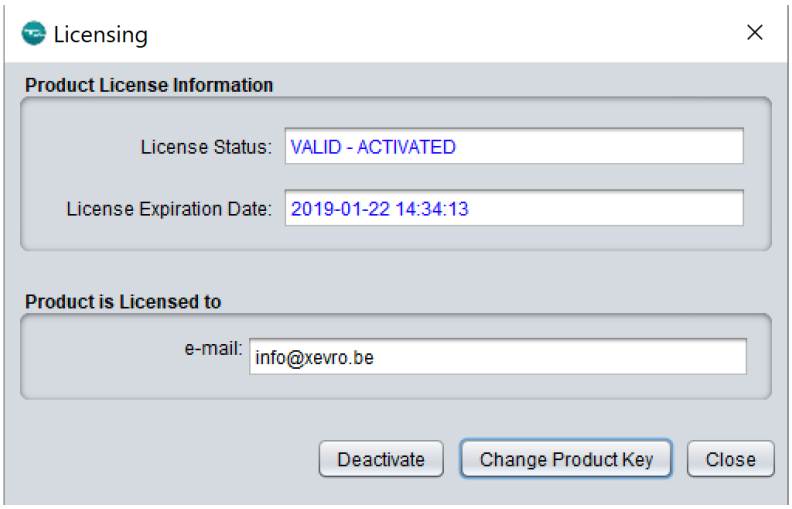


LICENSE REGISTRATION

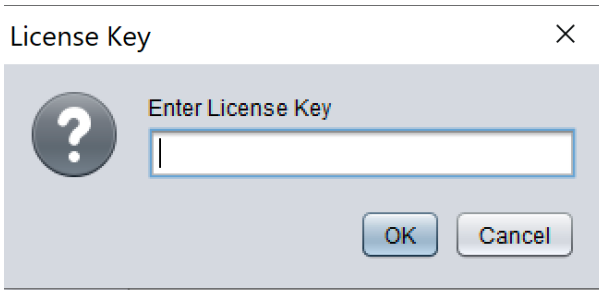
The Simulator is available in a full 30-day trial and a paid version. The first time you open the program there will be a license activation screen popping up where you can add the license key and activate the 30-day trial or the paid license.

Click on the 'Change Product Key' to insert the license key you copied, after entering this you need to click on the 'activate' button that will appear after adding a valid license.

When you want to change the trial as a paid version just replace the license key by clicking on the 'Change Product Key'. After entering the license key, you can activate the key with the 'activate' button.



Change license key

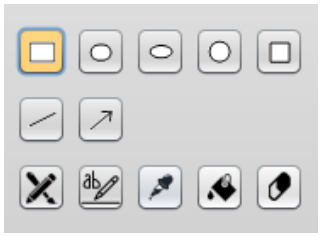


DRAWING SHAPES

 Draw squares  Draw circles  Draw ellipses

 Draw round rectangle  Draw round squares

 Draw arrows  Draw lines



The first 4 tools have the same color, these colors are stored for the next use. The line and arrow tools each have a different color that is customizable. The transparency is customizable with the slider.

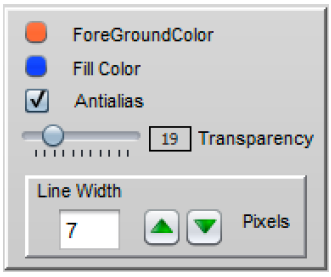
The line thickness of all tools can be adjusted.

STYLE

If a tool is selected, you can change the line using the style button.

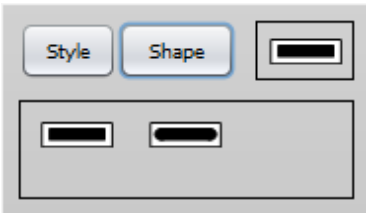
There is choice of a full line  , dotted line  or long dotted line  .

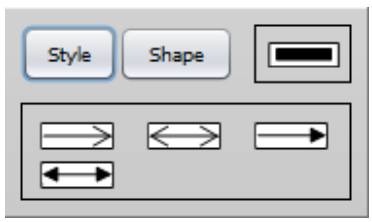
If you draw a line, you can customize the style and shape. The style for the line is the same as below. With the shape you can customize the beginning and end point, with the arrow just the beginning. Press the shift key to draw a perfect horizontal or vertical line.



There is a choice of a right angle  or a rounded corner  .

The arrow point can be adjusted, there is a single arrow  , each side an arrow  , a fat arrow  and a fat arrow at both ends  .



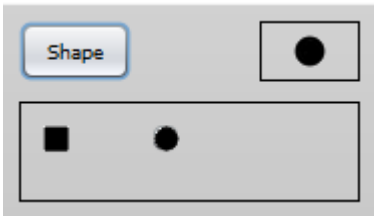


DRAWING TOOLS

 Pencil  Set text  Eyedropper

 Fill tool  Erase

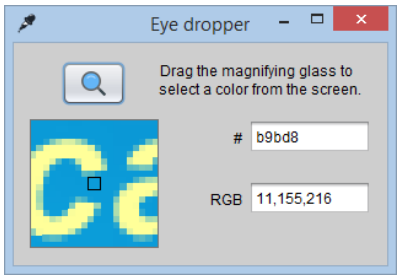
With the pencil you can draw free lines. The shape of the beginning and end of pencil can be changed, there is a choice of a square ■ or a circle ●. Press the 'shift' key to make the line straight.



To put text in the field, type the text in the text-field. The font can be customized by pressing the 'font' button. With the small red button, you can clear the text-field. There are 3 lines in the 'Text Area' available.

If you place the text in the field while holding the left mouse button pressed, then press '+', '- key and the text begins to rotate, the number of degrees can be seen next to the red clear button.

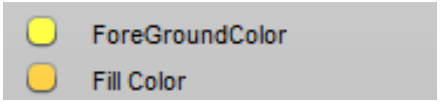
If you see a color that you would like to use, use the eyedropper to find the color you want. To activate the eyedropper, click on the 'eye' button and hold down the mouse while moving, then move across the screen to scan the colors.



With the fill tool it is possible to fill a level in the form of one of the 5 shapes. Select one of the 5 shapes and select the fill tool and draw.

Select the erase tool to remove. Adjust the thickness by changing the value in the text field or by increasing or decreasing the value with the arrows.

To change the color of the foreground and fill color, click on the colored buttons, this opens a color chooser panel.



TOOLBAR

The zoom in  and out  buttons are used to zoom in or out on the work area. When the  minimum or  maximum zoom factor is reached, the button will turn yellow. If you have a slow processor, the drawing and zooming tools will maybe work slower.

With the clipboard  button it's possible to save the picture in the RAM-Memory to paste the picture somewhere else.

The undo  and redo  buttons are used to undo or redo the things you changed on the picture. Turn the picture 90 degrees clockwise  or 90 degrees counterclockwise  .

To flip the picture horizontally or vertically, use these buttons: Horizontally  and vertically  .

Save the picture to a specific place. 

To change the background, press the folder button, this opens a file chooser where you can choose an image. 

Add a blank white sheet to get the drawings cleaned up. 

The refresh button is used to repaint the worksheet if there is a graphical isue. 

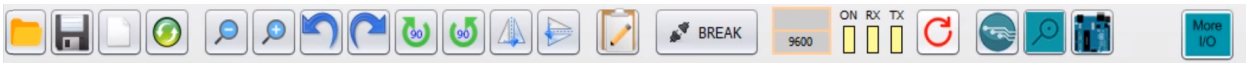
Open a new Arduino IO Simulator sketch  (sketch can't be saved, use save as…)

Use the reset button to reset the Arduino. 

Click this button to open the serial monitor. By clicking it again, you close it.

By clicking on the Arduino board icon, you will get an Arduino board viewer that shows you all the connected IO pins. The window is made a top-level window to view it all the time while working in the simulator.

To get more components click on the 'more I/O' button. By clicking it again, you close it. 



HOW TO USE IT

The Arduino IO Simulator is very easy to understand and work with. The Simulator requires 5 simple steps to simulate a project.

1. **Connect the Arduino board**
2. **Upload your custom Arduino code with the corresponding library file**
3. **Add the used libraries**
4. **Select the used in-outputs in the Arduino IO Simulator**
5. **Connect the Arduino IO Simulator to the Arduino board with the right serial port**

1. Connect the Arduino Board

The Arduino IO Simulator works with a lot of Arduino boards:

- Arduino UNO
- Arduino Mega
- Arduino Leonardo
- Arduino UNO WIFI Rev2 (TCP connection)
- Arduino UNO with Ethernet shield W5100 (TCP connection)
- Arduino...

Attention: Only the digital and analog pins that are available on the Simulator can be used! Disconnect the Arduino IO Simulator before uploading the Arduino code.

2. Upload your custom Arduino code with the corresponding library file

Open the simulator and go to 'Help -> Arduino UNO programming code -> Arduino UNO programming code (ino)'.
This will open an Arduino (ino) file with the corresponding library and important code in it.

3. Add the used libraries

To let the Simulator, understand the code, we have created our own libraries. To maintain the usability, we have decided to keep the instructions as they are, but we changed the libraries a bit, so they are compatible with our software.

There are a few libraries available to use. The simulator program library is necessary for the digitalWrite… instructions. To use the 16x2 LCD display you must add our liquidCrystalSim library to use it with the simulator. All the instructions are the same.

4. Select the used in-outputs in the Arduino IO Simulator

Each input and output on the simulator have a selection box where the used digital or analog pin can be connected.

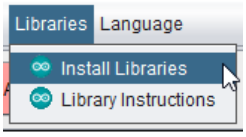
5. Connect the Arduino IO Simulator to the Arduino board with the right serial port

The Arduino IO Simulator knows which port is the Arduino board.
Make sure the Arduino is disconnected while uploading the Arduino code.

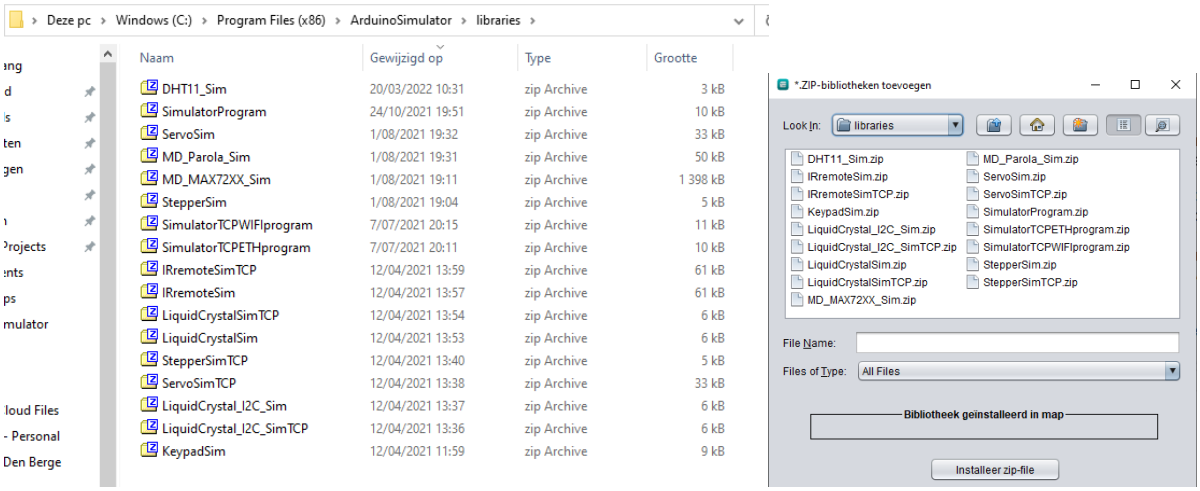
CUSTOMISED LIBRARIES

The Arduino IDE works with instructions that the IO read and write, by adding the libraries to your project it is possible to simulate the project.

We have chosen to keep the name of the instructions, so you don't have to change the code if you want to use the sketch without the simulator.
All libraries are automatically installed at first start-up of the simulator and when an upgrade is installed. If the installation of the libraries was unsuccessful, you can install them manually via the menu.



All available Simulator libraries

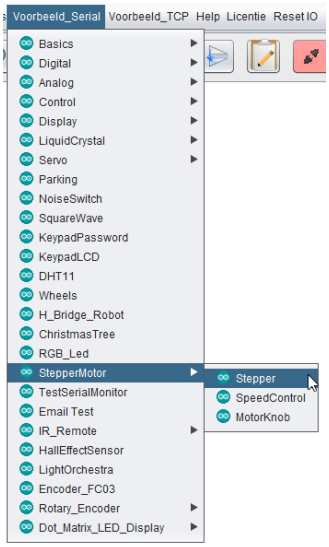


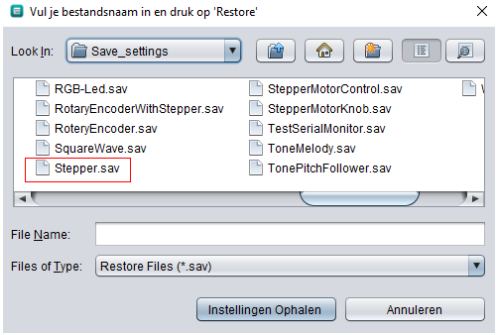
Go inside a folder and select the .zip file, click on the 'install zip-file' button to install the library. The library will be automatically recognized by the Arduino IDE. by adding the Arduino include statement to your project the library will be used in your project, and you can make simulations with the Arduino board:

```
#include <SimulatorProgram.h>
#include <LiquidCrystalSim.h>
```

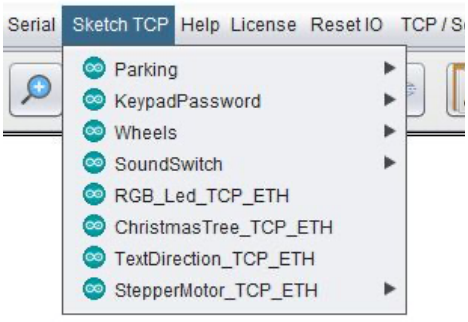
How to test an example:

1. Open a sample sketch called 'Stepper' and upload it to the Arduino board.
2. Drag the necessary components (I/O) into the sketch or select a preset layout 'Stepper.sav' via 'Restore Settings'.
3. Connect the Arduino IO Simulator to the board by selecting the COM port or the Pause button.
4. Simulate your Arduino in - and outputs on the simulator





There are 8 sketches for TCP communication. The first 4 examples have also been made suitable to work with an Arduino WIFI connection.



CHECK YOUR PROGRAM WITH 'CHECKVAR(NUM,VAR)' VARIABLES

With Checkvars it is possible to check your sketch, you can insert a variable on a line in your sketch and via the serial monitor you can follow the values of the variables.

You can enter many different variables as:

Int, long int, long unsigned int, word, double, float, char, string, Boolean

Instruction:

CheckVar(num , var);

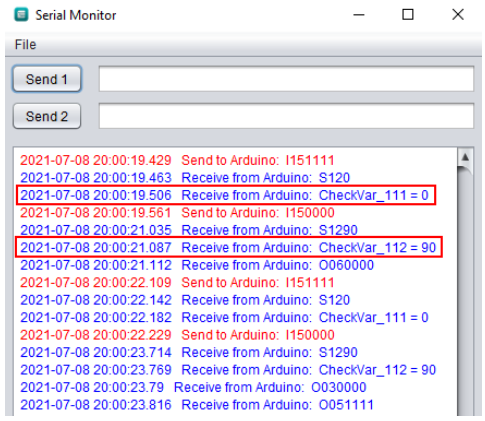
num: integer from 0 to 32768
var: Int, long int, long unsigned int, word, double, float, char, string, Boolean

Example sketch parking:

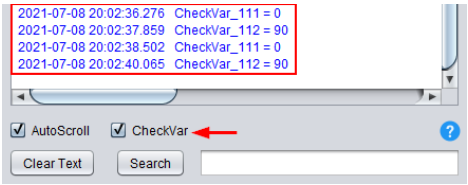
I want to check the variables 'BarUp' and 'BarLow' in the sketch, and I give the CheckVars the numbers 111 and 112 for BarUp and BarLow.

In the serial monitor you can follow the variables CheckVar_111 and CheckVar_112 and their values.

```
if (digitalRead(Exit) == 1)
{
  if (Available != CAPACITY) {
    Available++;
    myservo.write(BarUp);
    CheckVar(111,BarUp);
    delay(1500);
    myservo.write(BarLow);
    CheckVar(112,BarLow);
  }
}
```



It is also possible to see only the CheckVars by check the box 'CheckVar'.



DRAG & DROP

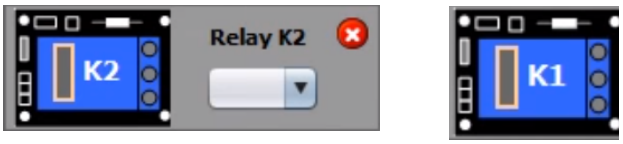
All the IO components can be dragged into the worksheet. The components can be resized by clicking on the component image itself or on top of it.

For example:

Click on the '…' by the LEDS to hide the IO selection.

Buttons:

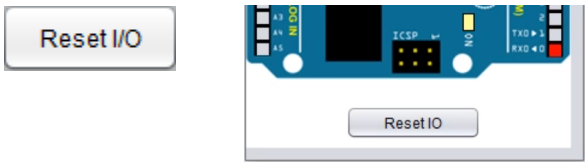
The relay can be resized by clicking on the image itself.



The slider can be resized by clicking in the green area.

The bargraph can be resized by clicking on the bargraph itself.

Some components like the 7-segment display, LCD display keypad can't be resized.
With the 'Reset IO' button you can set the components back to its original position. The button is in the left corner below, on the top menu bar or in the Arduino board IO viewer.

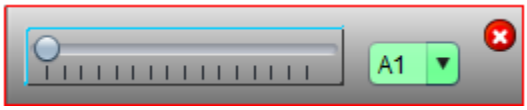


Drag functionally

When you drag the component in the worksheet you can see which instruction the component can be controlled with.
For example, when you choose a button, it shows you digitalRead().

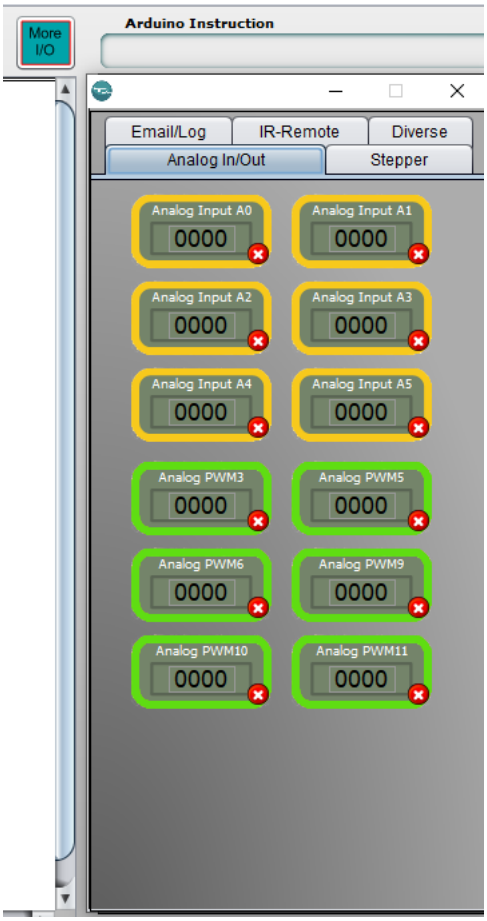
A LED will show digitalWrite(), that's the instruction that will control the LEDs.

The component border will turn red when it's ready to drag the part into the workspace.



EXTRA IO

To add more IO parts, we have decided to provide a button that opens a window with more parts. Click on the button again to hide the window.



ARDUINO BOARD VIEWER

By clicking on the Arduino board button, a window will open in which you will see an Arduino UNO board with all the used IO pins on it. The Reset IO button will clear all the IO pins to start with selecting IO again. The RX/TX LEDs are also visually simulated.

The Arduino UNO board window is set as a top-level window to make sure you can always see the Arduino board while you are simulating projects.

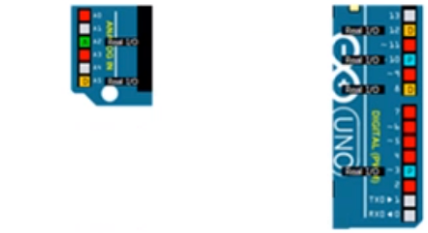
The real IO connect method in the setup will allow the simulator library to use simulated IO together with real IO pins if you want to use connected components on. When you perform a hardware reset on the real Arduino board or a reset from the simulator Arduino board you will lose all real IO connections, to get these connections back you must enter the following instruction in the setup.

When working with TCP you must place the instruction 'RealIO_Connect()' after the delay(5000).

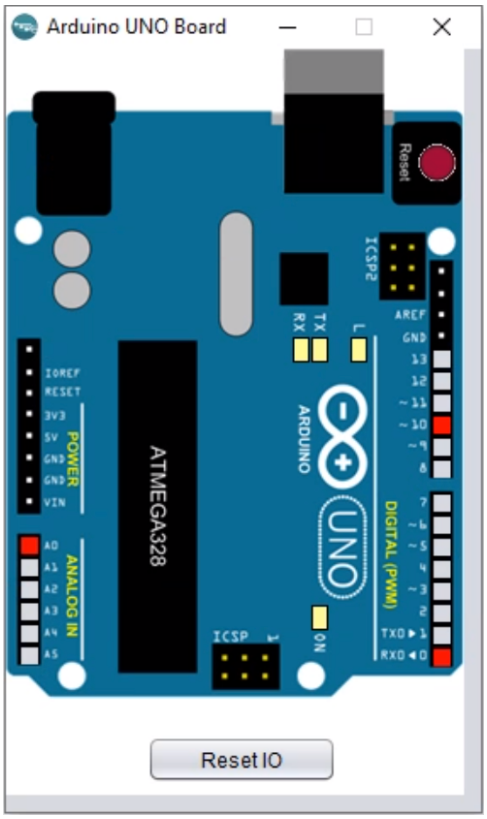
```
void setup() {

//********************************** code for SimulatorTCP ********************
  Serial.begin(9600);                                  // Simulator Serial Con
  inString.reserve(25);

  while (!Serial) {
    ; // wait for serial port to connect. Needed for native USB port only
  }
  Ethernet.begin(mac, ip, gateway, subnet);
  server.begin();                                      // Start the server.
  Serial.print("Init");
  delay(5000);
  RealIO_Connect();   // Used for connection between arduino and real IO , place
//lcd.port(portname);          // The lcd library needs this portname
//myservo.port(portname);      // The servo library needs this portname
//stepper.port(portname);      // The stepper library needs this portname
//irrecv.port(portname);       // The IRremote library needs this portname
//irsend.port(portname);       // The IRremote library needs this portname

//********************************** end code SimulatorTCP ********************
```

```
void setup() {

  // Simulator Serial Connection code
  Serial.begin(9600);
  inString.reserve(10);
  RealIO_Connect();   // Used for connection between
```

When you click on a pin you can change the status of the pin. To use an analog or digital pin as a real in or output you will have to click ones and it will show a 'D' OR 'A' in it. A PWM pin will show 'P'. Each time you click on a pin, the status will be sent to the Simulator library on the Arduino board.



- Real anlog input
- Real digital in – or output
- Real PWM output
- Select by simulator
- No selection



Attention when working with Ethernet shield W5100:

The Ethernet Shield use SPI (Pin 11, Pin 12, and Pin 13) along with Pin 10 for the Ethernet SPI Slave Select and Pin 4 for the SD Card SPI Slave Select. It shouldn't be using pin 3. It can optionally use Pin 2 for the W5100 "INT" signal, but the Ethernet library doesn't support it. It shouldn't be using Pin 14 (A0) or 15 (A1).

The FreqCount library (http://www.pjrc.com/teensy/td_libs_FreqCount.html) says:

Arduino Uno: Frequency Input Pin: 5 Pins Unusable with analogWrite(): 3, 9, 10, 11

That explains why 3, 9, 10, and 11 won't work for PWM.

So that leaves you with PWM pins:

3: Disabled by FreqCount

5: Needed buy FreqCount for counter input

6: Available

9: Disabled by FreqCount

10: Disabled by FreqCount and used by Ethernet Shield

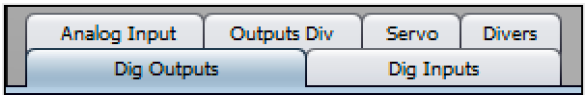
11: Disabled by FreqCount and used by Ethernet Shield

If you use the Wire library (#include <Wire.h>) then you cannot used A4 and A5

Board	I2C / TWI pins
Uno, Ethernet	A4 (SDA), A5 (SCL)

USE THE DIGITAL IO

All the IO components are placed in a tab pane that can be changed by clicking on the tabs above. The button 'More I/O' will open a window with more IO available.



LEDS

There are 14 LEDs available, for every pin of the Arduino 1 LED. LED D4 to D9 also have the option of choosing an analog pin as a digital pin (D14-19). D14 for the corresponding number is A0, example: D4 gets D14 in the combo box, D6 gets D16 and so on...

Use the combobox to connect it with the Arduino. The cross button is used to set the LED back to its original place in the tab pane. By clicking on the LED, you can change the color.

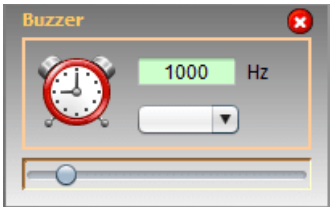
The LEDs can be controlled with the **digitalWrite()** function.

BUZZER

The buzzer is used to make a noise with a custom frequency. The combobox is used to connect the buzzer with the Arduino. D14-19 are the analog pins represented in a digital number. The cross button is used to set the buzzer back to its original place in the tab pane. Click on the clock to resize the buzzer and hide the settings.

By sending out a digitalWrite(pin, HIGH) signal in the Arduino code, the buzzer will make a noise with the adjustable frequency.

The buzzer can be controlled with the **digitalWrite()** function.

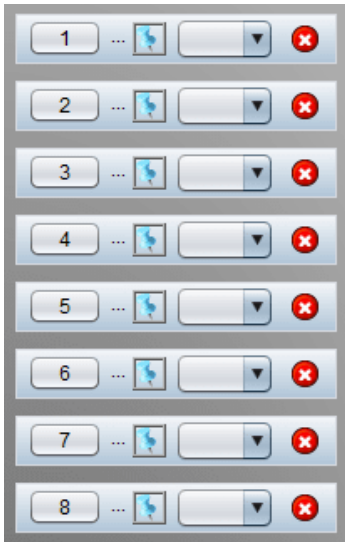


RELAY

There are 2 relays to simulate a relay contact. The combobox is used to connect the relay to one of the 14 IO pins. D14-19 are the analog pins represented in a digital number. The cross button is used to set the relay back to its original place in the tab pane. Click on the relay itself to resize and hide the combobox settings.

The relay can be controlled with the **digitalWrite()** function.

BUTTONS



There are 8 buttons available. The combobox is used to connect the button to one of the 14 IO pins. D14-19 are the analog pins represented in a digital number.

The cross button is used to set the button back to its original place in the tab pane. Click on the '…' to resize and hide the combobox settings. The light blue pin can be used to hold down the button while doing other things, the border changes to red when it's pressed.

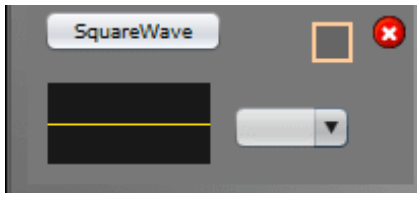
The buttons can be controlled with the **digitalRead()** function.

SQUAREWAVE

The squarewave sends pulls signals to the Arduino, when the signal is high you see the grey square lights up 'red'. The combobox is used to connect the square wave to one of the 6 analog pins (A0-A5 = D14-19).

The cross button is used to set the square wave back to its original place in the tab pane. When you click on the 'SquareWave' button there opens a second window with a slider to change the frequency.

The square wave can be controlled with the **digitalRead()** function.



MOTION DETECTION

The motion sensor sends signals to the Arduino every time there is a movement (click on the sensor image), when the signal is high you see the gray square lights up red. The combobox is used to connect the motion sensor to one of the 14 digital pins. D14-19 are the analog pins represented in a digital number. Use the '…' to resize and hide the settings. The cross button is used to set the sensor back to its original place in the tab pane.

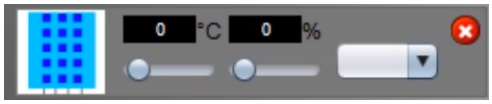
The motion sensor can be controlled with the **digitalRead()** function.

DHT11 SENSOR

The DHT11 simulates the temperature and humidity. The combobox is used to connect the sensor to one of the digital pins (D2-13). D14-19 are the analog pins represented in a digital number. The cross button is used to set the sensor back to its original place in the tab pane. The 2 sliders are used to change the value of the temperature (°C) and humidity (%).

Use the DHT11 example to test this sensor. The **Sim_Tmp** and **Sim_Hum** are the values of the two scroll bars °C and %.

The DHT sensor can be controlled with the **DHT.read11(DHT_11, Sim_Tmp, Sim_Hum)** function.



NOISE DETECTION

The noise detection is used to send an analog (0-1023) signal to the Arduino depends on the noise level. The combobox is used to connect the noise detector to one of the 6 analog pins (A0-A5).

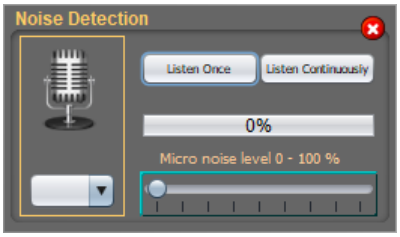
The cross button is used to set the noise detector back to its original place in the tab pane. When you click the 'Listen Once' button, the detection starts listening to the sound level of the microphone. If the sound level exceeds the value of the slider, it will send a signal (0-1023) to the Arduino.

Please note that in this situation, the limit value in the Arduino code is always lower than the 'Micro noise level 0-100%' slider.

With the button 'Listen Continuously' the sound detection stays on continuously, every 1s an analog value (0-1023) is sent to the Arduino, in this situation we do not work with the internal slider, but we use the simulator sliders (A0-A5) or external real slider.

The threshold value of the sound level in the Arduino software is determined by the external slider (A0-A5).

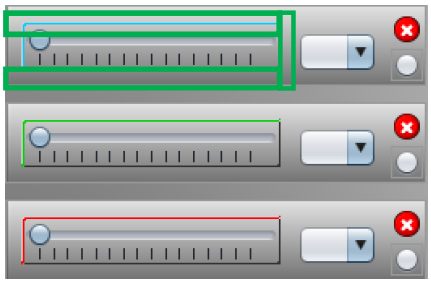
The noise detection can be controlled with the **analogRead()** function.



SLIDERS

There are 3 sliders to connect with one of the 6 analog pins (A0-A5). The cross button is used to set the slider back to its original place in the tab pane. The green rectangle shows the place you can click on to hide the combobox and make the component smaller. The value is sent to the Arduino after releasing the mouse when changing the slider, if you click on the small circle the Simulator will send constant values to the Arduino.

The sliders can be read by the Arduino with the **analogRead()** function.

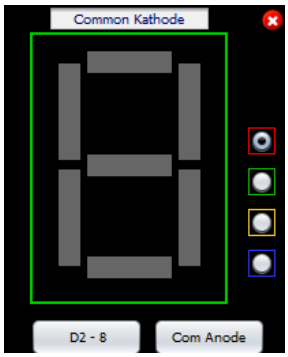


7 SEGMENT DISPLAY

The 7-segment display has 6 digital pins that can connect to D2-8 on the Arduino. The display can be connected in common anode or common cathode. The cross button is used to set the display back to its original place in the tab pane. There are 4 color options to change the segment colors.

To light up the display-use **digitalWrite(D2-8)** function.

See the example: Parking



TONE MELODY

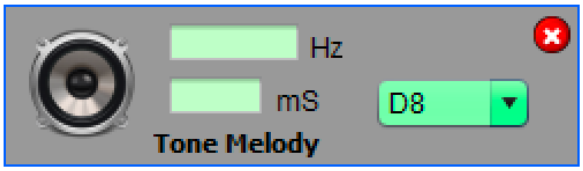
The tone melody can be connected to a digital pin from D0-9 of the Arduino. The cross button is used to set the tone melody back to its original place in the tab pane. The frequency and time of the sound (milliseconds) are present in the light green boxes.

Use tone(pin, **f**, **d**); and noTone(pin); (See example: Tone Melody)

noTone() stops playing sound.

f = frequency

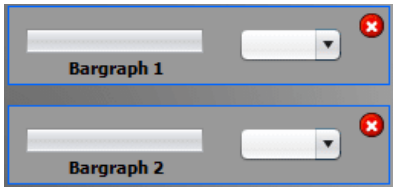
d = duration



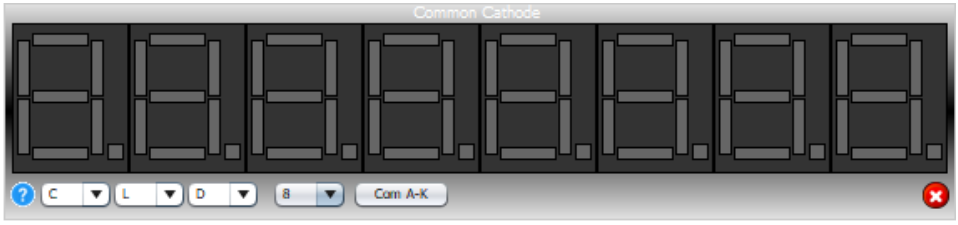
BARGRAPH

The bargraph can be connected to one of the 6 digital PWM pins of the Arduino. The cross button is used to set the bargraph back to its original place in the tab pane. The bargraph shows the % of your value (0-1023), this can be used to simulate a PWM signal as a % bar. By clicking on the bargraph itself you can resize it and hide the combobox to make it smaller.

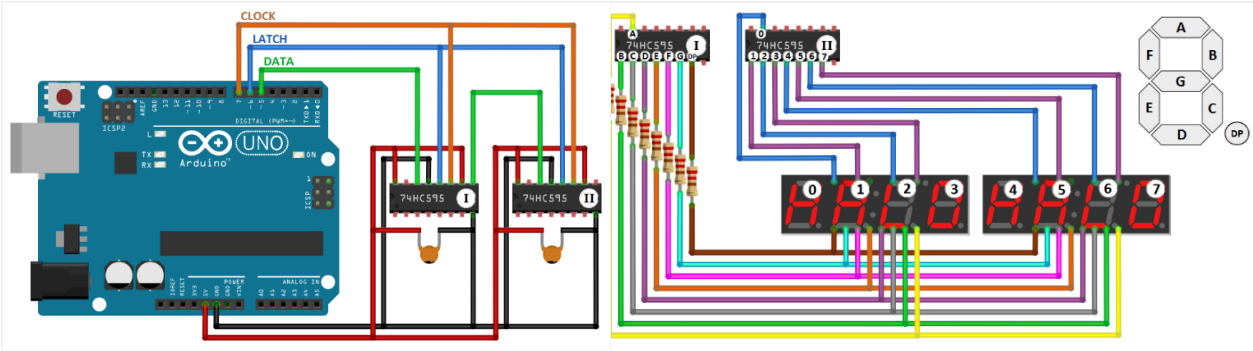
Use **analogWrite(pin, value)** to control the bargraph (See example: sound switch, use the restore function to get the IO already dragged into the work sheet).



8 DIGIT 7 SEGMENT DISPLAY



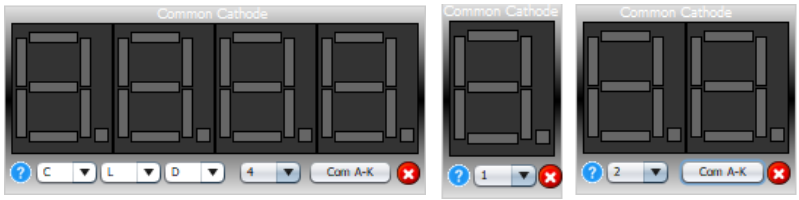
This is an 8-digit 7 segment display that uses the shift registers 74HC595.
This means that we only need 3 pins of the Arduino board to drive the display.



There are 3 combo boxes L (latch), C (clock), D (data) that you can connect to the digital pins (D2 to D13) of the Arduino board.

With the button 'Com A-K' you can choose to work with common anode or common cathode.

With the combobox '1-8' you can set the display size from 1 digit to 8 digits.



A library is needed to control the display from the Arduino board. We have chosen the Miguel Pynto library "**ShiftDisplay-3.6.1**" because it is easy to use.

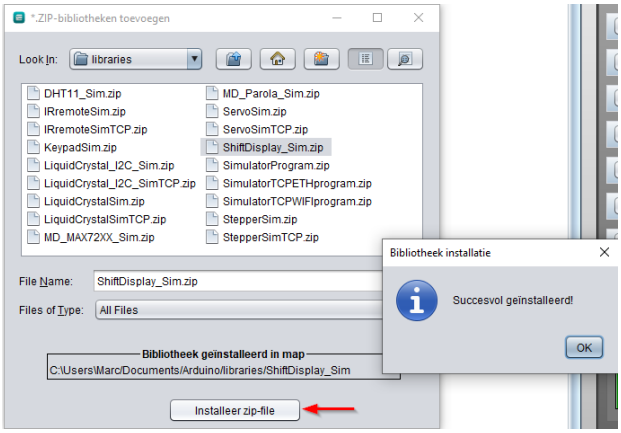
We modified the library to communicate with the simulator and named it "**ShiftDisplay_Sim**".

Features of the library:

Arduino library "**ShiftDisplay_Sim**" for controlling 7-segment displays using 74HC595 shift registers (by MiguelPynto)

- Displaying digits and text
- Merge multiple displays into one for up to 8 digits
- Compatible system with common cathode and common anode
- Only 3 pins used on the Arduino board

Normally the library "**ShiftDisplay_Sim**" is installed automatically when the simulator is installed, but this can also be done manually:



The instructions accompanying the library can be found on Miguel Pynto's website with text and explanation:

https://miguelpynto.github.io/ShiftDisplay

In the sketches we use the same instructions as the original library '**ShiftDisplay-3.6.1**', we have modified the library so that it sends its data to the simulator via serial communication.

It is important to note that the **<ShiftDisplay_Sim.h>** library must always be above the simulator library **<SimulatorProgram.h>** otherwise this will not work.

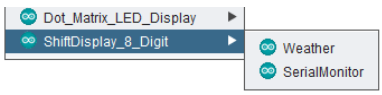
```
#include <ShiftDisplay_Sim.h>
#include <SimulatorProgram.h>
```

Remark:

Because the simulator itself uses serial communication, it is not yet possible for the display to work with the library '**#include <Wire.h>**'.

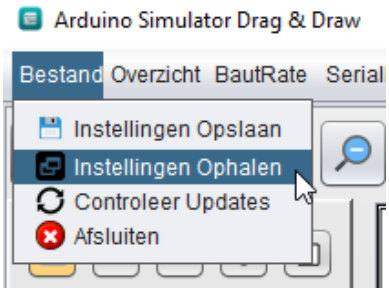
Do not forget to connect the comboboxes "C, L, D" to the Arduino board otherwise the display will not work.

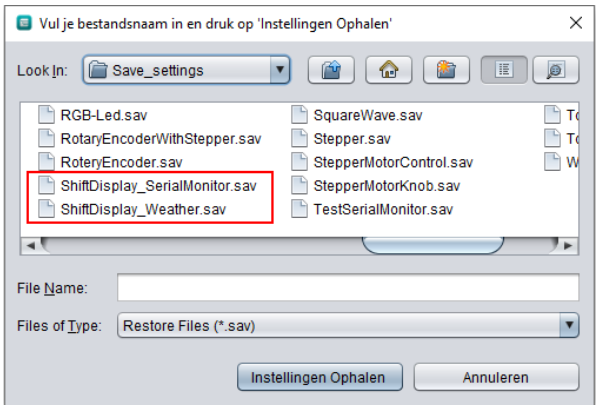
Example of serial sketches in the simulator:



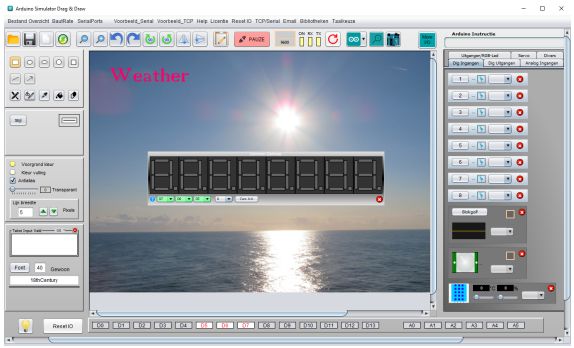
Click on 'Weather' or 'Serialmonitor', the Arduino IDE starts up with the sketch.

Retrieve simulator settings for the sketches:

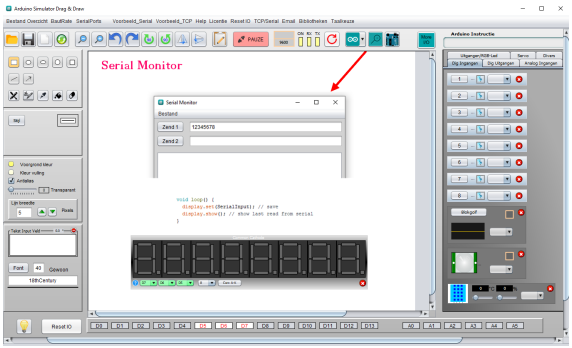




Weather



Serial Monitor

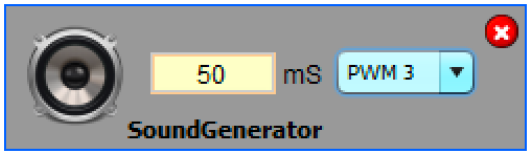


SOUND GENERATOR

The sound generator can be connected to one of the 6 digital PWM pins of the Arduino. The cross button is used to set the sound generator back to its original place in the tab pane.

By clicking on the sound box image, you can resize it and hide the combobox to make it smaller. By changing the time (ms) you change the duration that the sound goes off (1ms – 10 000ms). The frequency can go from 10hz to 10Khz.

Use **analogWrite(pin, value)** to control the sound generator.



ANALOG INPUT BOX

The analog input box shows the value of each analog pin (A0-A5). The cross button is used to set the analog value box back to its original place in the tab pane.

PWM VALUE BOX

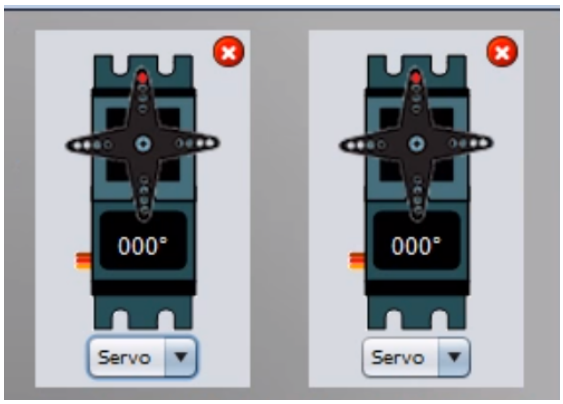
The PWM value box shows the value of each PWM pin of the Arduino. The cross button is used to set the PWM value box back to its original place in the tab pane.

SERVO

There are 2 servos that can simulate a servo wheel with just one digital pin (D2-13) of the Arduino. The cross button is used to set the servo back to its original place in the tab pane.

The number of degrees (°) is visible in the servo. Click on the servo to make the servo smaller through removing the background and combobox. Use **servo.write()** and **servo.attach().**

Add the servo simulator library to use it.



MOTOR WHEELS

There are 2 motor wheels that can turn forward and backwards with just 2 digital pins of the Arduino. To adjust the speed use one of the 6 PWM pins of the Arduino. The cross button is used to set the motor wheels back to its original place in the tab pane. By clicking on the wheel, itself you can hide the background and comboboxes.

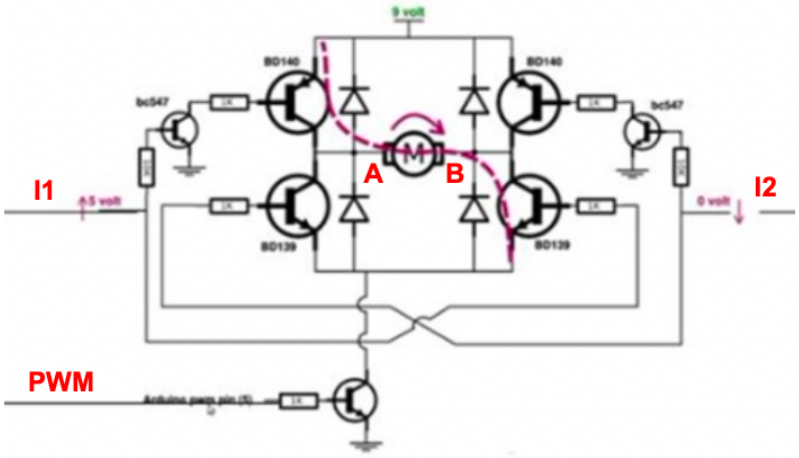
By turning the left wheel forward, you will turn your robot (example situation project) to the right because the right wheel doesn't turn. To drive forward, Run the 2 motors forward to drive forward. To control the motor wheels, you need to use digitalWrite() and analogWrite().

See the Wheels and H-bridge examples to see how it works.

The operation is based on a robot with 2 wheels, which must be able to drive forwards / backwards as well as left and right. We use an H-bridge for turning the DC-motor.

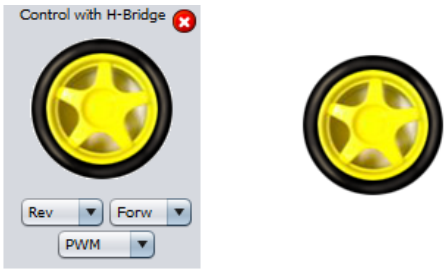
Transistor H-bridge operations:

I1	I2	A	B	Motion
Logic 0	Logic 0	0V	0V	Stop
Logic 1	Logic 0	9V	0V	Forward
Logic 0	Logic 1	0V	9V	Reverse
Logic 1	Logic 1	9V	9V	Brake



H-Bridge circuit

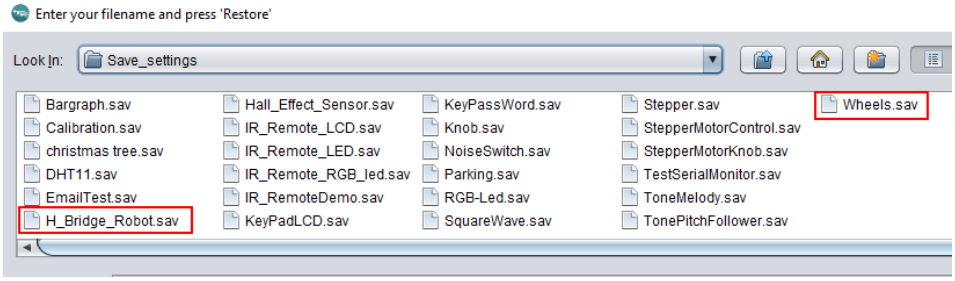
With the combo-box 'Rev' and 'Forw' (D2 to D13) can you simulate 'I1' and 'I2' (Reverse/Forward). With the combo-box 'PWM' (PWM 3 to PWM 11) can you simulate the speed. Click on the wheel removed the background:



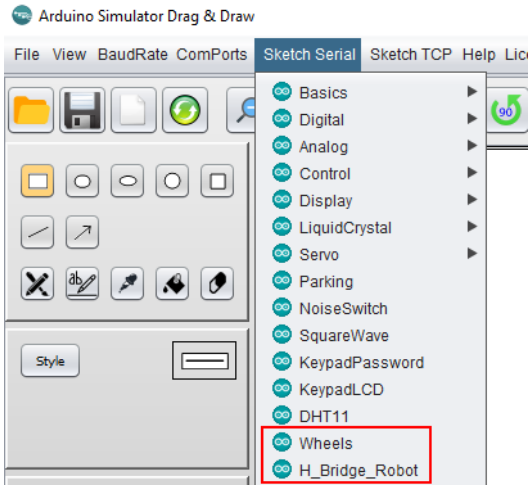
Attention: The wheels can only turn if a direction is selected (Rev or Forw)

Examples:

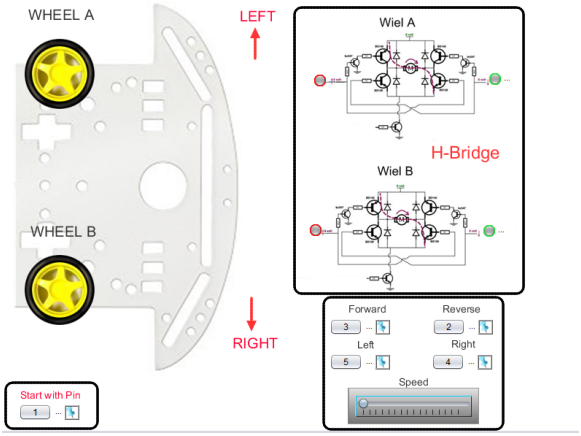
Restore components and settings



Load sketch into the Arduino board



H_Bridge_Robot

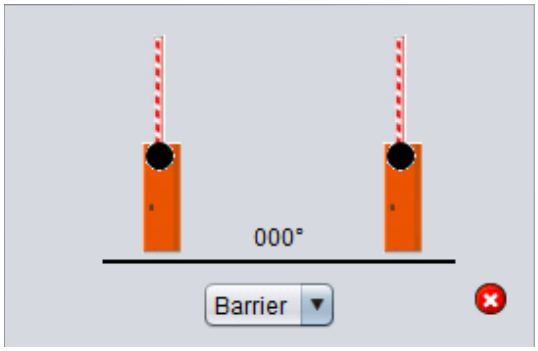


Wheels

BARRIER

The barrier works also like the servo with one signal (D2-13). The cross button is used to set the barrier back to its original place in the tab pane. By clicking on the barrier, itself you can hide the background and combobox.

Use **Myservo1Write()** and **servo.attach()** to control the barrier.



WEBCAM MOTION DETECTION (NOT FOR MAC)

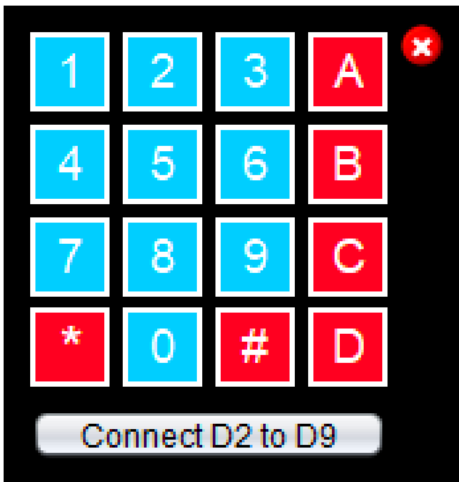
The webcam motion detection can be used to send a high signal by motion detection through the webcam. The combobox is used to connect the webcam detection to one of the digital pins (D2-13) of the Arduino.

The cross button is used to set the webcam detection back to its original place in the tab pane. When you click on the 'play' button the webcam input will be visible in the black area of 160x120. The grey square will light up 'red' when the movement is detected.

The webcam motion detection can be controlled with the **digitalRead()** function. The webcam motion detector will send a signal to the Arduino when there a movement detected.

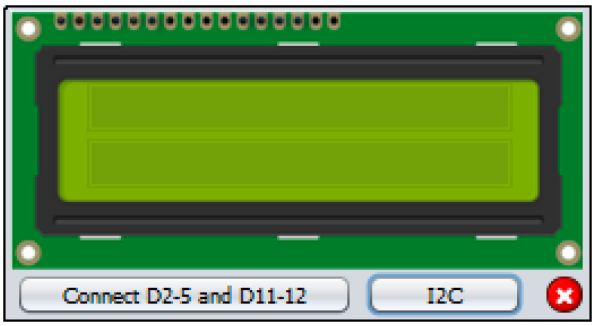
KEYPAD

Connect the keypad to the Arduino by pushing the 'Connect D2 to D9' button. The cross button is used to set the keypad back to its original place in the tab pane.



LCD DISPLAY

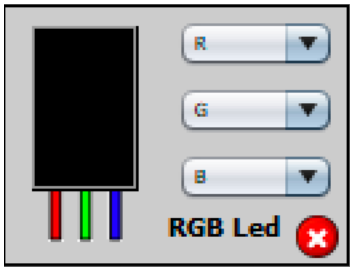
The LCD display can be connected to the Arduino by 2 modes. Connect D2-5, D11 and D12 or use the I^2C option (A4-A5). The cross button is used to set the LCD display back to its original place in the tab pane. Add the simulator LiquidCrystalSim library to make it work with the simulator. Add the LiquidCrystalSim I2C library if you want to use the I2C connection.



RGB LED

The RGB LED can be connected to the Arduino by 3 PWM pins. Connect 1 of the 6 PWM pins to each color value (R, G, B). The cross button is used to set the RGB LED back to its original place in the tab pane. Click on the LED itself to hide to settings. Each color represents a value of 0-255 which indicates a 0-255 color. Note: the 3 sliders are scaled to 0-1023.

To control the RGB LED you use **analogWrite()**.

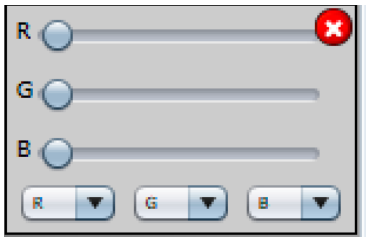


RGB SLIDER

The RGB LED can be connected to the Arduino by 3 analog pins. Connect 1 of the 6 analog pins to each color value sliders (R, G, B). The cross button is used to set the RGB slider back to its original place in the tab pane.

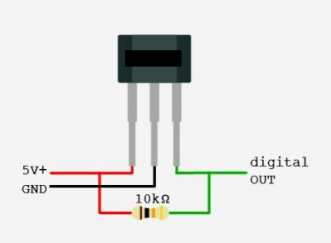
Use the 'RGB_Led' example and the 'RGB-Led.sav' (restore settings) to test the RGB LED with the sliders.

To control the RGB slider you use **analogRead()**.



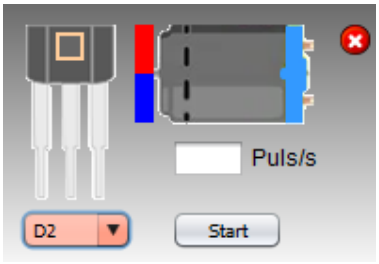
HALL EFFECT SENSOR

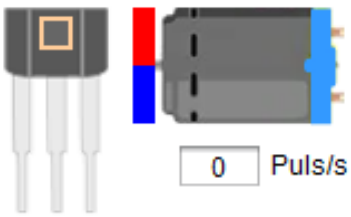
Hall effect sensors have three pins: VCC(5V), GND, and Vout(Signal). The pinout of a Hall effect sensor is as shown below:



Arduino Hall effect sensor pinout

The Vout or signal pin of the Hall effect sensor is connected to the Arduino's interrupt pin (digital pin 2 (D2))





Click on the sensor removed the background

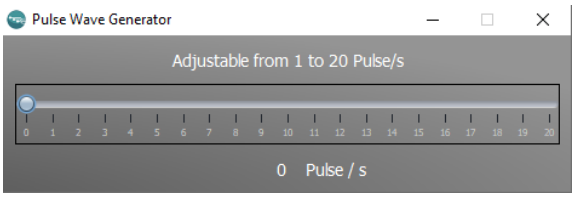
How Does It Work?

The Hall effect sensor works on the principle of the Hall effect, which states that whenever a magnetic field is applied in a direction perpendicular to the flow of electric current in a conductor, a potential difference is induced. This voltage can be used to detect whether the sensor is in the proximity of a magnet or not. The Arduino can detect this voltage change through its interrupt pin and determine whether the magnet is near the sensor or not. [1]

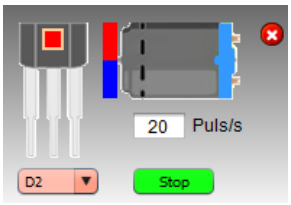
Start simulation:

Connect the sensor to the Arduino by select pin 'D2'.

By pressing on the start button, we can rotate the magnet at a max speed of 20 pulses/second, this speed can be adjusted with a slider.



In a text field you can see how many pulses/s the motor is running. You can stop the simulation by pressing the 'Stop' button.

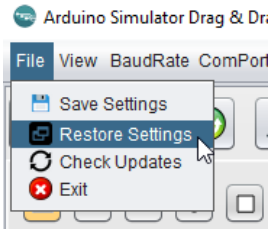


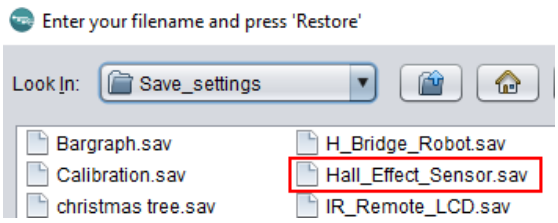
Attention:

In the simulator there is an example to test the hall effect sensor with a 16x2 LCD display that print the values out.

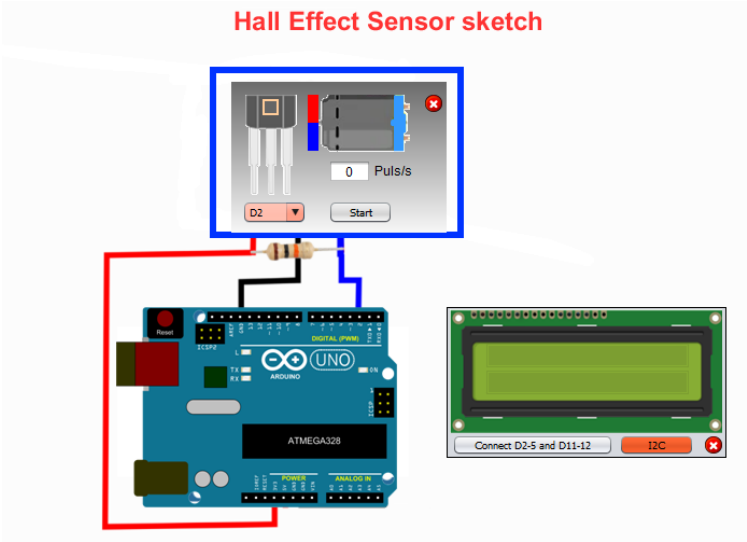
Start simulation with this example:

Load the necessary components by click on 'Restore Settings' and load the file 'Hall_Effect_Sensor.sav' into you're Arduino board.





The necessary components are loaded on the screen and are already connected to the simulator.

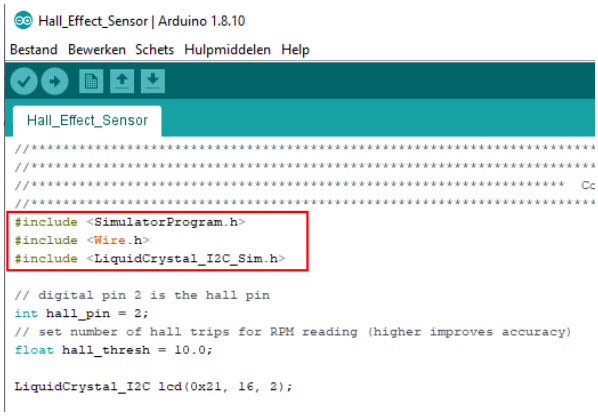


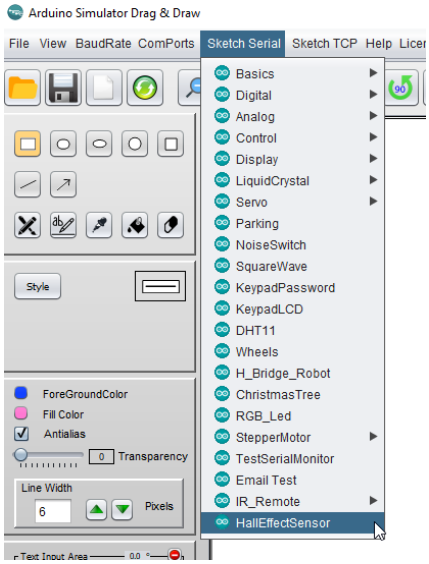
The components are projected on a drawing with an Arduino, the Arduino drawing with lines and resistor is only intended for the visual effect.

Load the sketch 'HallEffectSensor' into the Arduino (Sketch Serial).

For running this sketch, you need 2 libraries:

- SimulatorProgram.h
- LiquidCrystal_I2C_Sim.h





The library 'SimulatorProgram.h' is already present (is automatically installed by the program). The library 'LiquidCrystal_I2C_Sim.h' if not already installed, you still have to install it yourself.

To install a library, see section 'Code changes'.

For proper operation it is necessary to set the BaudRate as high as possible, so set it to "115200".

```
void setup() {

  Serial.begin(115200);
  inString.reserve(10);
```

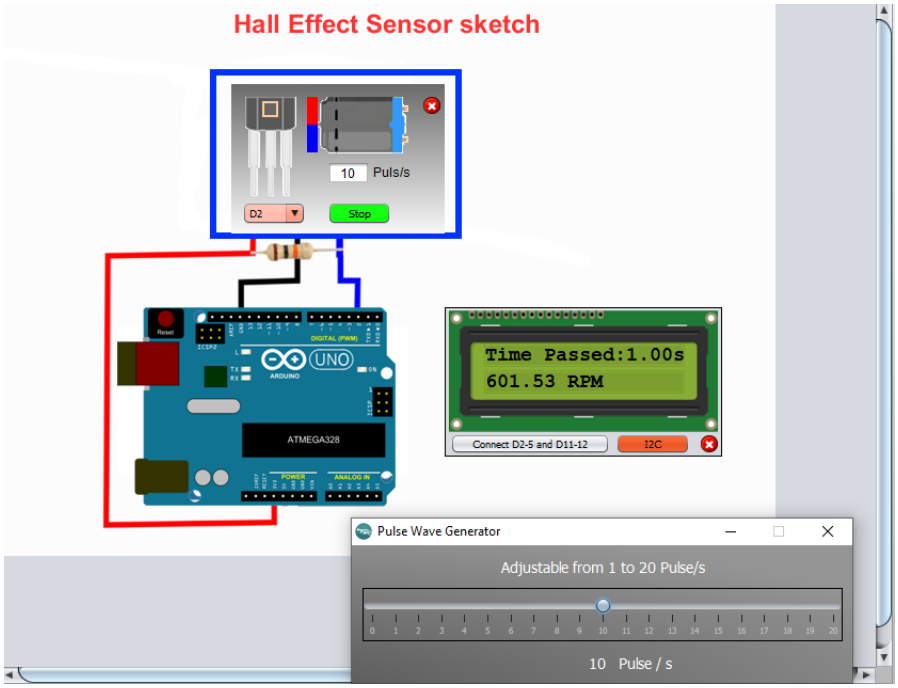
With the 'hall_tresh' variable you set the desired number of pulses per revolution.

This means that for 10 pulses /s the motor speed is 600 rpm.

The sketch calculates this for you and shows this on the LCD.

```
// digital pin 2 is the hall pin
int hall_pin = 2;
// set number of hall trips for RI
float hall_thresh = 10.0;
```

Example:

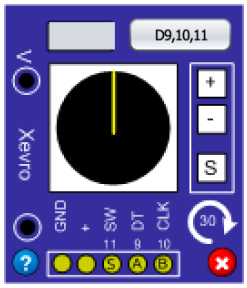


Attention: Do not forget to set the BaudRate to "9600" at the end of the simulation to make sure you don't forget it for other simulations.

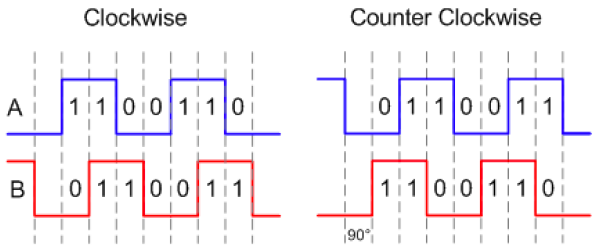
ROTARY ENCODER

The rotary encoder module can simulate 30 steps rotating potentiometer with a button. The rotary encoder can give 30 pulses within 1 full rotation. The button + and – buttons will increase and decrease the position. The '**S**' will push the button and sets an action like you programmed, for example confirming an action. If you keep pressing the +/- buttons, the encoder turns at 1 pulse/s (second) forward.

The rotary encoder can be connected to 3 pins, we can use digital pin 9, 10 and 11. When you click the button it can reset the counter and sets the encoder in its start position. There are 3 examples available to test in the sketches list as well as 3 restore files with the settings in. The simulated rotary encoder can't work with interrupted processes due to serial communication usage together with the simulator software.



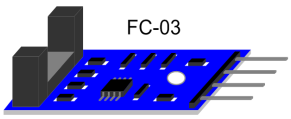
A visualization of the data pin statuses:

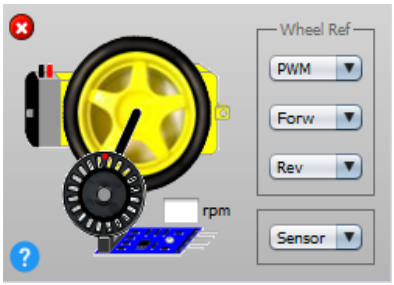


Output A (DT) = pin 9 on the Arduino (I09)
Output B (CLK) = pin 10 on Arduino (I10)
Serial code = ROTAB (open the serial monitor to track the codes)

More information can be found on this website:
https://howtomechatronics.com/tutorials/arduino/rotary-encoder-works-use-arduino/

ENCODER SPEED OPTICAL COUPLING SENSOR MODULE FC-03





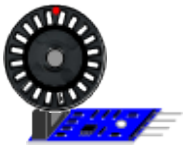
Description:

The Encoder speed sensor consists of an IR LED and an IR Photodiode together they are called Photo–Coupler or Opto–Coupler.
The Infrared Obstacle Sensor has a built-in IR transmitter and IR receiver.
An infrared Transmitter is a light-emitting diode (LED) that emits infrared radiation.
The module has an Analog and Digital output and includes two LEDs, one LED as a power indicator, and another LED is for a digital output indicator.

How the Encoder Speed Optical Coupling Sensor Module FC-03 works:

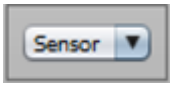
Digital output will be HIGH when something is within the Sensor gap, blocking the sensor. Of course, LOW when there is nothing in the gap.

Encoder Coded Disc 20 Holes for Motor and Speed Sensor



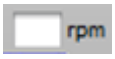
20 pulses = 1tr/s => 60tr/min

The maximum speed is limited to 60tr/min



The sensor is connected to the interrupt inputs D2 or D3

Interrupt 0 is digital pin 2 and Interrupt 1 is digital pin 3



The speed is shown on the screen

Example read interrupt input

```
void EncoderFc03() {
   if (millis() - timeold >= 1000){  /*Update every one second, this will be equal to reading frecuency (Hz).*/

  //Don't process interrupts during calculations
   detachInterrupt(1);
   //Note that this would be 60*1000/(millis() - timeold)*pulses if the interrupt happened once per revolution
   rpm = (60 * 1000 / pulsesperturn )/ (millis() - timeold)* pulses;  //60tr/min = 20p/s = 1 revolution
   timeold = millis();
   pulses = 0;
   CheckVar(1,rpm);
   //Restart the interrupt processing
   attachInterrupt(1, counter, HIGH);
   }
 }

 void counter()
 {
    //Update count
      pulses++;
 }
```

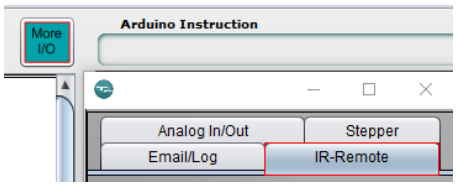
Remark

Do not connect a real encoder when using the simulation encoder as the input D2 or D3 will toggle between HIGH and LOW by simulation

IR REMOTE CONTROL

With the IR remote control simulator part, it is possible to simulate an IR LED and remote controller by using the IRremote library that we adjusted so it works together with the simulator. The Arduino instructions for the IR remote are the same as for the original library, you only must change the library in order to use the simulated IR remote controls.

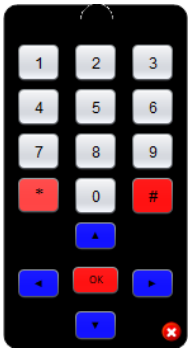
Go to the tab page 'IR-Remote' by pressing the "More IO" button to show more IO parts:



Here you can use various IR tools:

1. **Remote controller**

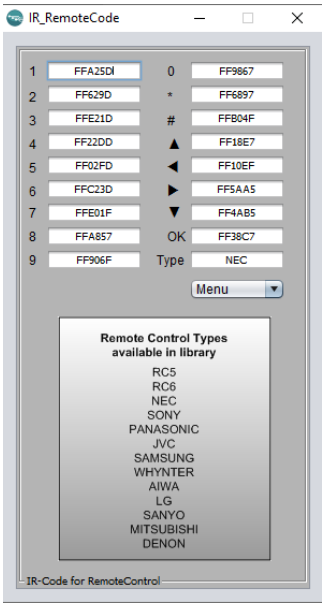
   With this remote controller you can send a code to the Arduino by pressing the keys on the controller, you can see the IR led flashing. (Standard NEC code)
   It is possible to link your own code to the keys.

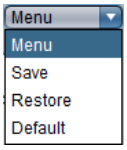


   By pressing the button 'IR_RemoteCode' a window will appear with the default codes (standard NEC), but you can adjust these codes according to your needs. (Image on next page).

   With the combobox 'Menu' you can Save and Restore your code to a file, or you can choose the default code (NEC).

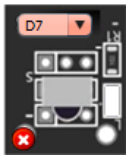
   In the box under the 'Menu' you will see the names of the remote-control types that are in the library.





2. IR receiver

With the combobox you can connect the receiver to the desired Arduino pin, for the IR receiver is this normally D7 or D11.



By pressing a key on the simulator remote controller or a real remote controller, you can see the receiver flashing.

3. IR-transmitter

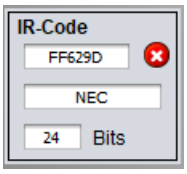
With the combobox you can connect the transmitter to the desired Arduino pin, for the transmitter is this normal D3.

If the Arduino sends a signal on D3 or by pressing a key on a real remote controller, the IR-LED will start flashing.

If you give a mouse, click on the LED, then you see only the LED.

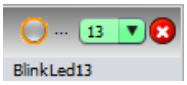
4. **IR-codebox**

   In this box you see the received code in Hex format, number of bits and type of remote controller.



5. **Blinkled13**

   In the void setup you can enable/disable the blinking of pin D13 on IR processing with the instruction 'irrecv.blink13(true/false)'.



   If you give a mouse, click on the '…' then you see only the LED.

Note: With 'View'- 'Collapse IO' you can adjust all the objects in one click.

USE THE IR REMOTE LIBRARY

6. Install the library 'IRremoteSim.zip'

We have adapted the 'IRremote' library and rename him to 'IRremoteSim' so that we can work with the same instructions.

1 instruction has been added to the library: IRrecv::SimRcvIRcode (long value, int bit, int type)

In the directory C:\Program Files (x86)\ArduinoSimulator\libraries\IRremoteSim you can find the '**IRremoteSim.zip**' file, you need to install the IR library to use the IR tools, this can be done by installing the library in the simulator.

How to install the library '**IRremoteSim.zip'**:

Click on the 'libraries' tab in the tools bar and select the IRremoteSim folder. Select the .zip file and install the library. This will add the library to the Arduino/libraries folder and can now be found in the Arduino IDE libraries list.

7. Programming Arduino IR-code

```
#include "SimulatorProgram.h"
#include <IRremoteSim.h>

int RECV_PIN = 7;
IRrecv irrecv(RECV_PIN);
decode_results results;
IRsend irsend;

void setup()
{
  Serial.begin(9600);
  inString.reserve(10);

  // In case the interrupt driver crashes on setup, give a clue
  // to the user what's going on.
  Serial.println("Enabling IRin");
  irrecv.enableIRIn(); // Start the receiver
  Serial.println("Enabled IRin");
  irrecv.blinkl3(true);   //Enable blinking the LED when during reception

}
```

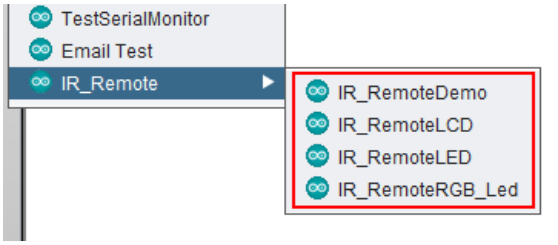
Attention:

If you write a program for the Arduino, the following program code must always be at the top in the void loop(), this program code sends the data from the simulator to the library 'IRremoteSim'.

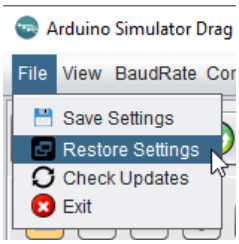
```
void loop() {
   // ****** Simulator IRremote code , NOT REMOVE: ******
    if (Sim_IRcode != 0){
       irrecv.SimRcvIRcode(Sim_IRcode,Sim_IRbits,Sim_IRtype);
       Sim_IRcode = 0;
    }
```

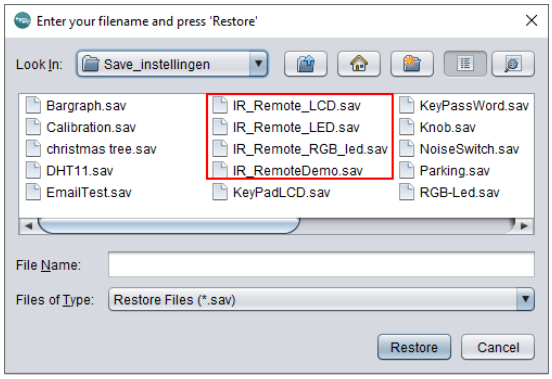
There are 4 program examples available:

Arduino IR sketches (choose Sketch Serial):

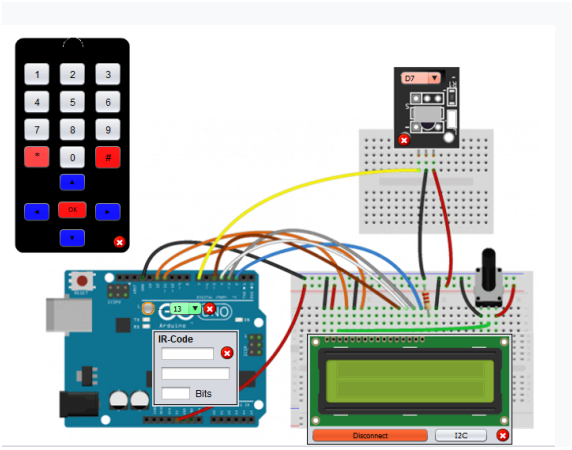


Restore the pre-programmed examples:

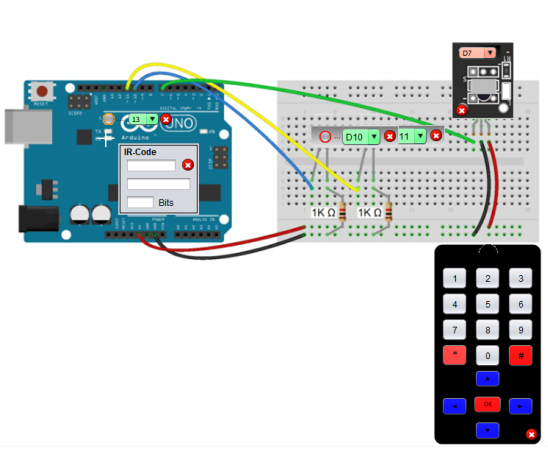




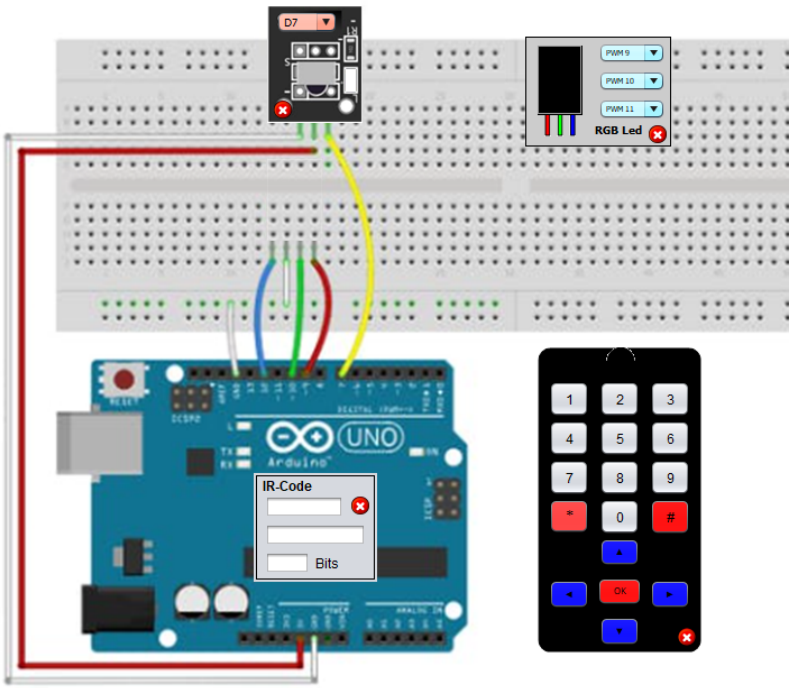
IR_Remote_LCD



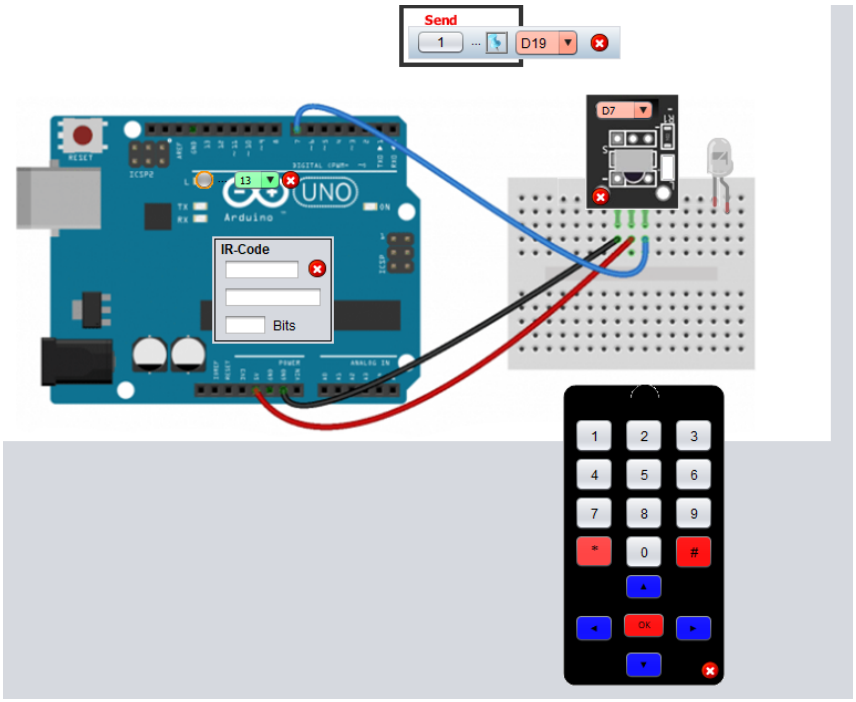
IR_Remote_LED



IR_Remote_RGB_Led



IR_RemoteDemo



STEPPER MOTOR 28-BYJ48

The Stepper motor can be connected to the Arduino by 2 or 4 digital pins (8, 10, 9 and 11). The driver module (ULN2003) is processed in the simulator. There are 4 LEDs that indicate which coil is energized on which specific moment in time. The number of steps and degrees is shown next to the 4 LEDs. Every simulation requires the change of a command in the Arduino IDE, with the stepper motor can you still use the original code. You only need to replace the library, and this will simulate. Read more about this under 'Stepper Library'.

The cross button is used to set the stepper motor back to its original place in the tab pane. You can find the stepper motor under the 'More I/O' button.

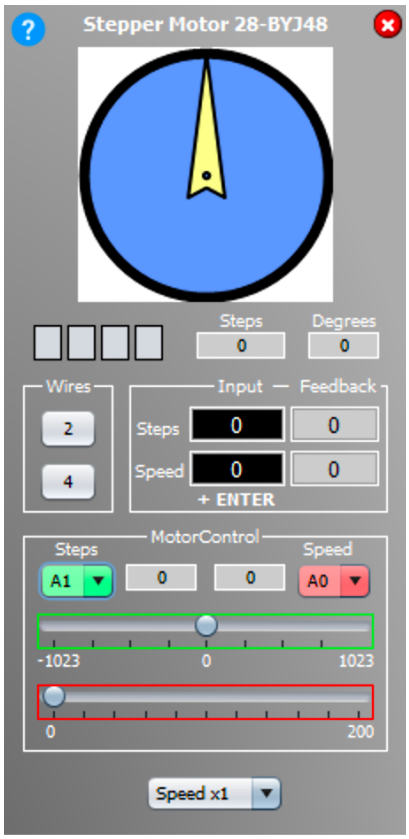
The simulator stepper motor has 2 input fields:

- Sim_STEPS
- Sim_SPEED

Steps = 1 to 2048 (360°)
Speed = 1 to 200

Input Steps -> Sim_STEPS
Input Speed ->Sim_SPEED

```
stepper.step(Sim_STEPS);

stepper.setSpeed(Sim_SPEED);
```

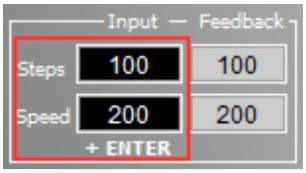


Use the 'Stepper.sav', 'StepperMotorControl.sav' and the 'StepperMotorKnob.sav' example (restore settings) to test the stepper motor.

If you are using the stepper motor and the serial monitor together, it's possible you will get a warning that will tell you to close the serial monitor and reset the Arduino because you are losing steps.

INPUT/FEEDBACK

If you want to specify the number of steps or speed, you must press the 'enter' key after typing in. The Arduino will send the steps and speed back to the simulator to show you it is received (Feedback).



Note: Make sure you click on the 'enter' key after adding the value for Sim_SPEED and Sim_STEPS

Speed

It's possible to speed up the stepper motor 2 times faster because of the serial port speed, the real stepper motor is a little bit faster. With even numbers the steps will be the same. With uneven numbers there will be a loss of 2 steps.

STEPPER LIBRARY

To control the stepper motor, you use can use the same commands as before but just change the library to our provided library 'StepperSim.zip' and add them to the Arduino IDE.

The original library has been changed so that it works together with the simulator 'Stepper_Sim.zip'.

You can find it on this directory:

C:\Program Files (x86)\ArduinoSimulator\Library or

C:\Program Files\ArduinoSimulator\Library

With the Arduino IDE, you use 'Include library' and select 'Add.Zip' Library to install the library 'Stepper_Sim.zip'.

You can also always download the library here:

https://xevro.be/onewebmedia/Arduino%20Simulator%20Drag%20&%20Drop%20Userguide/Stepper%20motor%20guide%20images/StepperSim.zip

In your Arduino sketch write '#include <Stepper_Sim.h>' to add the stepper library to your project.

The stepper motor commands are the same as the ones in the stepper library provided by Arduino.

stepper.setSpeed(value between 0-200);

Stepper(STEPS, pin1, pin2); For 2 coil winding

Stepper(STEPS, pin1, pin2, pin3, pin4); For 4 coil winding

setSpeed(rpm);

step(STEPS);

More information about the stepper commands:
https://www.arduino.cc/en/Reference/Stepper

CALCULATE THE STEPS PER REVOLUTION FOR THE STEPPER MOTOR

It's important to know how to calculate the steps per revolution for the stepper motor because only then you can program it effectively.
In the simulator, we will be operating the motor in 4-step sequence so the stride angle will be 11.25° since it is 5.625° for 8 step sequence it will be 11.25° (5.625 * 2 = 11.25). You can also choose for a 2-step sequence, but you will need to change the coil pins in the sketch.
-> Stepper stepper (STEPS, 8, 10);

Steps per revolution = 360/step angle
360/11.25 = 32 steps per revolution

The number of steps per revolution for our stepper motor was calculated at 32; therefore, we enter this as shown in the line below:

#define STEPS 32

Next, you have to create instances in which we specify the pins to which we have connected the stepper motor.

4 coil wires: Stepper stepper (STEPS, 8, 10, 9, 11);
2 coil wires: Stepper stepper (STEPS, 8, 10);

Note: The pins number are disordered as 8, 10, 9, 11 on purpose. You have to follow the same pattern even if you change the pins to which your motor is connected.

Since we are using the Arduino stepper library, we can set the speed of the motor using the below line. The speed can range between 0 to 200 for the 28-BYJ48 stepper motor.

stepper.setSpeed(200);

To make the motor move one step we can use the following line.

stepper.step(val);

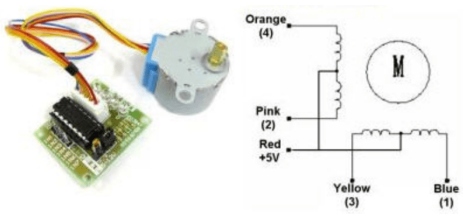
The number of steps to be moved will be provided by the variable 'val'. Since we have 32 steps and 64 as the gear ratio, we need to move 2048 (32*64 = 2048), to make one complete rotation.
The value of the variable 'val' can be entered by the user using the serial monitor.

Coil wires: 2 or 4 

Select in the simulator how many windings (2 or 4) your stepper motor has.

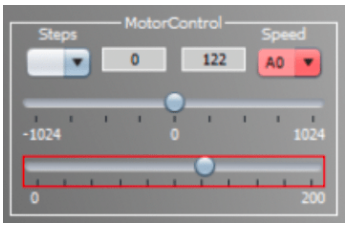
For 4 coil winding: `Stepper stepper(STEPS, 8, 9, 10, 11);`

For 2 coil winding: `Stepper stepper(STEPS, 8, 9);`



MOTORCONTROL

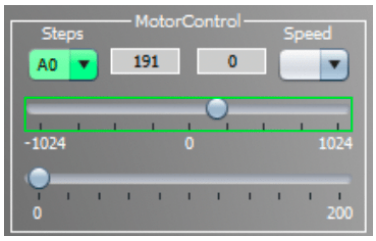
To adjust the speed of the motor you can use the provided slider and select a pin from A0-A5.



Arduino code:

```
int motorSpeed = map(sensorReading, 0, 1024, 0, 100);
int sensorReading = AnalogRead(A0);
myStepper.setSpeed(motorSpeed);
```

To adjust the steps of the motor you can use the provided slider and select a pin from A0-A5.

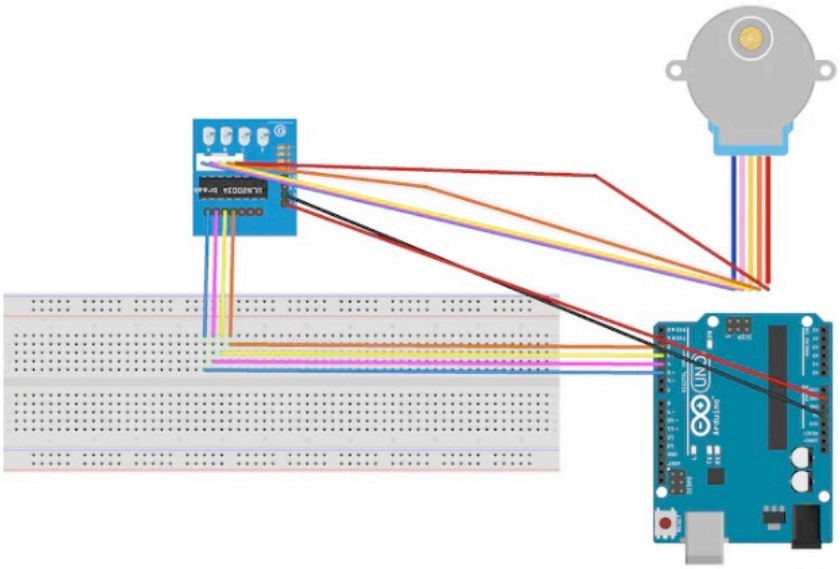


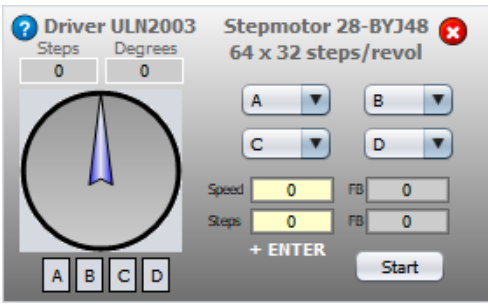
Arduino code:

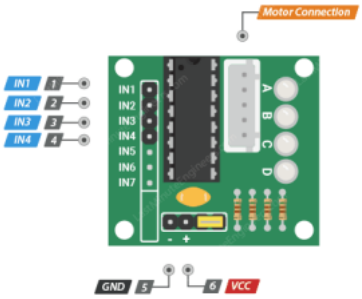
```
int val = AnalogRead(0);
stepper.step(val - previous);
previous = val;
```

Note: If you can't start the stepper motor, you can click on the reset button in the simulator, and it will send all the start values again. Disconnect the coil (2 or 4) and then reconnect it again.

STEPPER MOTOR 28-BYJ48 WITH ULN2003 DRIVER

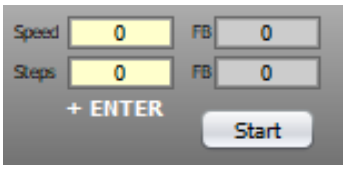






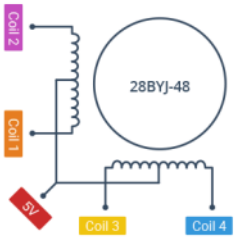
Control buttons simulation driver ULN2003

- This driver can work with or without library (StepperSim.h).
- The displays Speed, Steps, FB's (Feedback) are used only with library.



- The Speed and Steps are input fields, the FBs are filled in by the Arduino library.
- Note that after filling in the input fields Speed and Steps, one should always confirm with ENTER.

- The 4 coils of the stepper motor 28-BYJ48 are connected to the Arduino board via combo boxes A,B,C,D.



Not paired with the Arduino

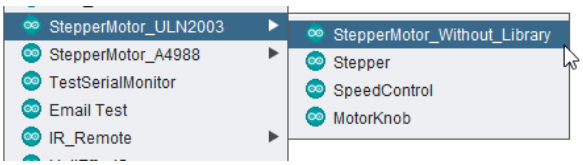
Paired with the Arduino on pins 5,6,7,8

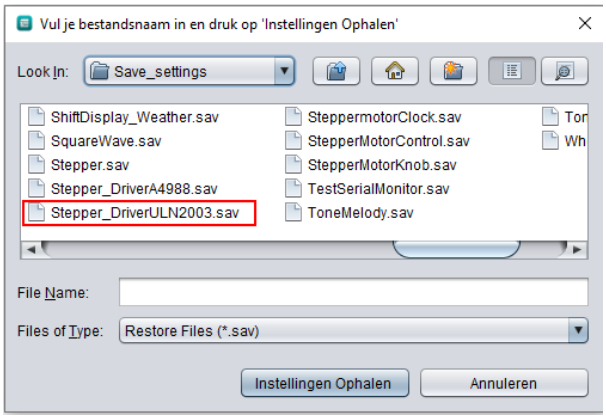
- If one clicks on the Stepper Motor then the control buttons disappear

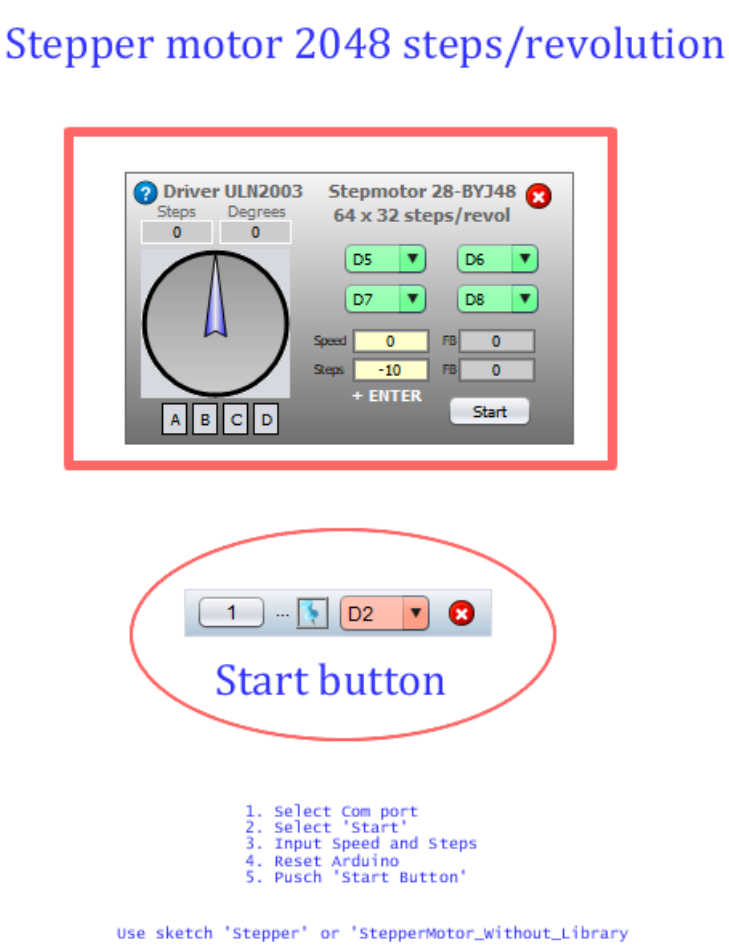
- The number of steps and degrees can be followed along on the displays.

- Visualisation of which coil is energised.

EXAMPLE SKETCH



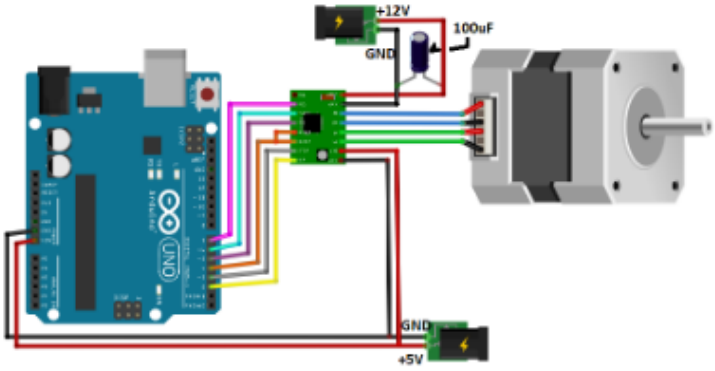




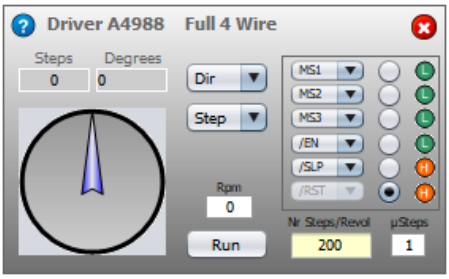
Tips for operation with serial communication between Arduino and simulator:

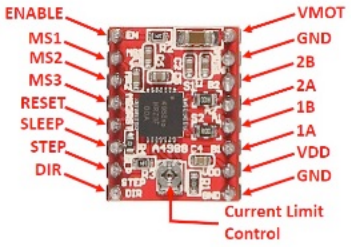
- Sometimes Arduino may be in loop operation, so the button is not received properly, therefore press the button again.
- If one performs a 'reset Arduino' then we lose the state of the buttons in the Arduino, you must press the button on or off again after the reset so that the state is relayed.

MOTOR STEPPER WITH A4988 DRIVER



Simulation Driver A4988 with microsteps





Control buttons simulation driver A4988

ENABLE - Pin to enable the A4988 driver. It is enabled by default. To disable, a logic 1 (High) needs to be connected.
In software, rotation is blocked, the last state is memorised.

MS1, MS2, MS3 - Microstepping selection pins. Different combination of inputs define the specific setting (see further below for details).

RESET When activated, it ignores all inputs sent to the “STEP” pin until deactivated. RESET is activated when is pulled down. This pin is floating, so one way to keep it high is by keeping it connected to the SLEEP pin.
In the software, rotation and pulse inputs are blocked, the last position is memorised.

SLEEP Can be used to minimize power consumption when the motor is not in use.
In software, rotation is blocked, the last state is memorised.

STEP This is where you tell the A4899 to move the stepper motor by one step (defined by the microstepping setting). One signal on HIGH equals one step. Speed is defined by how fast / how frequently we switch the HIGH/LOW signal.

DIR This is where you define the direction of rotation (clockwise or counter-clockwise).

Run This button puts the driver in service and must always be on to ensure operation.

Rpm Speed only visible when working with the library.

µSteps Shows the number of microsteps determined by the arduino programme or by the radio buttons MS1,MS2,MS3.

Nr. Steps/Revol –Entry field where one must enter the number of steps per revolution, defaults to 200 steps/revolution

Radio buttons can be used to simulate hardware wiring, so there is no need to make real connections on the arduino, the state 'L' and 'H' is indicated.

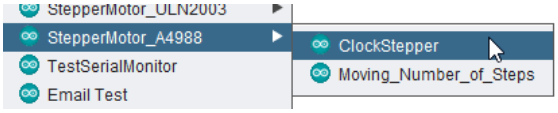
Eg: MS1 and MS3 are set to 1 and MS2 to 0

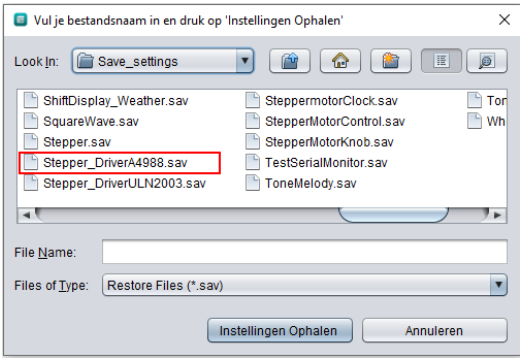
With the comboboxes, one chooses the output pin one wants to control from the arduino programme.
A combination of combobox with radiobutton is not possible.

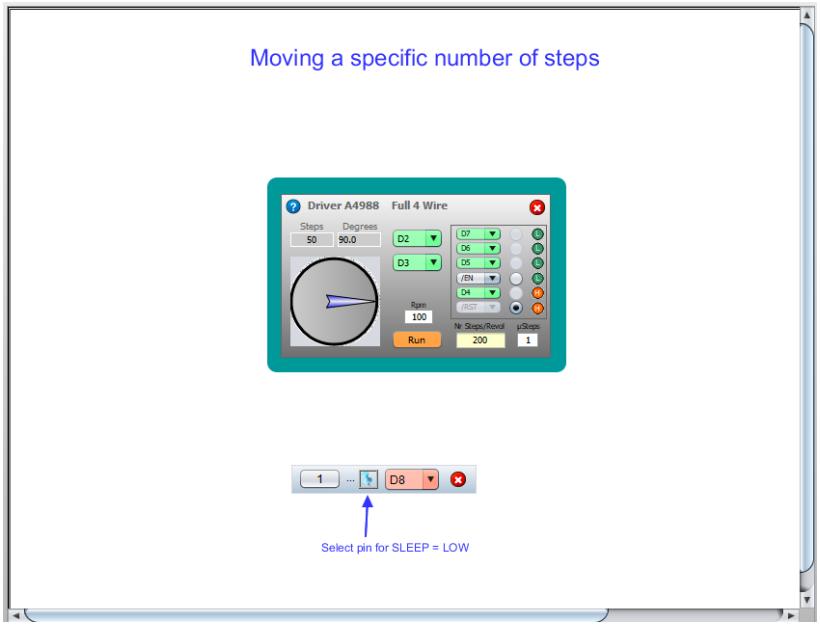
A4988 Microstepping Settings

MS1	MS2	MS3	Microstep Resolution
Low	Low	Low	Full Step
High	Low	Low	Half Step
Low	High	Low	Quarter Step
High	High	Low	Eighth Step
High	High	High	Sixteenth Step

EXAMPLE SKETCH







Tips for operation with serial communication between Arduino and simulator:

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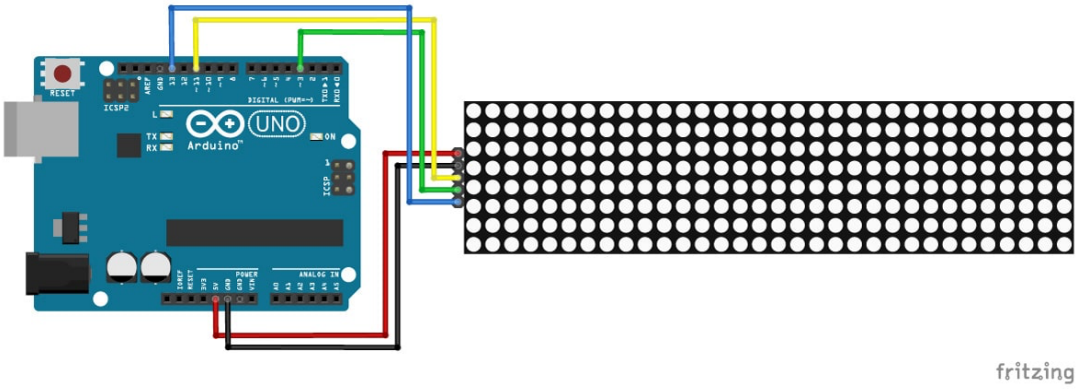
MAX7219 LED dot matrix display



In this tutorial, you will learn how to control a MAX7219 LED dot matrix display with Arduino. The code in this tutorial can be used for 8×8, 8×32, and even larger displays.

For this tutorial, I will be using the MD_Parola in combination with the MD_MAX72XX Arduino library. These libraries make displaying scrolling text and other animations super easy.

ABOUT THE MAX7219 LED DRIVER

The MAX7219 LED driver can be used to control 7-segment displays up to 8 digits, bar-graph displays, or 64 individual LEDs. The driver communicates with the Arduino through SPI, so you only need three wires to control the display.

Since the MAX7219 can control a maximum of 64 LEDs, the maximum size dot matrix display it can drive is 8×8 pixels. However, you can daisy chain multiple drivers and matrices together and easily control much larger displays like 8×32, 8×64, or even bigger. Still, you only need three wires to control all of the ICs, so you need very few I/O pins of the Arduino. [2]

HOW TO CONNECT THE DOT MATRIX DISPLAY TO THE ARDUINO

The MAX7219 LED display driver communicates with the Arduino through SPI (Serial Peripheral Interface). To learn more about this data protocol, please see https://www.arduino.cc/en/reference/SPI on the Arduino website.

With an SPI interface there is always one master device (the Arduino) that controls the peripheral devices (also known as slaves). You can control the display either through the Arduino's AVR microcontroller hardware SPI interface or three arbitrary digital pins (software SPI).

The hardware SPI pins (MOSI, MISO, and SCK) are at a specific location on each Arduino board. This interface is faster than using software SPI, but you will need to use the following fixed output pins:

HARDWARE SPI PIN LOCATIONS ARDUINO UNO

CLK_PIN 13 (SCK)

DATA_PIN 12 (MISO)

CS_PIN 11 (MOSI)

Note that the MOSI, MISO, and SCK pins are also at a consistent physical location on the 6-pin ICSP header:

```
#define CLK_PIN   13
#define DATA_PIN  11
#define CS_PIN    10
```

To control MAX7219 displays you only need to make three connections:

- **MOSI** (Master Out Slave In) connected to **DIN** – The Master line sending data to the peripherals.
- **SCK** (Serial Clock) connected to **CLK** – The clock pulses which synchronize data transmission generated by the master.
- **SS** (Slave Select) connected to **CS** – The pin on each device that the master can use to enable and disable specific devices.

Note:

We use the software 'SPI.h' library with the simulator, you can connect DIN, CS, and CLK to any of the digital pins on the Arduino. You just need to specify the pin numbers in the setup of the Arduino code (see example below).

To control the MAX7219 display we will be using two awesome Arduino libraries created by Marco Colli from MajicDesigns. The **MD_Parola** library can be used to create many different text animations like scrolling and sprite text effects. This library depends on the **MD_MAX72XX** library which implements the hardware functions of the LED matrix.

This are some functions and features of the library:

- Left, right, or center text justification
- Text scrolling with entry and exit effects
- Control display parameters and animation speed
- Multiple virtual displays (zones) in each string of LED modules
- Support for hardware SPI-interface
- User-defined fonts and/or individual characters substitutions
- Support for double-height displays
- Support for mixing text and graphics on the same display

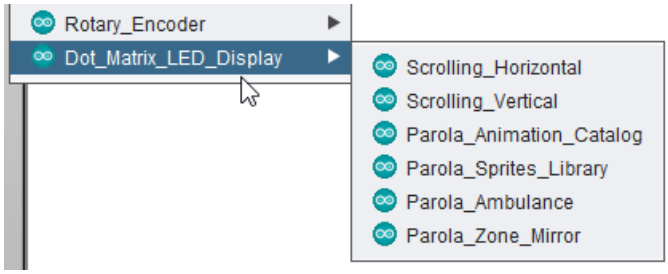
To make the libraries work with the Arduino simulator, we had to make a small adjustment and rename the library. Nothing has changed in the way of operation, just an adjustment to send the data serially to the simulator.

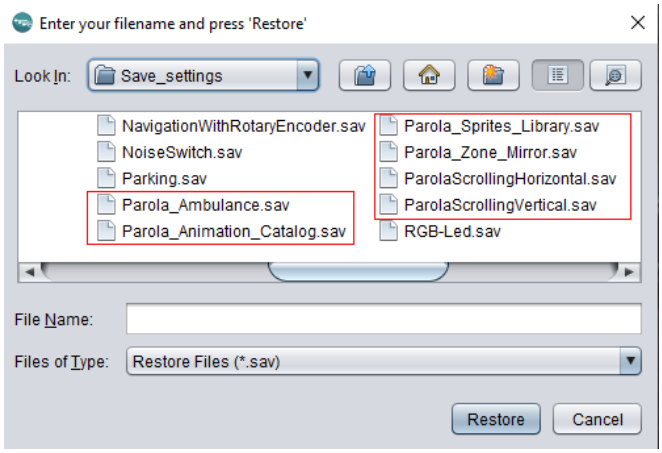
The new libraries are called **MD_Parola_Sim** and **MD_MAX72XX_Sim.**
The simulator has 2 FC16 modules.

The FC-16 8x8 or 8x16 module:

- The radio button 'On' makes the matrix available
- The radio button '90°' rotates the matrix vertically
- By pressing the 'On' button Off, you can clear the matrix
- By pressing the red cross button, the matrix goes back to its starting position
- For correct operation, matrix2 must become before matrix1

By clicking on the border you can drag and drop the matrix in the simulator field.
There are 6 sketches available witch have a saved profile that can be restored.

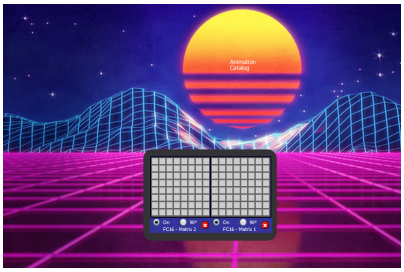




These 6 examples are available to try:

Parola_Ambulance

Parola_Animation_Catalog



Parola_Animation_Catalog

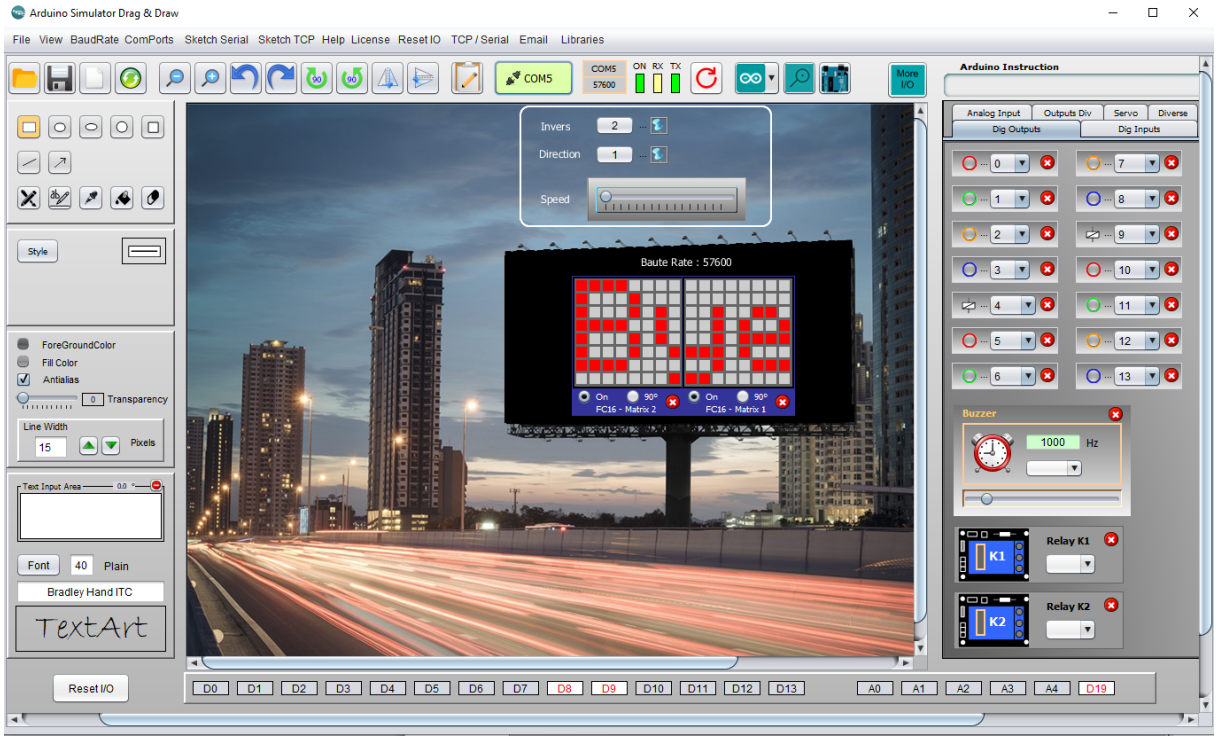
Parola_Zone_Mirror

Parola_Scrolling_horizontal

Parola_Scrolling_Vertical

You can find all the Parola sketches on the C:\Program Files (x86)\ArduinoSimulator\ArduinoSketches

EXAMPLE SKETCH "PAROLA_SCROLLING_HORIZONTAL"



HARDWARE CONFIGURATION IN ARDUINO

When setting up the display in your Arduino code you need to set the **HARDWARE_TYPE** to **FC16_HW** and specify the number of devices you have connected, in this case 2.

An 8×8 matrix counts as 1 device, so if you want to control an 8×16 module you need to set **MAX_DEVICES** to 2 (an 8×16 display contains 2 MAX7219 ICs).

```
#define HARDWARE_TYPE MD_MAX72XX::FC16_HW
#define MAX_DEVICES 2
```

HOW THE CODE WORKS

The first step is to include all the required Arduino libraries. As mentioned before, the MD_MAX72XX_Sim library implements the hardware functions of the LED matrix and the MD_Parola_Sim library text effects. You will also need to include the SPI library and the Simulator library, which comes pre-installed in the Arduino IDE. The SPI library is used for the Serial Peripheral Interface communication between the display and the Arduino.

```
// Include the required Arduino libraries:

#include <MD_Parola_Sim.h>
#include <MD_MAX72xx_Sim.h>
#include <SPI.h>
#include <SimulatorProgram.h>
```

Next, we need to specify which hardware we are using. I used 2 standard 8×8 display (also known as **FC-16**), I set the **HARDWARE_TYPE** to **FC16_HW**. The number of MAX7219 ICs in an 8×16 display is 2 so I set **MAX_DEVICES** to **2**.

Lastly, I defined to which pin the CS pin of the display is connected (output pin 10 in this case).

Because we work with software SPI, we also need to define the data and clock output pins and pass these as parameters when setting up the sketch.

```
#define HARDWARE_TYPE MD_MAX72XX::FC16_HW
#define MAX_DEVICES 2
#define CLK_PIN   13
#define DATA_PIN  11
#define CS_PIN    10
```

The statement #define is used to give a name to a constant value. The compiler will replace any references to this constant with the defined value when the program is compiled. So everywhere you mention CS_PIN, the compiler will replace it with the value 10 when the program is compiled.

After this, a new instance of the MD_Parola class is created with the function MD_Parola().

This function needs five parameters: **Hardware type, Data_Pin, CLK_Pin, CS_Pin, Max_Devices.**

Note that I have called the MD_Parola object '**P**' but you can use other names as well. You will need to change '**P**' to the new name in the rest of the sketch.

```
// SOFTWARE SPI
MD_Parola P = MD_Parola(HARDWARE_TYPE, DATA_PIN, CLK_PIN, CS_PIN, MAX_DEVICES);
```

In the setup section of the code, the first 3 lines are need for the simulator:

- Initialize the serial connection (BaudRate 57600)
- Stringbuffer simulator (25)
- RealIO_Connect() for working with the real in- or outputs on the board

```
void setup()
{
  Serial.begin(57600);
  inString.reserve(25);
  RealIO_Connect();   // Used for connection between arduino and real IO
```

The next lines are using for the control functions (button and slider)

```
// set to 1 if we are implementing the user interface pot, switch, etc
#define USE_UI_CONTROL 1


#if USE_UI_CONTROL
  pinMode(SPEED_IN, INPUT);
  pinMode(DIRECTION_SET,INPUT);
  pinMode(INVERT_SET,INPUT);
  doUI();
#endif // USE_UI_CONTROL
```

In the setup section of the code, we first initialize the object with the function begin()

```
P.begin();
```

At the end of the setup section, we specify how we want to display the text with the function displayText(curMessage, scrollAlign, scrollSpeed, scrollPause, scrollEffect, scrollEffect). This function takes 5 arguments.

The first parameter is the text string, in this case curMessage.

The second argument sets the alignment of the text during the optional pause. In this case PA_LEFT.(other are PA_RIGHT , PA_CENTER)

The third and fourth arguments set the speed of the animation and pause time respectively. The speed of the display is the time in milliseconds between animation frames. The lower this time the faster the animation. If you want to pause the text in between the in and out animation, you can set the pause time in milliseconds. If the pause is zero so the text scrolls continuously.

Next, the in and out effects are specified. In this case I used PA_SCROLL_LEFT for both. See the example below for other text effects.

```
uint8_t scrollSpeed = 10;    // default frame delay value
textEffect_t scrollEffect = PA_SCROLL_LEFT;
textPosition_t scrollAlign = PA_LEFT;
uint16_t scrollPause = 20; // in milliseconds

P.displayText(curMessage, scrollAlign, scrollSpeed, scrollPause, scrollEffect, scrollEffect);
```

With the function 'doUI' you can use buttons, sliders for manipulating the matrix.

```
// set to 1 if we are implementing the user interface pot, switch, etc
#define USE_UI_CONTROL 1
```

With a slider from the simulator, you can change the speed, but the effect is not great due to the slow serial communication.

```
#if USE_UI_CONTROL

void doUI(void) {
  // set the speed if it has changed
  {
    int16_t speed = map(analogRead(SPEED_IN), 0, 1023, 10, 150);
    if ((speed >= ((int16_t)P.getSpeed() + SPEED_DEADBAND)) ||
      (speed <= ((int16_t)P.getSpeed() - SPEED_DEADBAND)))
    {
      P.setSpeed(speed);
      scrollSpeed = speed;
      PRINT("\nChanged speed to ", P.getSpeed());
    }
  }
```

With a button from the simulator, you can change the direction or invert (it is not possible to invert a sprite with the simulator).

```
if (digitalRead(DIRECTION_SET) == HIGH) // SCROLL DIRECTION
{
  PRINTS("\nChanging scroll direction");
  scrollEffect = (scrollEffect == PA_SCROLL_LEFT ? PA_SCROLL_RIGHT : PA_SCROLL_LEFT);
  P.setTextEffect(scrollEffect, scrollEffect);
  P.displayClear();
  P.displayReset();
}

if (digitalRead(INVERT_SET) == HIGH)  // INVERT MODE
{
  PRINTS("\nChanging invert mode");
  P.setInvert(!P.getInvert());
}
```

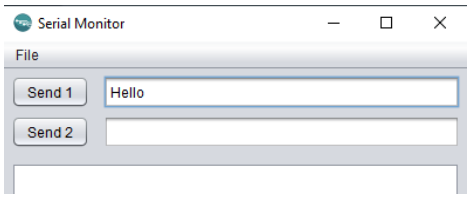
In the loop section, you only need two functions to create a scrolling text display.

First, we use the function displayAnimate() in an if statement. This function animates the display using the currently specified text and animation parameters and returns true when the animation has finished.

When the animation has finished, we reset the display with the function displayReset() so the text is displayed in a loop.

```
if (P.displayAnimate())
{
  if (newMessageAvailable)
  {
    strcpy(curMessage, newMessage);
    newMessageAvailable = false;
  }
  P.displayReset();
}
```

With de function ‘readSerial’ you can change the text online with help of the Serial monitor.



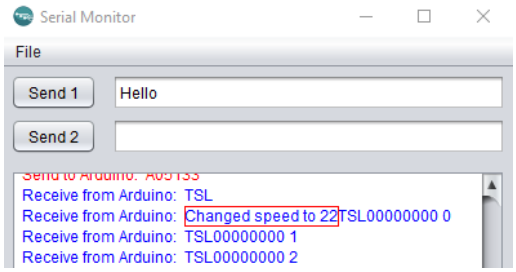
All the data from the simulator can be seen on the matrix if you activate the ‘readSerial’ function in the void loop(). (Button ex. I091111)

```
void readSerial(void)
{
  static char *cp = newMessage;
  //static String *cp = newMessage;
  while (Serial.available())
  {
    //*cp = (char)Serial.read();
    if ((*cp == '\n') || (cp - newMessage >= BUF_SIZE-2)) // end of message character or full buffer
    {
      *cp = '\0'; // end the string
      // restart the index for next filling spree and flag we have a message waiting
      cp = newMessage;
      newMessageAvailable = true;
    }
    else  // move char pointer to next position
      cp++;
  }
}
```

With the debugger you can make your changes visible in the Serial Monitor

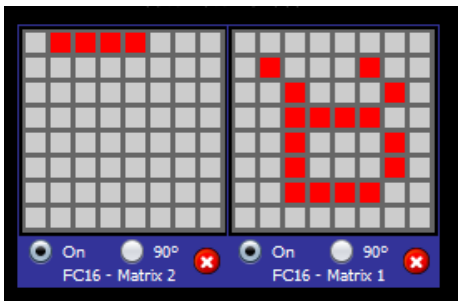
```
// Turn on debug statements to the serial output
#define DEBUG 1

#if DEBUG
#define PRINT(s, x) { Serial.print(F(s)); Serial.print(x); }
#define PRINTS(x) Serial.print(F(x))
#define PRINTX(x) Serial.println(x, HEX)
#else
#define PRINT(s, x)
#define PRINTS(x)
#define PRINTX(x)
#endif
```

Example change speed with slider:



Attention: It is possible that the 'PRINTS' from the debugger the text disturbs.

A print instruction in the setup disturbs also the start of the text, so do not place printing instructions in the setup.
It looks like this:



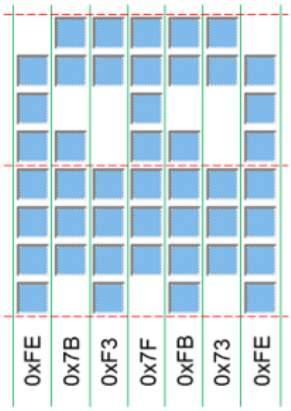
OTHER TEXT EFFECTS

The library MD_Parola_Sim includes several other text effects that you can use:

- PA_PRINT,
- PA_SCROLL_LEFT,
- PA_WIPE,
- PA_SCROLL_UP_LEFT,
- PA_SCROLL_UP,
- PA_SCROLL_UP_RIGHT,
- PA_BLINDS,
- PA_SCROLL_DOWN_LEFT,
- PA_WIPE_CURSOR,
- PA_DISSOLVE,
- PA_SCROLL_DOWN_RIGHT,
- PA_SCROLL_RIGHT,
- PA_SLICE,
- PA_SCROLL_DOWN

More information on this link about the Parola library:
https://majicdesigns.github.io/MD_Parola/page_software.html

MAKE YOUR OWN SPRITES



Each frame is defined by a sequence of numbers that encode the columns of the bitmap. In the example on the left (a Pacman 'ghost' character), each column of bits is represented by the hexadecimal number at the base of the bitmap. The least significant bit is at the top of the bitmap. If the sprite has a front and rear, the bitmap should be defined for the sprite moving to the right. The library will mirror reverse the image when it moves left.

The sprites are essentially defined in the same way as the character font and the same tools can be used to define the data for the sprite bitmap. Note that, like the font definition, the sprite is stored in PROGMEM to save RAM space.

A sprite has at least one frame. If more than one frame is required, a similar definition is created for each frame of the animation, and a data table constructed defining the animated sprite, as shown in the code snippet below, which is for the ghost character with shifting eyes.

Two convenience constants are used to define the sprite, one for the width (number of bytes) data for one sprite and the other for the number of frames contained in the animation. The total number of bytes required is the width * number of frames. [3]

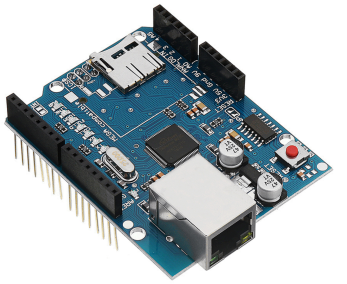
More information on https://arduinoplusplus.wordpress.com/2018/04/19/parola-a-to-z-sprite-text-effects/

```
const uint8_t F_GHOST = 2;
const uint8_t W_GHOST = 7;
static const uint8_t PROGMEM ghost[F_GHOST * W_GHOST] =
{
 0xfe, 0x7b, 0xf3, 0x7f, 0xfb, 0x73, 0xfe,
 0xfe, 0x73, 0xfb, 0x7f, 0xf3, 0x7b, 0xfe,
};
```

To ensure smooth animations, you should remember that once the last frame is reached, it will loop back to the first. Avoid discontinuities between the two ends of the data table.

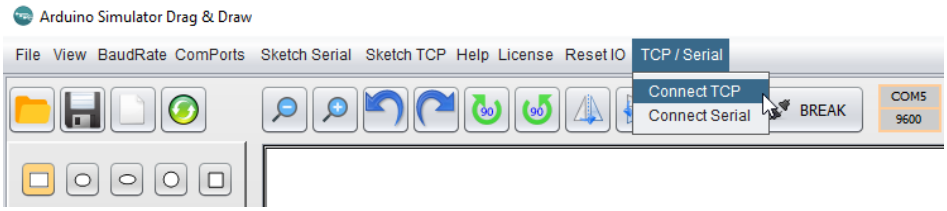
ARDUINO TCP ETH-WIFI CONNECTION

The Arduino simulator can connect to an Arduino with an ethernet or WIFI wireless connection. We used an Arduino W5100 ethernet shield for the Arduino UNO and an Arduino UNO WIFI rev2.



Example:
Laptop or PC IP-address: 192.168.0.120
Arduino IP-address: 192.168.0.100 Port: 8888

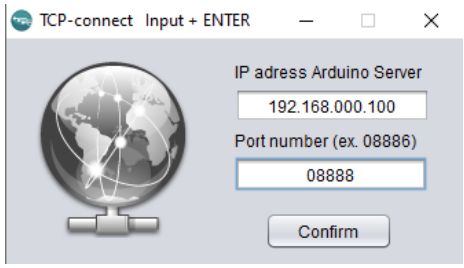
Select 'Connect TCP' to open the TCP settings window.



Insert 'IP-address and port number' + confirm.
Keep in mind to use the IP-address format of 12 numbers!
IP-address: **000.000.000.000** (12 numbers + ENTER)
Port number: 00000 (5 numbers + ENTER)

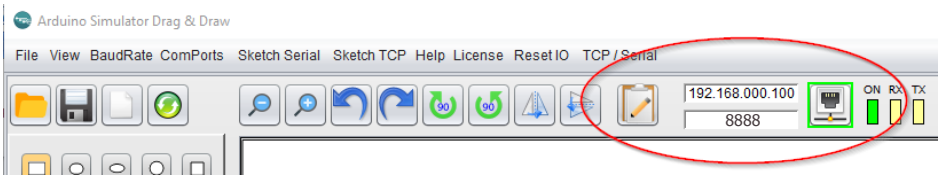
Example: 192.168.1.15 Port: 80

IP-address: 192.168.001.015
Port number: 00080

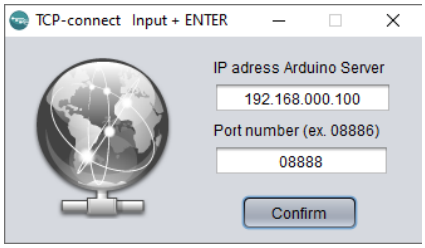


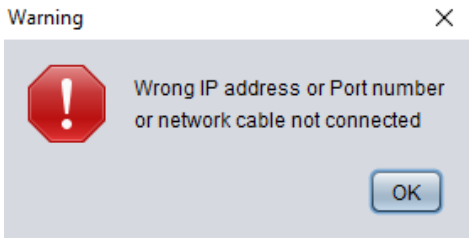
Always press enter when you have entered the field.

If everything is filled in, the IP address and port number will appear in the top bar, the border color of the "TCP button" is green (connection ON).

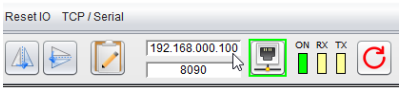


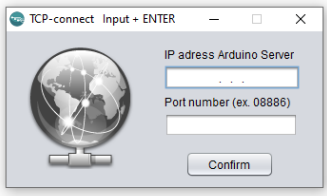
If you fill in a wrong IP-address or port number or the network cable is not connected, then after 20s a warning window appears.



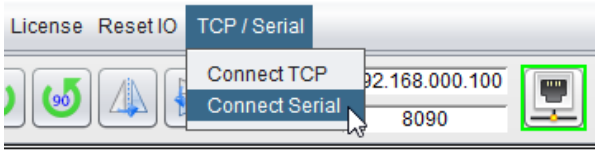


If the IP-address is accepted and you want to change it again, then you can only change it by clicking on the IP-address or port field, an input window appears to fill it in.





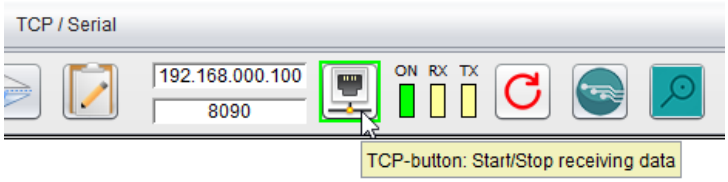
With the menu field is it then only possible to change between serial or TCP. The reason for this is to switch quickly between serial and TCP.



TCP CONNECTION BUTTON

With the TCP button we can start and stop the receiving data, this button also helps to re-establish the TCP connection if we have lost it.

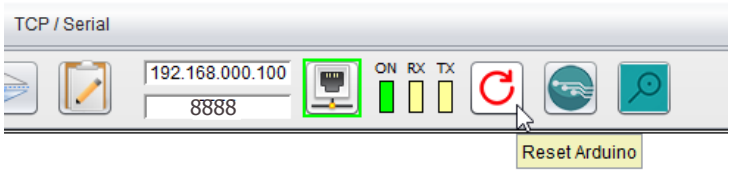
After a manual reset of the Arduino, we must stop and restart with this button for reconnecting the simulator with the Arduino.



RESET ARDUINO BUTTON

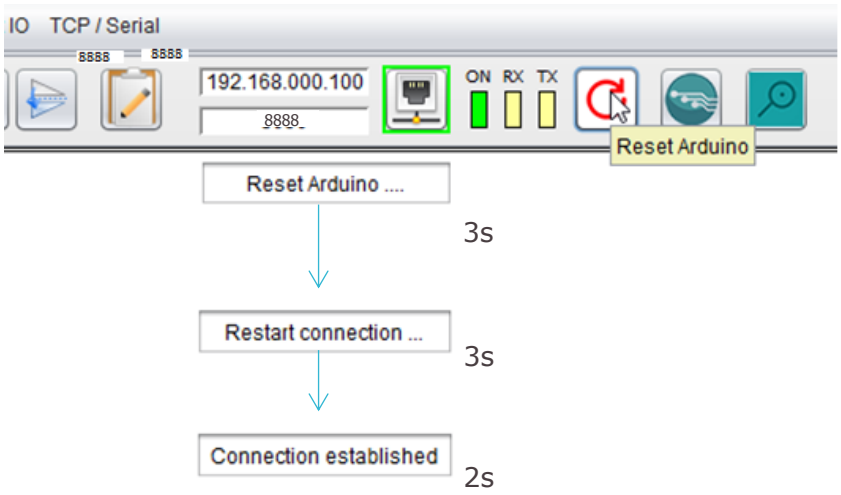
You may only use this button if the connection has been established.

With this button you restart the Arduino (reset Arduino), you need this to give the simulator all the starting data of the Arduino program. (Example: Parking_TCP.ino)

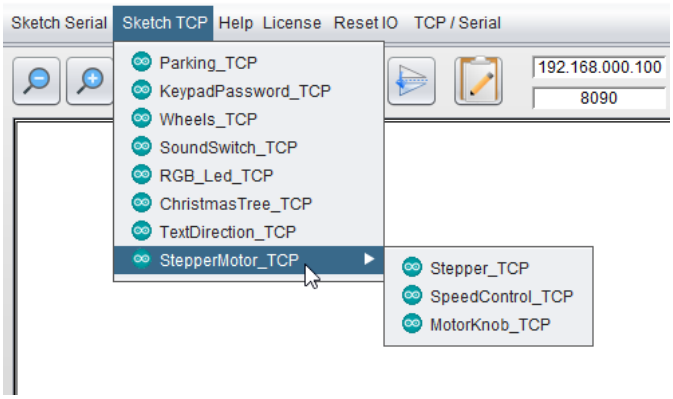


We can follow the Arduino Reset status through a text field that shows us the different steps.

A reset takes approximately 8 seconds.

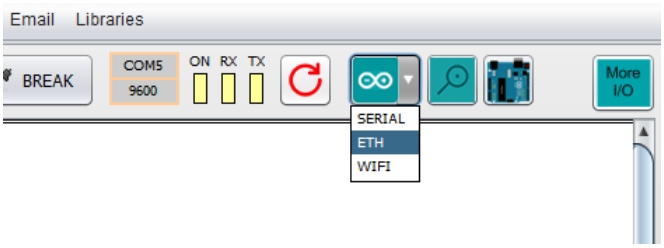


There are 8 sketch examples that work with a TCP ethernet shield. 4 of them are sketches that also work with an Arduino UNO WIFI rev2 or something else with WIFI functionality.

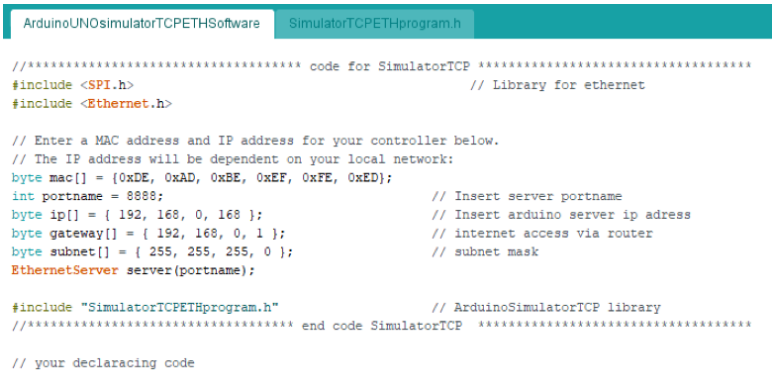


NEW SKETCH

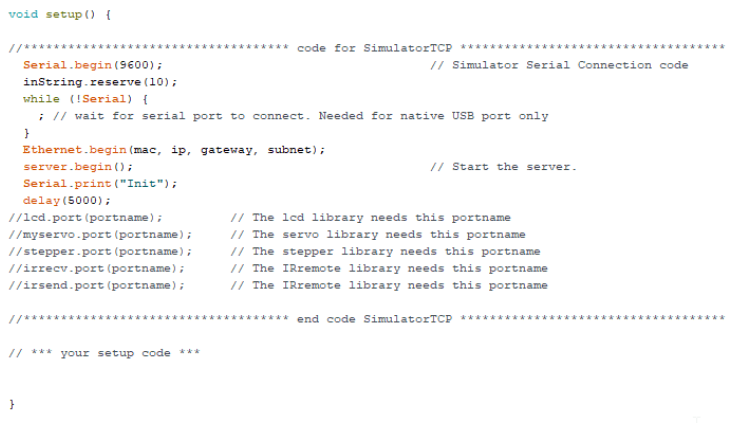
Select the item 'ETH' to open a new ethernet Arduino sketch:



Here you find the Arduino code for making a TCP connection between the * lines (***). For your sketch, you must change the IP address, port name, gateway, and subnet.



All the TCP-libraries needs a port name for sent the data to the simulator, in comment can you see the port names, delete the '//' for the library you need.



Here you find the Arduino simulation code in the void loop().
The function 'TCP_Recv()' is very important and must be on the first line.
You may have to use this function "TCP_Recv ()" several times in your program to read the data at the right times:

- After a delay()
- In or after a for next loop
- In or after a doWhile()

```
void loop() {
  TCP_Recv();          // Put this funtion always on the first line
                       // After a delay()
                       // In a for next loop
                       // In a do while loop

// *** your programming code ***
```

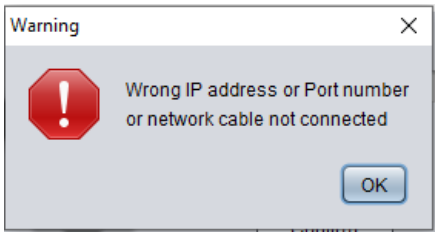
Example:

```
void loop() {

  TCP_Recv();  // Put this funtion always on the first line
               // After a delay()
               // In a for next loop
               // In a do while loop

  sensorValue = analogRead(sensorPin);           // Reading sensor value of the Simulator
  PotValue_Gain = analogRead(Potmeter_Gain);
  PotValue_Dim = analogRead(Potmeter_Dim);
  DimWaarde = (1023 - PotValue_Dim)/4;              // 0V potmeter_Dim (PotValue_Dim=0) => DimWaarde = 255 => ledstrip max
                                                 // 5V potmeter_Dim (PotValue_Dim=1023) => Dimwaarde = 0 => ledstrip min
  teller = 0;

  if (setLed == 1) {                             // ledstrip on
      analogWrite(Bright,DimWaarde);             // Write to Analog output (0V <-> 5V) Arduino Simulator part
  }

    if ((sensorValue > PotValue_Gain) && (setLed == 0)) {    // Geluidswaarde > grenswaarde en ledstrip uit = Ledstrip aan
      digitalWrite(ledPin, HIGH);                    // Control led on
      setLed = 1;
      analogWrite(Bright,DimWaarde);               // Write to Analog output (0V <-> 5V) Arduino Simulator part
      delay (2000);                                 // 2s wachten
    }

    TCP_Recv();
    sensorValue = analogRead(sensorPin);                   // reading microphone signal
    PotValue_Gain = analogRead(Potmeter_Gain);      // reading slidersignal Gain

    if ((sensorValue > PotValue_Gain) && (setLed == 1)) {    // Geluidswaarde > grenswaarde en ledstrip aan = Ledstrip uit
      digitalWrite(ledPin, LOW);                   // Arduino Simulator code
      setLed = 0;
      for (teller=0; teller <= DimWaarde;) {
        analogWrite(Bright,DimWaarde-teller);                  // writing to Analog output
        teller = teller + 5;
        delay(20);
      }
      delay (2000);
    }
}
```

WARNINGS AND ERRORS

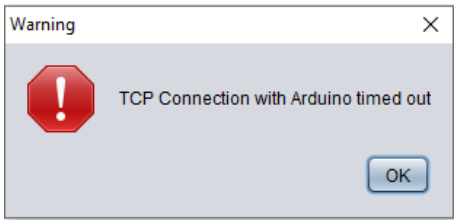
If there is a problem with the TCP connection between the simulator and the Arduino, then we can get the following warnings.

If the network cable is not connected after confirming, this window appears after 20 seconds.



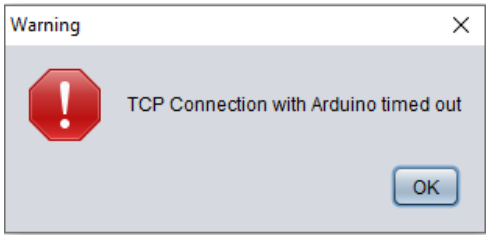
If we don't have any connection when pressing the button 'Reset Arduino', this window appears after 10 seconds.

First solve the connection problem and get the connection back in order by pressing the 'TCP button' off/on.



By quickly pressing the 'TCP button off/on' several times in succession then it is possible that we lose the connection, a window appears after 20 seconds.

To get the connection back in order, we must manually reset the Arduino and then pressing the TCP-button off/on or restart the simulator program.



TCP CONNECTION ON A WIDE AREA NETWORK

to get the Arduino on the global network you must perform a port forwarding in the modem.

Example

Ip address of the modem where Arduino is connected: 091.250.356.028

Arduino Forwarded ip-adress: 192.168.1.105 Port: 8888

Simulator program at home input IP/port: 091.250.356.028 Port: 8888

For Arduino side: search your own ip-address, you can do this as follow:

https://whatismyipaddress.com (ex. 091.250.356.028) or take a look in your modem setup 192.168.1.1

With port forwarding you can open a port in your modem for connect with the Arduino.
Example

TCP port: 8888

forwarded port: 192.168.1.105

In the simulator write the Arduino worldwide IP address with port number + click confirm.

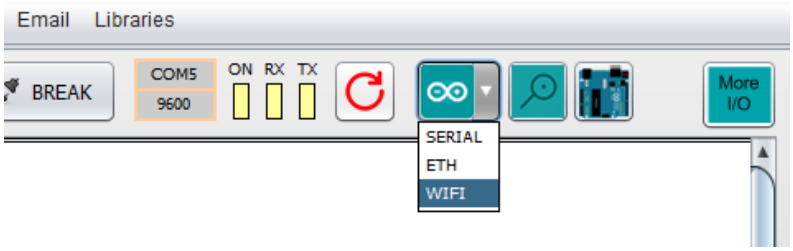
The Arduino code is as follow:

```
int portname = 8888;                    // Insert server portname
byte ip[] = { 192, 168, 1, 105 };       // Insert Arduino server ip address
byte gateway[] = { 192, 168, 1, 1 };    // internet access via router
byte subnet[] = { 255, 255, 255, 0 };   // subnet mask
```

The full Arduino code can be found under Arduino UNO Serial, TCP ETH, or TCP WIFI Programming code:

WIRELESS CONNECTION WITH ARDUINO WIFI

Make a wireless connection on your network with the Arduino WIFI. As a result, the Arduino TCP ethernet sketch and library will not work. Therefor we have made some examples that work with the WIFI network library.



Arduino TCP with ethernet connection code with forwarded port 192.168.1.105:8888

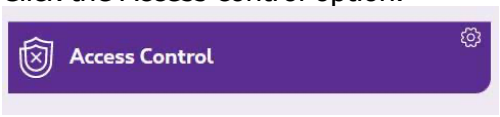
```
//********************************** code for SimulatorTCP **********************************
#include <SPI.h>                                    // Library for ethernet
#include <WiFi.h>

char ssid[] = "network-name";                        // Network name to connect to
char pass[] = "network password";                    // Network password
int keyIndex = 0;

int status = WL_IDLE_STATUS;
WiFiServer server(80);

#include "SimulatorTCPWIFIprogram.h"                // ArduinoSimulatorTCP library
//********************************** end code SimulatorTCP  **********************************
```

PORT FORWARD ON MODEM B-BOX3

Port opening or forwarding (NAT) is sometimes requested by certain software and peripherals such as video games consoles (Nintendo, PlayStation, Microsoft Xbox, etc.), home automation equipment, etc.

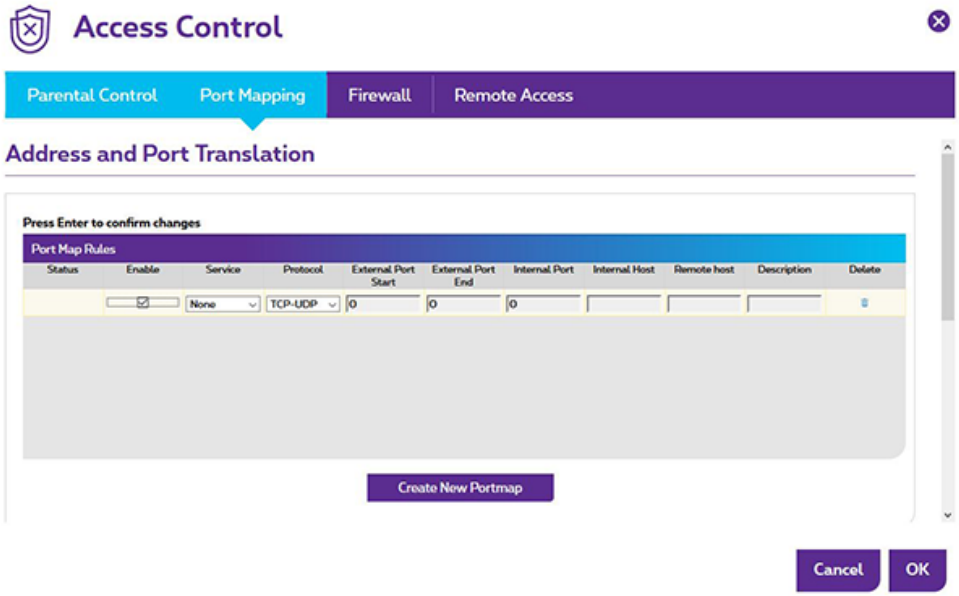
Log in to your modem at home through the address 192.168.1.1
Identify yourself on the modem with the user password provided (located under or on the rear of the modem.

Click the Access control option.



Select the Port mapping tab.
Click the Create new portmap button.
Select the required protocol (TCP for example) and enter the desired port number.

Enter the IP address of the peripheral that requires port forwarding.
Click OK to save the settings.

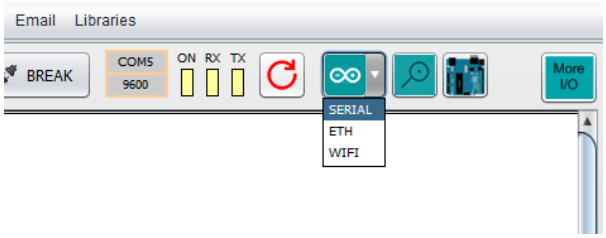


ARDUINO SIMULATOR SKETCH

Open a new Arduino IO Simulator sketch (this sketch can't be saved, save it with 'save as…' or you choose the Simulator UNO-program (.ino)

To open an empty ethernet or WIFI sketch choose the WIFI or ETH in the dropdown menu. The library is also available to add it I case you don't have it. The sketches are under:

C:\Program Files (x86)\ArduinoSimulator\ArduinoSketches…



- Start the 'Arduino IDE' application

You can set your own code into the Arduino, if it's uploaded in the Arduino, you can test it with the Simulator by connecting the simulator after uploading.

- Uploading of a new program to the Arduino UNO
- Start the Arduino IDE
- Open the sketch
- Connect the Arduino UNO board with the computer:

- Select board 'Arduino UNO'
- Select the Serial port (COM…)
- Upload the program into the Arduino UNO

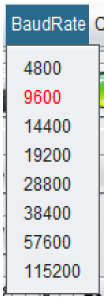
Attention: The BaudRate on the simulator is default set on 9600.

Make sure you disconnect the simulator before uploading the Arduino code.

CONFIGURE THE SERIAL PORT

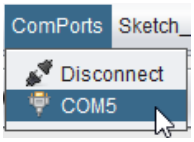
Set the BaudRate

The BaudRate is set to 9600 by default or change the BaudRate in the Arduino code and in the Simulator as desired.



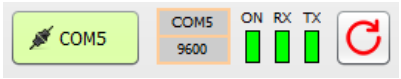
Set the Com port

The Simulator automatically detects the Com port of the Arduino. You have to click on the Com port to start the connection.



Before the selection

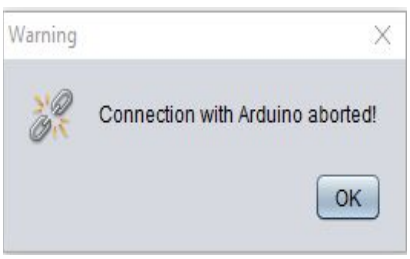
After the selection



Attention:

You get an error message if you want to connect to a pin that is already in use.

If you cut the USB connection to the Arduino board, you get a warning.

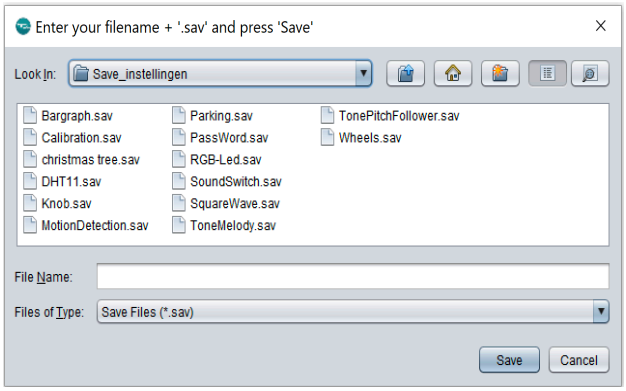


SAVE AND RESTORE OF SETTINGS

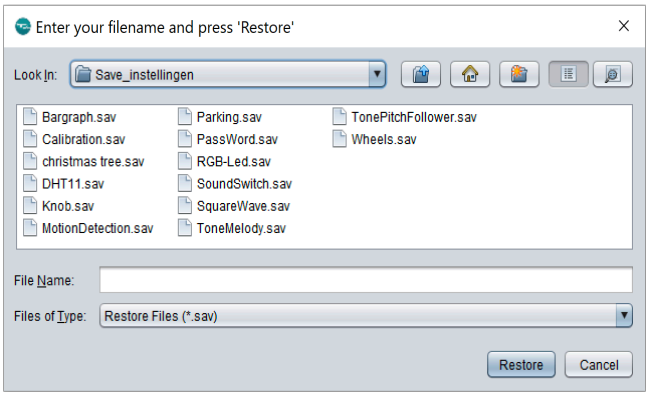
With 'Save' you can save your selected I/O, dictated texts and drawings.
the 'Restore' button restores the settings to make it easy to use.

We can save the filename of the extension with *.sav or *.txt.
You find the 'Save and Restore' function under 'File'.

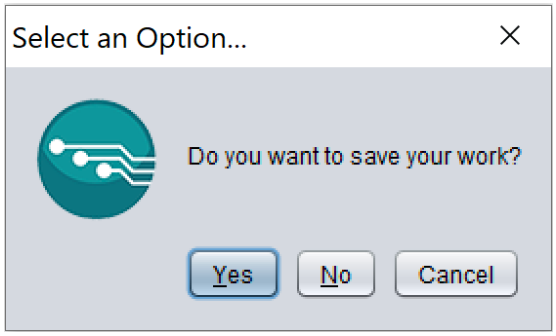
Save



Restore



Before closing the simulator, you will be asked if you want to save your work.



SERIAL MONITOR

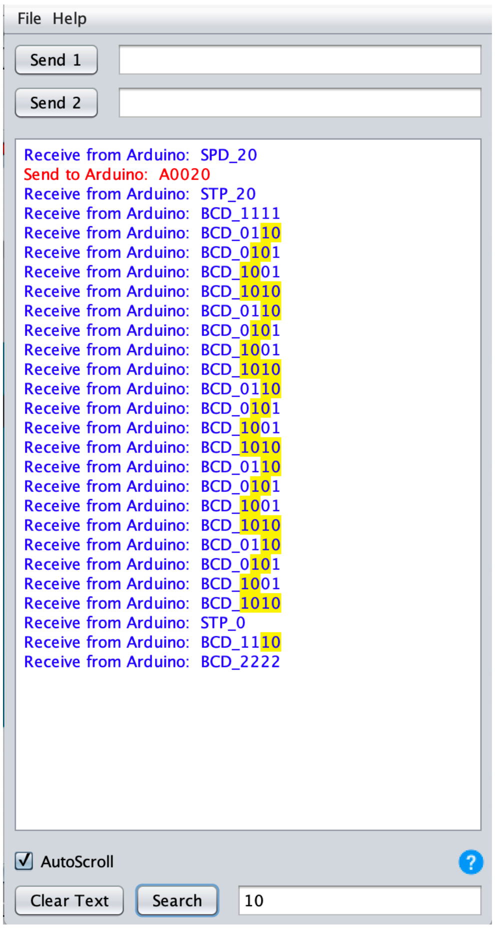
In the simulator, it's now also possible to view the serial data. There are 2 buttons that you can use to send a signal to the Arduino. The monitor shows you a 'Receive from Arduino' line when the Arduino sends data to the simulator and a 'Send to Arduino' line will be shown when you send something to the Arduino with the simulator.

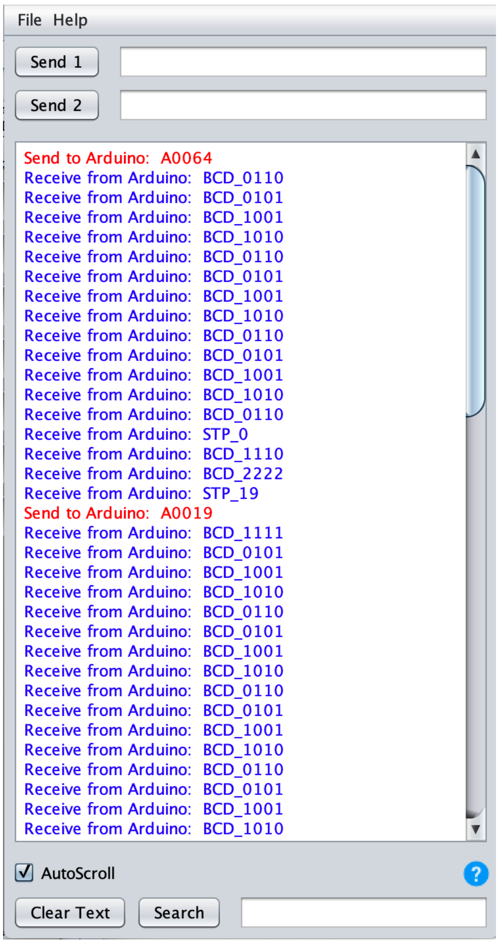
If you want to save the serial monitor output, you can save the whole text or a selected area.

With the search function, it's possible to search for a specific word or character. if the word or character is found, it will be highlighted in yellow. By clicking on the blue question mark you get the explanation of all the simulator codes.

By using Serialprint(); in the Arduino IDE, you can send a serial message.

The serial message will start with 'txt_' in the serial monitor.





EMAIL LOGGER

You must have a Google account for this item.

If you don’t have a google account, then go to Google and make an account, this is for free

To create a Google account:

1. Go to www.**google**.com.
2. Click **Create** an **account**.
3. The signup form will appear.
4. Review **Google's** Terms of Service and Privacy Policy, click the checkbox, then click Next step.
5. The **Create** your profile page will appear.
6. Your **account** will be created, and the **Google** welcome page will appear.

How to make a google account: https://edu.gcfglobal.org/en/googleaccount/creating-a-google-account/1/

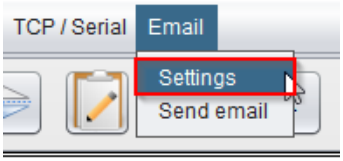
Important:

Gmail considers regular email programs and backup programs (i.e. Java Programs , Outlook, etc.) to be "less secure", so in order for them to get access into your account, your "**Allow less secure apps**" option must be turned on.

Turning on 'less secure apps' settings as mailbox user

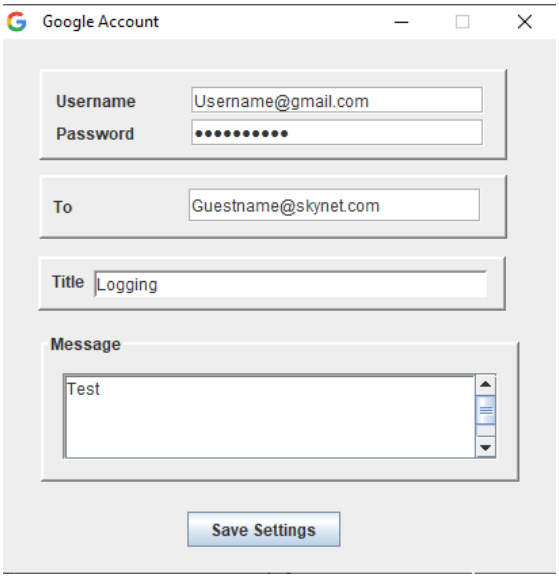
1. Go to your (Google Account).
2. On the left navigation panel, click Security.
3. On the bottom of the page, in the Less secure app access panel, click Turn on access.
   If you don't see this setting, your administrator might have turned off less secure app account access (check the instruction above).
4. Click the Save button.

Go to the settings in the simulator to setup the username and password for sending emails.

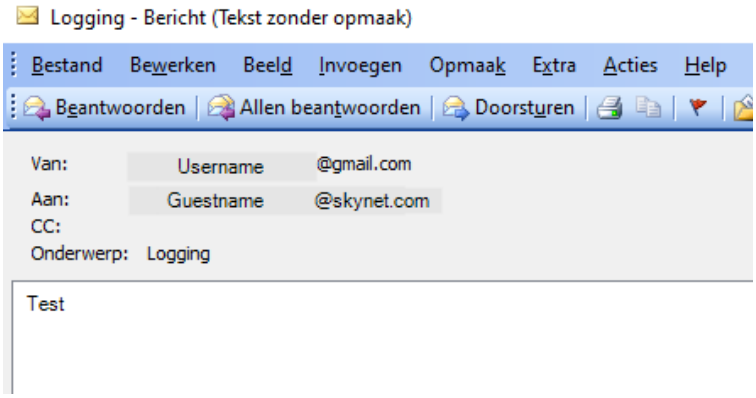


Enter your own google Username and password + Enter the guest's name to receive the mail.

You can enter a title and a message. After this you save the settings. Now you can send the email by pressing the "Send email" button.



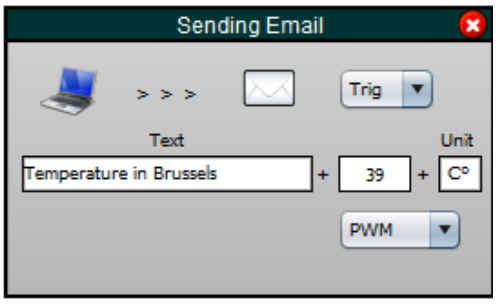
This message appears in the inbox mail from the guest:



THE EMAIL BOX

With the 'Trig' combobox you can select a trigger output in the range from D2 to D13. With the 'PWM' combobox you can select an output value in the range from 'pwm3 to pwm11. Enter a text and unit, for example Temperature … C°.

The field with the 39 in will show the value of the selected trigger output.



Example sketch 'Emailtest': send temperature to the Guestname@skynet.com when pressing the button.

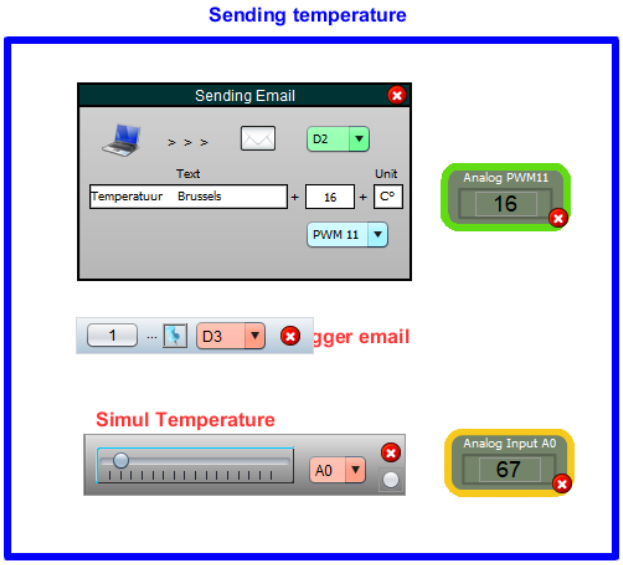
With the slider 'A0' you can simulate the temperature (Arduino receive the temp value).

Select output 'D2' for the trigger (Arduino triggers the output).

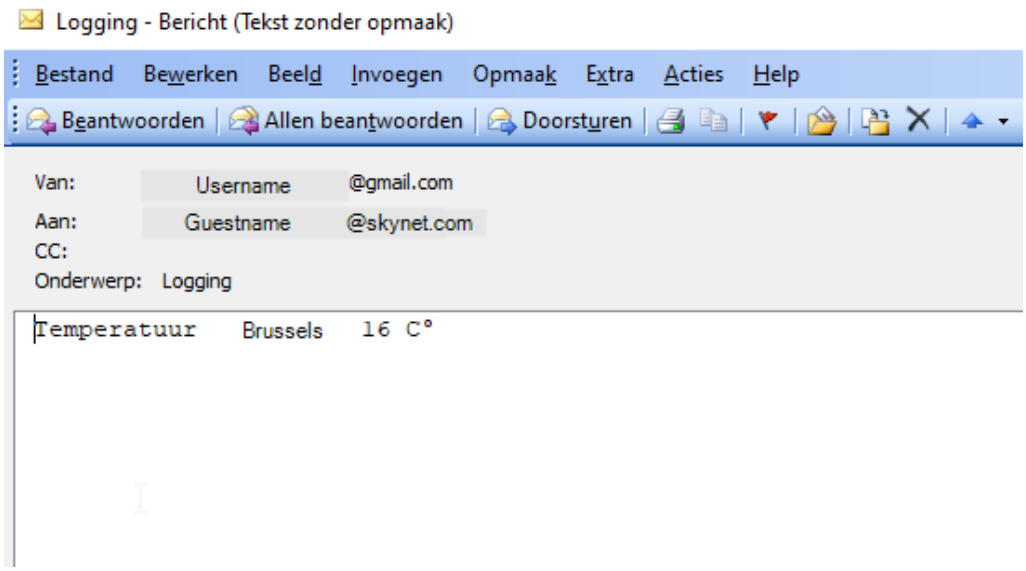
Select output 'PWM11' for sending temperature value (Arduino send it to the simulator).

Select input 'D3' for the button (Arduino receive commando)

By pressing the button, you will send an email to the guest's name (email address).

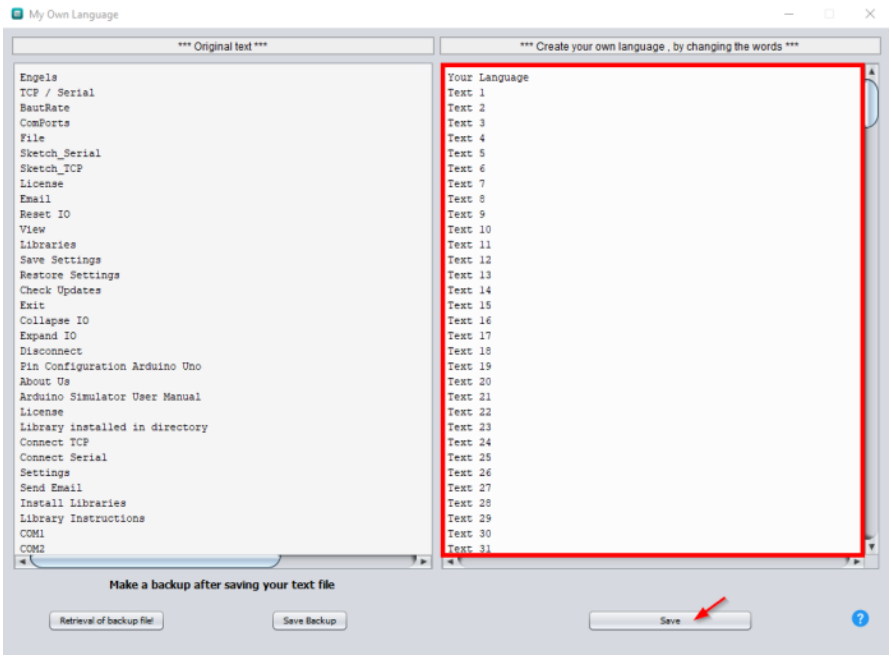


This message appears in the inbox from the guest:

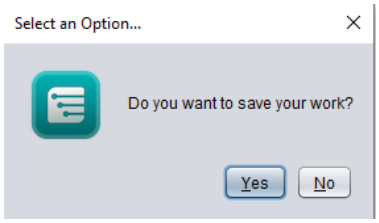


Create your own language

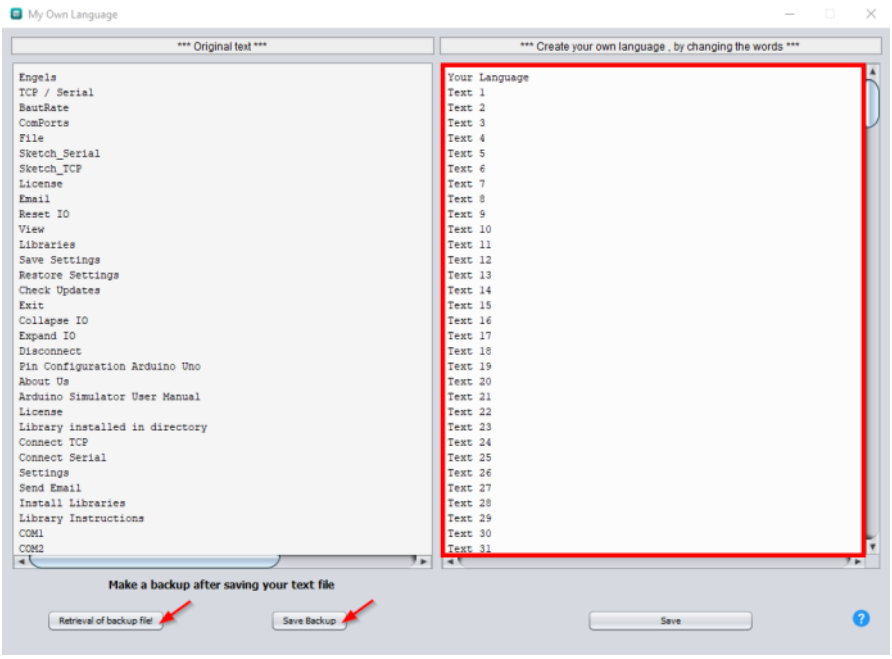
With this tool you can implement your own language in the simulation program, just replace the texts 'text 1 to text 299' with your own text.



Do not forget to save your text in between and at the end, when you exit the tool you will be asked to save your text again.



In order not to lose your own texts when a new version of the simulator is released, you can make a backup by pressing 'Save Backup', your own text file will then be written to the directory: C:\Users**YourUsername**\Documents\ArduinoUnoPar



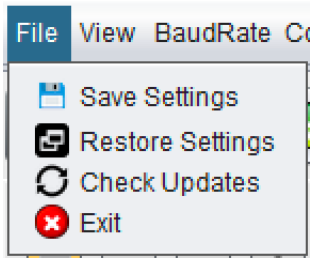
After installing the new simulator version, you can retrieve the backup file via 'Retrieval of Backup file'.

Select 'Language' from the main menu and click 'My own language', from now on all texts in the simulator program will be filled with your own texts.

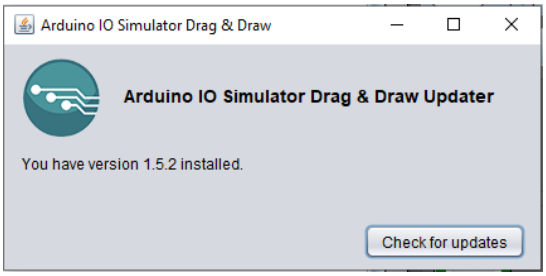
The program remembers the language choice on each new start.

CHECK FOR UPDATES

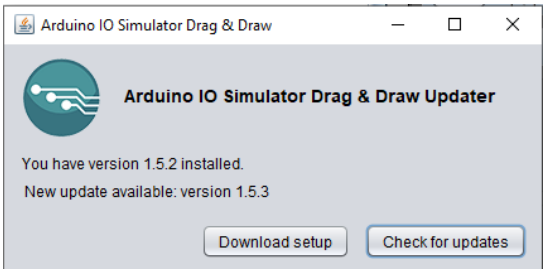
You can check if there are any updates available for the Arduino IO Simulator by clicking file –> Check Updates.



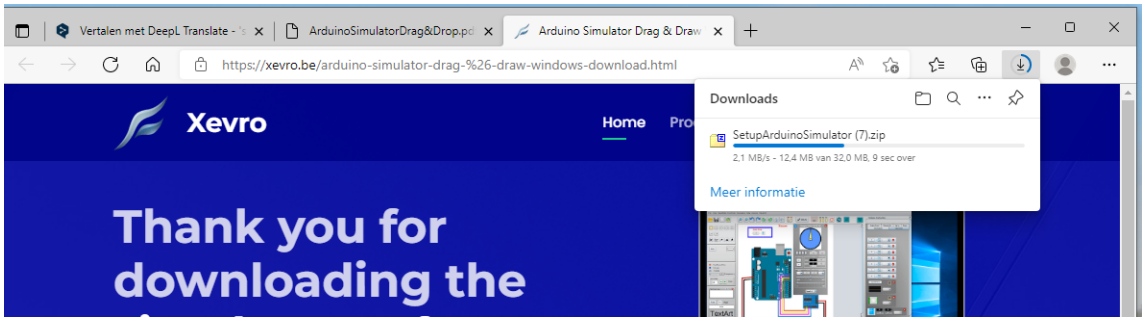
A window will appear indicating which version is installed, click on 'Check for Updates'.



If a new version is available, click on 'Download Setup'.



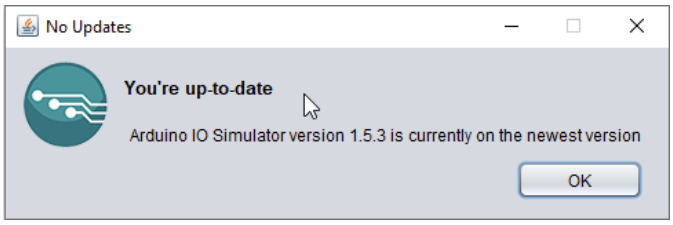
Xevro's website will open and automatically download the zip file to your hard drive.



- Remove the old version of the Arduino simulator from your computer and install the new version.

- Leave the old version and it will overwrite it with the new version of Arduino simulator.

If there is no new version available, the following window will appear:



SOURCES

[1] „Hall effect sensor,” Wikipedia, 21 July 2021. [Online]. Available: https://en.wikipedia.org/wiki/Hall_effect_sensor. [Geopend 2021].

[2] B. d. Bakker, „MAX7219 LED dot matrix display Arduino tutorial,” Makerguides, [Online]. Available: https://www.makerguides.com/max7219-led-dot-matrix-display-arduino-tutorial/. [Geopend 4 Augustus 2021].

[3] marco_c, „Parola A to Z – Sprite Text Effects,” Arduino plusplus, 19 April 2018. [Online]. Available: https://arduinoplusplus.wordpress.com/2018/04/19/parola-a-to-z-sprite-text-effects/. [Geopend 4 Augustus 2021].