ENGINE

Erasmus+

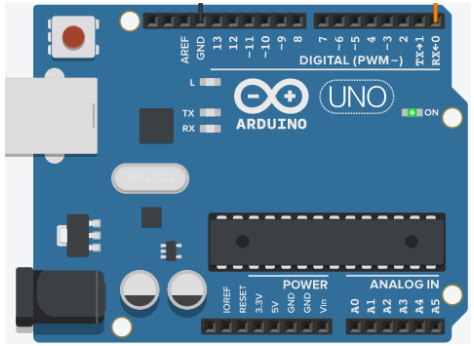
TEACHING ONLINE ELECTRONICS, MICROCONTROLLERS AND PROGRAMMING IN HIGHER EDUCATION

Module_1-4. LCD 16x2

Arduino Uno with Tinkercad

Contents

- Liquid crystal display (LCD) 16x2
- Programming functions for the Arduino Uno
- Example

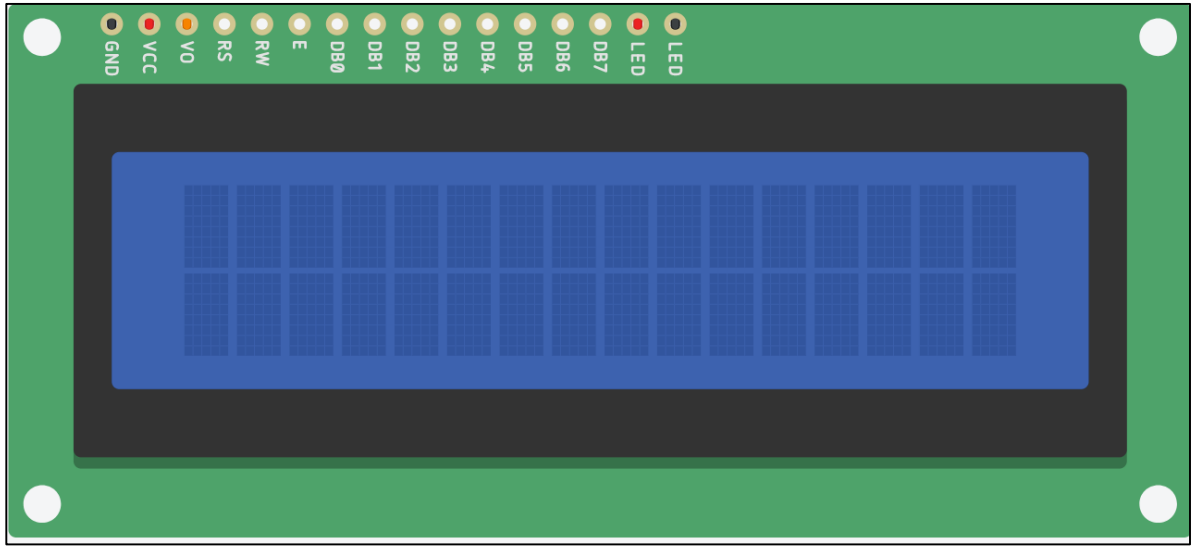


Module_1-4. LCD 16x2

Liquid crystal display

A liquid crystal display 16x2, consists of

- 16 columns
- 2 rows



LCD 16x2

These columns and rows form “rectangles” in which we can display a character

1. https://www.elprocus.com/lcd-16x2-pin-configuration-and-its-working/

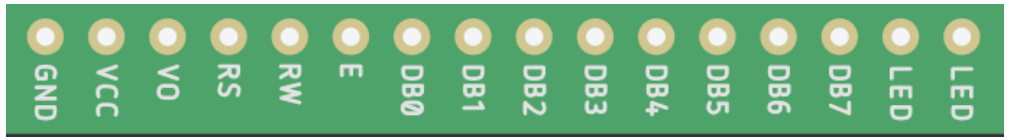
Module_1-4. LCD 16x2

Liquid crystal display

A liquid crystal display16x2, has 16 pins

Pin	Name	Function
1	Gnd	Source
2	Vcc	Source
3	V0 (contrast)	Control
4	RS (register select)	Control
5	RW (read/write)	Control
6	E (enable)	Control
7	DB0	Data
8	DB1	Data

Pin	Name	Function
9	DB2	Data
10	DB3	Data
11	DB4	Data
12	DB5	Data
13	DB6	Data
14	DB7	Data
15	LED+	Backlight Anode
16	LED-	Backlight Cathode



Pinout of LCD 16x2

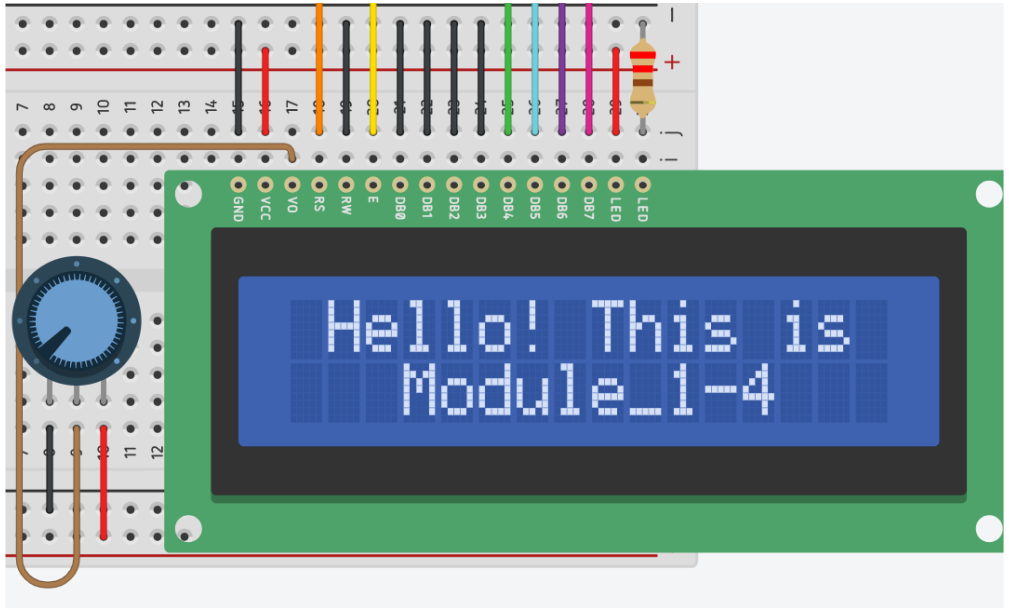
Module_1-4. LCD 16x2

Liquid crystal display

LCD interface with 4 data pins

Pin	Connection
1	Gnd
2	Vcc
3	Potentiometer
4	Arduino
5	Gnd
6	Arduino
7	Gnd
8	Gnd

Pin	Connection
9	Gnd
10	Gnd
11	Arduino
12	Arduino
13	Arduino
14	Arduino
15	Vcc
16	Gnd



LCD connections

The current in the backlight must be limited by means of a resistor

Functions that can be used on the Arduino Uno as we have seen:

- pinMode(pin, value), delay(value)
- digitalRead(pin), digitalWrite(pin, value)
- analogWrite(pin, value), analogRead(pin)
- Serial.begin(value), Serial.print(), Serial.available()

1. https://www.arduino.cc/reference/en/

New functions:

- millis(): returns the number of milliseconds since the Arduino Uno started operating
- lcd.begin(cols, rows): determines how many columns / rows the LCD will use. The count starts at 0, not 1
- lcd.print(): prints text on the LCD
- lcd.noDisplay(): hides the LCD text without deleting it
- lcd.display(): reappears LCD text - used after lcd.noDisplay()
- lcd.setCursor(col,row): places the cursor at a specific point to write text there

1. https://www.arduino.cc/reference/en/language/functions/time/millis/
2. https://www.arduino.cc/en/Reference/LiquidCrystal

LiquidCrystal lcd(rs, enable, d4, d5, d6, d7): the Arduino pins that will drive the LCD are declared

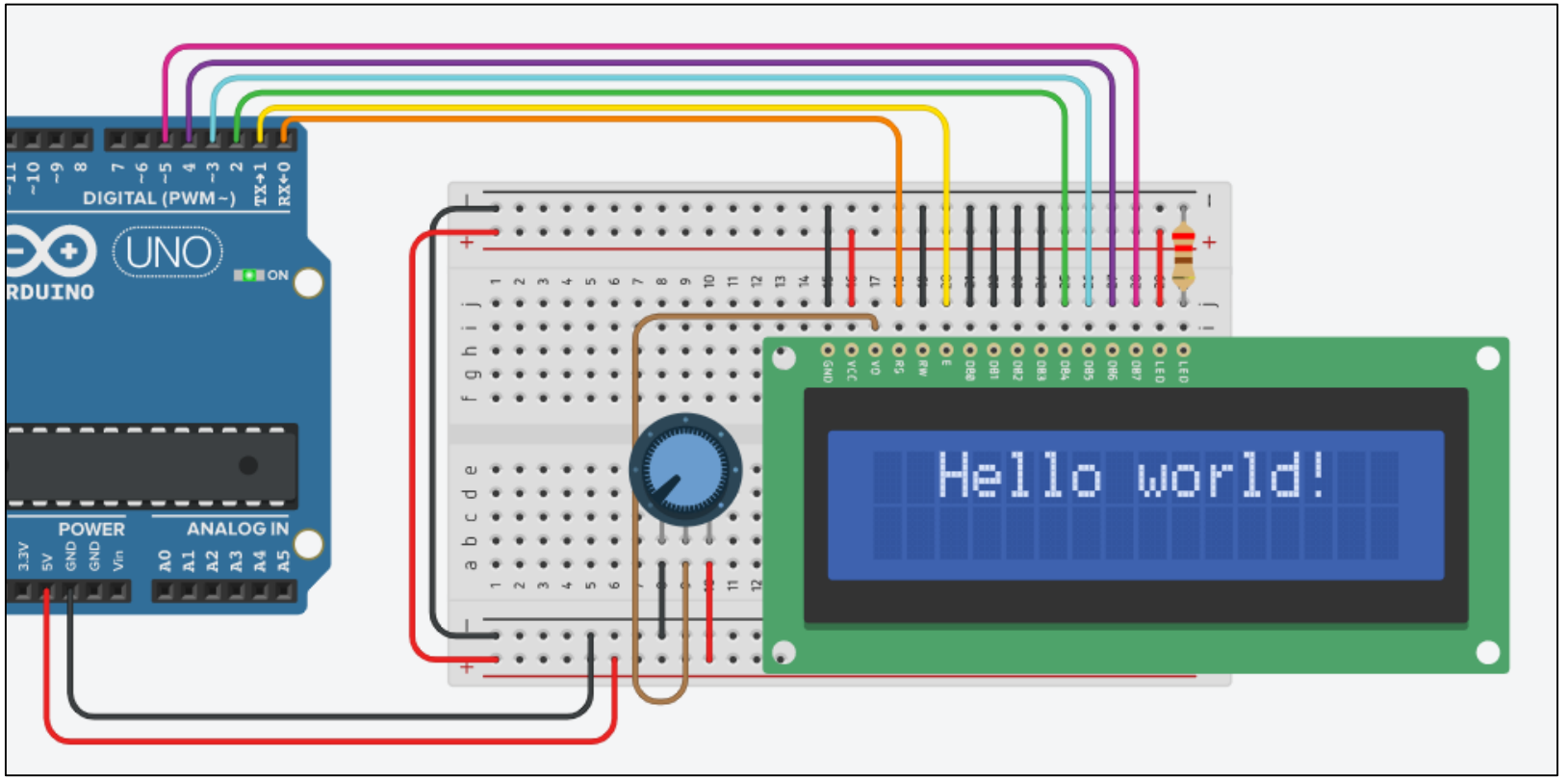
```
//include the library
#include <LiquidCrystal.h>

#define RS 0          //give the name "RS_pin" to PIN_0
#define EN 1          //give the name "EN_pin" to PIN_1
#define DB4 2         //give the name "DB4_pin" to PIN_2
#define DB5 3         //give the name "DB5_pin" to PIN_3
#define DB6 4         //give the name "DB6_pin" to PIN_4
#define DB7 5         //give the name "DB7_pin" to PIN_5

//configure the library with Arduino Uno - LCD interface
LiquidCrystal lcd(RS, EN, DB4, DB5, DB6, DB7);
```

1. https://www.arduino.cc/en/Reference/LiquidCrystalConstructor

Module_1-4. LCD 16x2

Example

The example uses a LCD 16x2 to display the message "Hello world!"



Circuit connections

Module_1-4. LCD 16x2

Example

The code:

```
/* Hello world!

Circuit Connections:
** LCD
        Ground          => Gnd
        Power                   => Vcc
        Contrast        => Potentiometer
        RS                      => PIN_0
        RW                      => Gnd
        E                       => PIN_1
        DB0                     => Gnd
        DB1                     => Gnd
        DB2                     => Gnd
        DB3                     => Gnd
        DB4                     => PIN_2
        DB5                     => PIN_3
        DB6                     => PIN_4
        DB7                     => PIN_5
        LED Anode       => Vcc
        LED Cathode     => Resistor 220Ω => Gnd
** Potentiometer
        Terminal 1      => Gnd
        Wiper                   => LCD_Contrast
        Terminal 2      => Vcc
*/
```

```
//include the library
#include <LiquidCrystal.h>

#define RS 0            //give the name "RS_pin" to PIN_0
#define EN 1            //give the name "EN_pin" to PIN_1
#define DB4 2           //give the name "DB4_pin" to PIN_2
#define DB5 3           //give the name "DB5_pin" to PIN_3
#define DB6 4           //give the name "DB6_pin" to PIN_4
#define DB7 5           //give the name "DB7_pin" to PIN_5

//configure the library with Arduino Uno - LCD interface
LiquidCrystal lcd(RS, EN, DB4, DB5, DB6, DB7);

//The setup() function initializes and sets the initial values
//It will only run once after each power up or reset
void setup() {
  //configure the LCD's columns and rows
  lcd.begin(16, 2);
  //print a message
  lcd.print("  Hello world!");
}

//loops consecutively
void loop() {
  ; //do nothing
}
```

ENGINE Partnership

- Warsaw University of Technology (PL) - *coordinator*
- IHU - International Hellenic University (GR)
- EDUMOTIVA - European Lab for Educational Technology (GR)
- University of Padova (IT)
- University of Applied Sciences in Tarnow (PL)

ENGINE ERASMUS+ 2020-1-PL01-KA226-HE-095653

CONTACT:

www.engined.eu

angelika.tefelska@pw.edu.pl

@projectENGINE1

@EUprojectEngine

Erasmus+

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.