# I2C LCD2004

From Wiki

I2C LCD2004

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# Introduction


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As we all know, though LCD and some other displays greatly enrich the man-machine interaction, they share a common weakness. When they are connected to a controller, multiple IOs will be occupied of the controller which has no so many outer ports. Also it restricts other functions of the controller. Therefore, LCD2004 with an I2C bus is developed to solve the problem.
I2C bus is a type of serial bus invented by PHLIPS. It is a high performance serial bus which has bus ruling and high or low speed device synchronization function required by multiple host system. I2C bus has only two bidirectional signal lines, Serial Data Line (SDA) and Serial Clock Line (SCL). The blue potentiometer on the I2C LCD2004 is used to adjust backlight to make it easier to display on the I2C LCD2004.

# Test Experiment

## Components

- 1 *SunFounder Mars board
- 1 * I2C LCD2004 module
- 1 * USB cable
- Several jump wires

## Experimental Principle

In this experiment, we will let I2C LCD2004 display 4 lines characters by programming.
I²C (Inter-Integrated Circuit), pronounced I-squared-C, is a multi-master, multi-slave, single-ended, serial computer bus invented by Philips Semiconductor (now NXP Semiconductors). It is typically used for attaching lower-speed peripheral ICs to processors and microcontrollers. Alternatively I²C is spelled I2C (pronounced I-two-C) or IIC (pronounced I-I-C).
I²C uses only two bidirectional open-drain lines, Serial Data Line (SDA) and Serial Clock Line (SCL), pulled up with resistors. Typical voltages used are +5 V or +3.3 V although systems I²C (Inter-Integrated Circuit), pronounced I-squared-C, is a multi-master, multi-slave, single-ended, serial computer bus invented by Philips Semiconductor (now NXP Semiconductors). It is typically used for attaching lower-speed peripheral ICs to processors and microcontrollers. Alternatively I²C is spelled I2C (pronounced I-two-C) or IIC (pronounced I-I-C).
I²C uses only two bidirectional open-drain lines, Serial Data Line (SDA) and Serial Clock Line (SCL), pulled up with resistors. Typical voltages used are +5 V or +3.3 V although systems with other voltages are permitted.
For more information about I2C operation principle, please visit I²C (https://en.wikipedia.org/wiki/I²C).

# Experimental Procedures

## Step 1: Connect the circuit

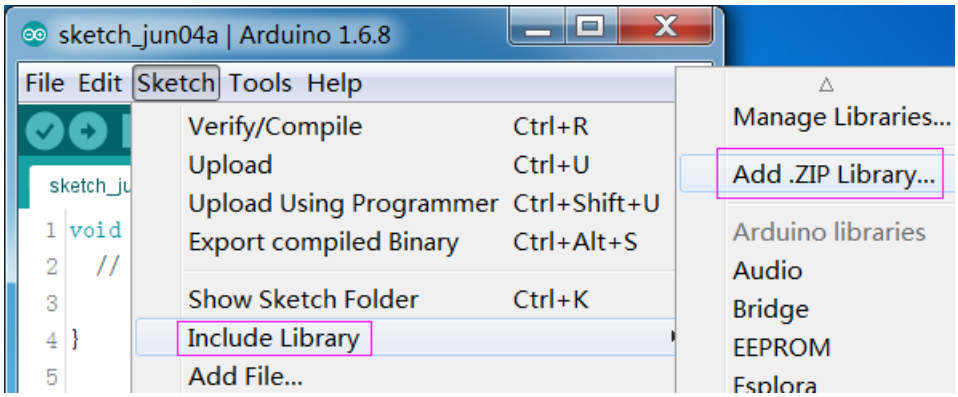
See the following table for connection between the I2C LCD2004 and the SunFounder Uno board:

| I2C LCD2004 | SunFounder Mars board |
|---|---|
| GND | GND |
| VCC | 5V |
| SDA | A4 /pin 20 mega2560 |
| SCL | A5 /pin 21 mega2560 |

## Step 2:Add library

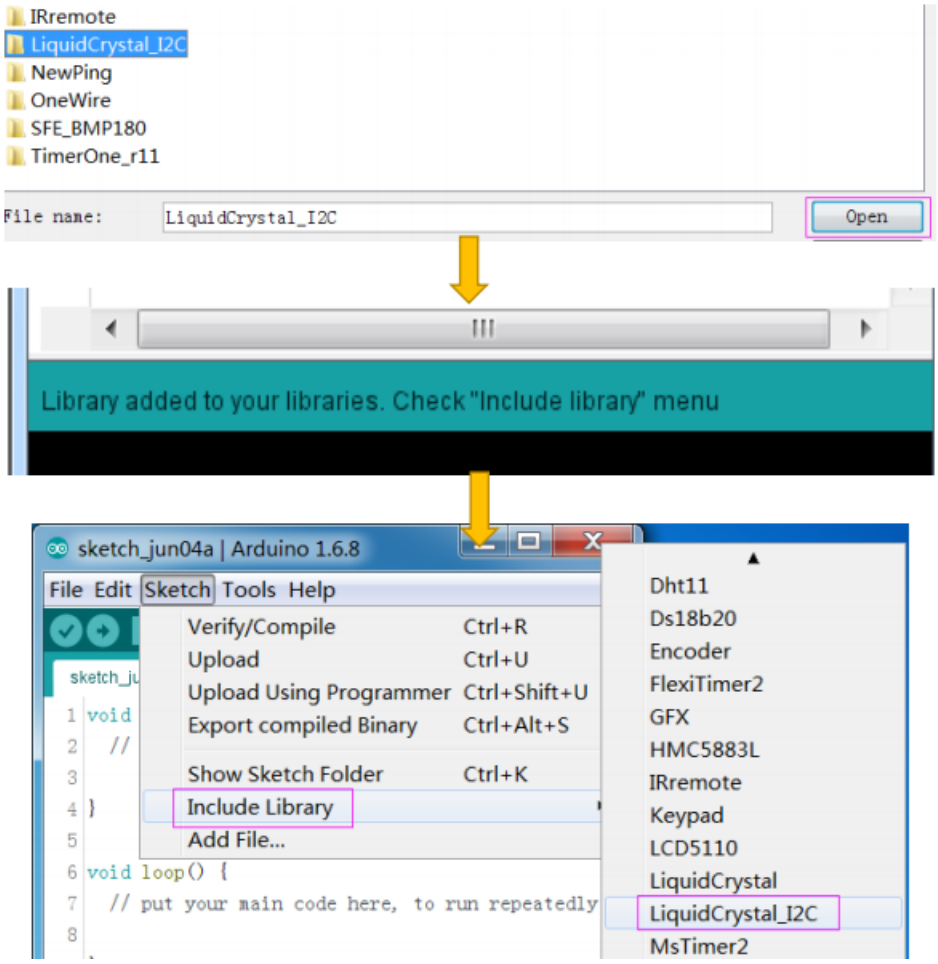
Before you upload the code to the control board,you neeed to add the LiquidCrystal_I2C library.
1) Download the **LiquidCrystal_I2C library** (http://wiki.sunfounder.cc/images/7/7e/LiquidCrystal_I2C.zip)

2) Open the Arduino IDE,Select Sketch -> Include Library -> Add ZIP Library




3) Find the file LiquidCrystal_I2C which you just download. Click it open and then you'll be prompted by "Library added to your libraries. Check 'Import libraries'". You also can see the libraries just imported have appeared on the list by Sketch->Include Library-

>LiquidCrystal_I2C.




## Step 3: Copy the code

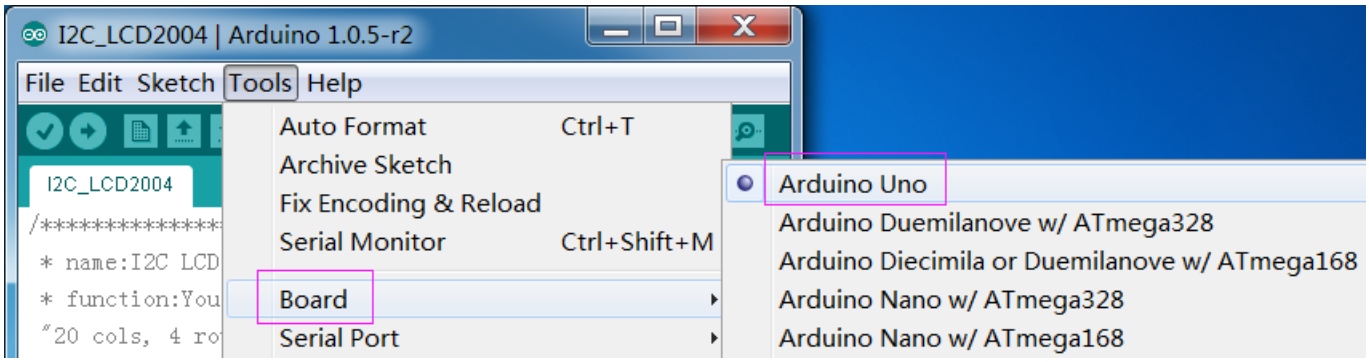
Copy the follwing code to the Arduino IDE

```
/**************************************
 * name: I2C LCD2004
 * function: You should now see your I2C LCD2004 display "Hello,world!","IIC/I2C LCD2004"
 * "20 cols, 4 rows","www.sunfounder.com"
 *********************************/
//Email:service@sunfounder.com
//Website:www.sunfounder.com

/*********************************/
// include the library code
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,20,4);  // set the LCD address to 0x27 for a 16 chars and 2 line display
/*****************************************************/
void setup()
{
  lcd.init();  //initialize the lcd
  lcd.backlight();  //open the backlight


  lcd.setCursor ( 0, 0 );            // go to the top left corner
  lcd.print("    Hello,world!    "); // write this string on the top row
  lcd.setCursor ( 0, 1 );            // go to the 2nd row
  lcd.print("   IIC/I2C LCD2004  "); // pad string with spaces for centering
  lcd.setCursor ( 0, 2 );            // go to the third row
  lcd.print("  20 cols, 4 rows   "); // pad with spaces for centering
  lcd.setCursor ( 0, 3 );            // go to the fourth row
  lcd.print(" www.sunfounder.com ");
}
/*****************************************************/
void loop()
{

}
/*****************************************************/
```

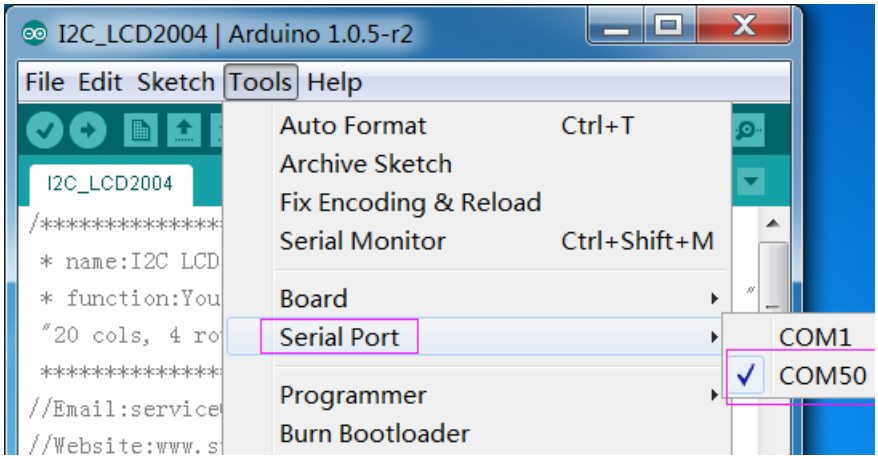
### Step 4: Upload the code

Before upload the code ,you need to select correct Board and Port,please follow the steps:

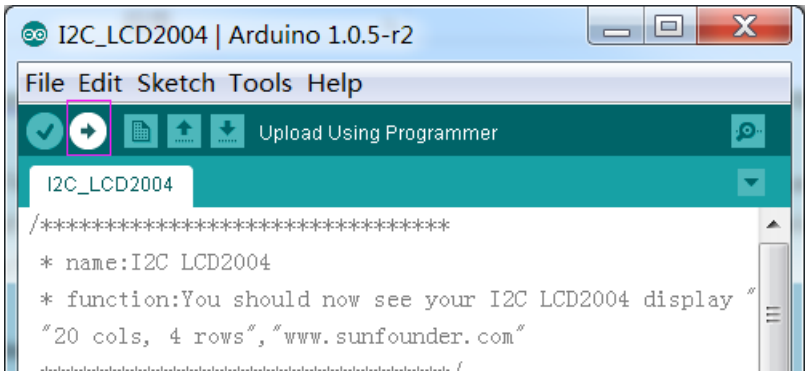
1) Click Tools ->Board and select Arduino/Genuino Uno.




2) Then select Tools ->Port.



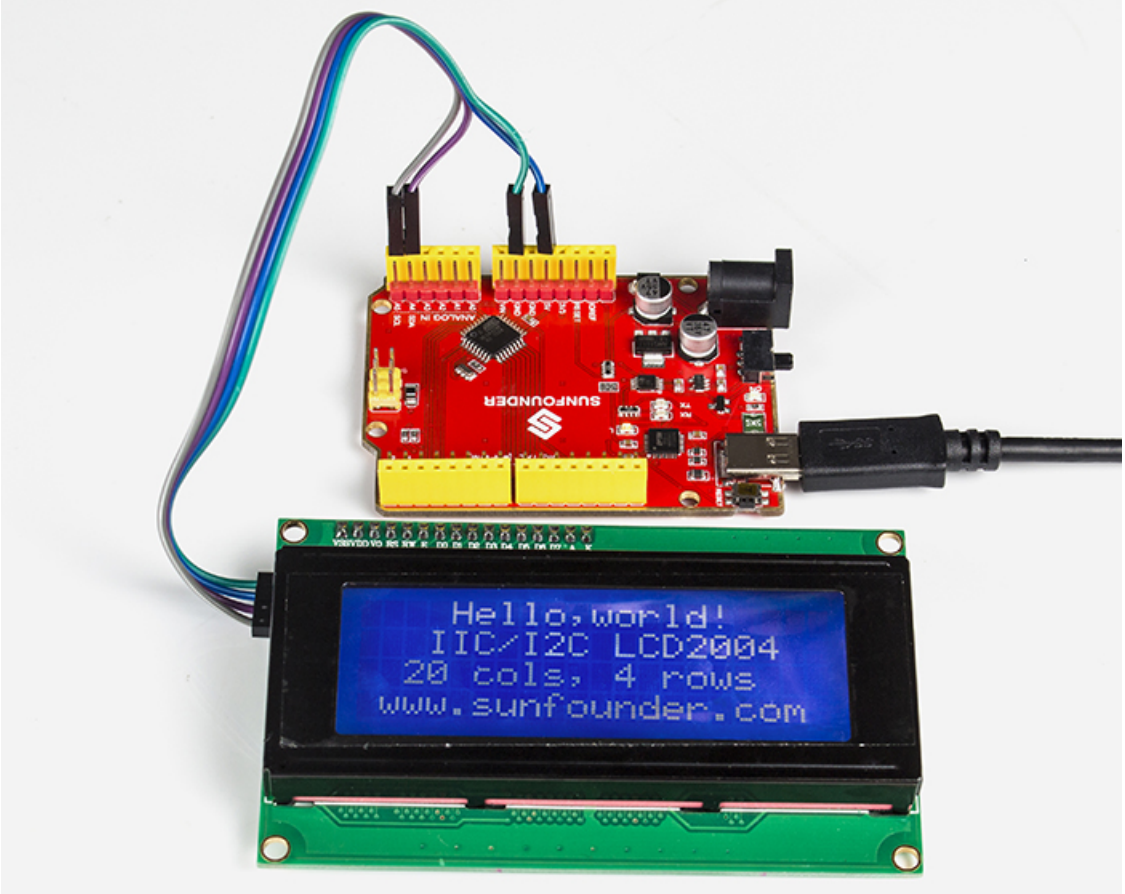

3) Click to the upload icon to upload the code to the control board




If "Done uploading" appears at the bottom of the window, it means the sketch has been successfully uploaded.

## experimental phenomenon

```
You should now see your I2C LCD1602 display the flowing characters "Hello,world!","IIC/I2C LCD2004", "20 cols, 4 rows" and "www.sunfounder.com"
```




## Read I2C Address

If everything is correct,But the display just shows 16 black rectangles on Line 1.it may be the address of i2c is not 0x27,therfore you need to run the following code to read the address,then modify the 0x27 to which you read.

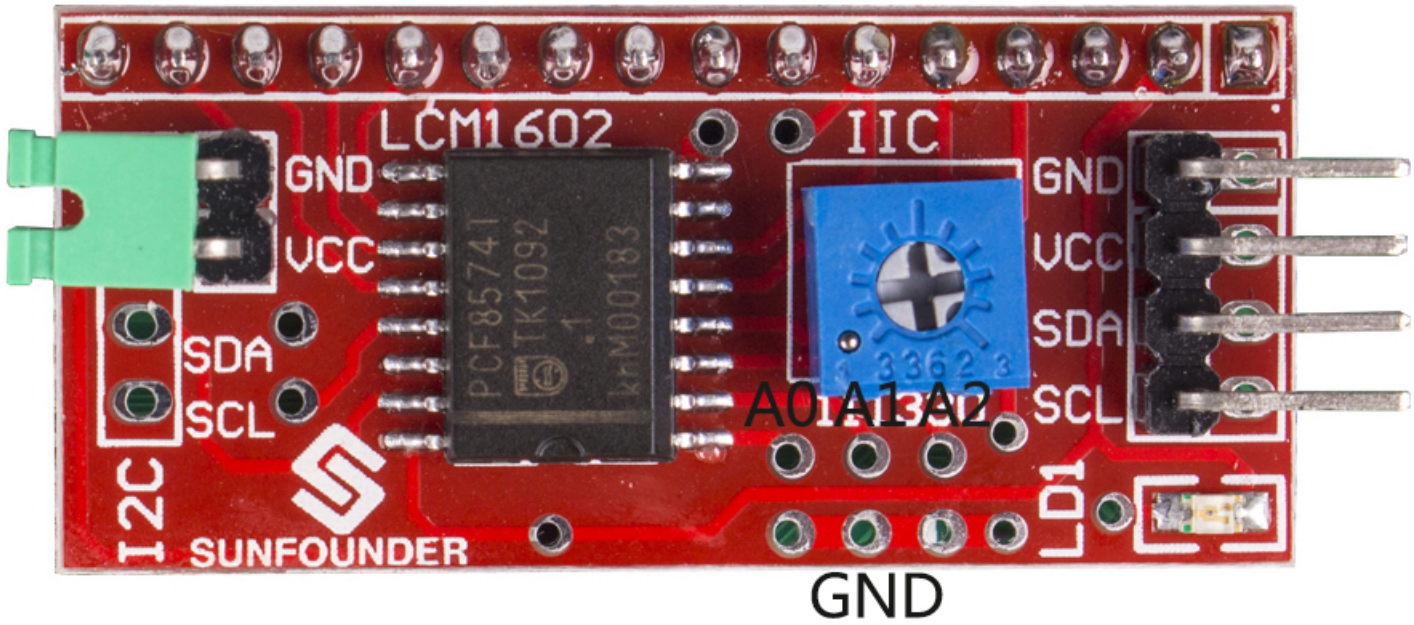
```
LiquidCrystal_I2C lcd(0x27,16,2);
```

```
/*********************************************************
 * name:I2C_Address
 * function:read the address of the I2C lcd1602
 * Connection:
 * I2C                 UNO
 * GND                 GND
 * VCC                  5V
 * SDA                  A4(pin20 in mega2560)
 * SCL                  A5(pin21 in mega2560)
 *********************************************************/

#include <Wire.h>

void setup()
{
  Wire.begin();
  Serial.begin(9600);
  Serial.println("\nI2C Scanner");
}
void loop()
{
  byte error, address;
  int nDevices;
  Serial.println("Scanning...");
  nDevices = 0;
  for(address = 1; address < 127; address++ )
  {
    // The i2c_scanner uses the return value of
    // the Write.endTransmisstion to see if
    // a device did acknowledge to the address.
    Wire.beginTransmission(address);
    error = Wire.endTransmission();
    if (error == 0)
    {
      Serial.print("I2C device found at address 0x");
      if (address<16)
        Serial.print("0");
```

```
      Serial.print(address,HEX);
      Serial.println(" !");
      nDevices++;
    }
    else if (error==4)
    {
      Serial.print("Unknow error at address 0x");
      if (address<16)
        Serial.print("0");
      Serial.println(address,HEX);
    }
  }
  if (nDevices == 0)
    Serial.println("No I2C devices found\n");
  else
    Serial.println("done\n");
  delay(5000); // wait 5 seconds for next scan
}
```

## Change I2C Address

When a conflict happens on the I2C address, you can change the I2C address by setting the A0, A1, A2 pins to 1 or 0 on the PCF8574 chip. There is a red module on the back of the I2C LCD, the main chip is PCF8574 or PCF8574T, pin A0, A1, A2 has been extended, as shown below.




For PCF8574T chip, I2C address format: 0 0 1 0 0 A2 A1 A0. The default address is: 0x27
For PCF8574 chip, I2C address format: 0 0 1 1 1 A2 A1 A0. The default address is: 0x3F
If you want to modify the default address, just need connect pinA0, A1, A2 to GND respectively.
For PCF8574T chip, I2C address range: 0x20-0x27
For PCF8574 chip, I2C address range: 0x38-0x3F
If you are not sure, you can use the above code to scan the changed address.

## Resources

I2C_LCD2004 test code (http://wiki.sunfounder.cc/images/5/56/I2C_LCD2004.zip)

PCF8574T_datasheet (http://wiki.sunfounder.cc/images/1/18/PCF8574T_datasheet.pdf)

LiquidCrystal_I2C library (http://wiki.sunfounder.cc/images/7/7e/LiquidCrystal_I2C.zip)