Mechatronics Design – Class#2

Liwei Lin

Professor, Dept. of Mechanical Engineering
Co-Director, Berkeley Sensor and Actuator Center
The University of California, Berkeley, CA94720
e-mail: lwlin@me.berkeley.edu
http://www.me.berkeley.edu/~lwlin

Outline

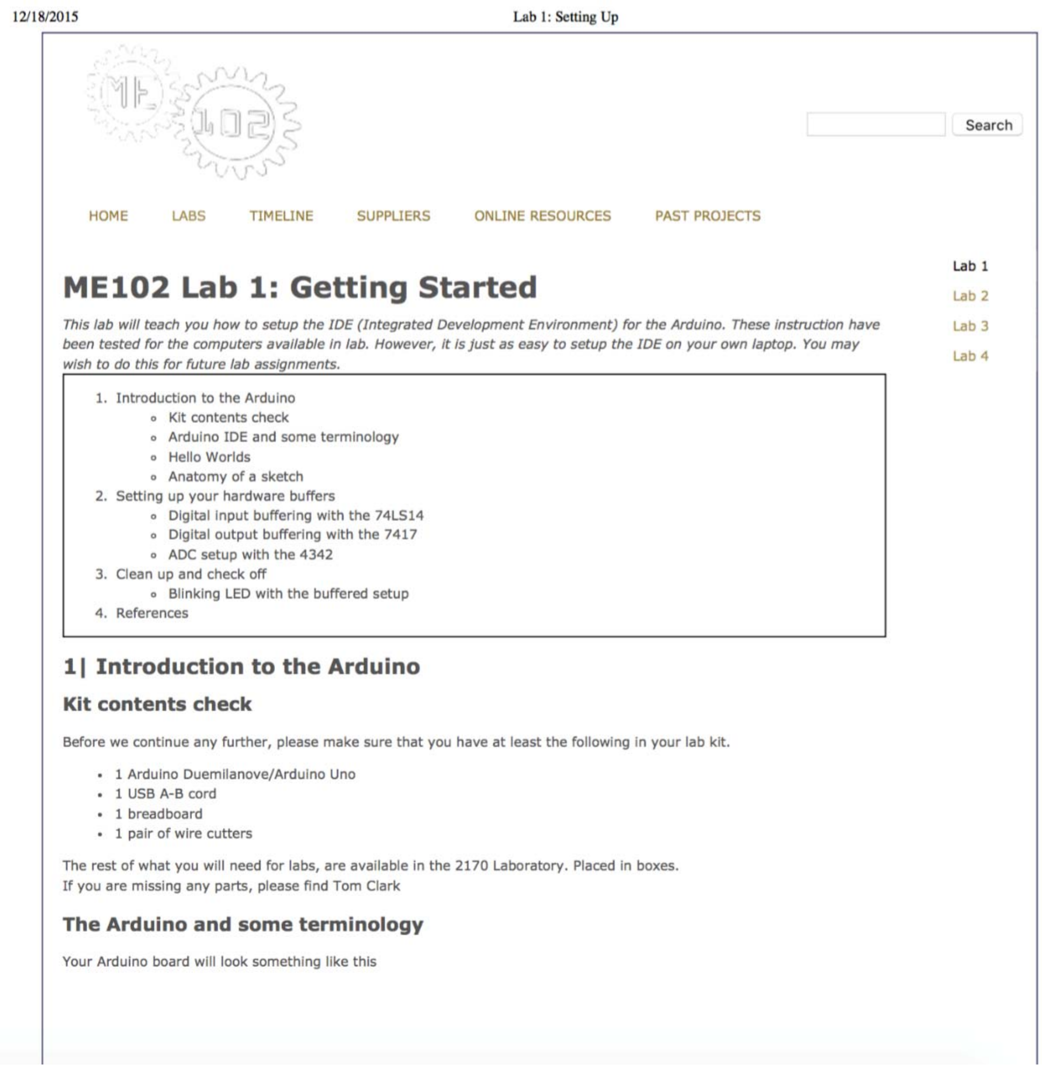
- Announcements
- Lab #1
- Project Team discussions

Lab #1

- Labs are online:
  - Professor Lin's website:
    http://www.me.berkeley.edu/~lwlin/me102B/2016fall.html
  - ME102 course website:
    http://courses.me.berkeley.edu/ME102B/labs.html

Lab #1

- ME102 course website:
- Datasheets here!


12/18/2015 Lab 1: Setting Up

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Lab 1
Lab 2
Lab 3
Lab 4

ME102 Lab 1: Getting Started

This lab will teach you how to setup the IDE (Integrated Development Environment) for the Arduino. These instruction have been tested for the computers available in lab. However, it is just as easy to setup the IDE on your own laptop. You may wish to do this for future lab assignments.

1. Introduction to the Arduino
   - Kit contents check
   - Arduino IDE and some terminology
   - Hello Worlds
   - Anatomy of a sketch
2. Setting up your hardware buffers
   - Digital input buffering with the 74LS14
   - Digital output buffering with the 7417
   - ADC setup with the 4342
3. Clean up and check off
   - Blinking LED with the buffered setup
4. References

1| Introduction to the Arduino

Kit contents check

Before we continue any further, please make sure that you have at least the following in your lab kit.

- 1 Arduino Duemilanove/Arduino Uno
- 1 USB A-B cord
- 1 breadboard
- 1 pair of wire cutters

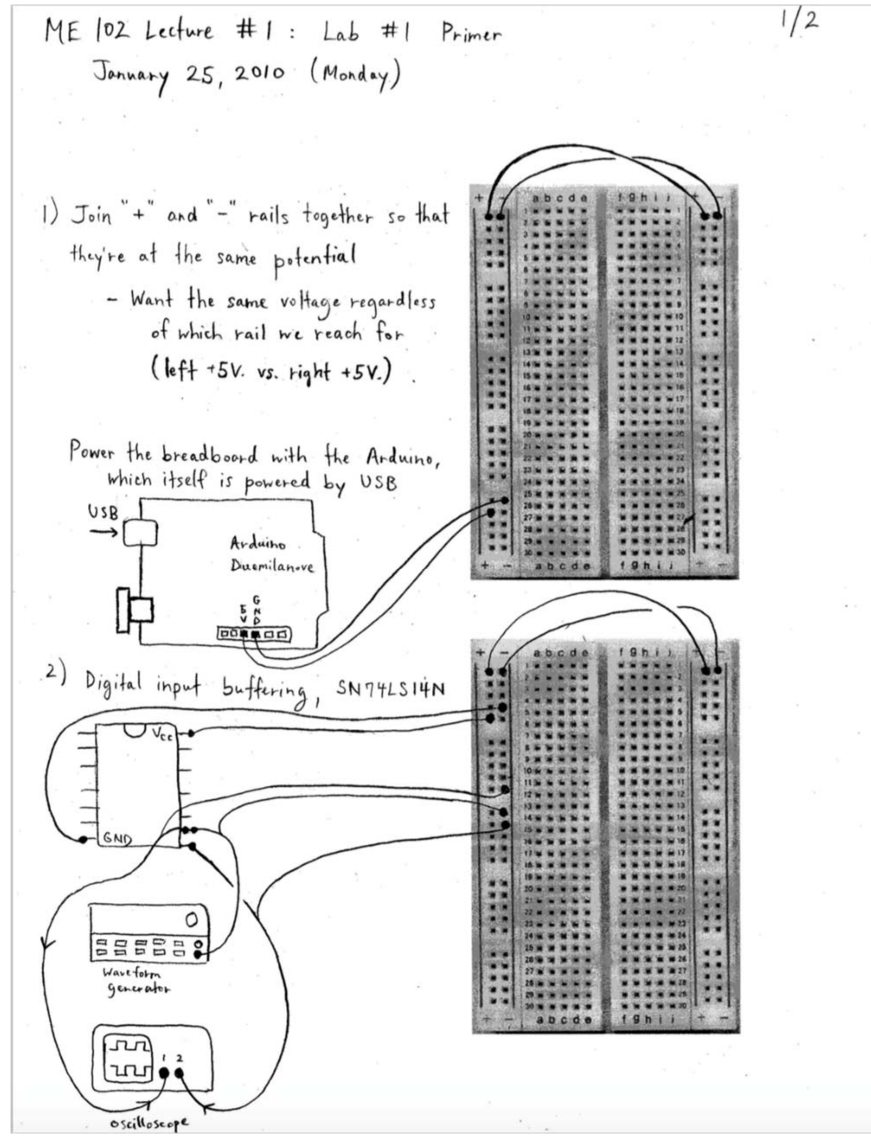
The rest of what you will need for labs, are available in the 2170 Laboratory. Placed in boxes.
If you are missing any parts, please find Tom Clark

The Arduino and some terminology

Your Arduino board will look something like this

Lab #1

- Professor Lin's website:



Lab #1

ME102 Lab 1: Getting Started

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Learn the Arduino interface

Lab #1

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Set up input and output buffers
Set up ADC voltage follower

Lab #1

ME102 Lab 1: Getting Started

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Test with blinking LED

Lab Kit

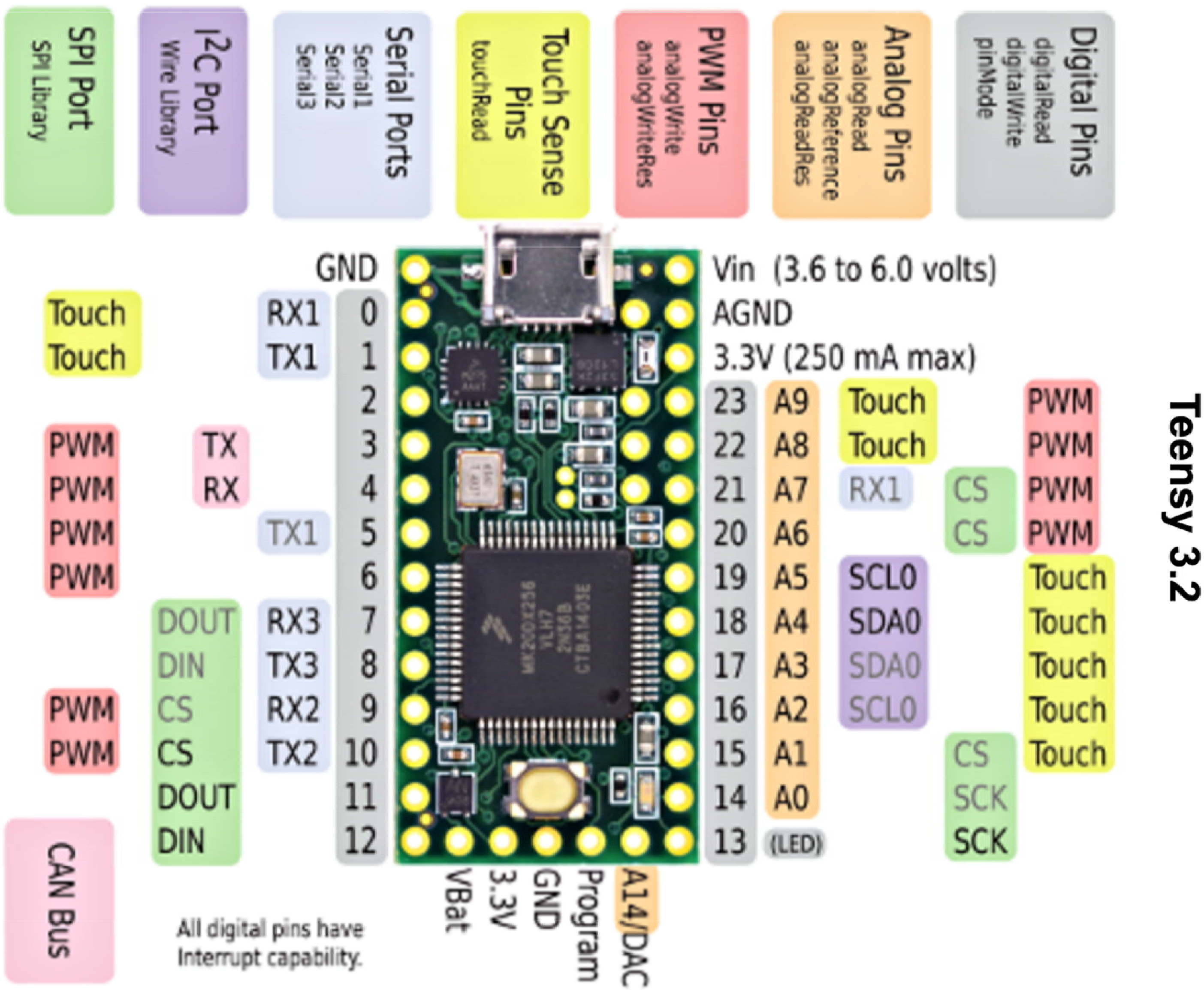
Kit contents check

Before we continue any further, please make sure that you have at least the following in your lab kit.

- 1 Arduino Duemilanove
- 1 USB A-B cord
- 1 breadboard
- 5 LED's of assorted colors
- 2 tactile switches
- 1 DC motor
- 1 tiny RC servo
- 1 potentiometer
- 1 optical encoder (datasheet)
- 1 pair of wire cutters
- 1 74LS14 (datasheet) Input buffer
- 1 DM7417 (datasheet) Output buffer
- 1 OPA4342(datasheet) or TLV2374I (datasheet) ADC voltage follower

If you have any problems identifying your parts, please notify a GSI
If you are missing any parts, please find Tom Clark

Arduino


SPI Port
SPI Library
I2C Port
Wire Library
Serial Ports
Serial1
Serial2
Serial3
Touch Sense Pins
touchRead
PWM Pins
analogWrite
analogWriteRes
Analog Pins
analogRead
analogReference
analogReadRes
Digital Pins
digitalRead
digitalWrite
pinMode
GND
Vin (3.6 to 6.0 volts)
AGND
3.3V (250 mA max)
Touch
Touch
RX1
TX1
0
1
2
3
4
5
6
7
8
9
10
11
12
PWM
PWM
PWM
PWM
TX
RX
TX1
DOUT
DIN
CS
CS
DOUT
DIN
RX3
TX3
RX2
TX2
PWM
PWM
23 A9 Touch PWM
22 A8 Touch PWM
21 A7 RX1 CS PWM
20 A6 CS PWM
19 A5 SCL0 Touch
18 A4 SDA0 Touch
17 A3 SDA0 Touch
16 A2 SCL0 Touch
15 A1 CS Touch
14 A0 SCK
13 (LED) SCK
CAN Bus
All digital pins have Interrupt capability.
VBat
3.3V
GND
Program
A14/DAC
Teensy 3.2

- Labs are online:
  - Teensy Arduino website:

    https://www.pjrc.com/teensy/teensy31.html#specs
  - Code libraries

    https://www.pjrc.com/teensy/usb_debug_only.html
  - Professor Lin’s website:

    http://www.me.berkeley.edu/~lwlin/me102B/2016f.html

    ME102 course website:

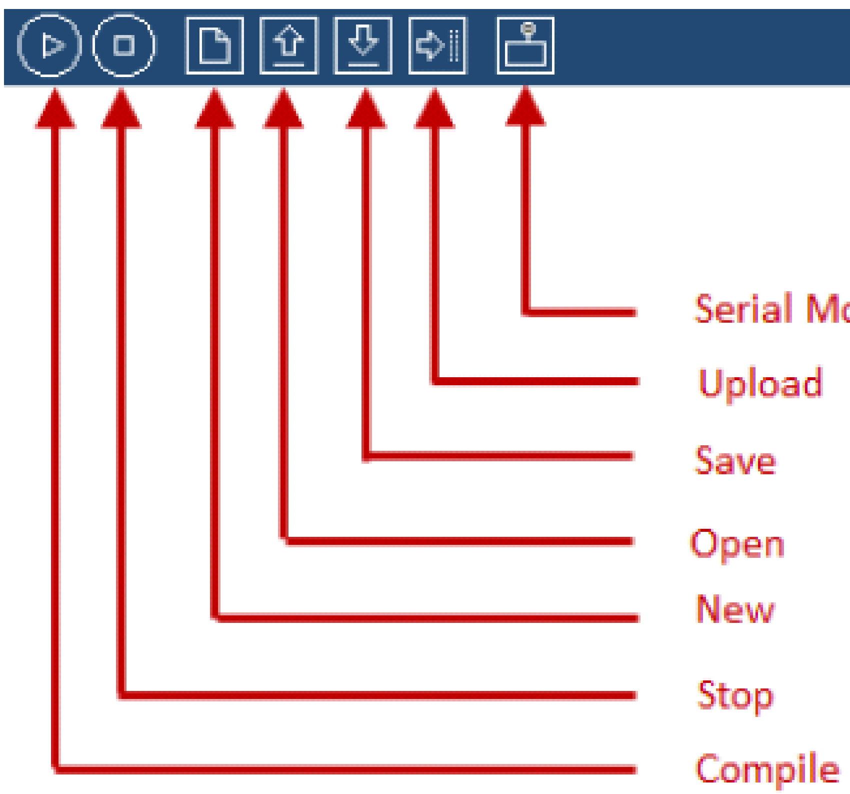
    http://courses.me.berkeley.edu/ME102B/labs.html

Arduino IDE

The largest benefit of the Arduino is the fact that you are not limited to programming in the lab. Instructions on how to install a copy of the Arduino IDE on your own machine can be found here (Mac, Windows and Linux).

Start the Arduino IDE by clicking the Arduino icon on the desktop.

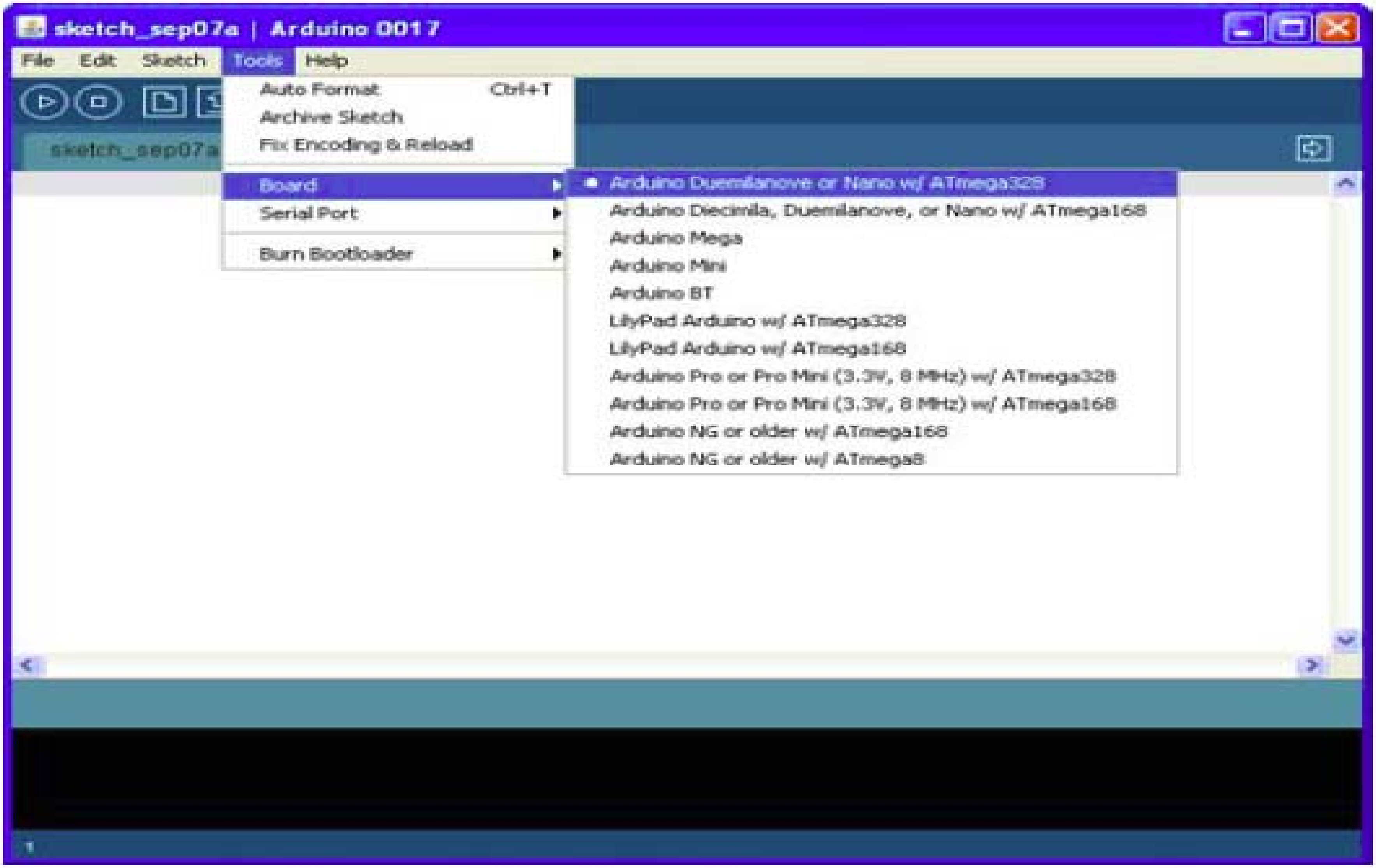
For those of you who are familiar with microprocessor programming, the first thing you will notice is the Arduino's minimalist approach.



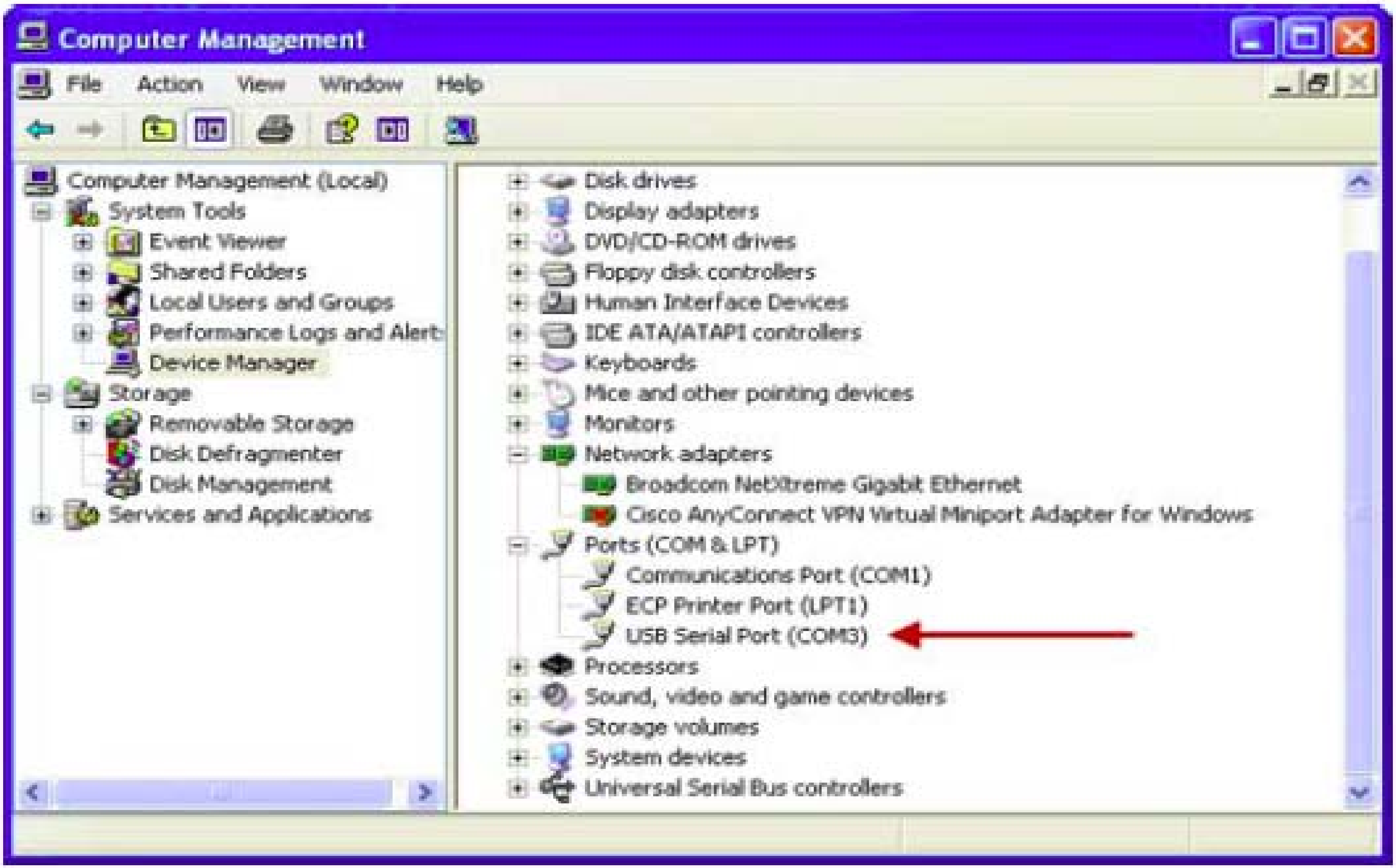
There are 7 shortcut commands that you can use with the Arduino IDE:

- **Serial Monitor** opens the only debugging tool you have with the Arduino. The Serial Monitor displays information passed from the Duemilanove to the computer.
- **Upload** compiles your program ("sketch" in the parlance of the creators of the Arduino, and sends it to the board if there are no compile-time errors.
- **Save** your sketch
- **Open** an existing sketch
- **New** creates a new sketch
- **Stop** interrupts compilation of your code.
- **Compile** your sketch in order to check for compile-time errors. As your sketch grows in size, it'll save time to verify that your code compiles before trying to upload it.

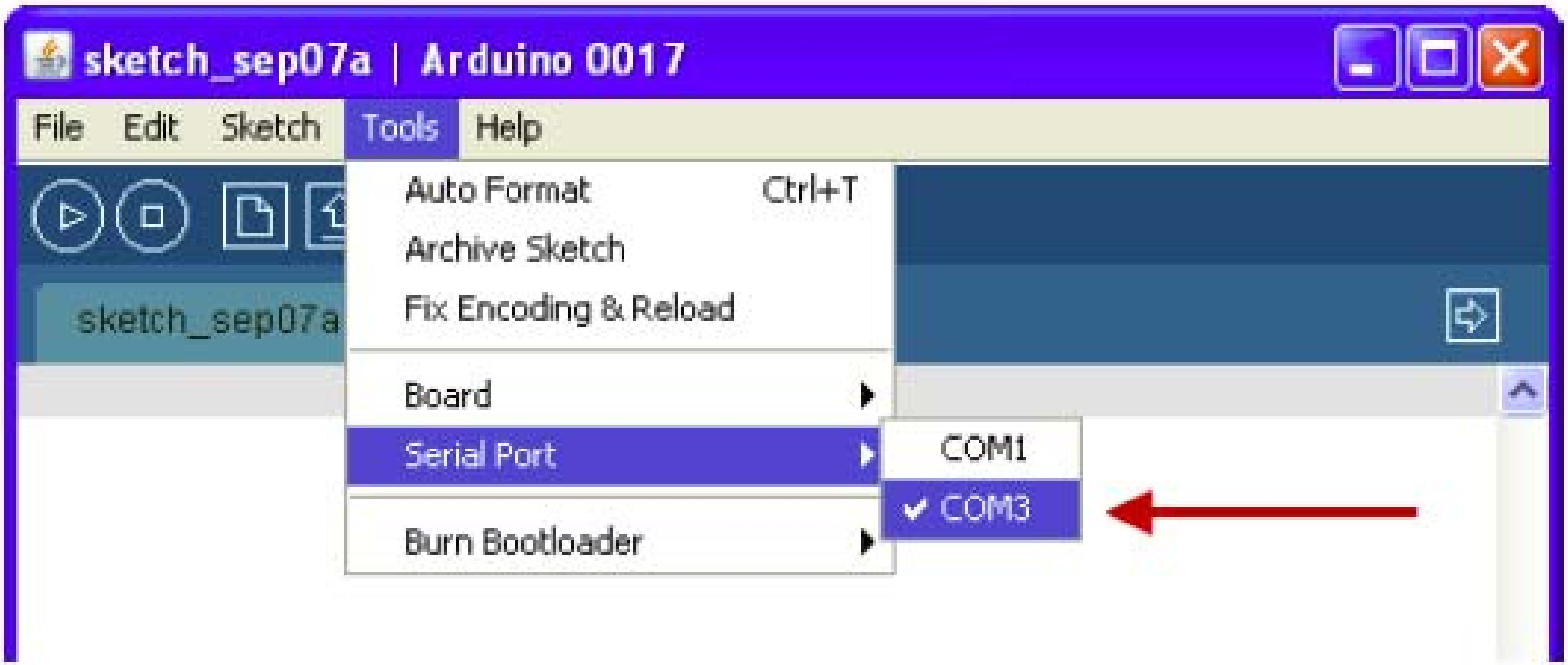
1. Tools → Board (select the right Arduino version)



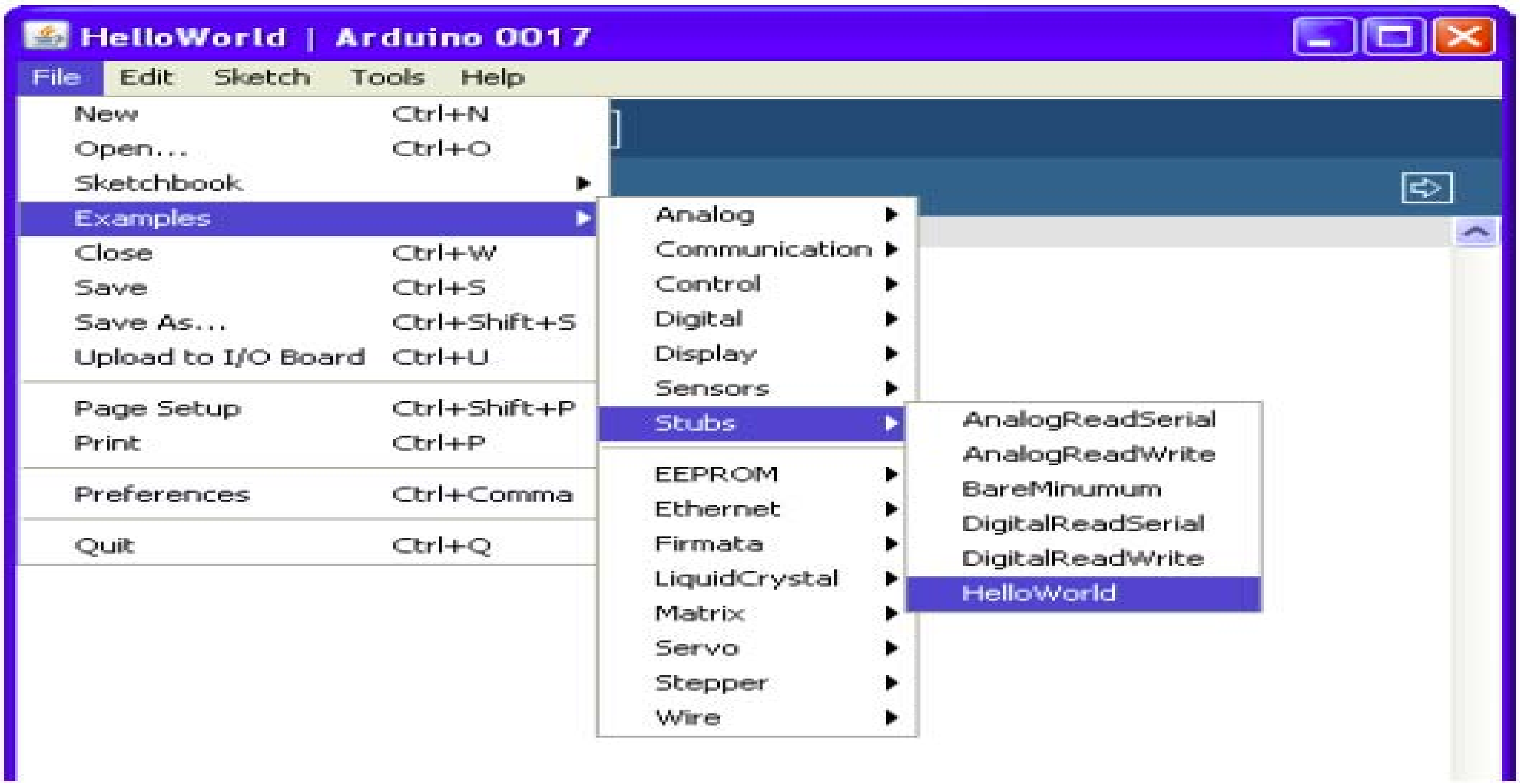
2. Computer → Device Manager →Ports →USB Serial (COM3)



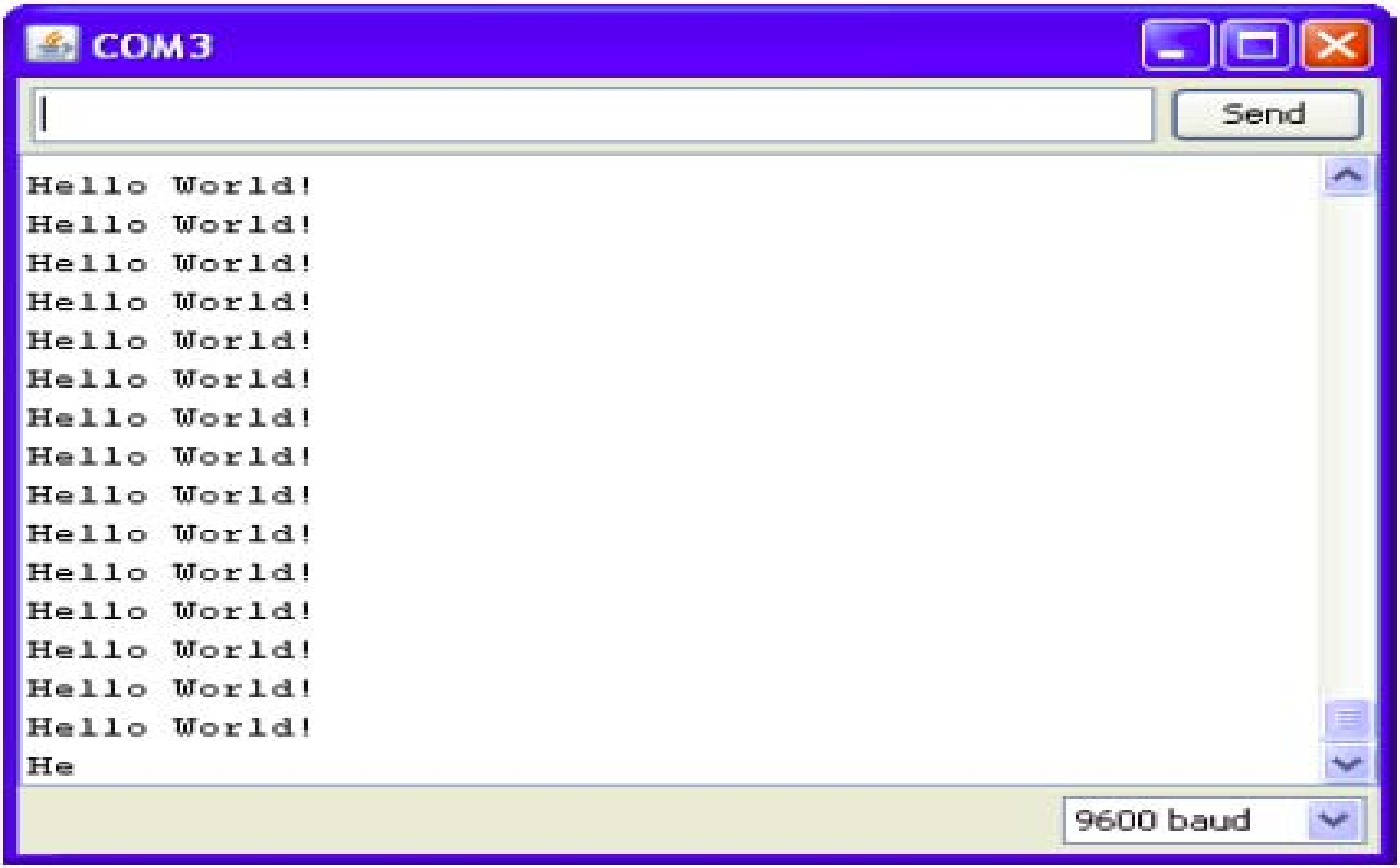
3. Tools → Serial Port → COM3



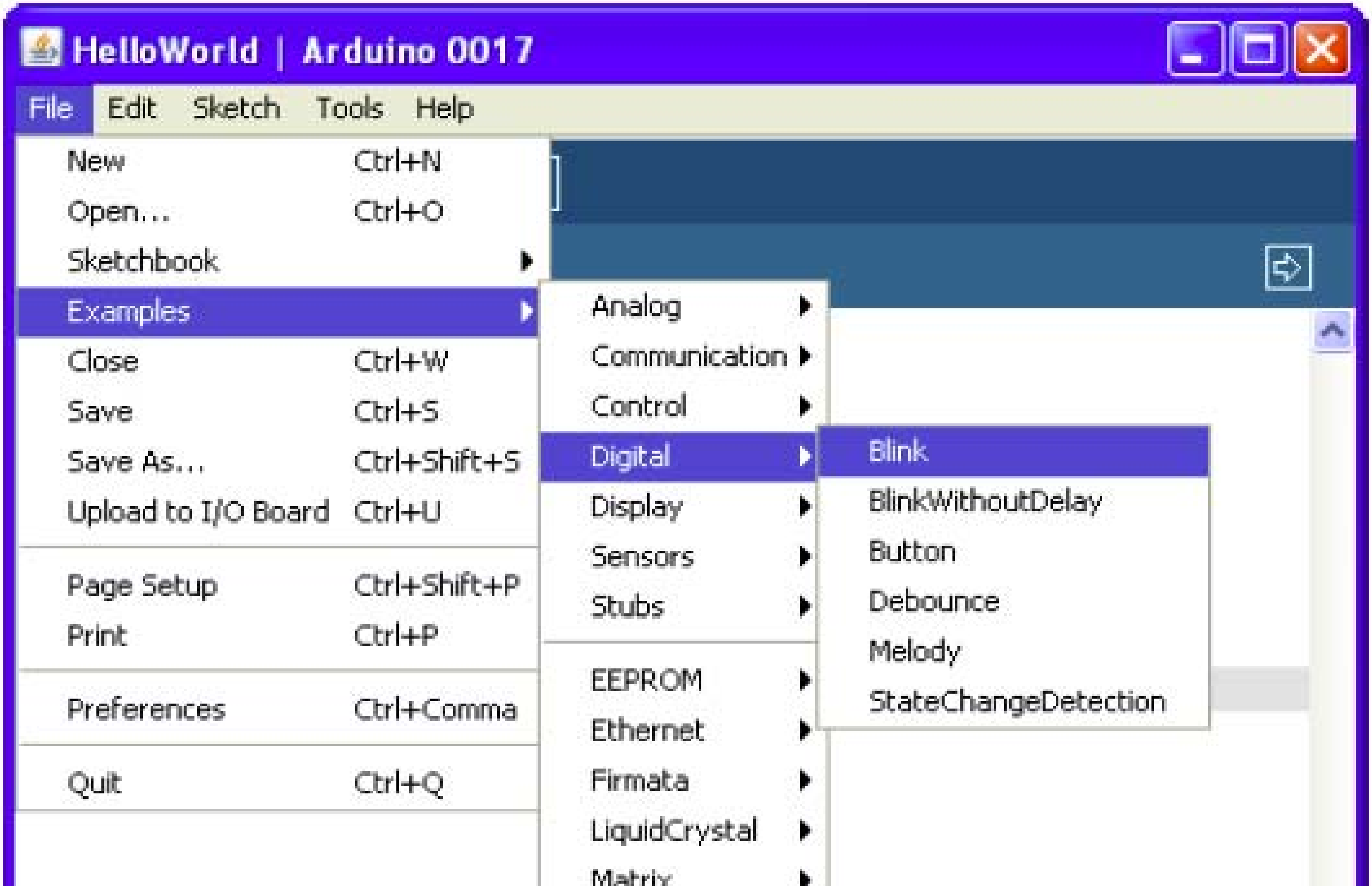
5. Files → Examples → Stubs → HelloWorld (load the program)



6. Verify the Screen (successful communication)



6. File → Examples → Digital → Blink (load a new program)



Software Introduction – "HelloWorld"

```
void setup() {
Serial.begin(9600);
}

void loop() {
Serial.println("Hello World!");
}
```

- setup() — where to use the board
- 9600 — please find out this yourself
- Serial.begin — serial communication
- loop() — never-ending loop
- Serial.println("Hello World!") — serial print on screen

Software Introduction – "Blink"

```
int ledPin =  13;    // LED connected to digital pin 13

void setup()   {
pinMode(ledPin, OUTPUT);
}

void loop()
{
digitalWrite(ledPin, HIGH);
delay(1000);
digitalWrite(ledPin, LOW);
delay(1000);
}
```

integer

comments

pin 13 is output

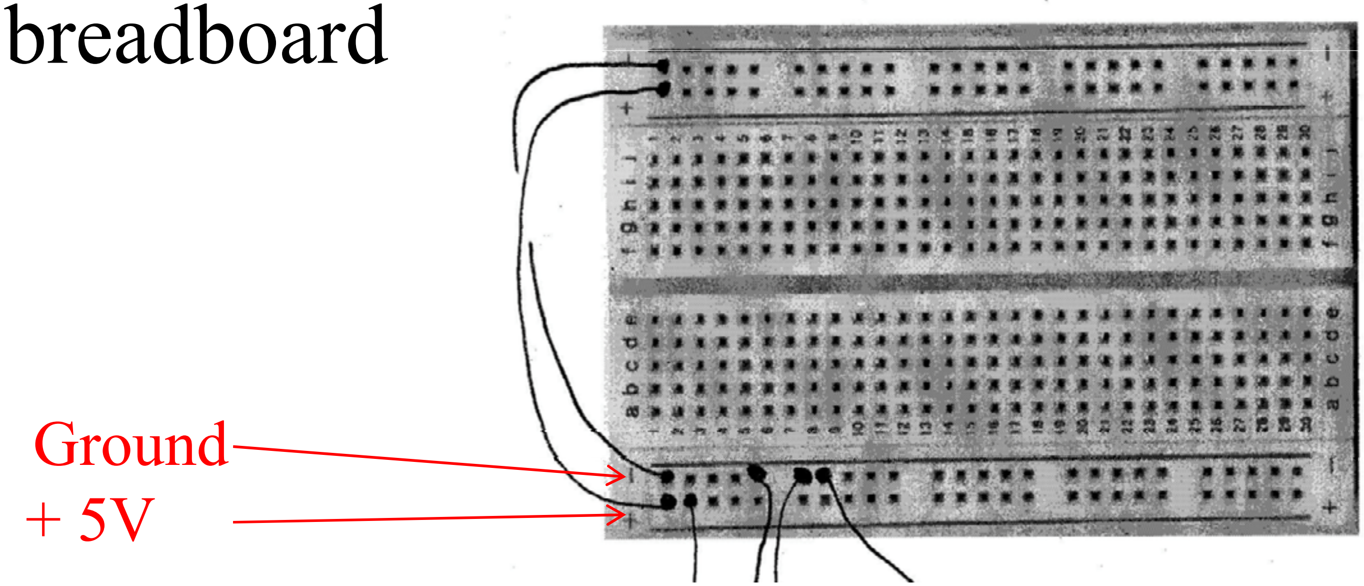
13

13

wait 1000 ms

Hardware - Setup

- Set 5Volt on one rail of the breadboard
- (the breadboard can also be powered by the Arduino board but the current is limited to 50mA by the Arduino)
- Connect the common ground (0Volt) to one rail of the breadboard



LAB #1

Digital Output Buffer – DM7417

Digital output buffering with the **DM7417** (datasheet) protects the Arduino. The DM7414 is a hex buffer with open collector high voltage output. An open-collector only guarantees that a LOW input results in a LOW output. There are no guarantees for a High Input