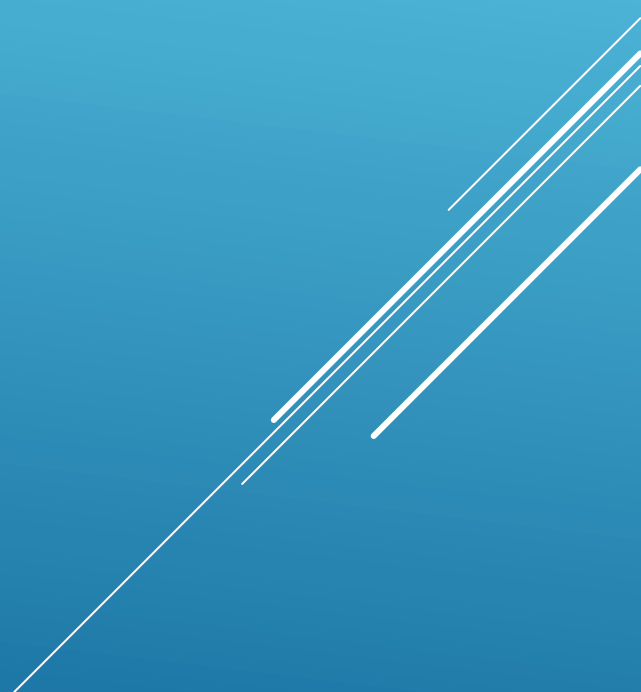


GETTING STARTED WITH ARDUINO PROJECTS

Jack Weaver – AA5VZ



INFORMATION SOURCES



Resource Guide – Partial Lis

Internet:

www.arduino.cc

www.youtube.com search “Arduino”|

www.google.com

www.adafruit.com

www.sparkfun.com

www.instructables.com/Arduino-Projects/

www.robu.in search “Arduino”

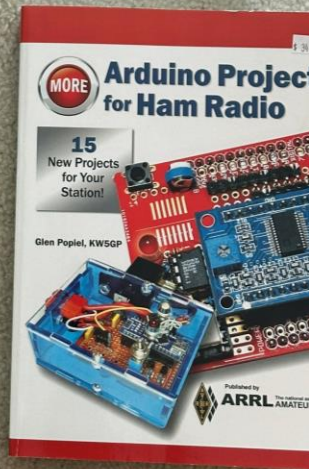
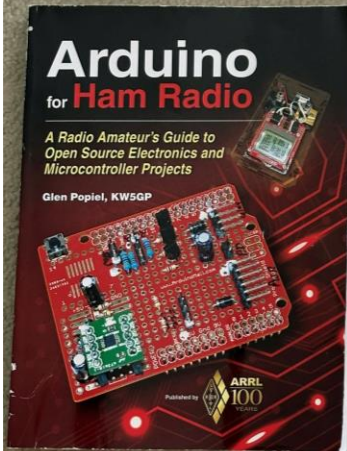
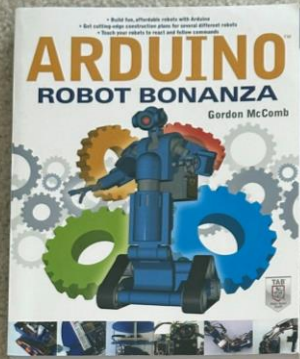
www.amazon.com

www.digikey.com

www.mouser.com

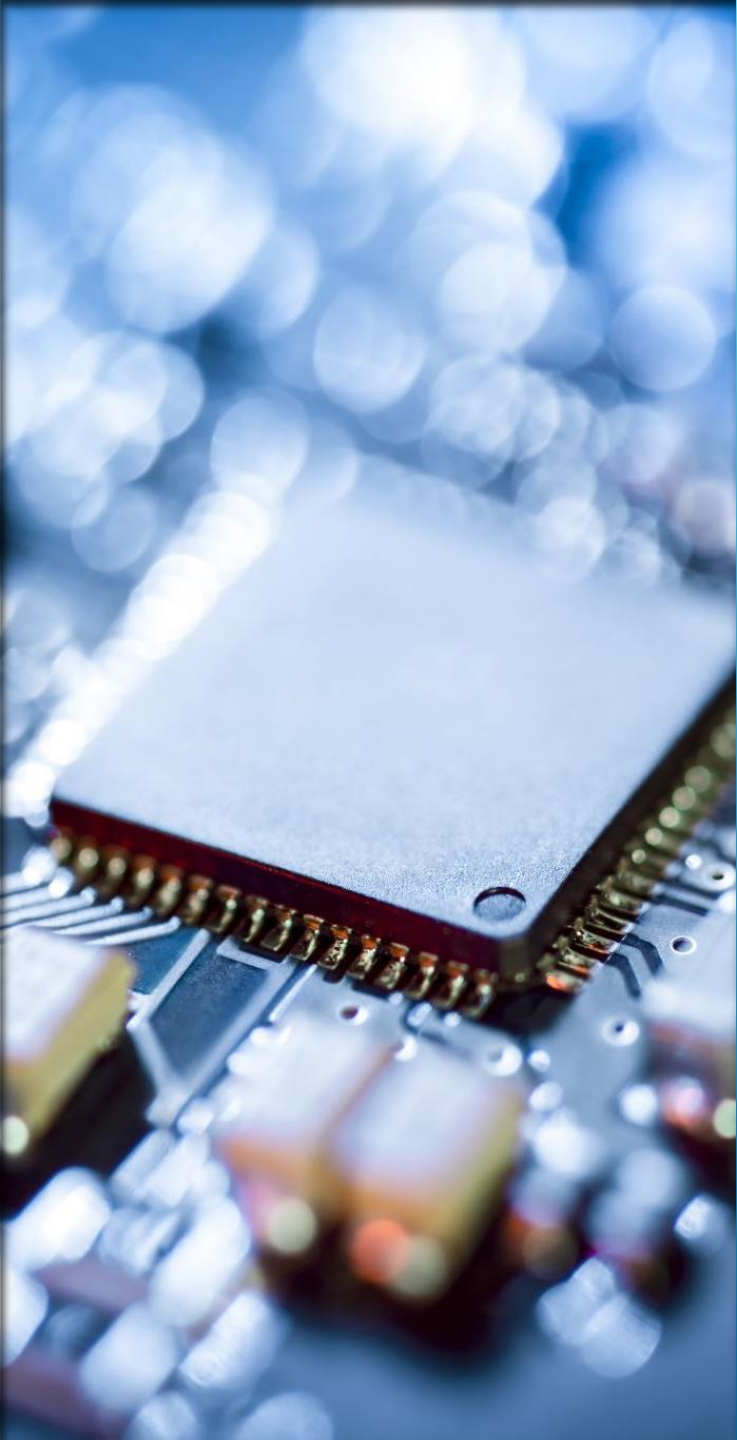
- ▶ [Popular links to on-line resources](#)
- ▶ [This “partial” list will get you started](#)

PROGRAM HANDOUT

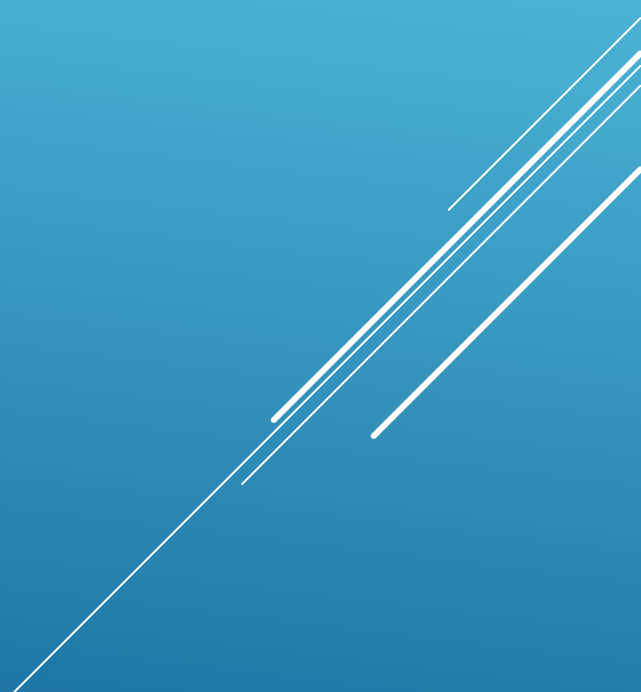


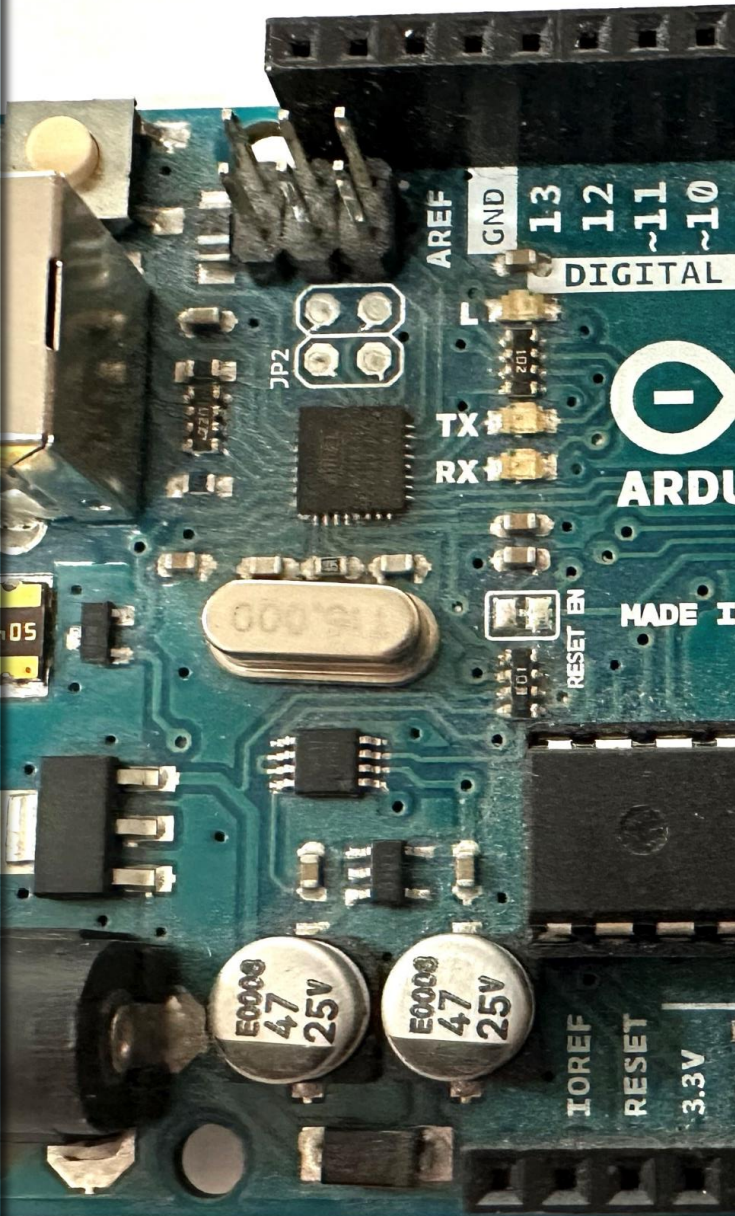
- ▶ Numerous titles available on-line
- ▶ Check local book stores
- ▶ Check local library
- ▶ Check ARRL web-site
- ▶ Pictured are some books I own

BOOKS

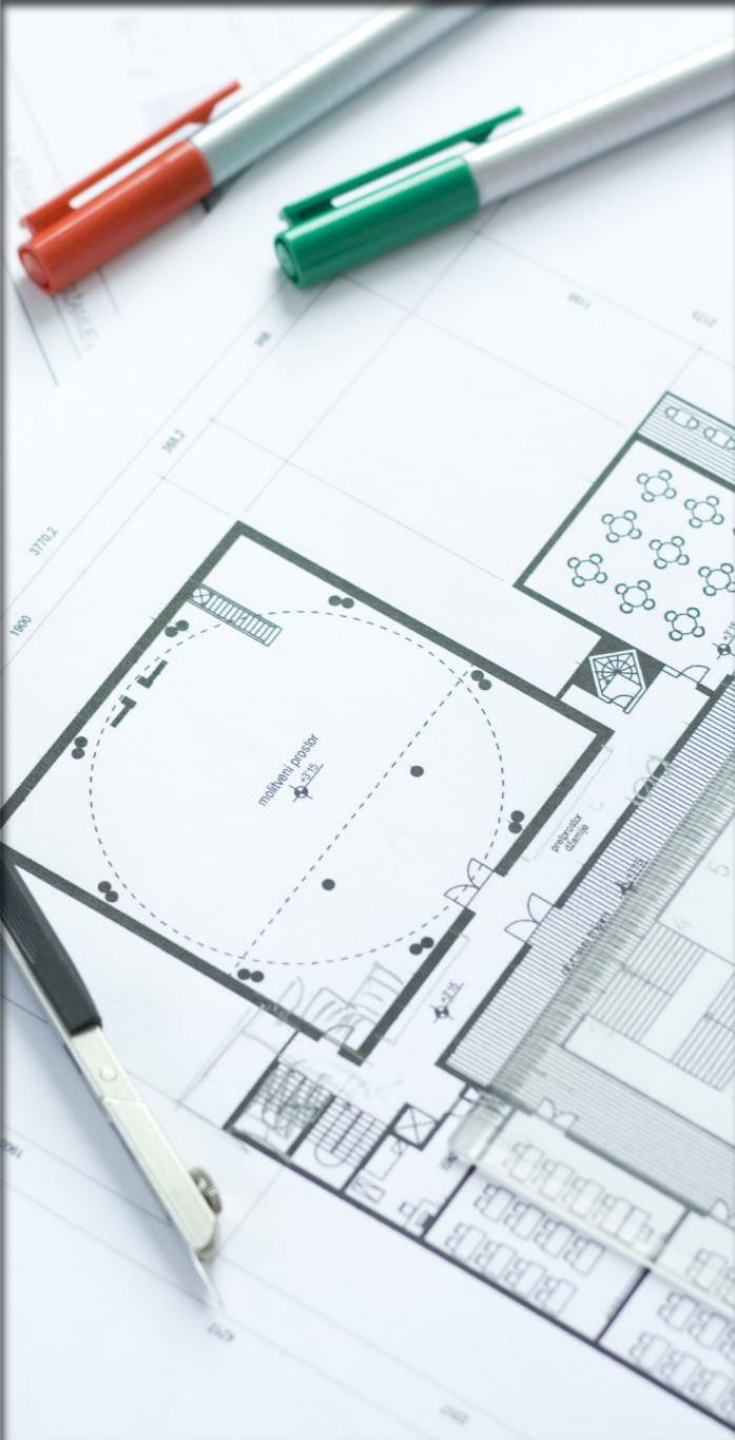


ARDUINO- WHAT IS IT?





- ▶ An Open-Source Electronics Platform
- ▶ A MICRO-CONTROLLER
- ▶ Takes Information from Sensors, Buttons, Switches, etc
- ▶ Produces Various Output Actions – Motors, Relays, Horns, LEDs, Conditions/Activates External Devices, etc.
- ▶ Prototyping Tool for Students, Hobbyists, Makers & Professionals
- ▶ Useful for Learning Electronics and Fast Prototyping
- ▶ Useful for Learning Computer Programming based on C++
- ▶ Great for Developing Fully Functional, Useful, Electronics Projects
- ▶ Suitable for Wide-Spread Applications
- ▶ RELAVENT to the AMATEUR RADIO HOBBY



PERSONAL EXAMPLES

Random Code Practice Generator

Project Featured in:

“Arduino for Ham Radio”, Pg. 7-1,
Glen Popiel, KW5GP

PERSONAL EXAMPLES



PERSONAL
EXAMPLES

Magnetic-Loop Antenna Tuner



PERSONAL
EXAMPLES

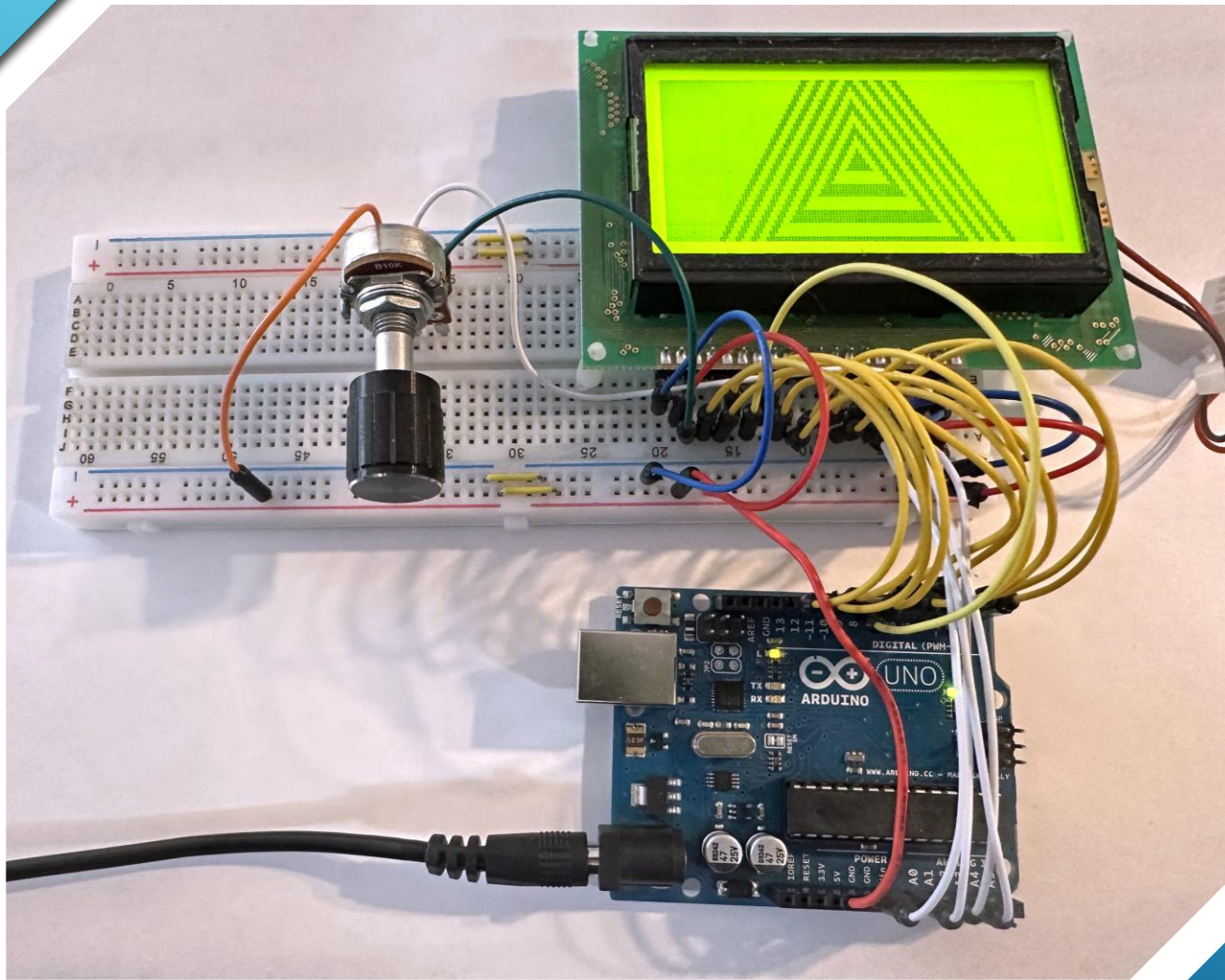
**4-Channel
Wireless
Controller for
Remote Mag-
Loop Antenna
Tuning**



PERSONAL
EXAMPLES

128x64 LCD Display Tester

<https://simple-circuit.com/interfacing-arduino-with-ks0108-glcd-graphics-display-128x64-pixel/>



PERSONAL EXAMPLES

SimpleSat Rotor Controller for SatPC-32

Tom Doyle, W9KE
January, 2012

<http://www.tomdoyle.org/SimpleSatRotorController/SimpleSatRotorController.html>



PERSONAL
EXAMPLES

All-Mode AZ-EL Controller for Portable Satellite Antenna System



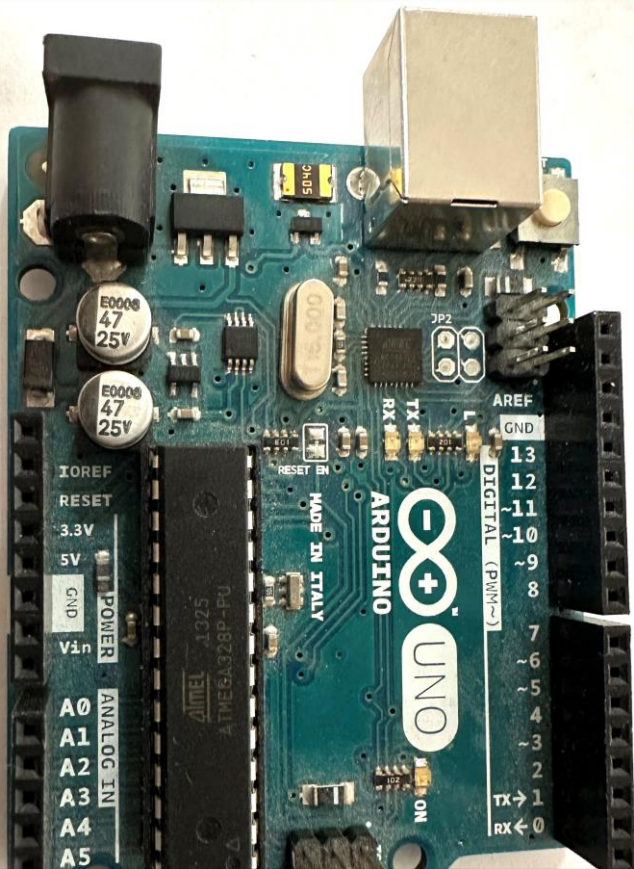


GETTING STARTED

WHAT IS NEEDED?

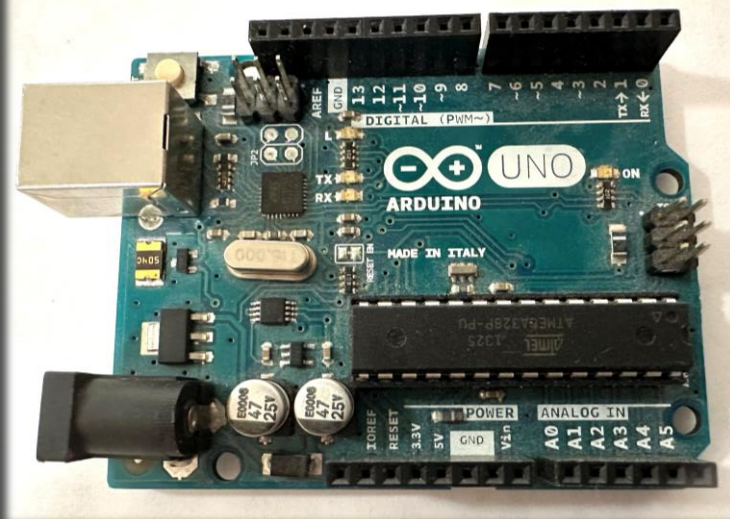
- ▶ ARDUINO BOARD OF CHOICE
- ▶ PC OR LAPTOP
- ▶ IDE SOFTWARE INSTALLED (FREE)
- ▶ PROTOTYPING BREADBOARD
- ▶ DC POWER SOURCE
- ▶ INTERCONNECTION WIRES
- ▶ MISC PARTS / COMPONENTS
- ▶ SMALL HAND TOOLS – BASIC SET
- ▶ VOM OR DVM (OPTIONAL)
- ▶ NOTEKEEPING SUPPLIES

POPULAR
ARDUINO
BOARDS

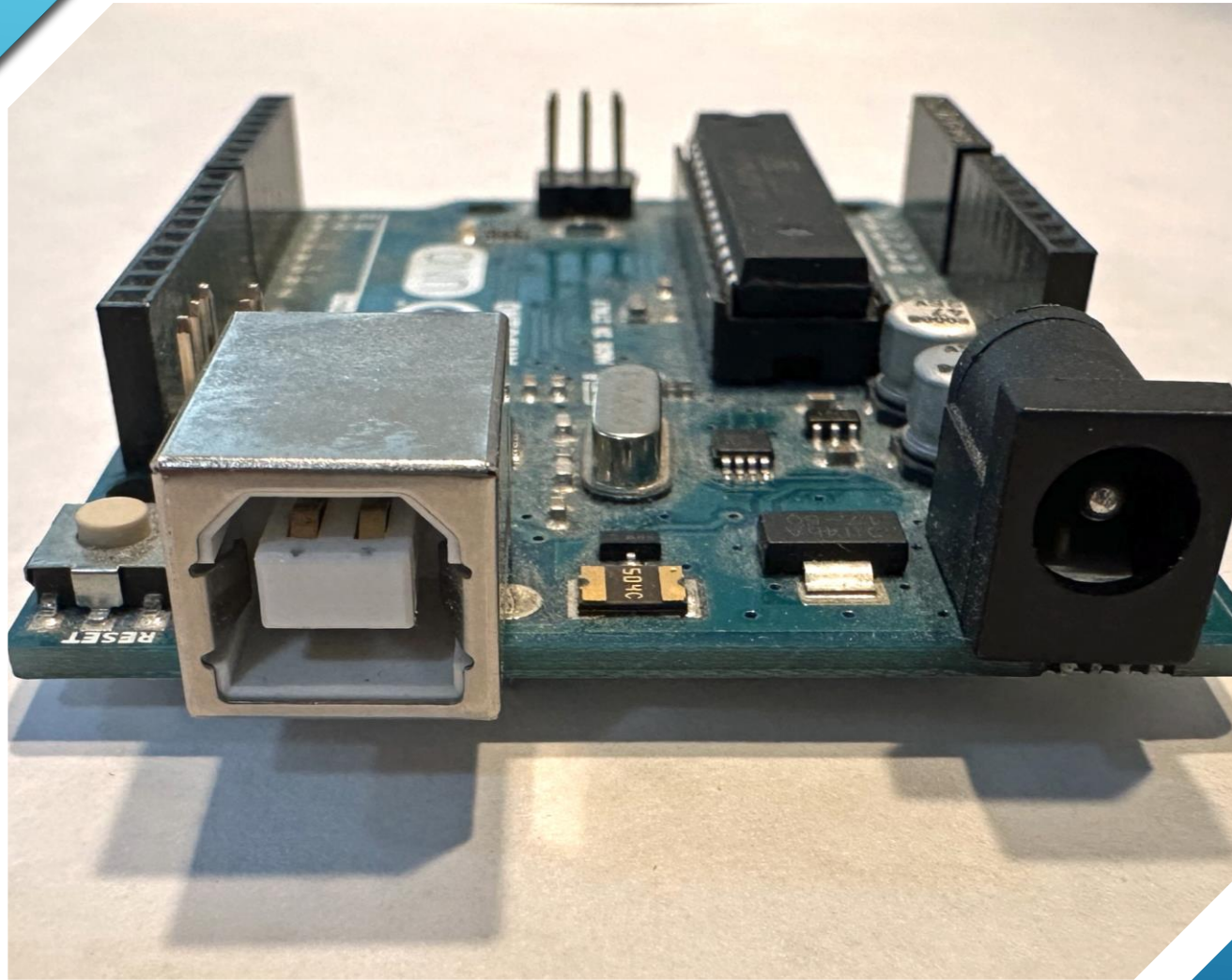


- ▶ ATmega328P Processor 16MHz
- ▶ USB-B
- ▶ Input Voltage – 7 to 12 Vdc
- ▶ I/O Voltage – 5 Vdc
- ▶ Digital I/O Pins - 14
- ▶ Analog Input Pins - 6
- ▶ PWM Pins – 6
- ▶ UART, I2C, SPI
- ▶ Power Connector – Barrel Plug

ARDUINO UNO-R3 DESCRIPTION

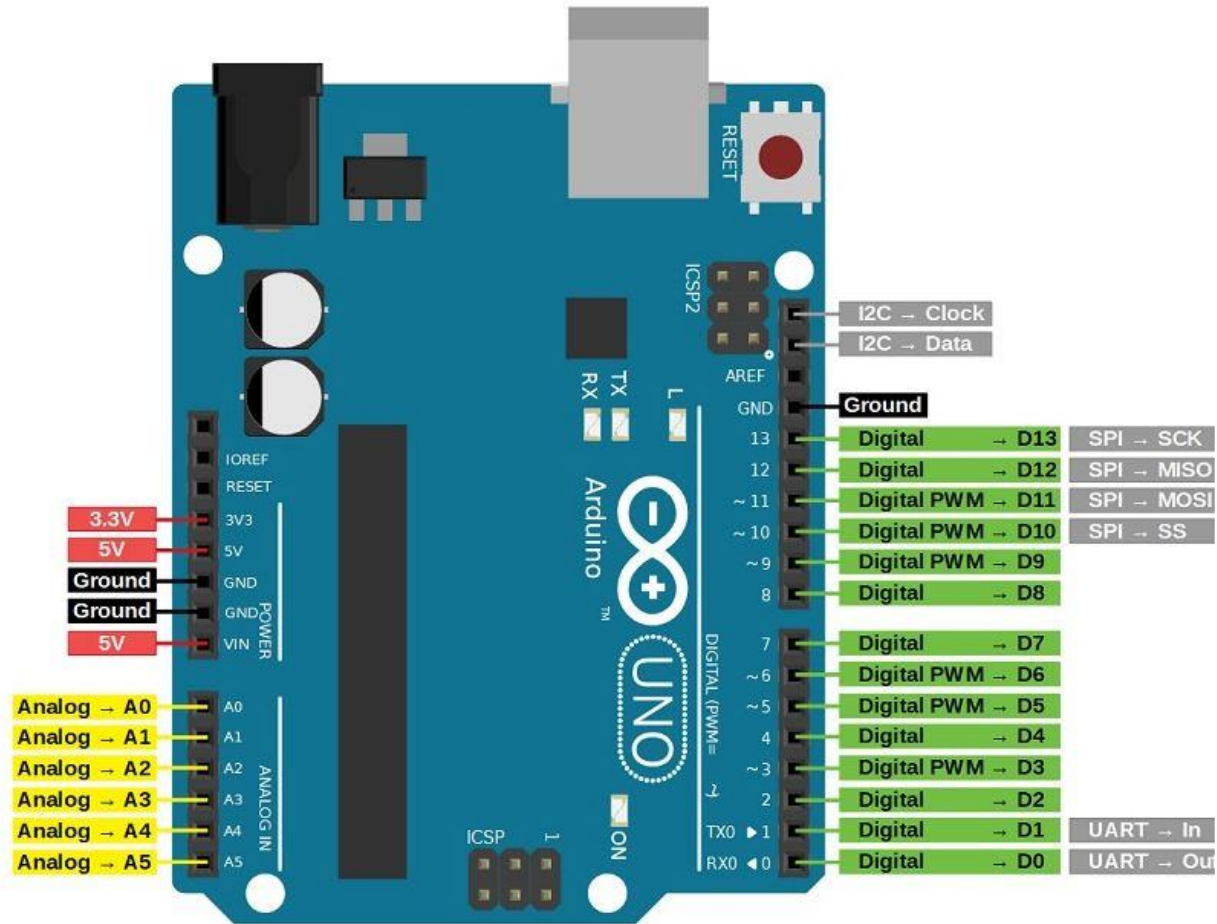


ARDUINO UNO-R3 (END VIEW)



- ▶ Master RESET Button
- ▶ USB-B for PC/Laptop
- ▶ Barrel Connector for DC Input
- ▶ I/O Connector Pins accept 24 AWG Solid Wire

ARDUINO UNO R3 PINOUT

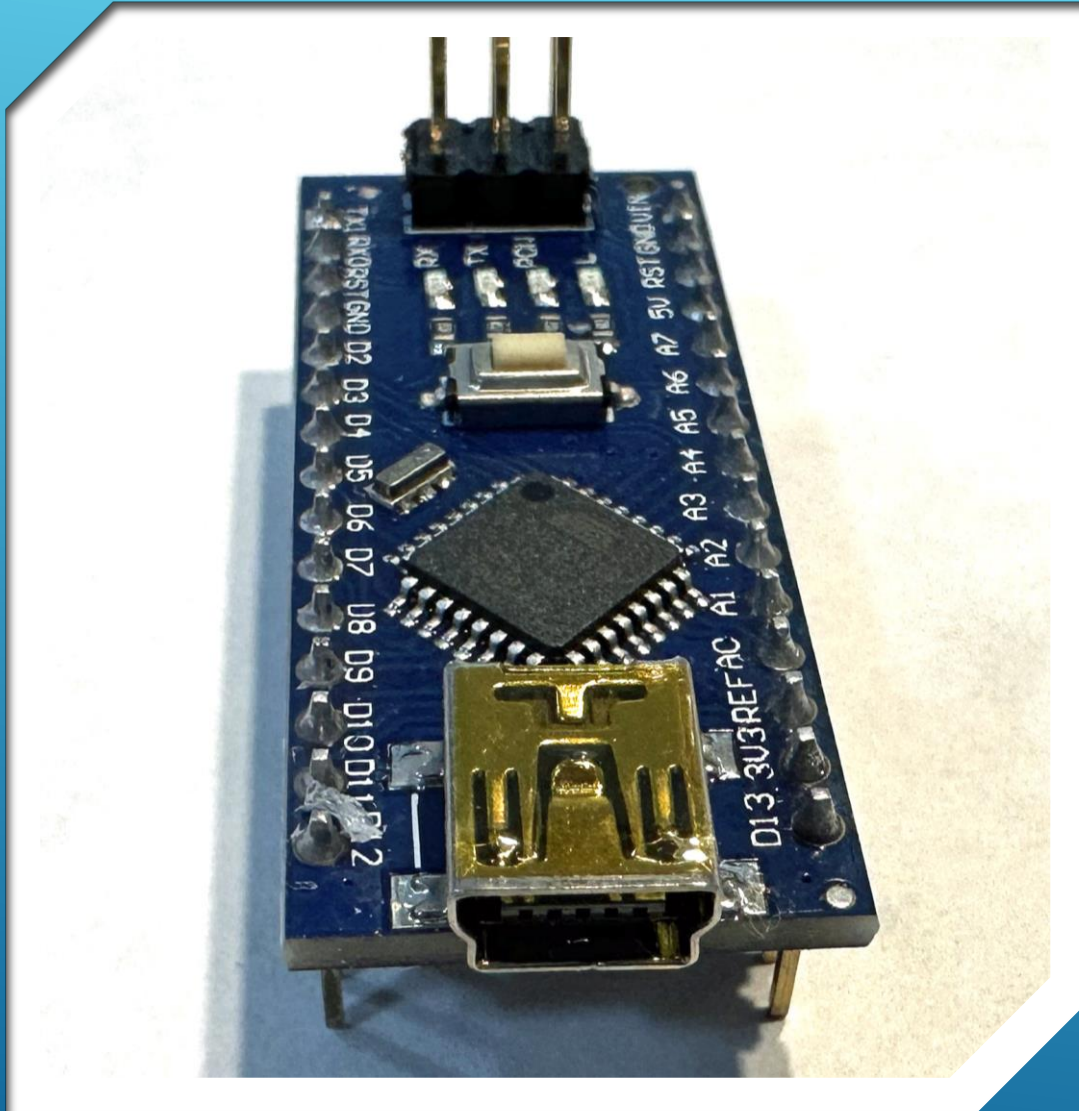


- ▶ Source: WWW.ROBU.IN
- ▶ Search – “ARDUINO”



- ▶ ATmega328P Processor 16MHz
- ▶ 2KB SRAM, 32KB Flash, 1KB EEPROM
- ▶ USB: Mini-B
- ▶ Input Voltage – 7 to 12 Vdc
- ▶ I/O Voltage – 5 Vdc
- ▶ Digital I/O Pins - 14
- ▶ Analog Input Pins - 8
- ▶ PWM Pins – 6
- ▶ UART, I2C, SPI
- ▶ Power Connection – from USB or wired to VIN Pin

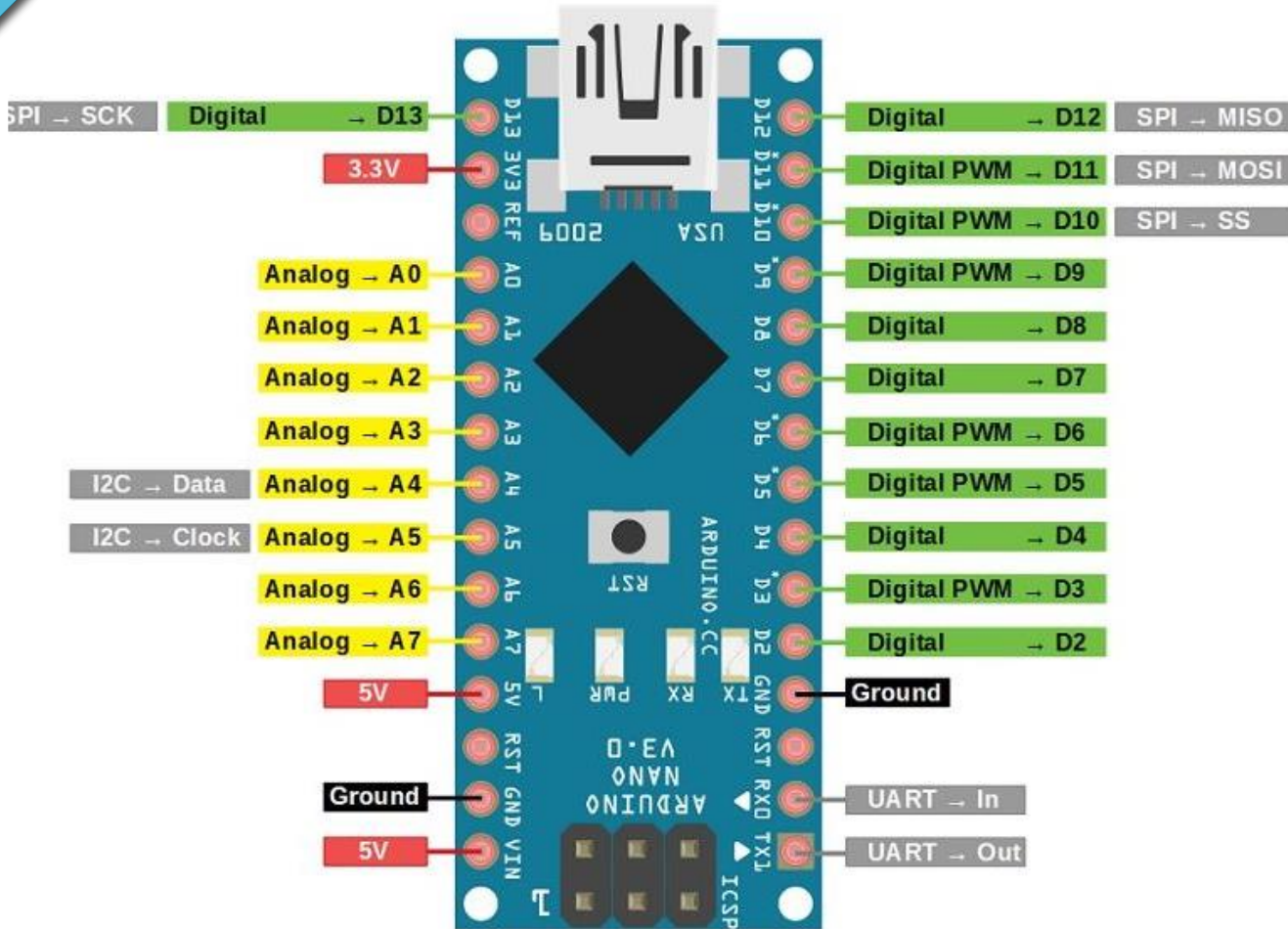
ARDUINO NANO DESCRIPTION



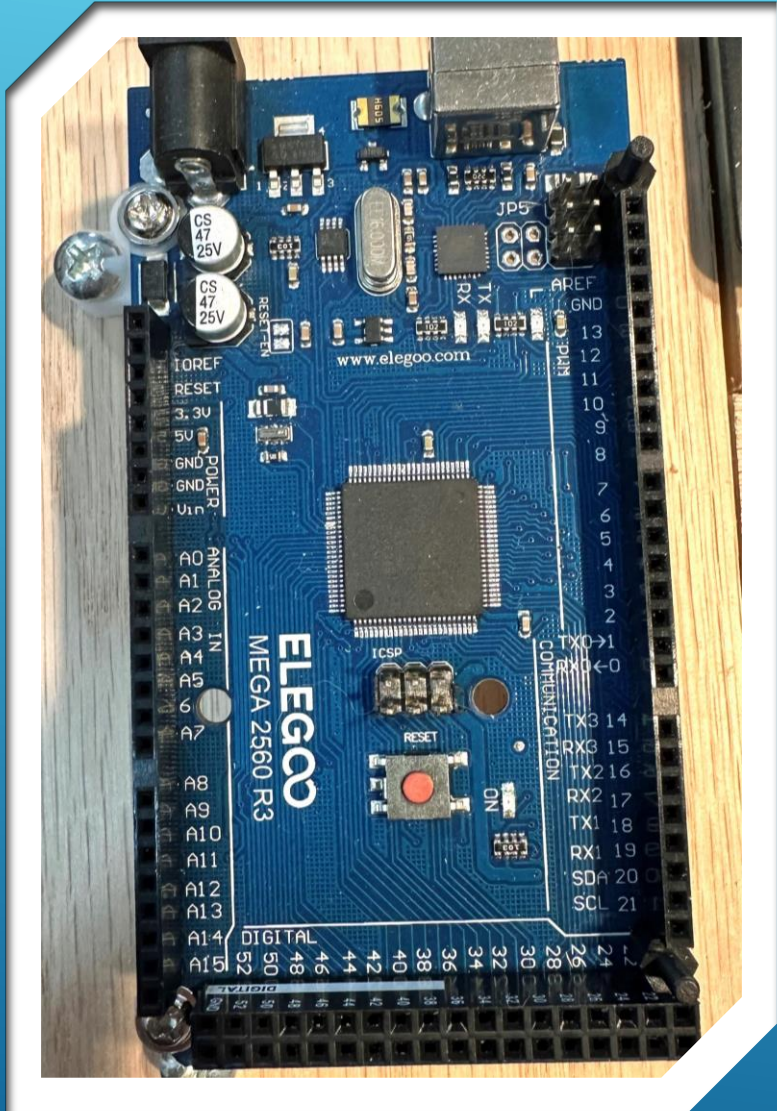
- ▶ Master RESET Button
- ▶ USB: Mini-B Comm/Pwr Connector
- ▶ 30 Dual In-Line Pins for Breadboard or PCB Connections

ARDUINO NANO END-VIEW

ARDUINO NANO PINOUT

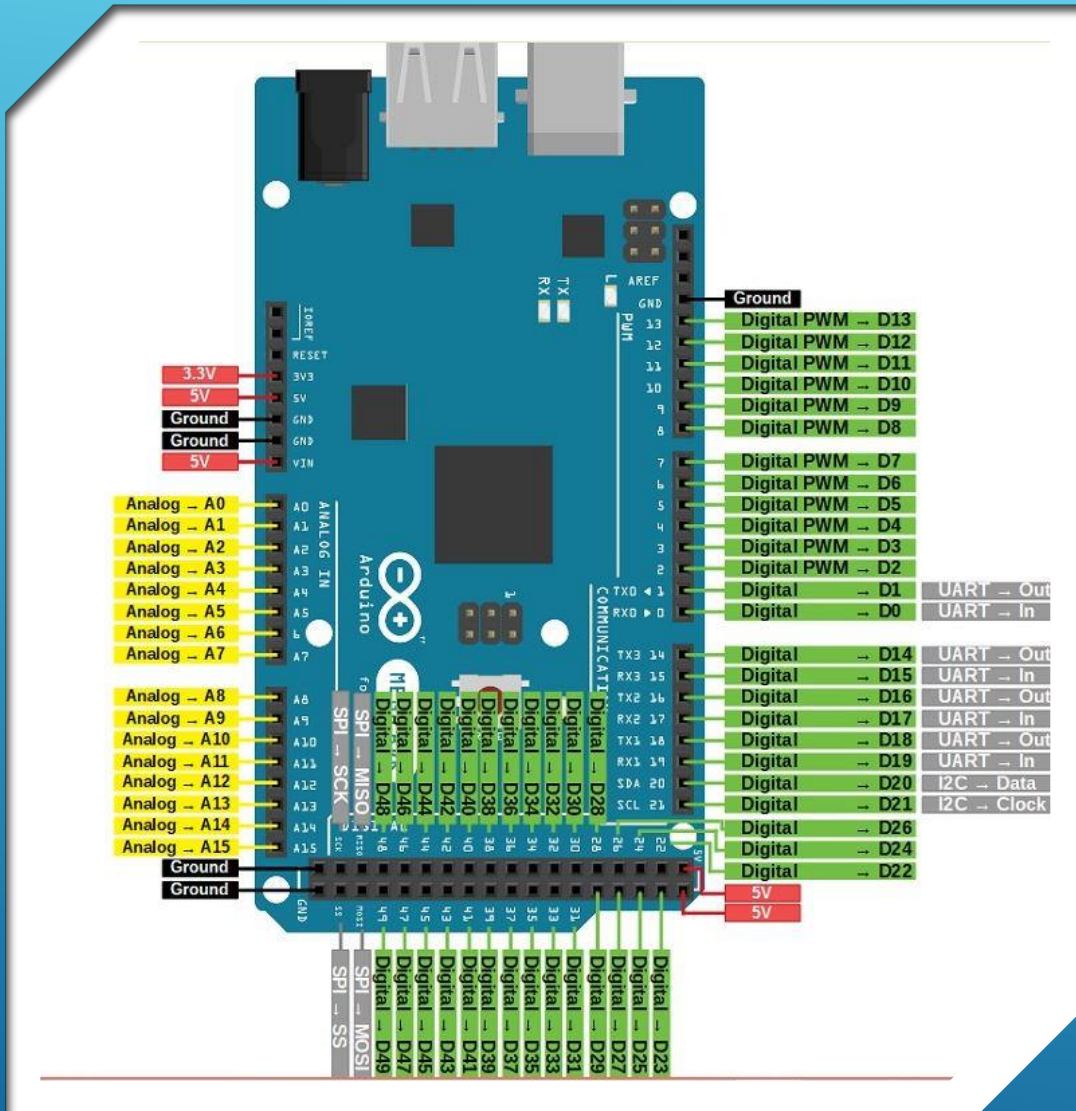


- ▶ Source: WWW.ROBU.IN
- ▶ Search – “ARDUINO”




- ATmega2560 Processor 16MHz
- 8KB SRAM, 256KB FLASH, 4KB EEPROM
- Master RESET Button
- USB-B
- Input Voltage – 7 to 12 Vdc
- I/O Voltage – 5 Vdc
- Digital I/O Pins - 54
- Analog Input Pins - 16
- PWM Pins – 15
- UART(4), I2C, SPI
- Power Connector – Barrel Plug

MEGA 2560 REV3 DESCRIPTION



- ▶ Source: WWW.ROBU.IN
- ▶ Search – “ARDUINO”

ARDUINO MEGA 2560 REV3 PINOUT



POPULAR
DC POWER
SOURCES



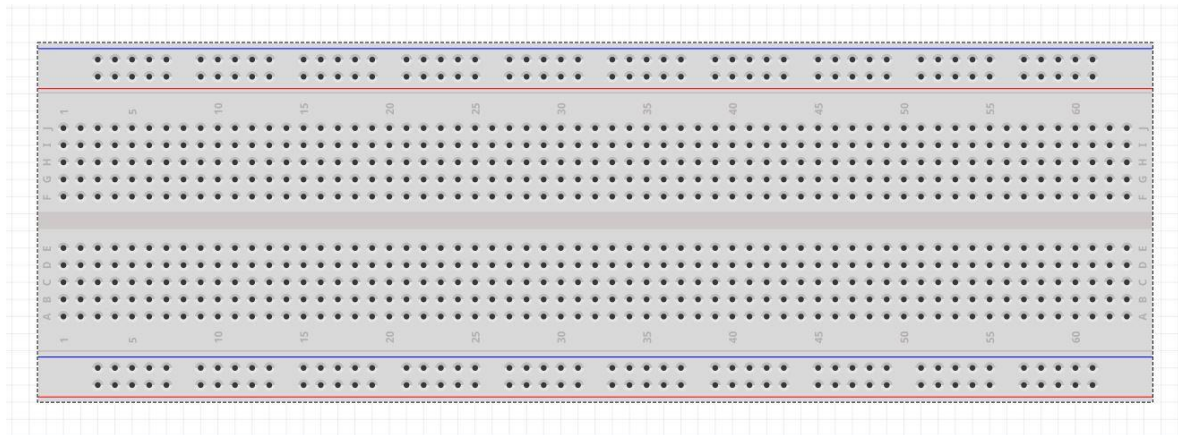
- ▶ Battery – 9Vdc
- ▶ Wall AC Power to DC Adapter (9 to 12Vdc)

DC POWER SOURCES

BREADBOARDING

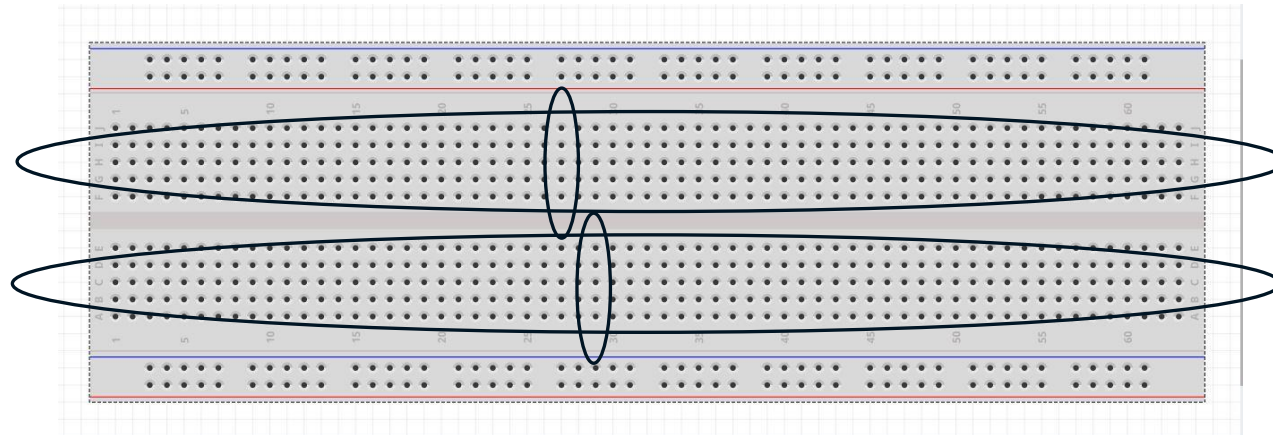


BREADBOARD



- ▶ Standard Size Breadboard
- ▶ 2 Sets of 63 Rows x 5 Connections/Row
- ▶ 2 Separated Buss-Pair Columns
- ▶ 50 Connections per individual Buss Column

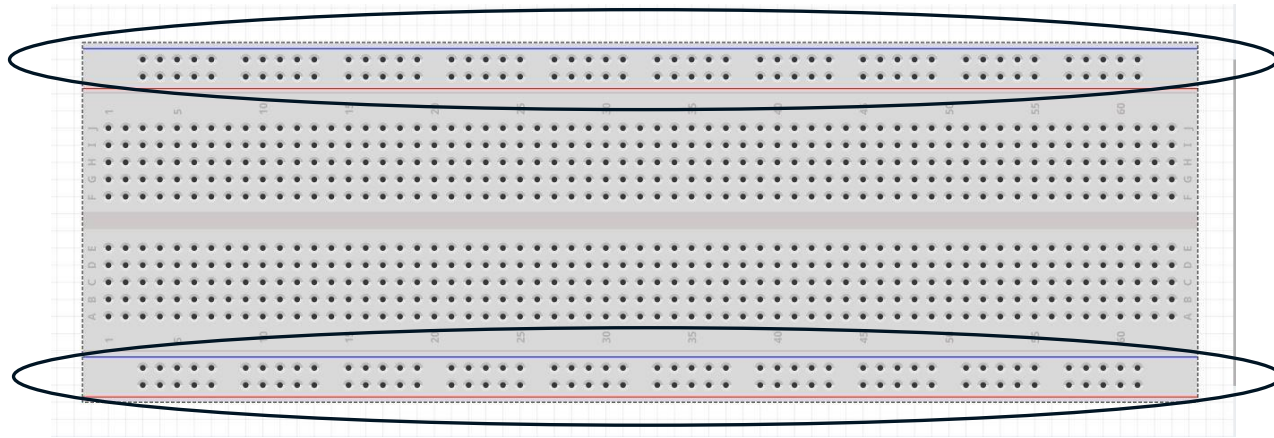
BREADBOARD

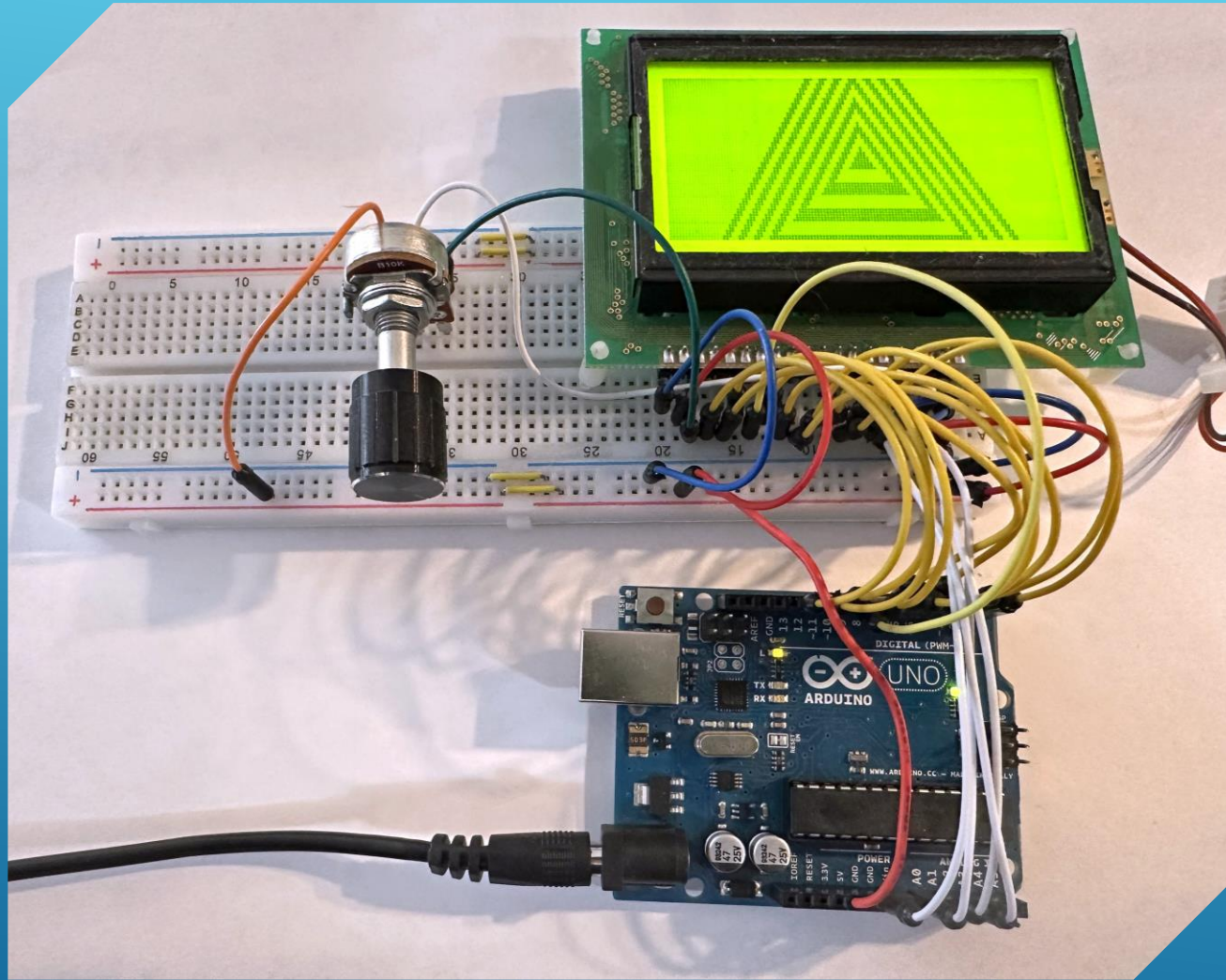


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- ▶ 2 Sets of 63 Rows x 5 Connections/Row
- ▶ 2 Separated Buss-Pair Columns
- ▶ 50 Connections per individual Buss Column

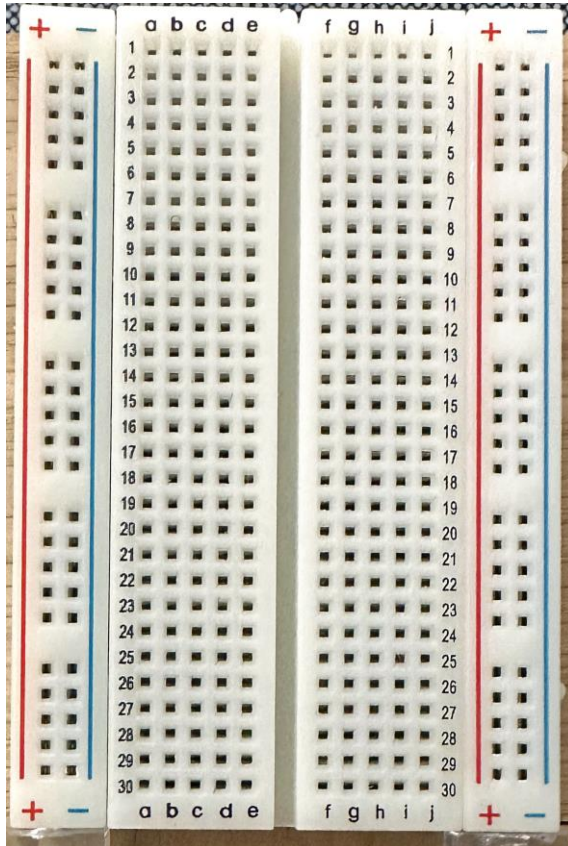
BREADBOARD

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- ▶ 2 Separated Buss-Pair Columns
- ▶ 50 Connections per individual Buss Column



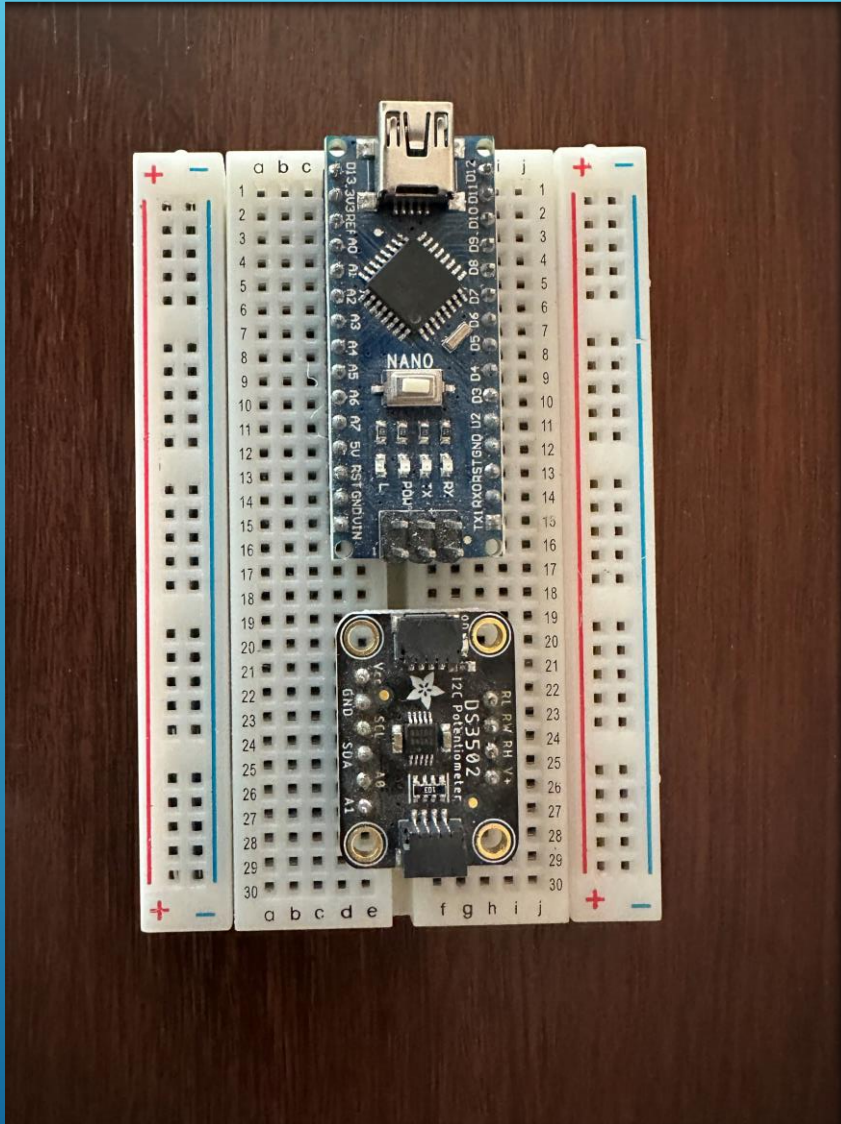


TYPICAL USE



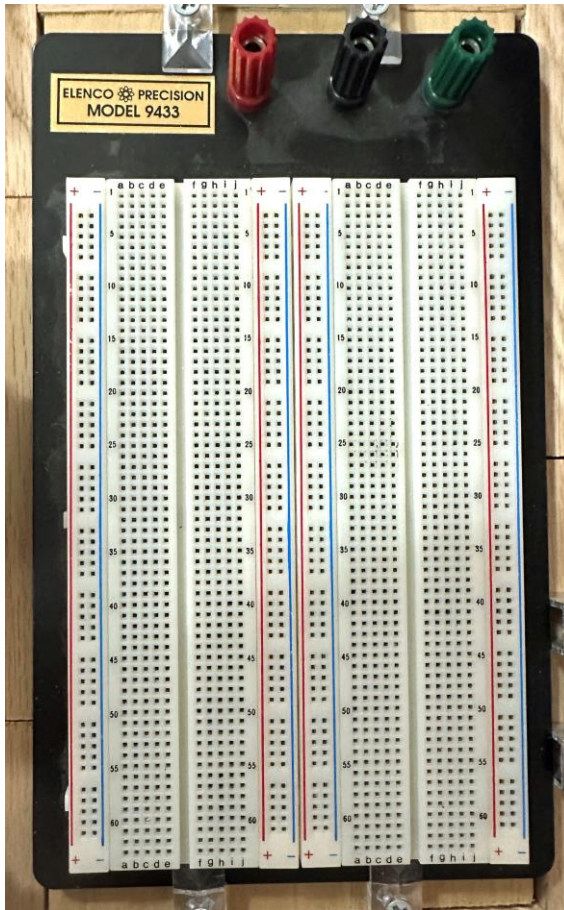
- ▶ Half-Size Breadboard
- ▶ 30 Rows x 2
- ▶ 5 Connections each Row
- ▶ 2 Separated Buss-Pair Columns
- ▶ 25 Connections per single Buss Column

BREADBOARD



- ▶ Half-Size Breadboard
- ▶ 30 Rows x 2
- ▶ 5 Connections each Row
- ▶ 2 Separated Buss-Pair Columns
- ▶ 25 Connections per single Buss Column

EXAMPLE USE



- ▶ Twin-Breadboard Set
- ▶ 4 Sets of 63 Rows x 5 Connections/Set
- ▶ 4 Separated Buss-Pair Columns
- ▶ 50 Connections per single Buss Column

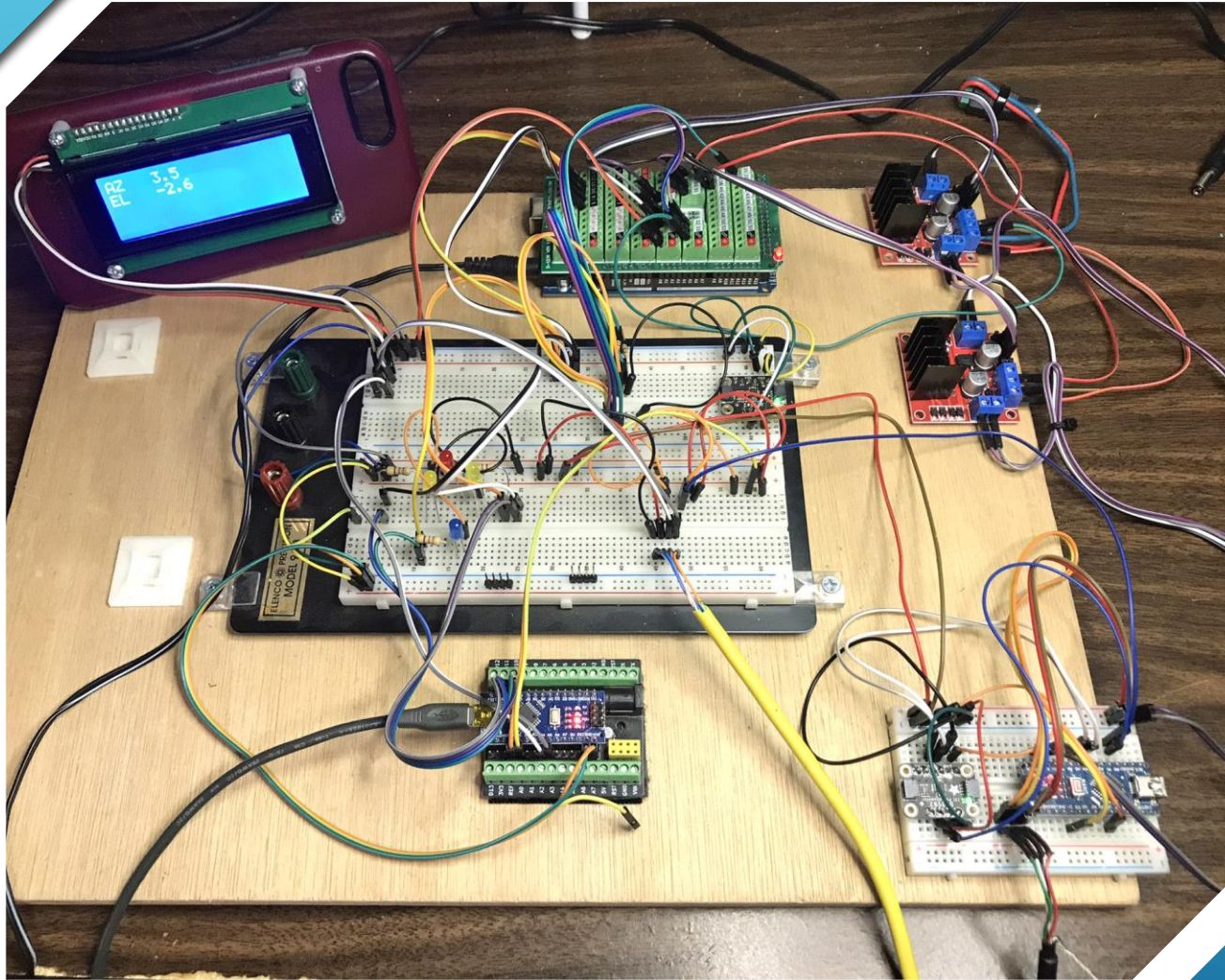
BREADBOARD

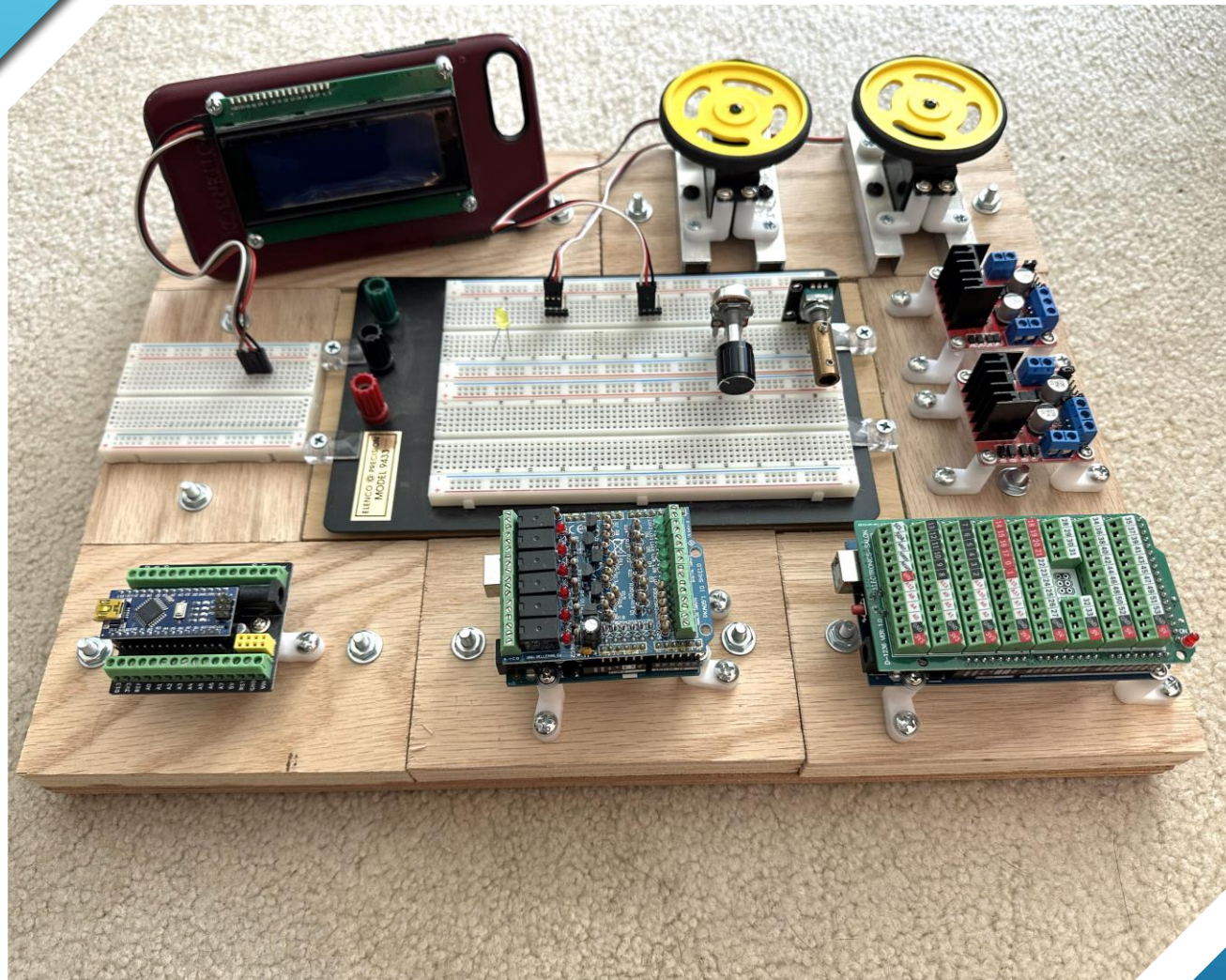


DEVELOPMENT BOARDS

BREADBOARDING


- ▶ Arduino Development Board
- ▶ Velcro-secured Devices
- ▶ Difficult to reposition / mount large components for additional projects



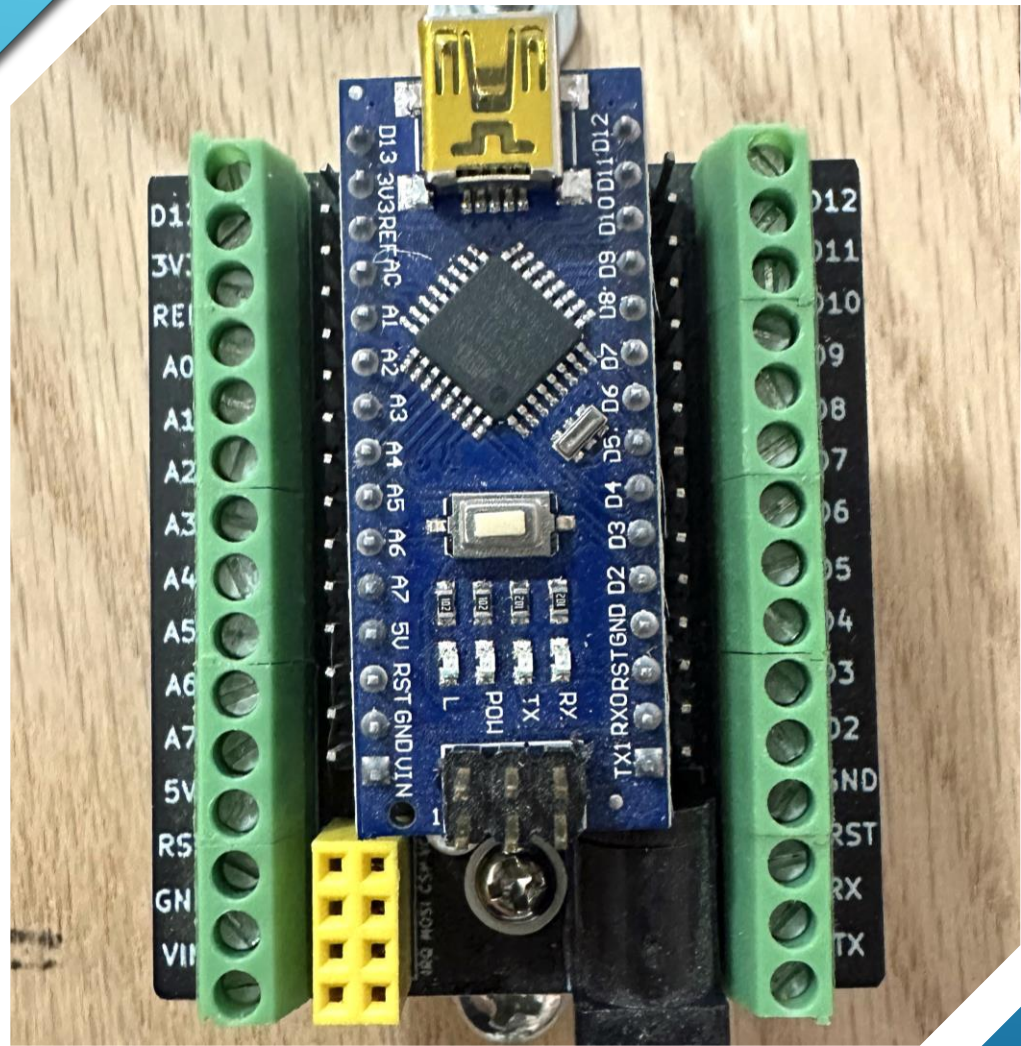


BREADBOARD

- ▶ Arduino Development Board
- ▶ Modular Style
- ▶ Easily reposition Major Components
- ▶ Large unused devices mounted & stored on additional modules



OPTIONAL
ACCESSORY
SHIELDS/BOARDS

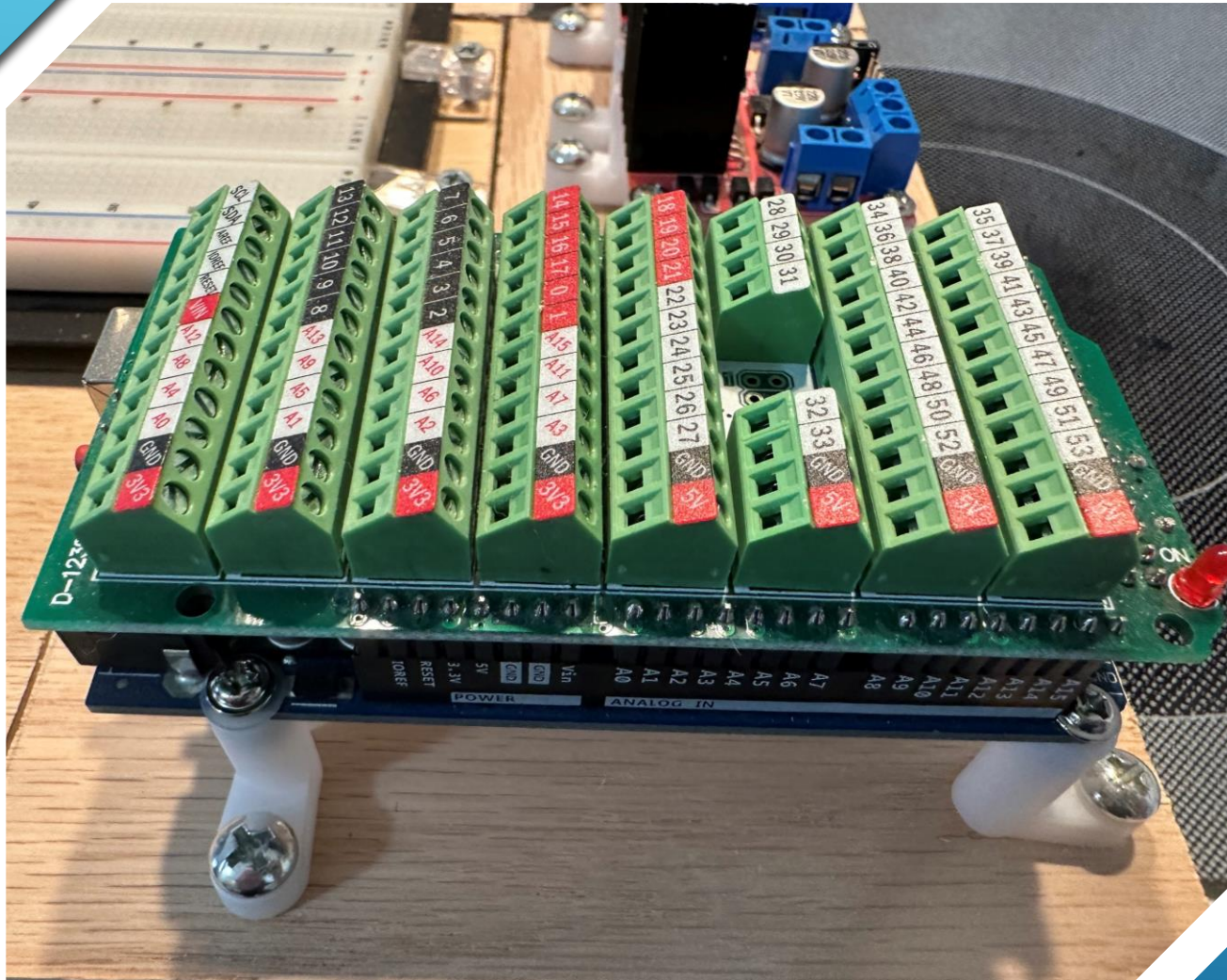


- ▶ NANO Termination Shield
- ▶ Lock-Down Screw Terminals
- ▶ Male Terminal Pin Sets
- ▶ Clearly Identifiable Labels

BREADBOARDING

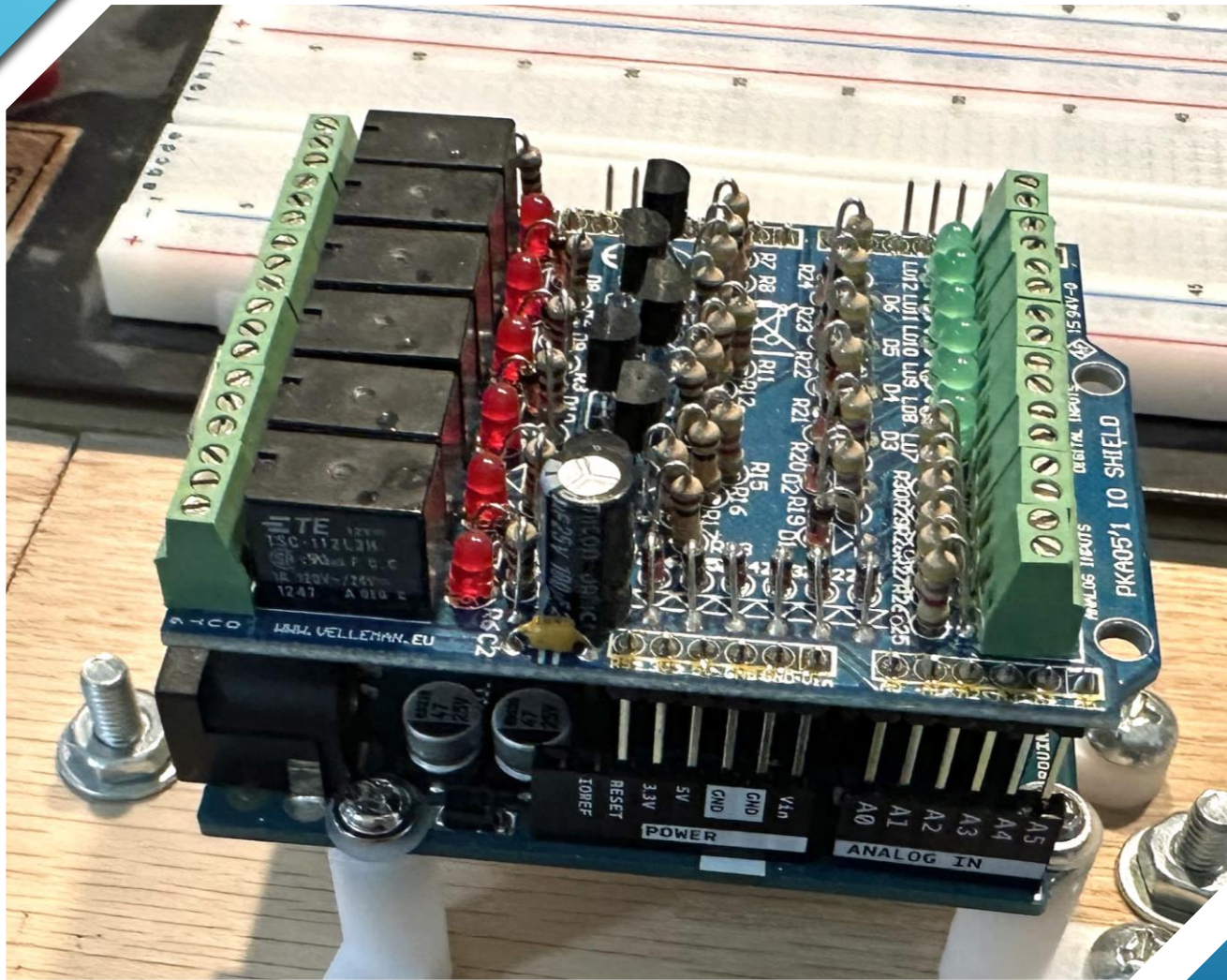
BREADBOARDING

- ▶ 2560-Mega Termination Shield
- ▶ Lock-Down Screw Terminals
- ▶ Well Organized Layout
- ▶ Numerous Pwr/Gnd Terminals
- ▶ Clearly Identifiable Labels



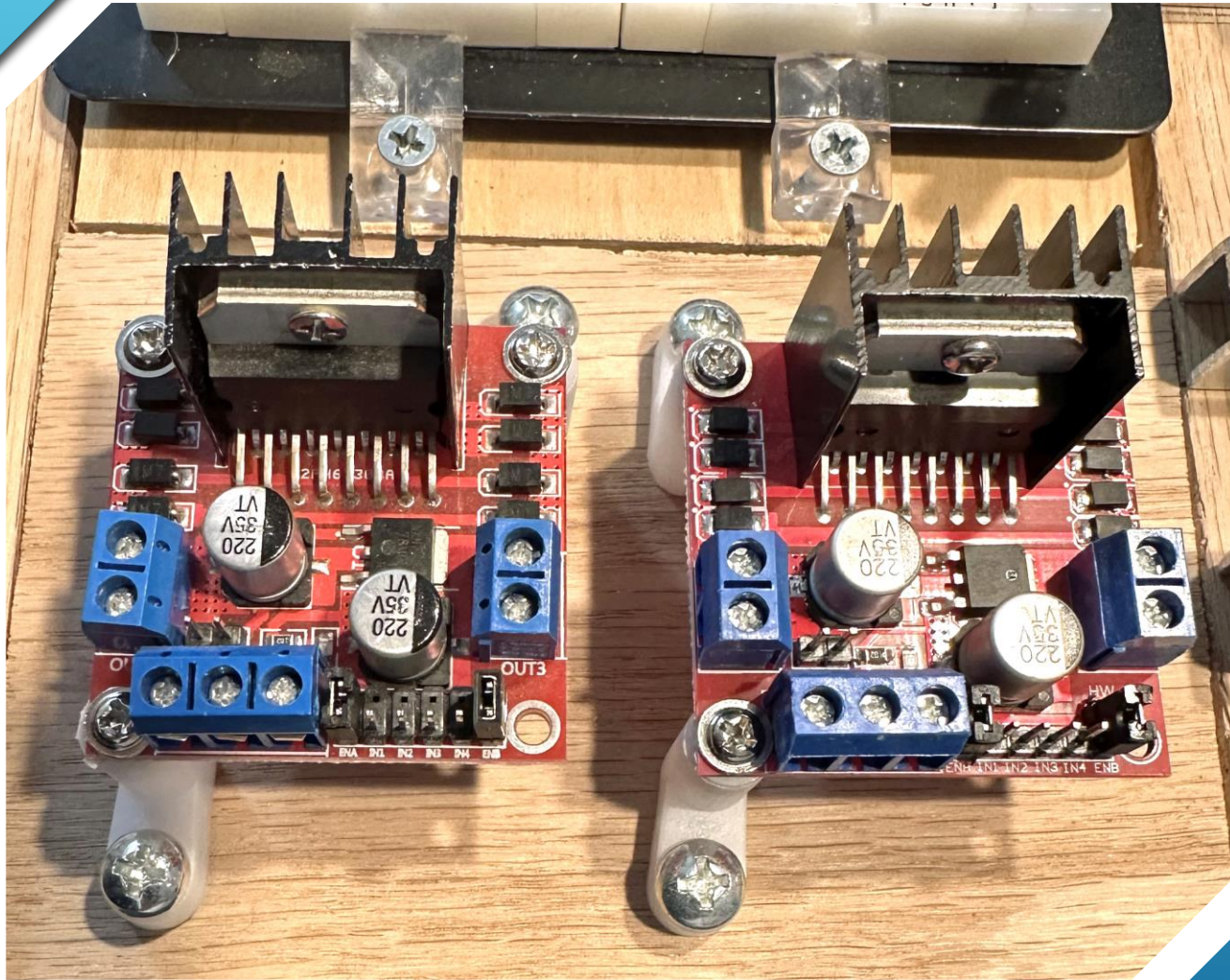
BREADBOARDING

- ▶ UNO I/O Termination Shield
- ▶ Lock-Down Screw Terminals
- ▶ 6 Relay Outputs
- ▶ LED I/O Status Indications
- ▶ 6 Digital Input Terminals
- ▶ 6 Switch-based Input Terminals
- ▶ Clearly Identifiable Labels



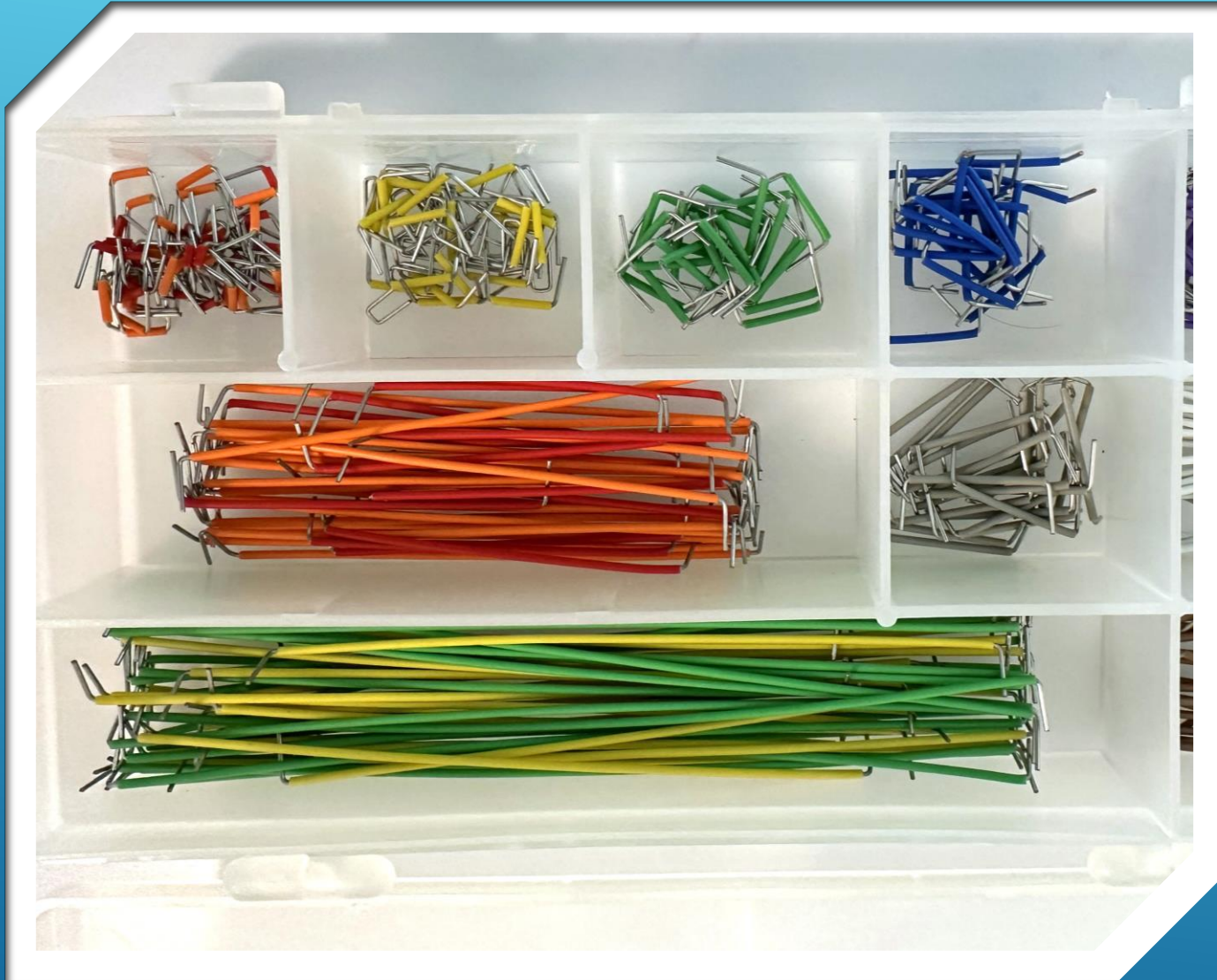
AUXILIARY CIRCUIT BOARDS

- ▶ Motor Driver Board Set
- ▶ Used with Stepper Motors
- ▶ One Motor per Board



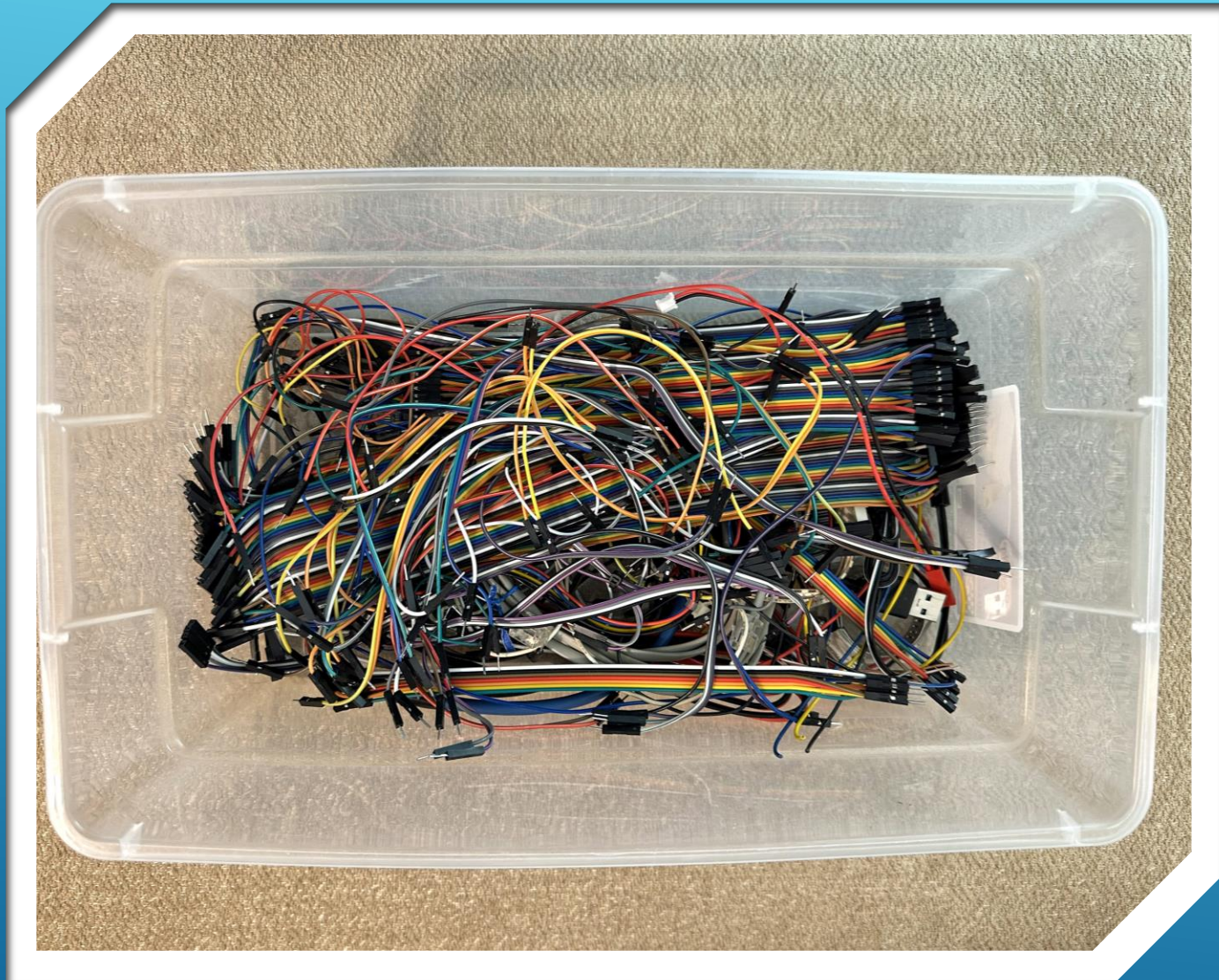


WIRES &
TOOLS



WIRES AND TOOLS

22 AWG Solid



WIRES AND TOOLS

22 AWG Solid



WIRES AND TOOLS

- Pin to Pin
- Socket to Socket
- Pin to Socket

22 AWG Solid

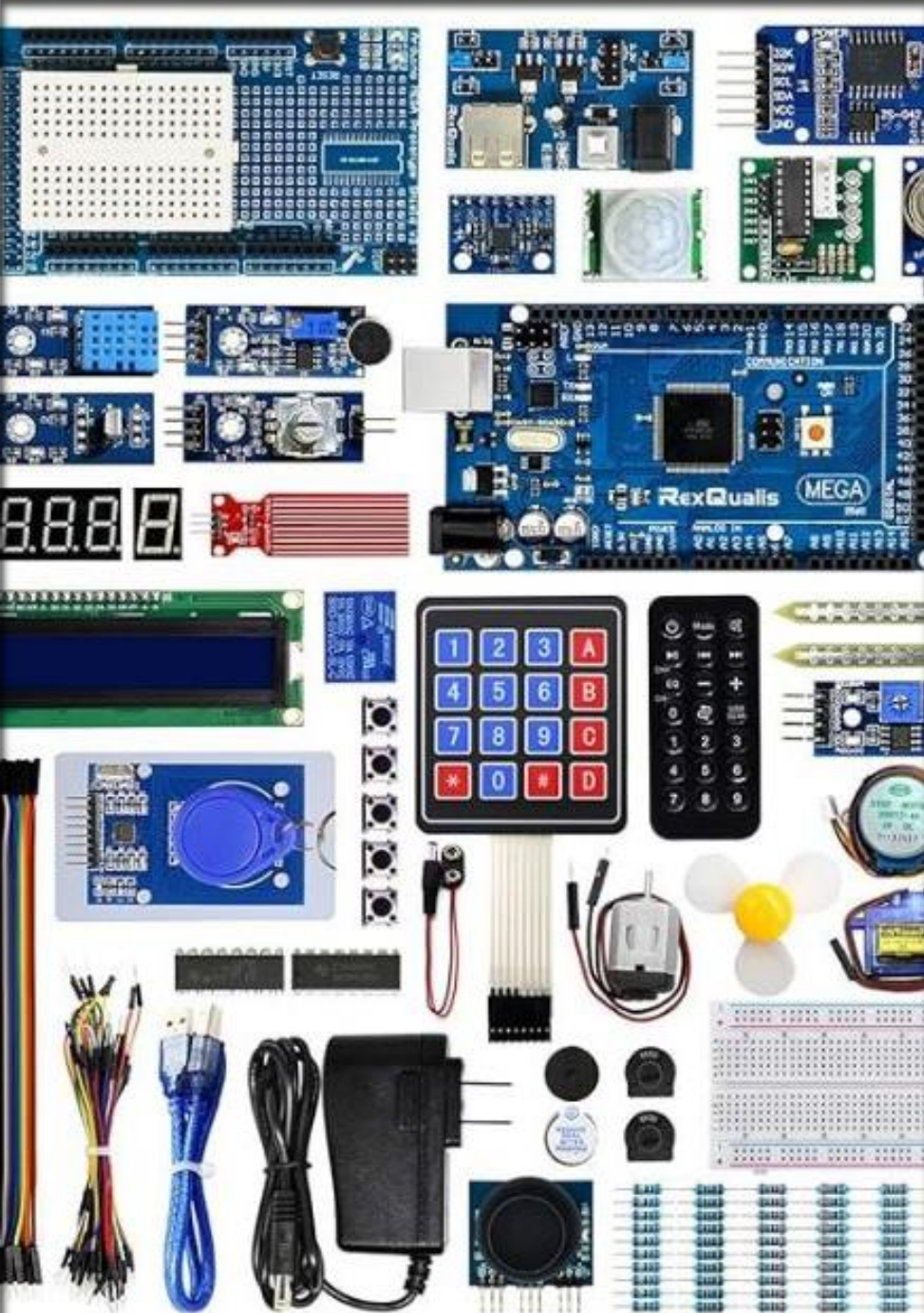


WIRES AND TOOLS

22 AWG Solid



PARTS &
PIECES



Roll over image to zoom in

PARTS AND PIECES

Available on-line...
www.amazon.com
Search: Arduino



PARTS AND PIECES

Available on-line...
www.amazon.com
Search: Arduino

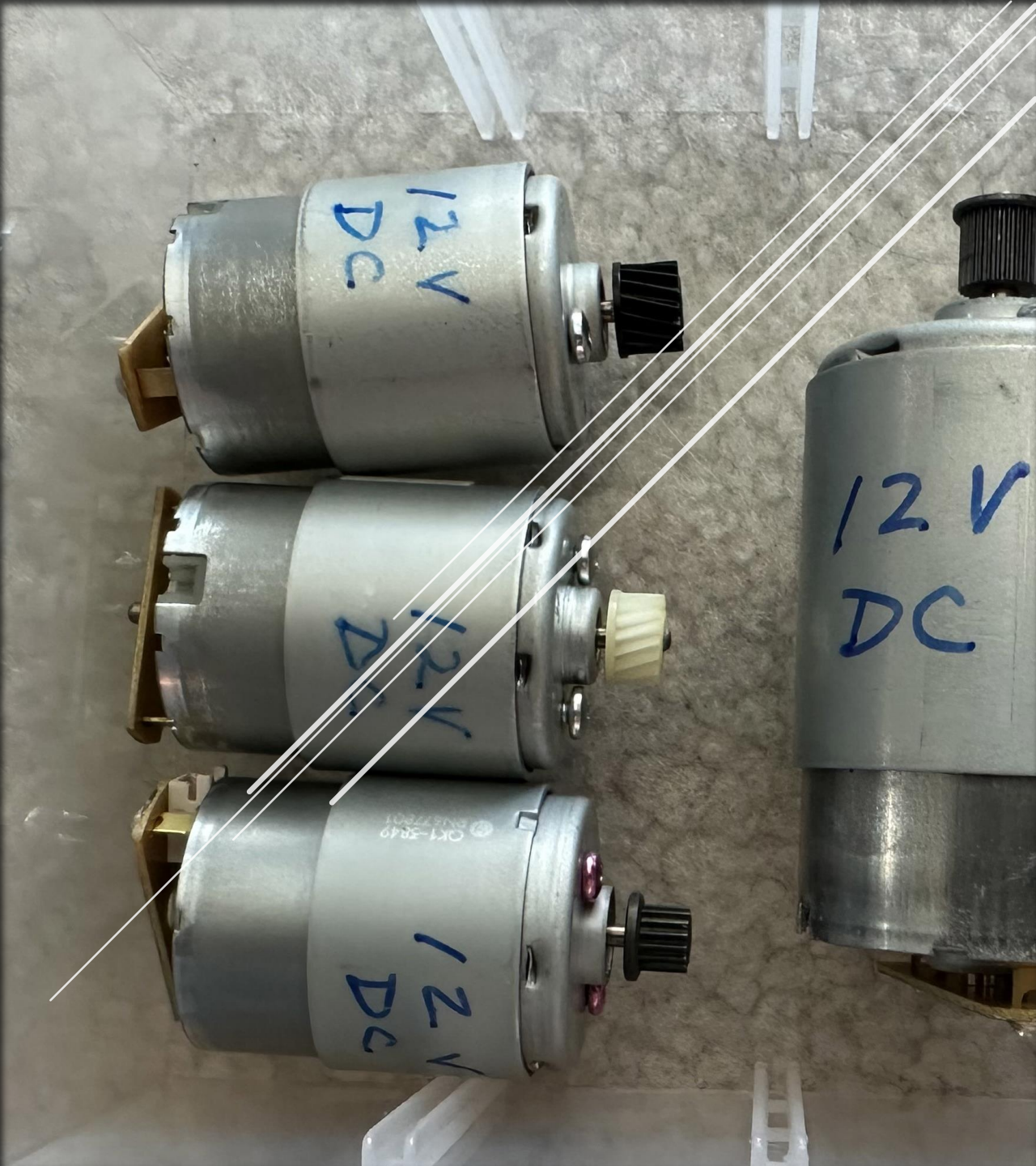
PARTS AND PIECES



PARTS AND PIECES



PARTS AND PIECES



PARTS AND PIECES





PC OR
LAPTOP

- WINDOWS
- LINUX
- macOS



SOFTWARE

Arduino IDE 2

Integrated
Development
Environment

www.arduino.cc

Search on Arduino.cc

HARDWARE SOFTWARE CLOUD DOCUMENTATION COMMUNITY ▼ BLOG ABOUT

WHAT IS ARDUINO?



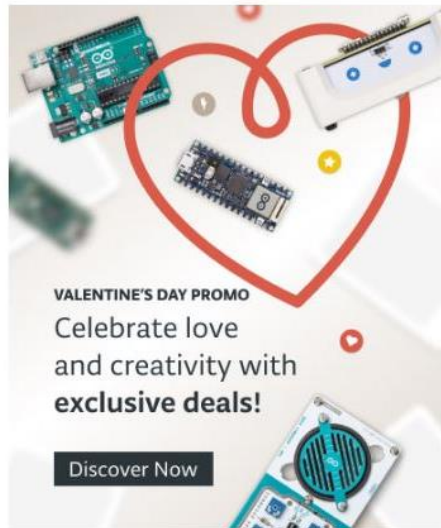
ARDUINO



ARDUINO

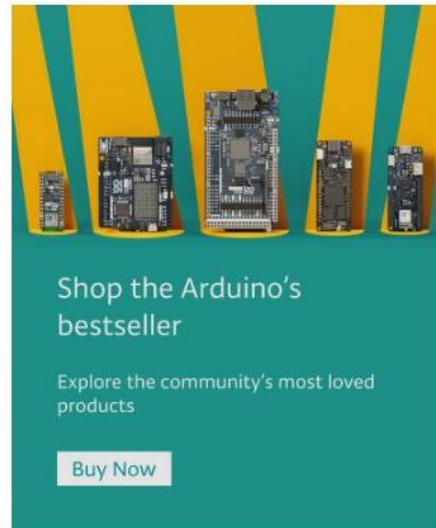


ARDUINO IN THE CLOUD



VALENTINE'S DAY PROMO
Celebrate love
and creativity with
exclusive deals!

Discover Now



Shop the Arduino's
bestseller

Explore the community's most loved
products

Buy Now



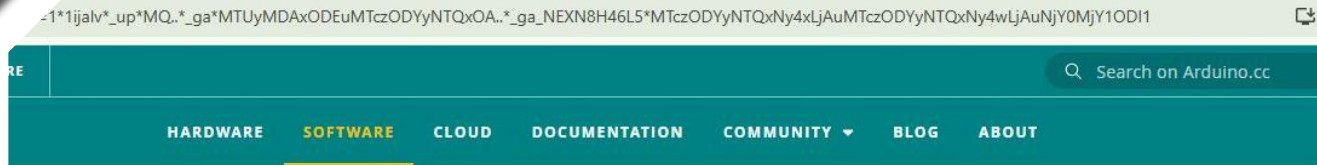
BLOG



BLOG

SOFTWARE

- ▶ [Arduino Home Page](#)
- ▶ www.arduino.cc
- ▶ [Software Downloads \(free\)](#)
- ▶ [Cloud Access](#)
- ▶ [Documentation](#)
- ▶ [Software Reference Guide](#)
- ▶ [Much More](#)



Arduino Cloud Editor

Experience the Arduino IDE online. Whether you're at home or on the go, code, upload and access your projects anytime from your browser **for free**.

[GO TO CLOUD EDITOR](#) [LEARN MORE](#)



Downloads

 **Arduino IDE 2.3.4**

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.

For more details, please refer to the [Arduino IDE 2.0 documentation](#).

Nightly builds with the latest bugfixes are available through [Nightly Builds](#).

DOWNLOAD OPTIONS

Windows Win 10 and newer, 64 bits
Windows MSI installer
Windows ZIP file

Linux AppImage 64 bits (X86-64)
Linux ZIP file 64 bits (X86-64)

macOS Intel, 10.15: "Catalina" or newer, 64 bits
macOS Apple Silicon, 11: "Big Sur" or newer, 64 bits

[Release Notes](#)

SOFTWARE

- ▶ [Arduino Home Page](#)
- ▶ www.arduino.cc
- ▶ [Select SOFTWARE Tab](#)
- ▶ [Download Arduino IDE 2.3.4](#)
- ▶ [Windows](#)
- ▶ [Linux](#)
- ▶ [macOS](#)

l_gj=1*108249*_up*MQ.*_ga*MTEzNTQyNjg2OC4xNzM4NjI1Nzc0*_ga_NEXN8H46L5*MTczODYyNTc3NC4xLjAuMTczODYyNTc3NC4wLjAuMTkyMjc3MjI3NA..

Search on Docs

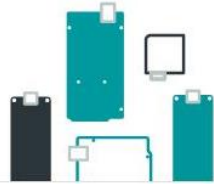
Arduino Documentation

Browse through all our documentation to learn everything for your Arduino journey.

Hardware

The vital pieces of hardware documentation you need to start your Arduino projects.

[BROWSE HARDWARE](#) →



Cloud

Arduino Cloud is an online platform that allows you to create, deploy and monitor IoT projects.

[DISCOVER CLOUD](#) →



Software

Learn about the IDEs, Web Editor, CLI and all the software tools that you need to get your hands dirty.

[DISCOVER SOFTWARE](#) →



Programming

All you need to know to program with Arduino, including library documentation.

[START CODING](#) →



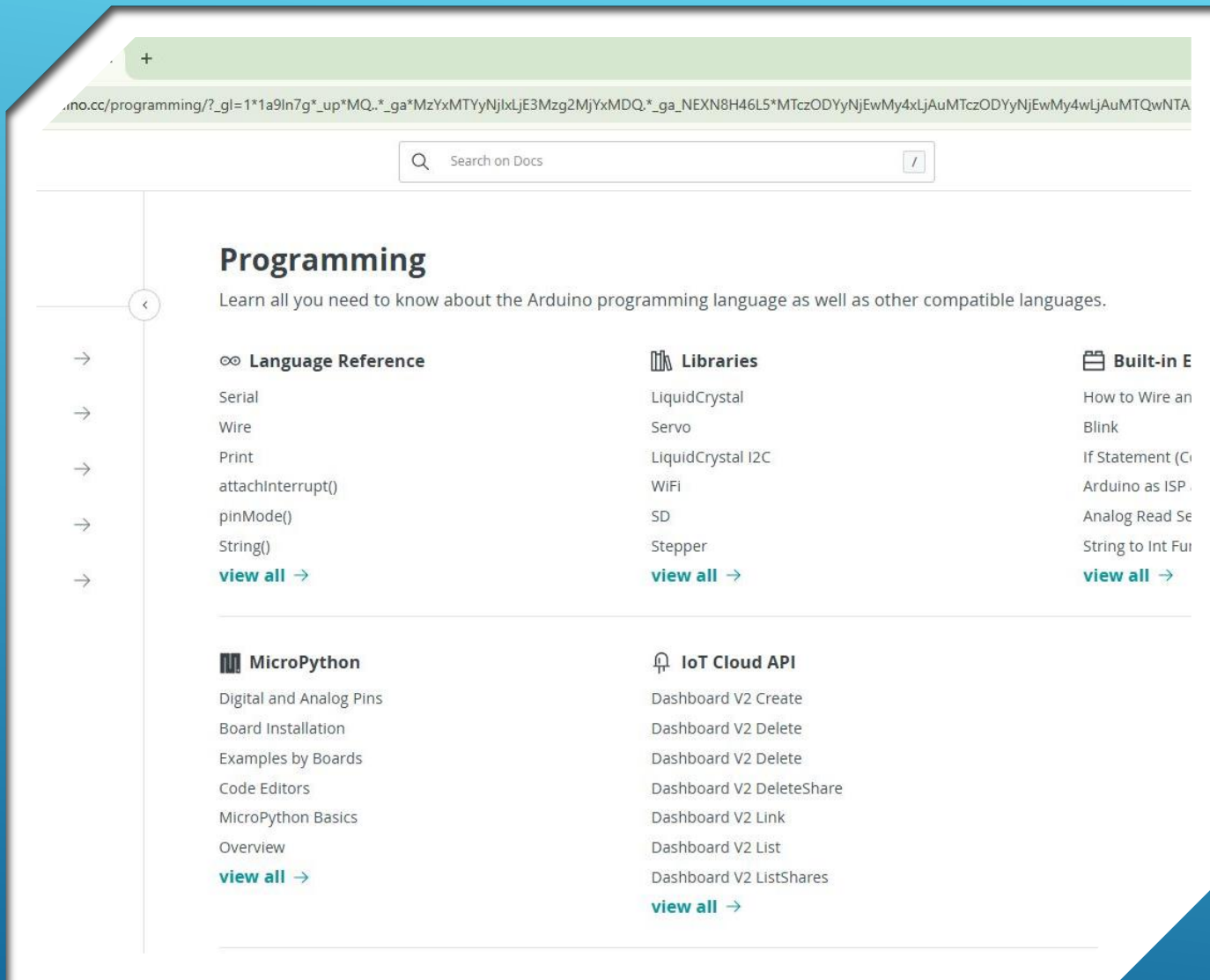
Set Up Your Arduino Board

Set up your Arduino board with this interactive Arduino hardware yet? Have a look at our



DOCUMENTATION

- ▶ [Arduino Home Page](#)
- ▶ www.arduino.cc
- ▶ [Select DOCUMENTATION Tab](#)
- ▶ [Browse through areas of interest](#)
- ▶ [Select desired Learning Topic](#)



PROGRAMMING

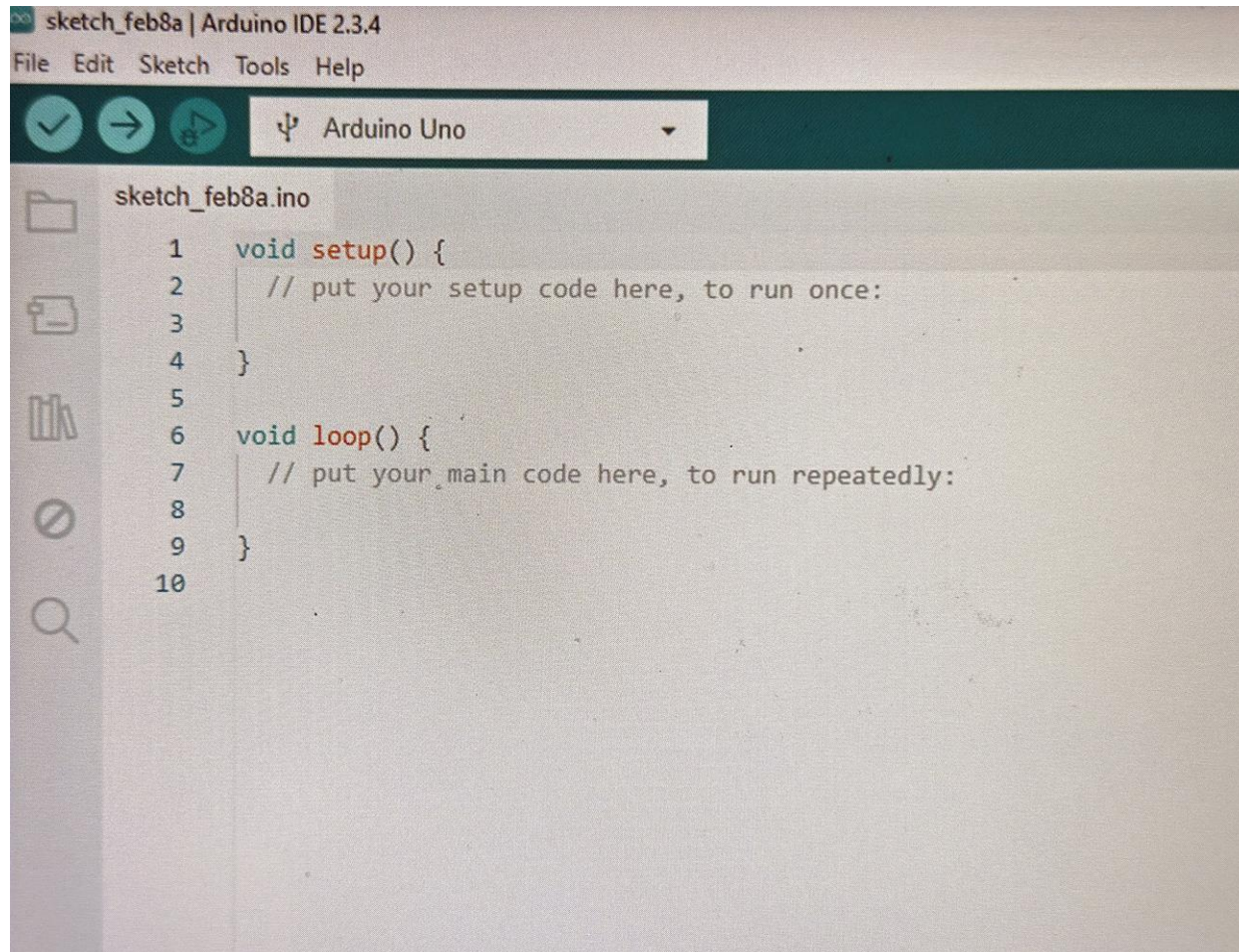
- ▶ [Arduino Home Page](#)
- ▶ www.arduino.cc
- ▶ [Select PROGRAMMING Tab](#)
- ▶ [Browse through areas of interest](#)
- ▶ [Select desired Learning Topic](#)
- ▶ [Ex: to view the full LANGUAGE REFERENCE GUIDE](#)
- ▶ [Click “View All” under LANGUAGE REFERENCE](#)



IDE TOUR

Arduino IDE 2

www.arduino.cc



```
sketch_feb8a | Arduino IDE 2.3.4
File Edit Sketch Tools Help
[Icons] Arduino Uno
sketch_feb8a.ino
1 void setup() {
2   // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7   // put your main code here, to run repeatedly:
8
9 }
10
```

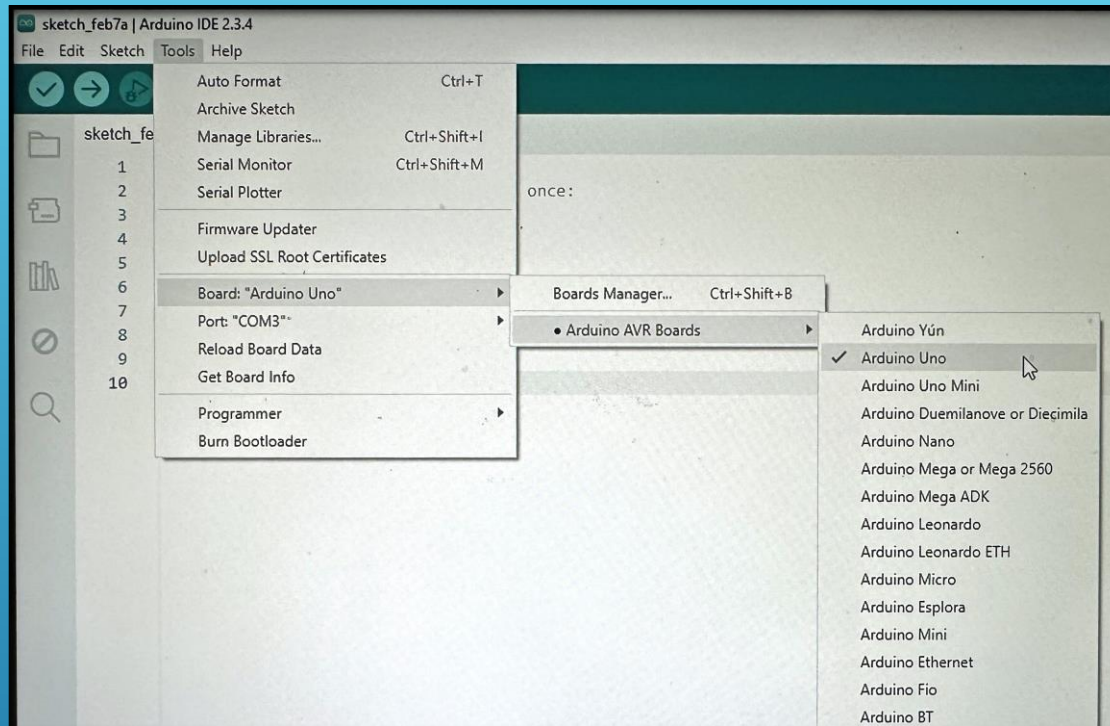
ARDUINO IDE

- ▶ [IDE Home Screen](#)
- ▶ [Blank Sketch](#)

```
sketch_feb8a.ino
1  void setup() {
2      // put your setup code here, to run once:
3
4  }
5
6  void loop() {
7      // put your main code here, to run repeatedly:
8
9  }
10
```

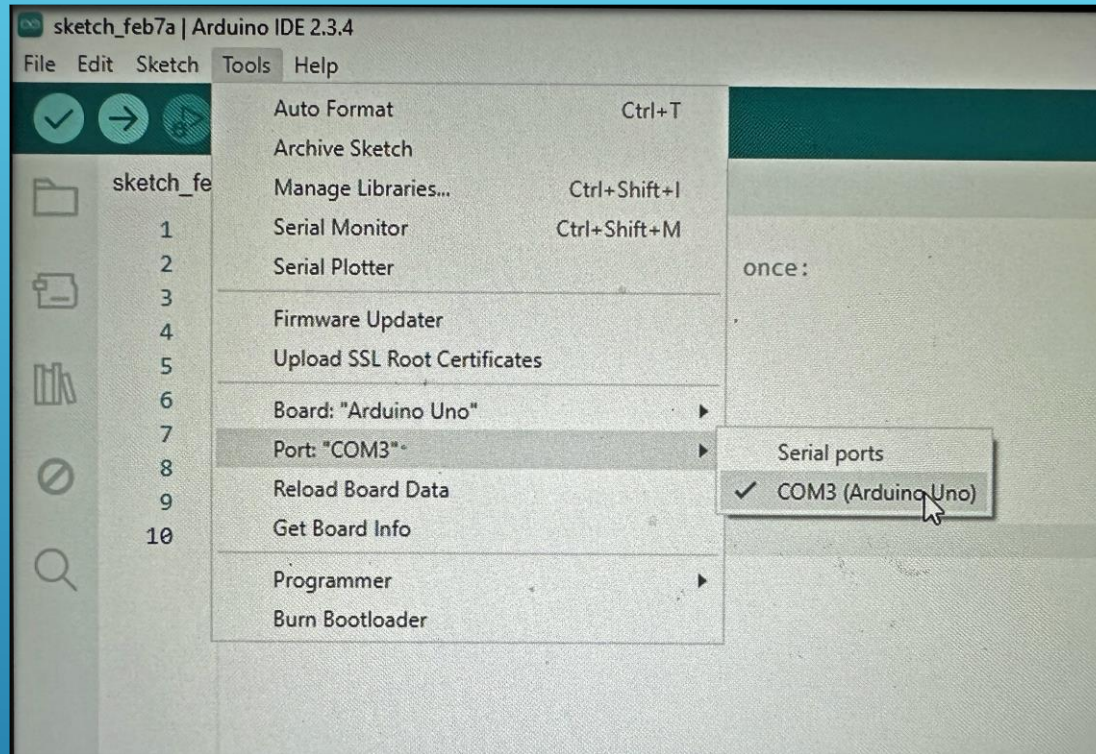
ARDUINO IDE

- ▶ [IDE Home Screen](#)
- ▶ [Blank Sketch](#)



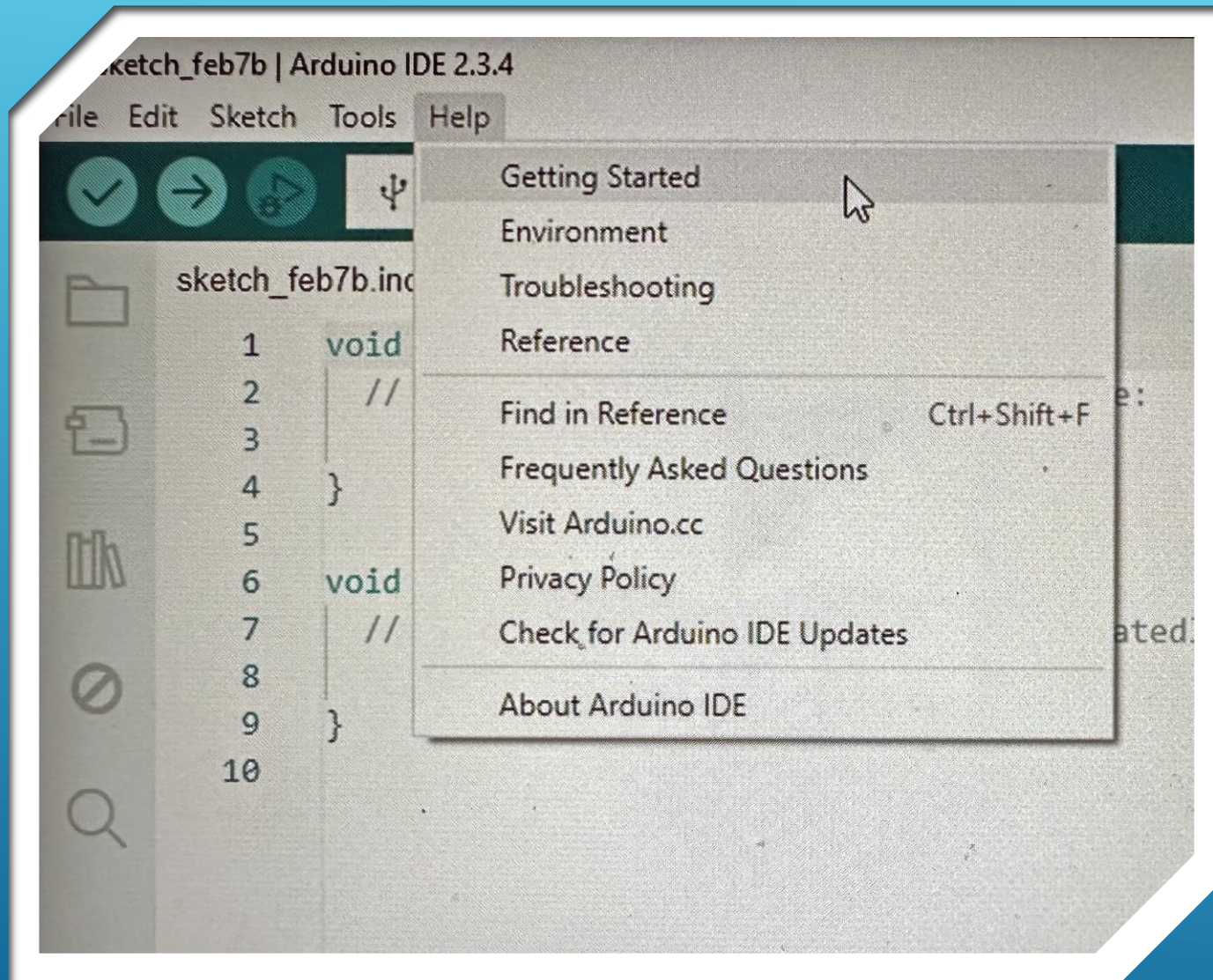
- ▶ To match IDE to BOARD type you are using-
- ▶ From IDE Home Screen:
- ▶ Select TOOLS
- ▶ Scroll to BOARD
- ▶ then ARDUINO AVR BOARDS
- ▶ Select ARDUINO UNO

ARDUINO IDE- SELECT BOARD TYPE



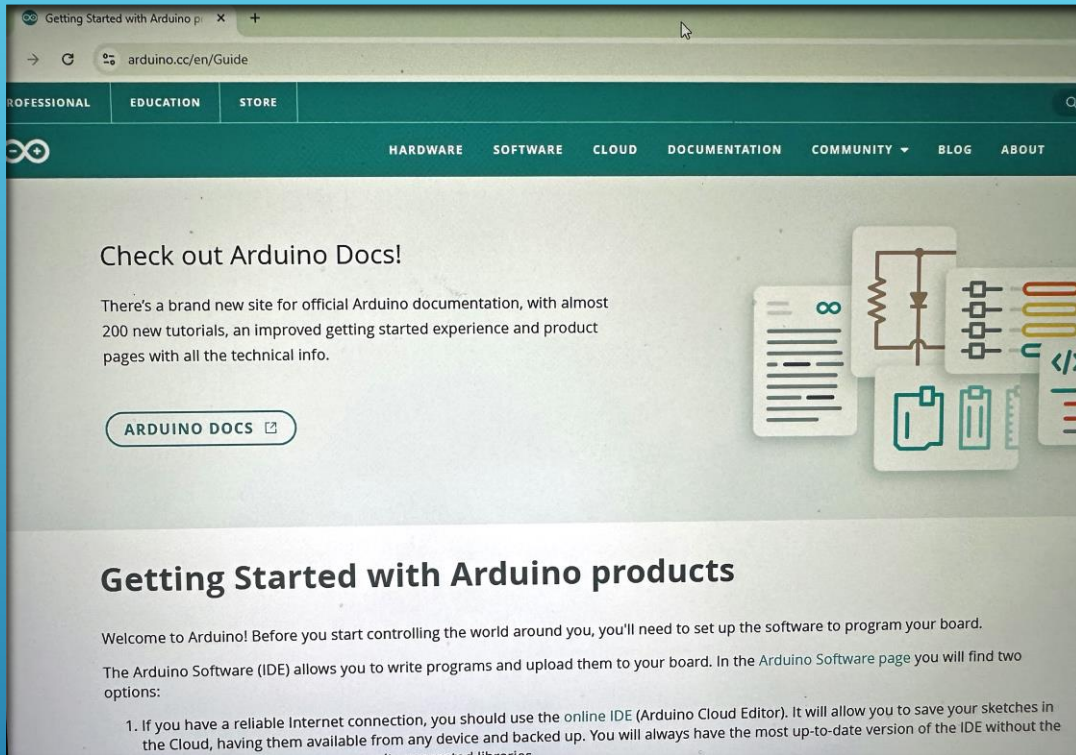
- ▶ ALLOWS PC to talk to the BOARD
- ▶ From IDE Home Screen:
- ▶ Select TOOLS
- ▶ Scroll to PORT:
- ▶ under SERIAL PORTS
- ▶ Select COM3(Arduino Uno)

ARDUINO IDE- SELECT COMMUNICATIONS PORT



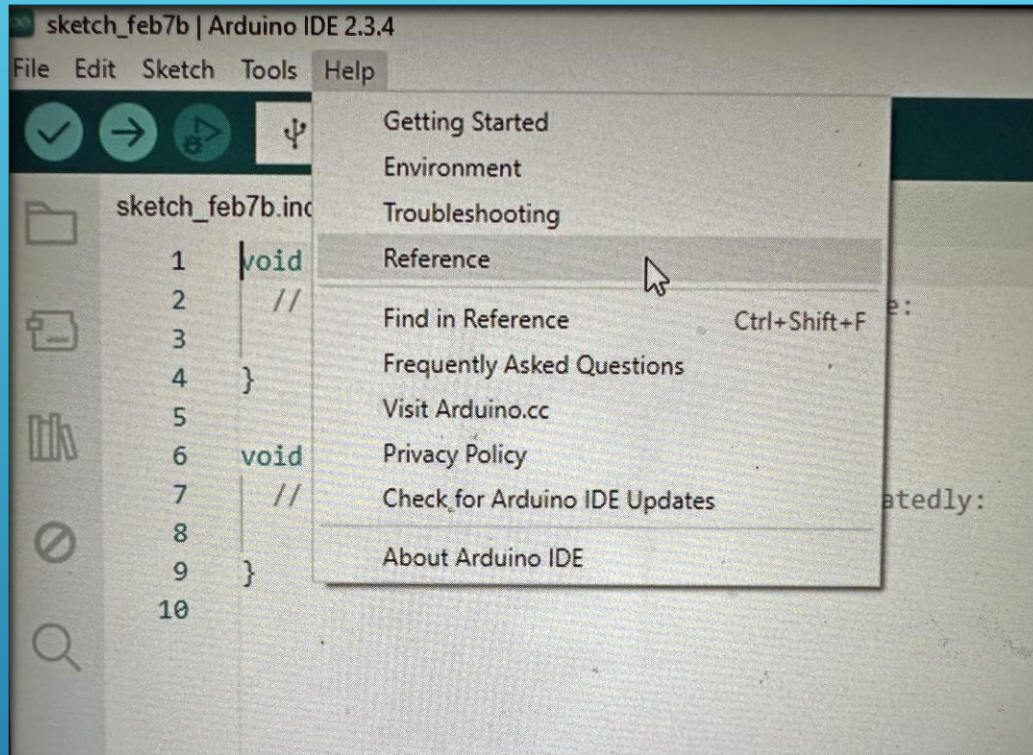
ARDUINO IDE GETTING HELP

- ▶ From IDE Home Screen-
- ▶ Select HELP
- ▶ Select desired Topic
- ▶ ex: GETTING STARTED



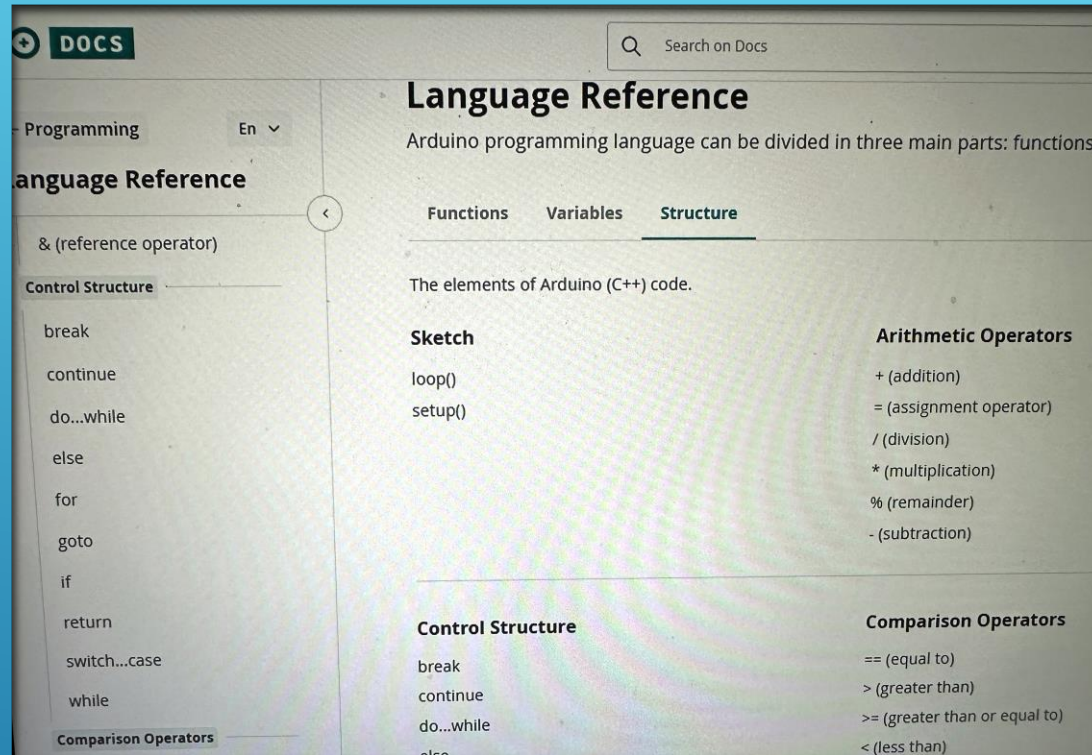
- ▶ Results from selecting-
- ▶ GETTING STARTED

ARDUINO IDE GETTING HELP



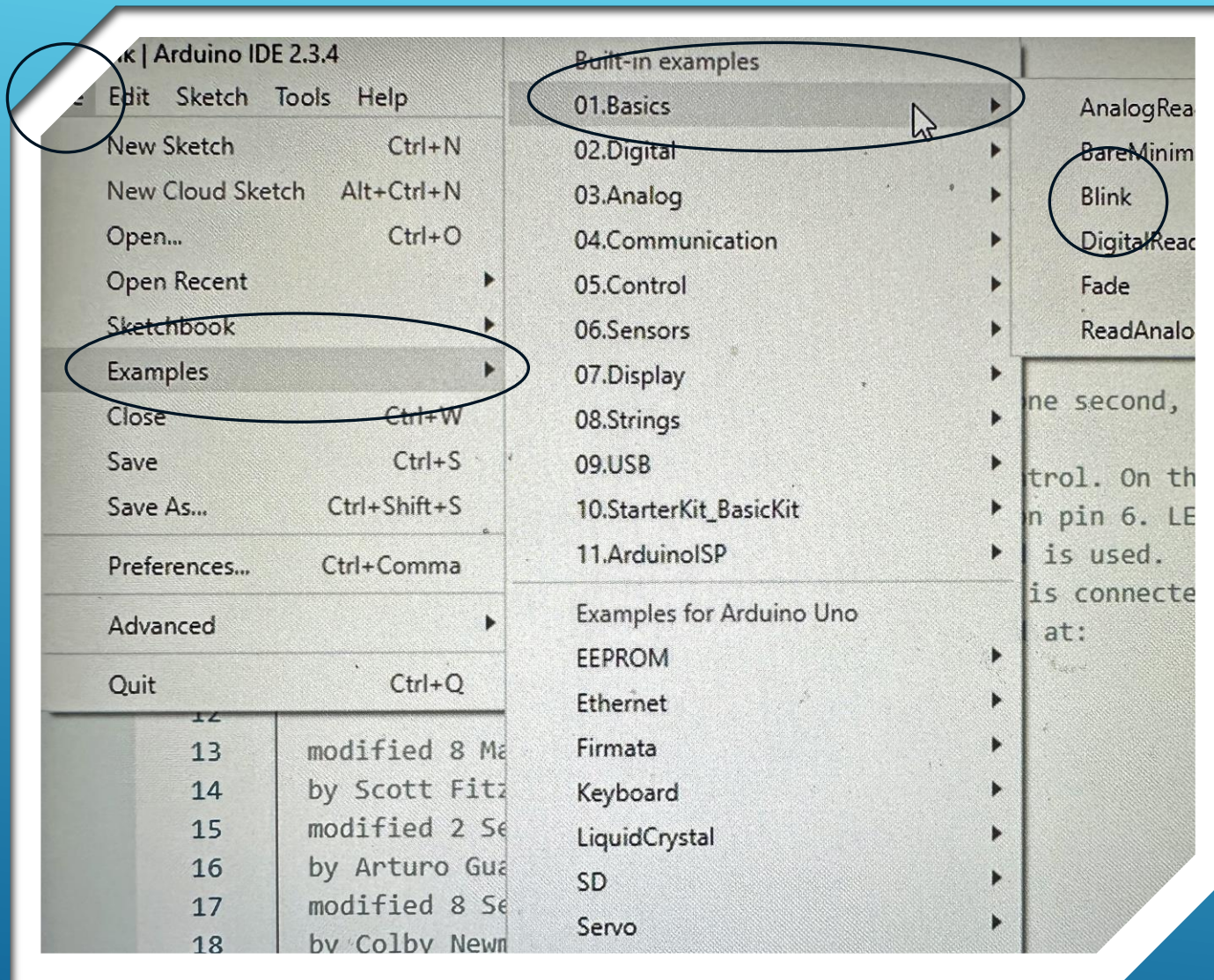
- ▶ From IDE Home Screen-
- ▶ Select HELP
- ▶ Select desired Topic
- ▶ ex: REFERENCE

ARDUINO IDE GETTING HELP



- ▶ Results from selecting-
- ▶ REFERENCE

ARDUINO IDE GETTING HELP



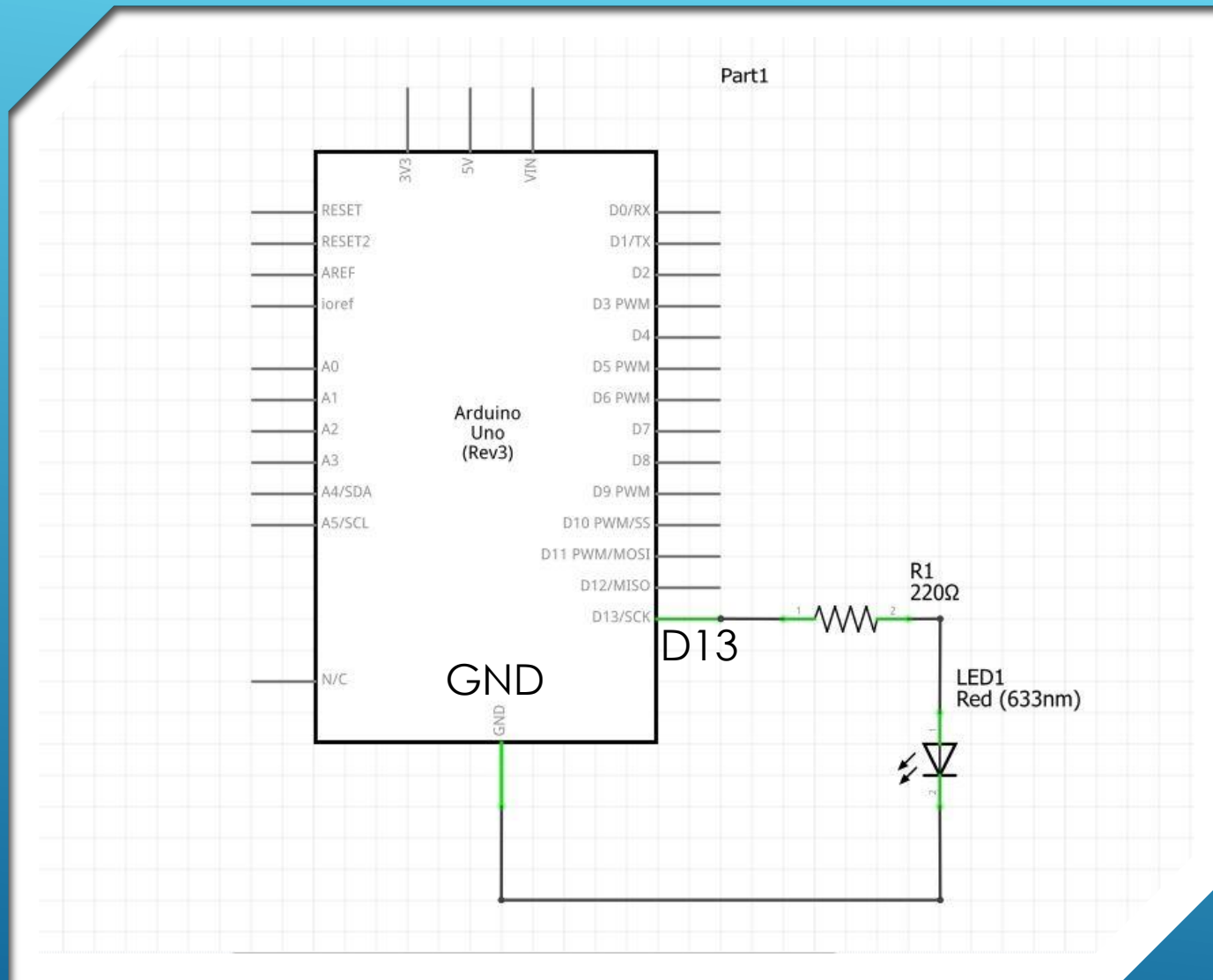
ARDUINO IDE- PRE-INSTALLED EXAMPLE SKETCHES

- ▶ From IDE Home Screen
- ▶ under FILE:
- ▶ Scroll to EXAMPLES
- ▶ Then - 01.BASICS and
- ▶ Select BLINK

```
20 This example code is in the public domain.
21
22 https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
23 */
24
25 // the setup function runs once when you press reset or power the board
26 void setup() {
27   // initialize digital pin LED_BUILTIN as an output.
28   pinMode(LED_BUILTIN, OUTPUT);
29 }
30
31 // the loop function runs over and over again forever
32 void loop() {
33   digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
34   delay(1000); // wait for a second
35   digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
36   delay(1000); // wait for a second
37 }
38
```

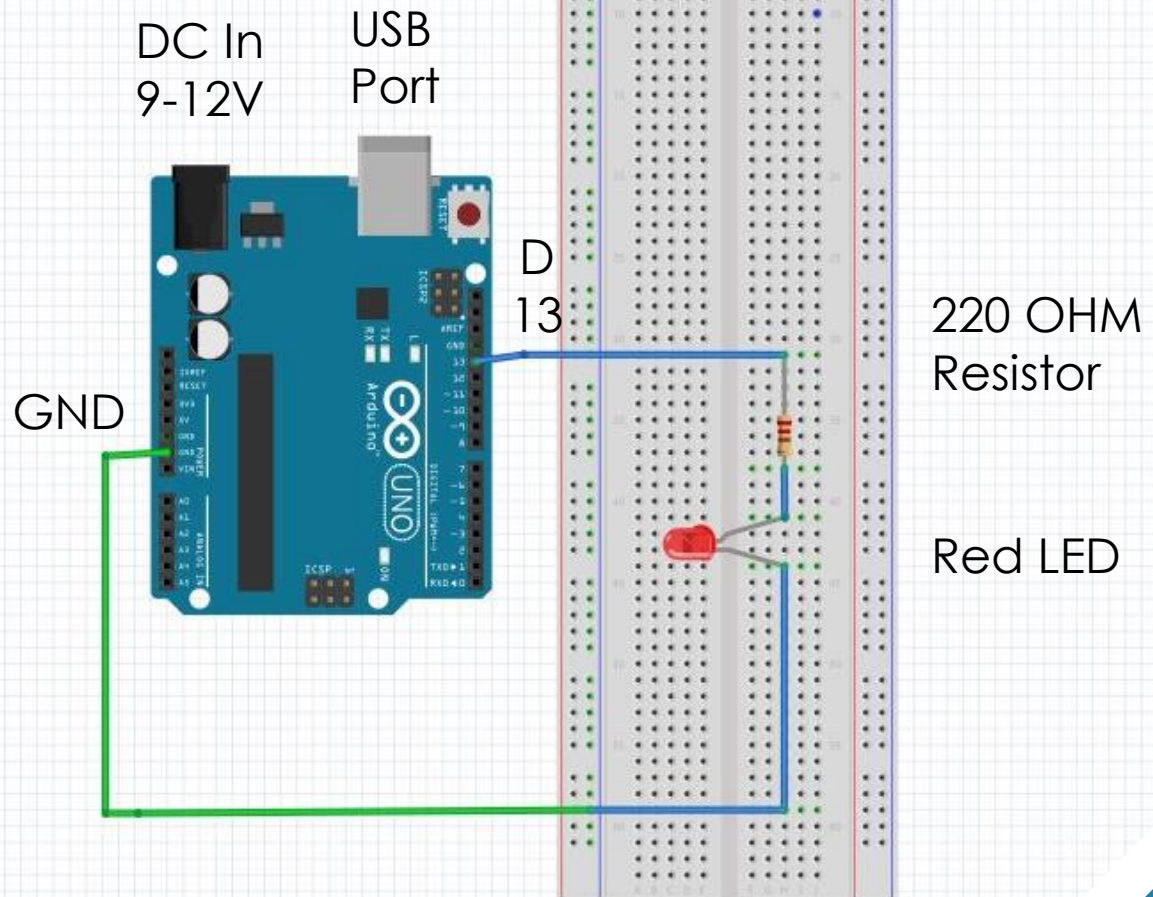
- ▶ Results from selecting-
- ▶ BLINK

ARDUINO IDE EXAMPLE SKETCH – “BLINK”



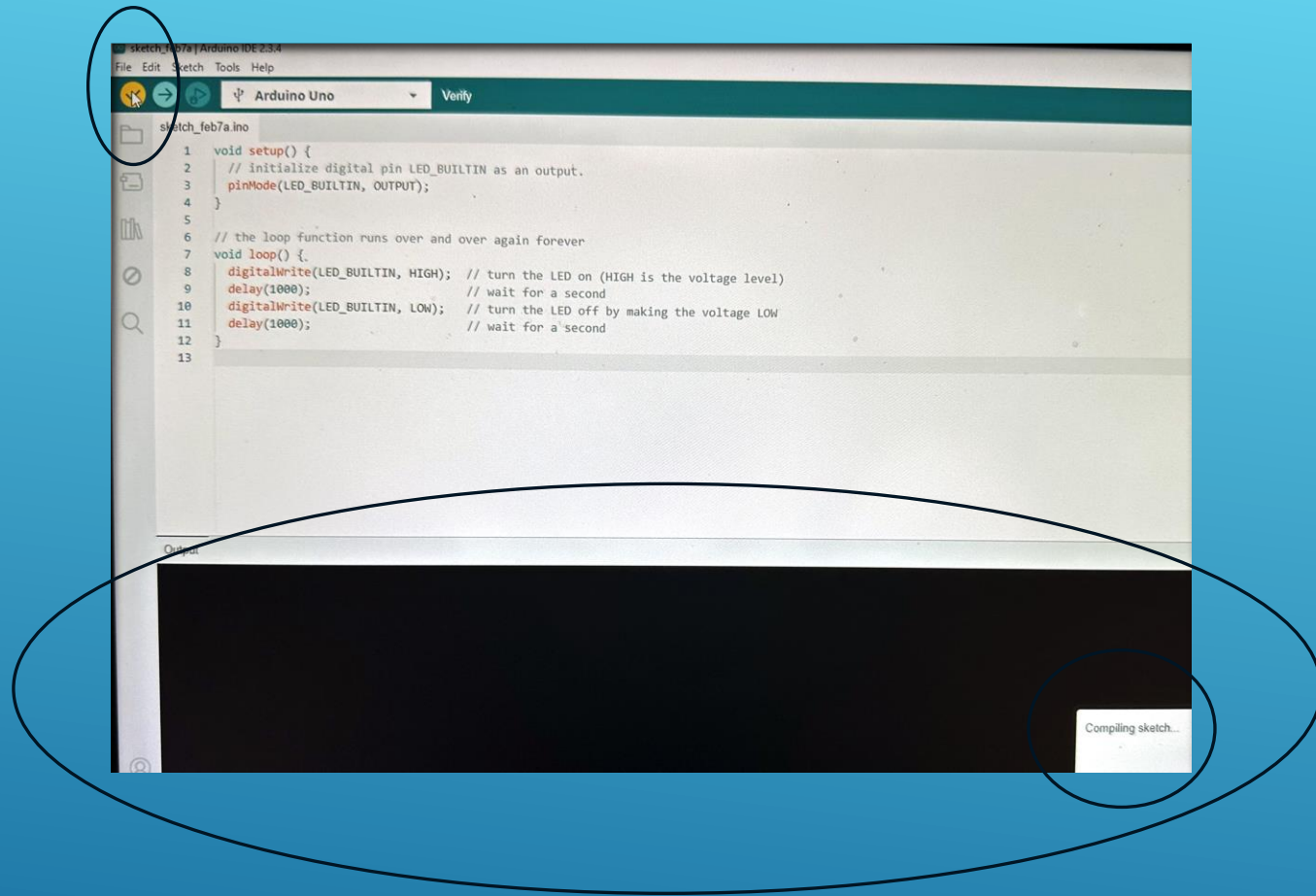
SCHEMATIC FOR EXAMPLE SKETCH – “BLINK”

- ▶ Parts needed to build:
- ▶ Arduino UNO
- ▶ Resistor – 220 OHM
- ▶ LED – Any Color
- ▶ Breadboard
- ▶ Wire
- ▶ DC Power Source



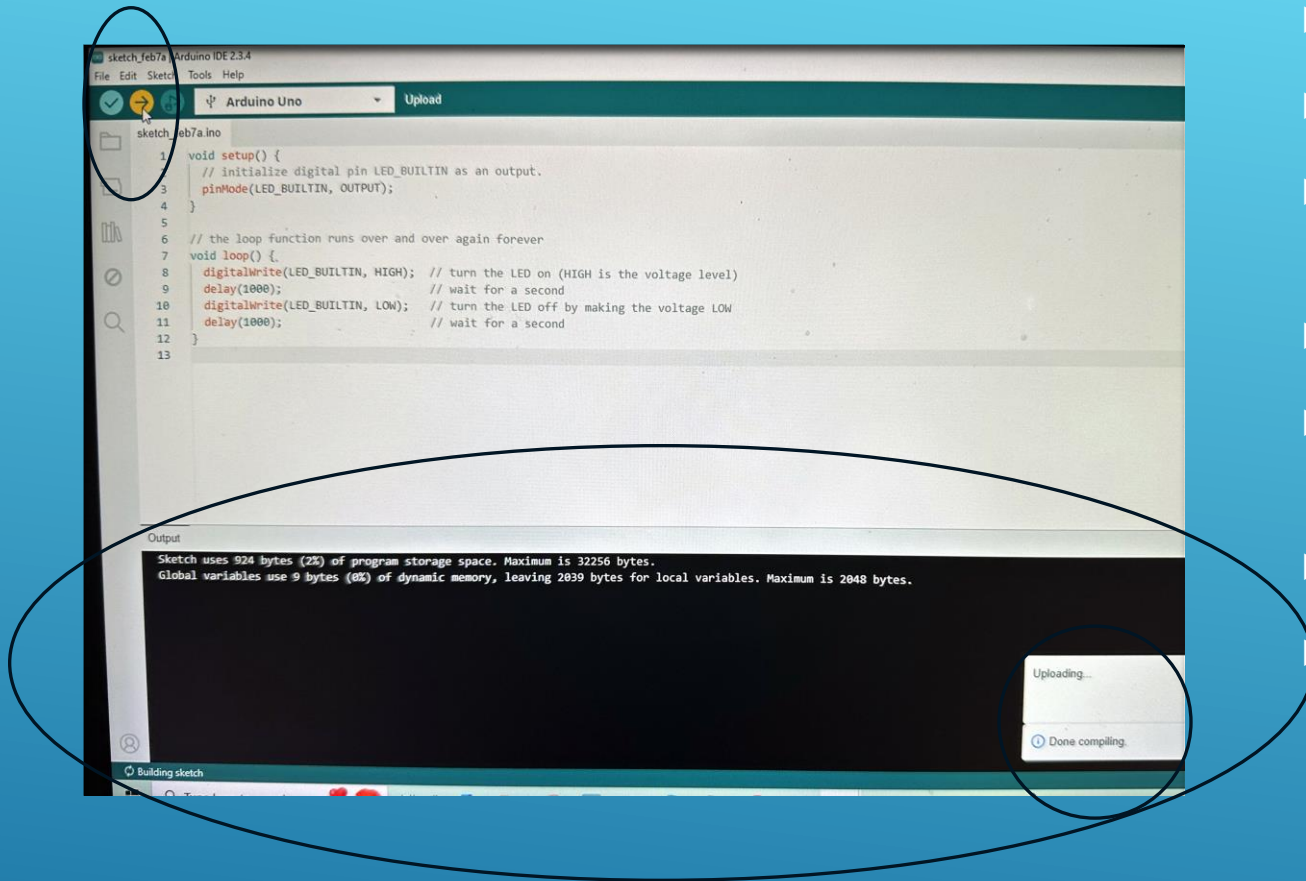
PARTS LAYOUT FOR EXAMPLE SKETCH – “BLINK”

- ▶ Parts needed to build:
- ▶ Arduino UNO
- ▶ Resistor – 220 OHM
- ▶ LED – Any Color
- ▶ Breadboard
- ▶ Wire
- ▶ DC Power Source



- ▶ Check Sketch prior to sending to board...
- ▶ Click Compile Button (orange)
- ▶ Results shown in bottom of screen
- ▶ Correct errors as necessary

CHECK / VERIFY SKETCH



- ▶ Upload Sketch to Board:
- ▶ Click UPLOAD Button (orange)
- ▶ Status/Results shown in bottom of screen
- ▶ Board attempts to run sketch
- ▶ Check the results: On-Board LED Blinks
- ▶ Breadboard-Mounted LED Blinks
- ▶ Correct errors as necessary

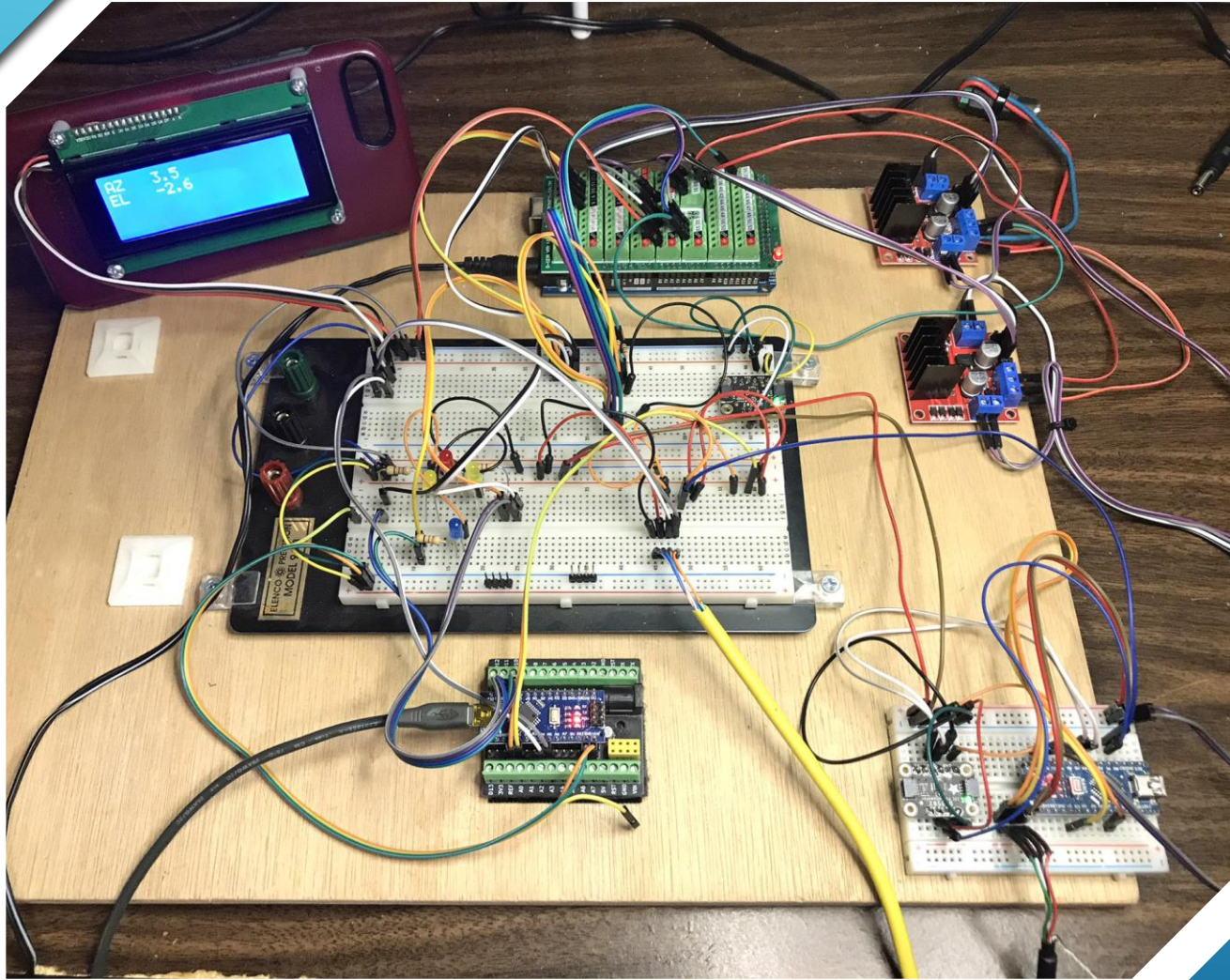
COMPILE / UPLOAD SKETCH



MOVING
FORWARD

PROTOTYPE
TO
FINISHED PRODUCT

PROTOTYPE TO FINISHED PRODUCT





GATHER MATERIALS

WHAT MAY BE NEEDED...

- ▶ PROPER ENCLOSURE
- ▶ DC POWER SOURCE
- ▶ BLANK CIRCUIT BOARD(S)
- ▶ INTERCONNECTION WIRES
- ▶ PARTS / COMPONENTS
- ▶ MOUNTING HARDWARE
- ▶ SMALL HAND TOOLS – BASIC SET
- ▶ VOM OR DVM
- ▶ DREMEL TOOL – IF NEEDED
- ▶ DRILL & BITS – IF NEEDED
- ▶ PROTECTIVE EYEWHERE, GLOVES AND CLOTHING
- ▶ SAFETY AWARENESS
- ▶ COMMON SENSE

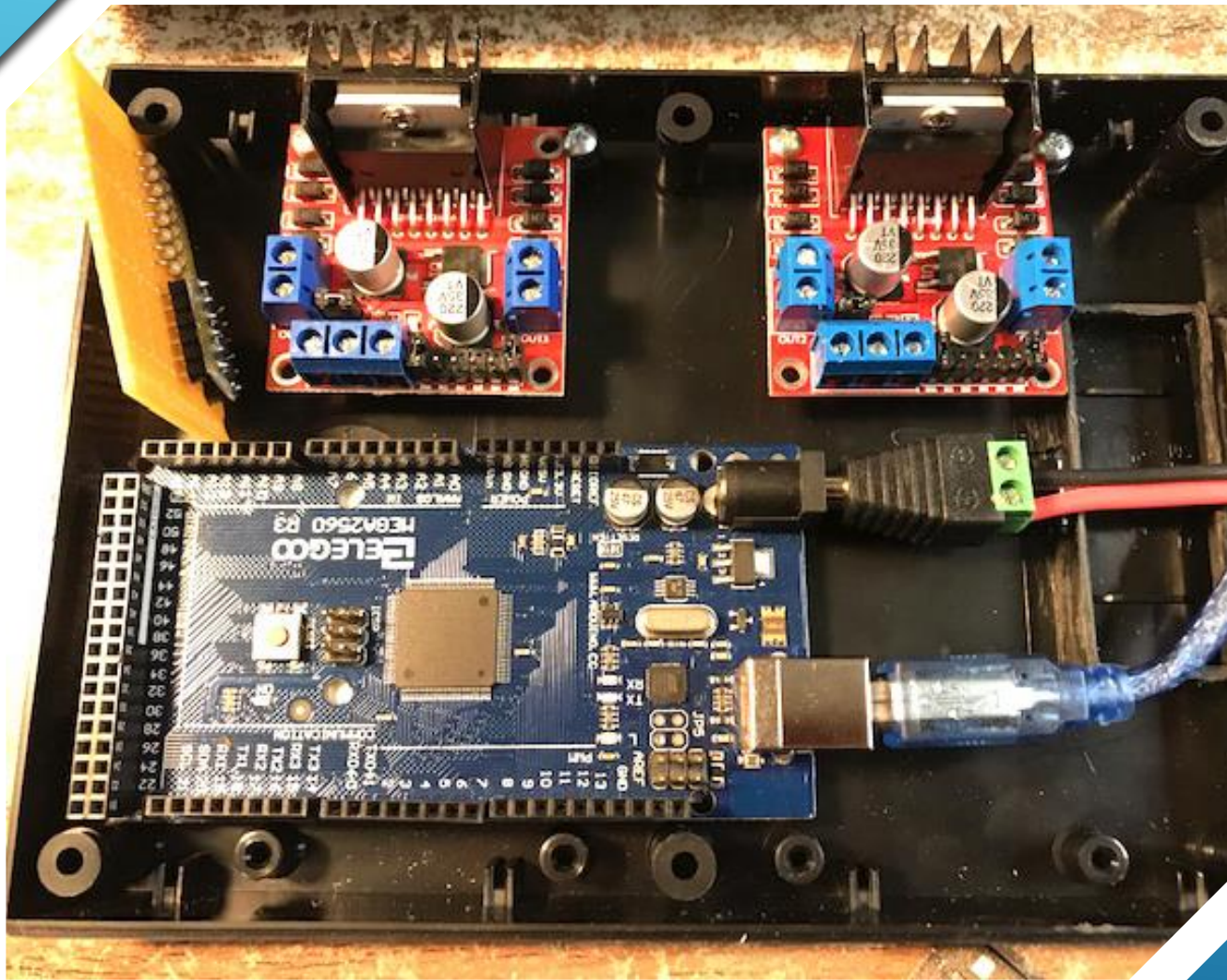
PROJECT CONSTRUCTION TIPS

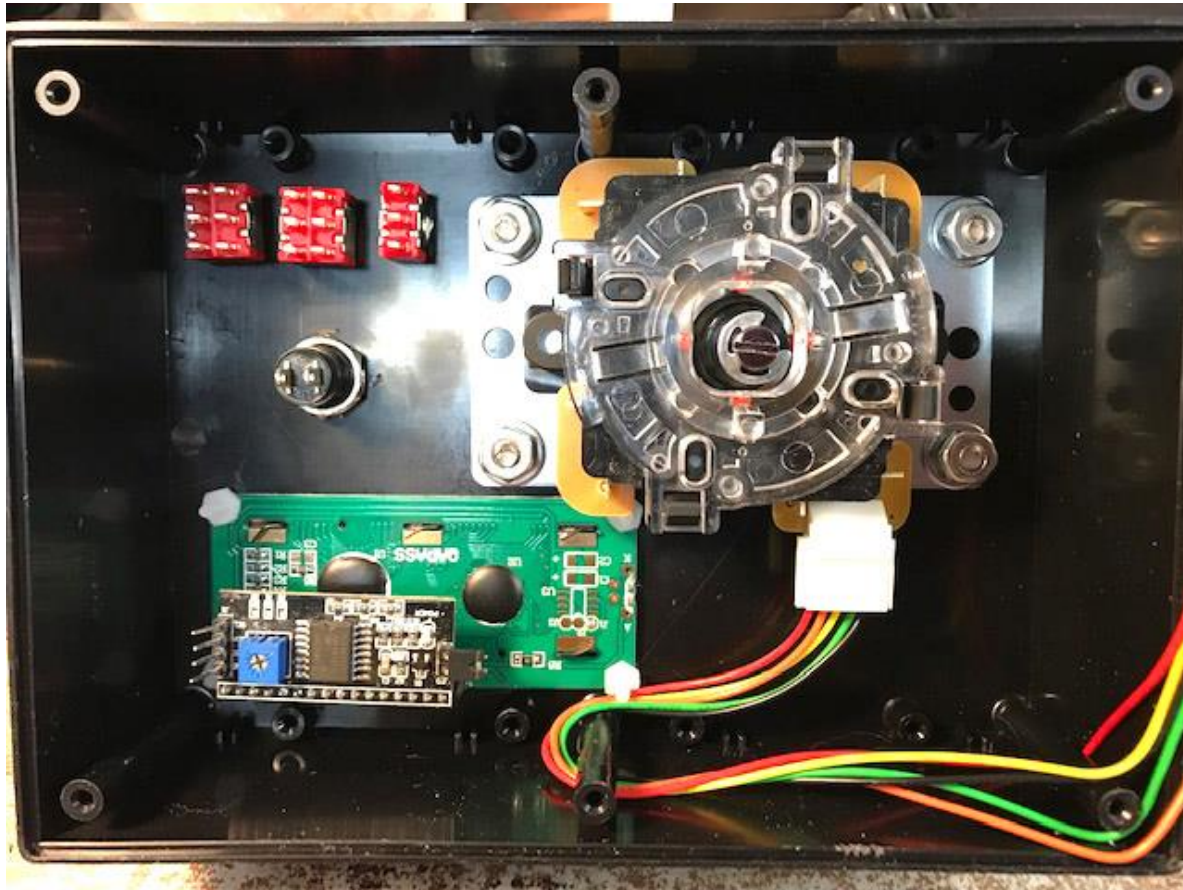
- ▶ Plan Layout Carefully
- ▶ Consider using a Graph-Paper overlay
- ▶ Plan steps carefully for cutting, drilling, mounting and soldering
- ▶ Wear Eye Protection and gloves when cutting or drilling
- ▶ Work in a safe environment
- ▶ Ensure adequate lighting
- ▶ Always operate power tools in a safe manner



PROJECT CONSTRUCTION TIPS

- ▶ Order a Properly-Sized Enclosure
- ▶ Plan layout carefully
- ▶ Consider wire routing
- ▶ Add a thin wooden Baseplate to mount ckt boards (not shown)





PROJECT CONSTRUCTION TIPS

- ▶ Plan layout carefully
- ▶ Consider wire routing
- ▶ Ensure adequate clearance when lid is connected to base.
- ▶ Use Insulated hardware when required



BONUS!!!

Let's talk about
FRITZING

ownload/

fritzing electronics
made easy

Projects Parts Download Learning Services Contribute **FORUM** FAB SIGN UP LOGIN

Fritzing is devoted to making creative use of electronics accessible to everyone.

The source code of Fritzing is available on our GitHub repository. Everyone is welcome to participate in the development.

We are asking you to pay 8€ (around US\$10) for downloading the application. This way we can ensure future releases, bugfixes and features.

Version **1.0.4** was released on **October 10, 2024**.

€ 8

€ 25

I am a business customer

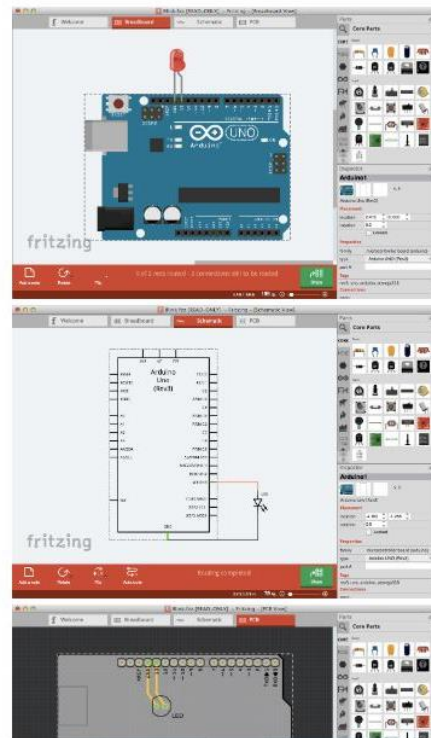
Pay & Download

Read the [installation instructions](#) below. If you have any problems with the installation, do not hesitate to contact us via the [contact form](#).

See [what's new](#) and the known issues.

This version includes translations for:

Deutsch (German), *English*, *Español* (Spanish), *Français* (French), *Italiano* (Italian), *Nederlands* (Dutch), *Português (eu)* (Portuguese EU), *Português (br)* (Portuguese BR), *日本語* (Japanese), *中文 (简体)* (Chinese Simplified), *正體中文 (繁體)* (Chinese Traditional), *Українська мова* (Ukrainian), *Русский* (Russian), *Čeština* (Czech), *한국어*



GO

[FAQ](#) [ABOUT](#) [CONTACT](#)

Blog

Fritzing 1.0.4 released
October 08, 2024

Fritzing 1.0.3 released
June 26, 2024

Fritzing 1.0.2 released
January 02, 2024

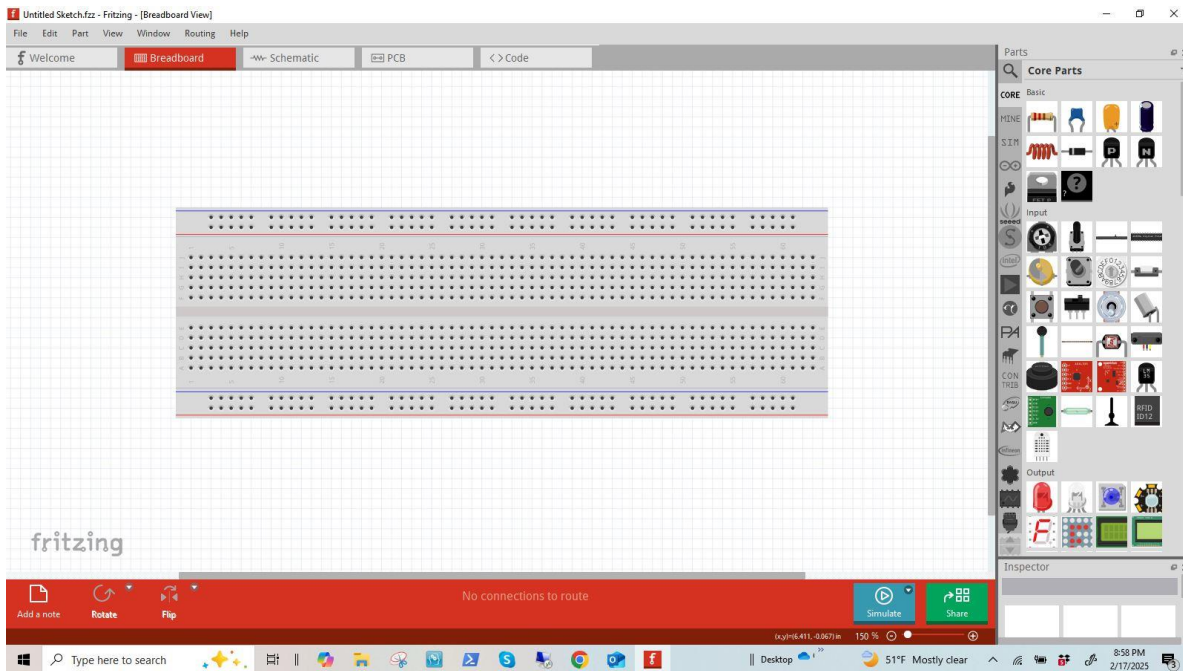
Fritzing 1.0.1 released
September 06, 2023

Fritzing 1.0.0 released
June 15, 2023

[More posts...](#)

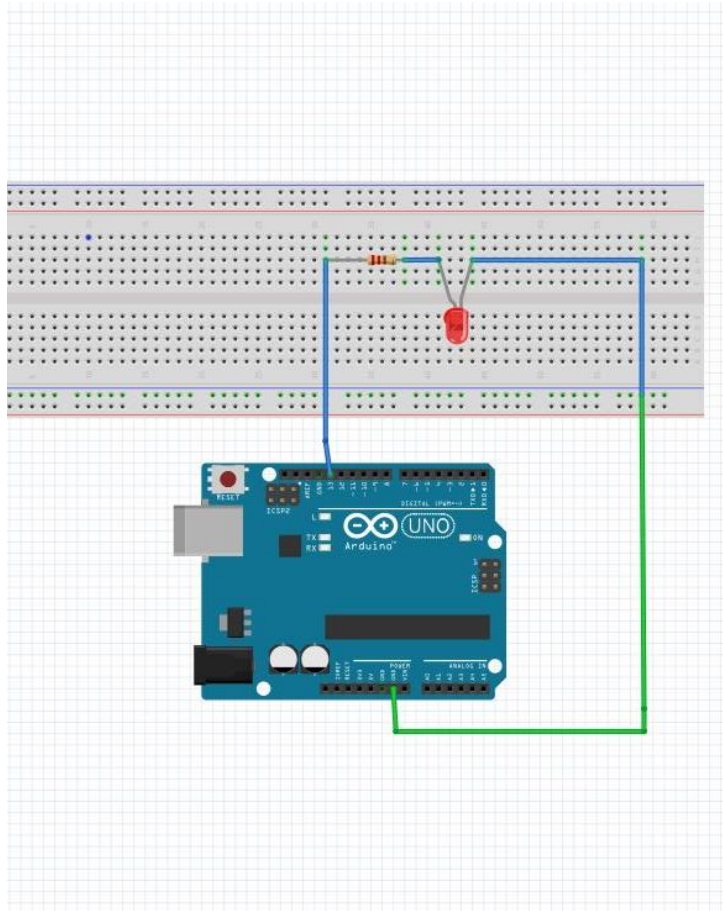
FRITZING

- ▶ [APP to Document Breadboard Layouts](#)
- ▶ [Draws Component Layouts and shows Schematics](#)
- ▶ [Comes with Learning Guides](#)
- ▶ [Broad Component Library Included](#)
- ▶ [One-time purchase – Low Cost](#)



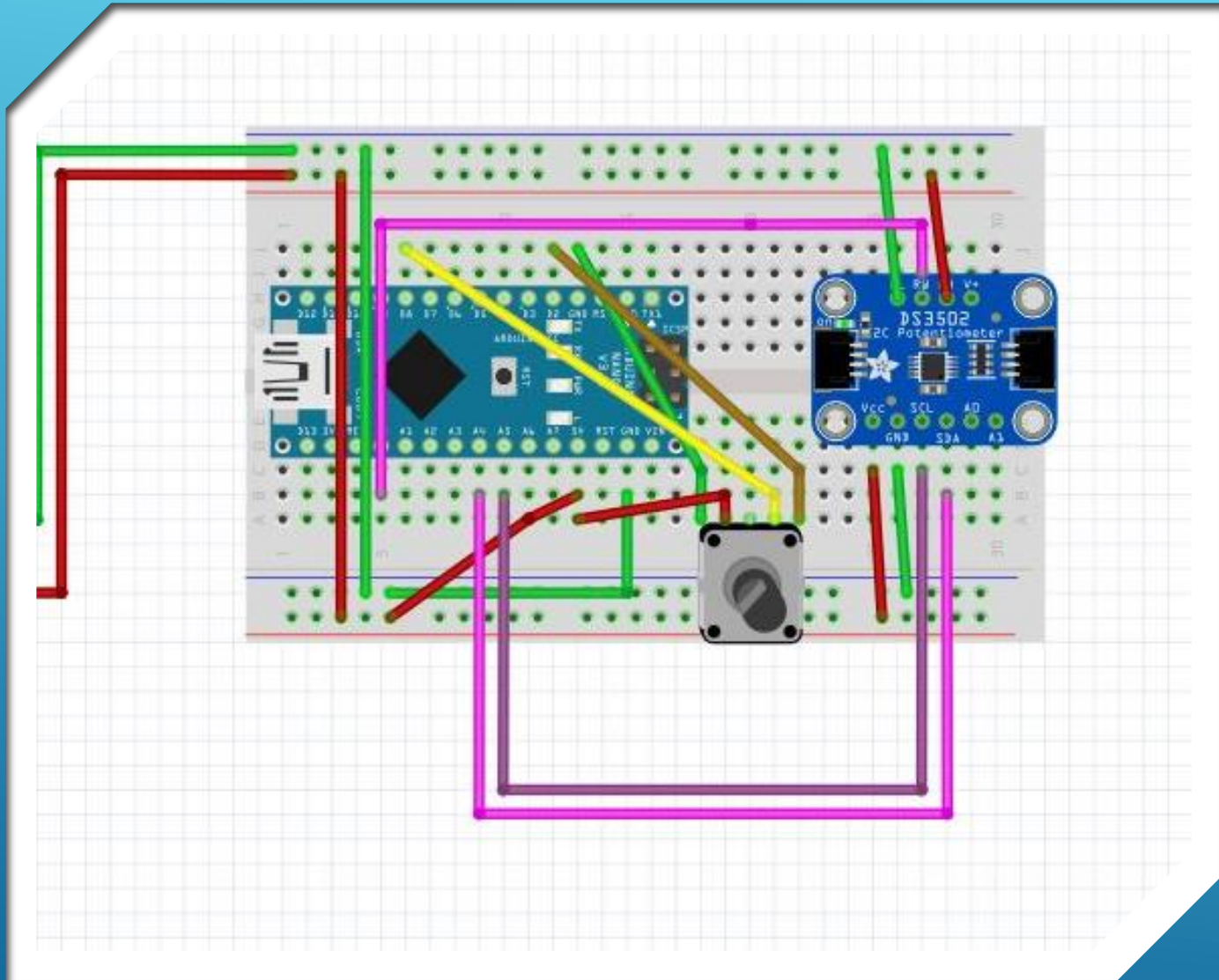
FRITZING

- ▶ Breadboard Tab selected
- ▶ Start with Blank Breadboard
- ▶ Add Components from Library
- ▶ Connect and Route Wires. Assign Colors.
- ▶ Save and Print your Dwgs.



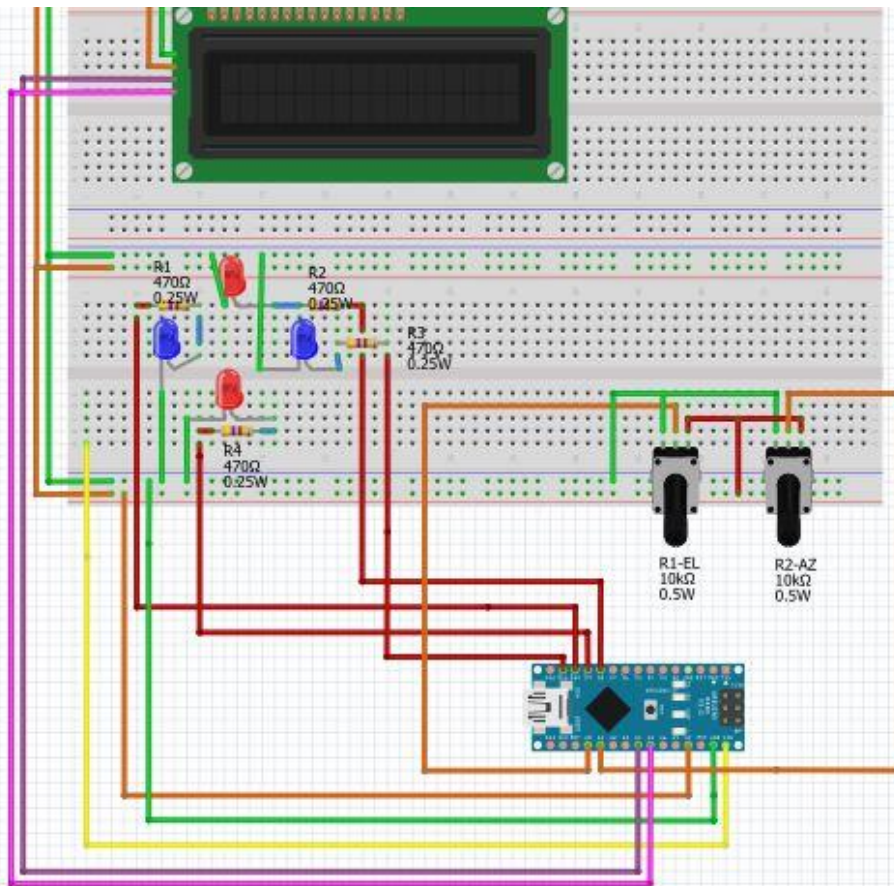
FRITZING

- ▶ Draw Simple Circuits



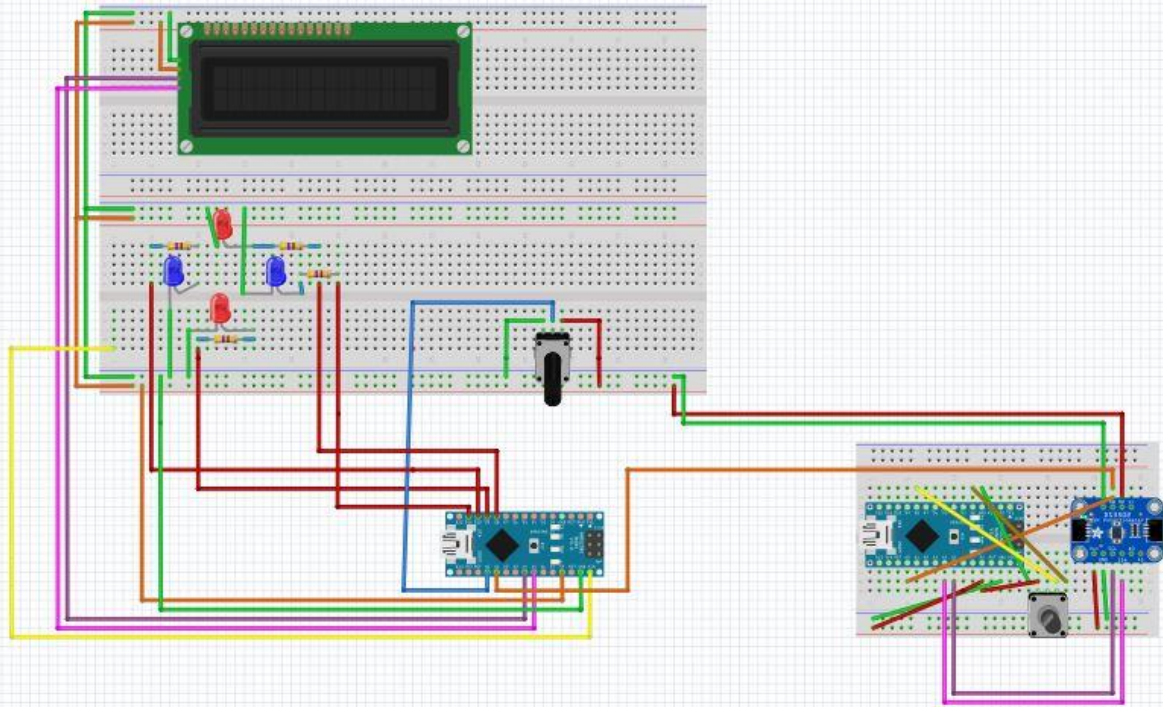
FRITZING

- ▶ Add Components and Complexity



FRITZING

- ▶ Start with an original design concept



FRITZING

- ▶ Add and Save Changes Accordingly



QUESTIONS...?

Getting Started
with Arduino
Projects

**THANK
YOU**

'73

Getting Started
with Arduino
Projects

GETTING STARTED WITH ARDUINO PROJECTS

Jack Weaver – AA5VZ