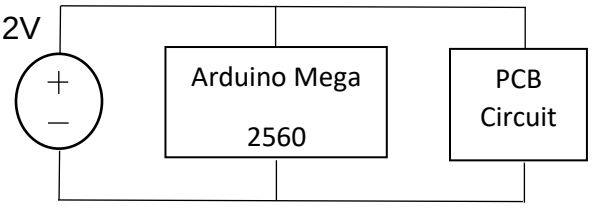
Instructions set for building the Linear Gradient Mixer.

Procedure:

1. Open the GitHub Link for all the files and documentation needed.
2. Open the folder “3D Case” download both .stl files and send them to production.
3. Open the folder “PCB/Production_Files”. If the company printing the PCB request for the Gerber files in a zip file, then download the document “KGGradient_Mixer_06072021.zip” and send it for production. Otherwise, if the company request for the .pdf or .svg files then download the needed folder, zip it and send it. Those folders are in “PCB/Production_Files”
    - If you want to edit the PCB, the .fzz file is included so you can edit it.
4. Once you have the PCB, start soldering the components into the PCB. You can follow the Circuit Diagram for a guide on where to solder the components. The file is on the folder “Circuit” under the name “Circuit_Diagram.pdf” Please use this documentation as reference when soldering the components.
5. **Tips when soldering:**
    - Note that the PCB includes the name and numbering for the component. R5 means resistor 5, D1 diode 1, Q1 transistor 1 and so on.
    - Note that the positive part of the 12V input should be connected to the cathode part of the diode.
    - For the solenoid valve output, the polarity doesn’t matter but, it is better to consider the transistor part as negative and the positive 12V part as positive.
    - The 12V power supply can be connected in parallel to the Arduino and in parallel to the PCB circuit. In this way we only use one 12V power supply and not two. i.e.:



    - Remember that the PCB will be top mounted to the Arduino Mega2560. Therefore, don’t forget to solder the short pins into the PCB. Use short

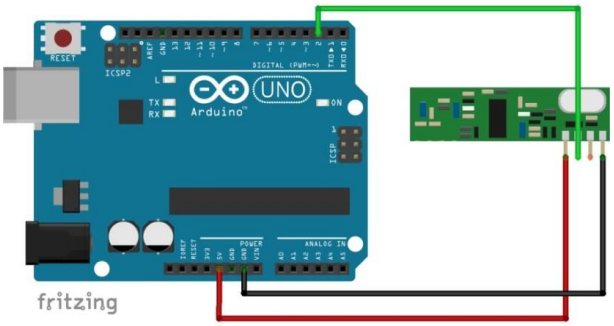
pins only to the PCB connections that are used in the Arduino. Which are:

  - pins Gnd,8,9,10,18,19,20,21

- Solder the antenna transmitter to the PCB. Make sure you leave space for the top-mounted 3,2” LCD Touch Screen with the TFT Shield.
- Insert the 3,2” LCD Touch Screen into the TFT Shield. Then, top-mount the whole thing into the PCB. At the button part of the PCB solder the shield pins with the extended pins. After soldering the Shield pins with the extended pins, cut all the pins so they are at the same height as the short pins from the PCB.
- Solder one side of the cables to the peripherals (Buttons and LED) and the other side solder it to the PCB, so you have room to move them and place them in their spot.

6. Download Arduino IDE.
7. Install needed libraries into Arduino IDE.
    - Download the “Needed_Libraries.zip” file which is located in “Code/Needed_Libraries.zip"
    - Unzip the file, three folders will appear. Each folder is a library.
    - Move the three folders into a desire location, make sure to remember the path.
    - Open Arduino IDE, go to the “sketch” tap on the top left part.
    - Go to “Include Library” and then to “Add .ZIP Library…” and then select one folder out of the three and then done.
    - Repeat the last two steps to include the other two folders libraries.
    - Restart the Arduino IDE
8. Now you are ready to mount the whole circuit to the Arduino Mega, but before that we need to find the binary on and off code, pulse length and protocol of your 433Mhz Power Outlet.

- In order to find the needed parameters to control your 433MHz Power Outlet you need to connect an 433MHz RF receiver to Digital Pin 2 of your Arduino.



- Connect the Arduino into your PC.
- Go to “tools” -> “Board” select Arduino Mega2560.
- Go to “tools” -> “Processor” select ATMega2560
- Go to “tools” -> “Port” select the Arduino port it may be as COMXX where XX is a number
    - You can get the number of the COM port under the device manager part of windows.
- Go to “Files” -> “Examples…” -> “rc-switch” -> “Received_demo_Advanced”. A new tap with a code will appear
- Press the upload button.
- Now, the Arduino is receiving and reading all the signals at the 433Mhz frequency. To see the signal code and protocols. Open the Arduino IDE serial monitor.
- Once you have the serial monitor open, the Arduino will display all the signal properties. Grab your 433Mhz RF remote control and turn on the power outlet. Once you did that, you will notice that two code lines appeared at the screen.
- From these code lines record the Binary code, Pulse Length, and Protocol number for turning the outlet on.
- Repeat the last two steps but this time by turning the outlet off.
- Once you have recorded all three values for on and three for off you can unplug the Arduino from your PC and disassemble the whole circuit.

9. Adapting the code.
    - Download the Gradient Mixer code the file name is “GradientMixer.ino” first download it from “Code/Original Code/GradientMixer”
    - Open the file and go to the void setup(){} function.
    - Below the comment “//Optional set pulse length” is the code line “mySwitch.setPulseLength(714);” change the number 714 to your recorded Pulse Length.
    - Also, change the parameters for the protocol and for the binary code. The codeline for the protocol is “mySwitch.setProtocol(2);” and for the binary is “mySwitch.send("100000010000100001011110000000000");”
    - Look for **all** the “mySwitch.send("");” codelines in the code and change the binary code for your own binary code. Be careful, please read the comments and make sure you are inserting correctly the binary code for turning the outlet on or off at the correct place (comments on the code will say if it is supposed to be for turning off or on).
    - If you want to change the time limit, which currently is 360 min. Please look for the comment

      /*

      You can change the restrictions in here (in the if statement)!!

      To Change time limit, change the inequality value for "time2<=360" meaning that 360 it’s the maximum allowed minutes time.

      */”

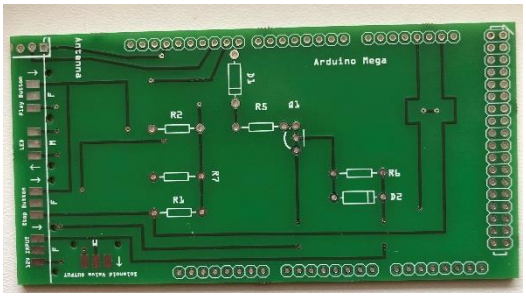
      And change the 360 value to the desire value in the if statement.

10. After adapting the code, we are done with all editing part and now we are just missing to test it and assemble the final product. Please top mount the Solder PCB with the touch screen and the shield to the Arduino Mega 2560.
11. Connect the Arduino Mega 2560 to your PC, check that the values of “tools” -> “Board”; “tools” -> “Processor”; and “tools” -> “Port” are the correct ones. (See step 8 for reference)

12. Press the upload button, and wait until all the code has been uploaded to the Arduino.
13. Test the LCD touch screen. If screen detects the touch in the same x-axis but in the inverted y-axis. Then repeat step 9 but with the code “Gradient_Mixer.ino” from “Code/LCD Inverted Code/Gradient_Mixer” and not from “Code/Original Code/GradientMixer”.
14. Once the Touch Screen works perfectly. Go ahead and assemble the gradient mixer with the 3D case.
15. **Tips for assembling the final product**
    - Use the female power connector pins and place them in the circular part of the case.
    - Use the 6 screws to hold everything in place.
    - Solder one part of the cable to the PCB ports and the other side of the cables to the power female adapters. In the male power adapters to connect to the gradient mixer from the outside. The power connectors should be for the solenoid valve and for the 12V power input.
    - Use the USB2.0B extension to connect the Arduino and to connect the other part of the extension in square that’s on the left side of the case.
16. Enjoy your Gradient Mixer.
17. For more information read the README files on the GitHub link for more information while doing the Gradient Mixer.

Materials:

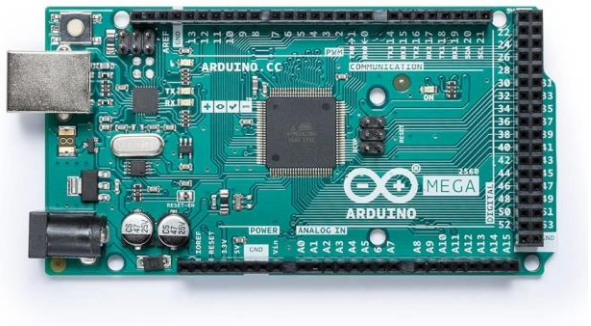
- Printed Circuit Board (PCB) (files provided)



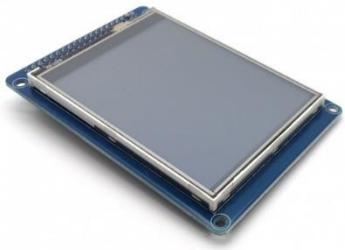
- Printed 3D Case (files provided)

- 12V 3/2-Way Mini Solenoid Valve made from PTFE (Reichelt Chemietechnik)

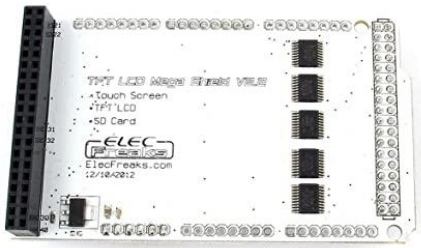
- Arduino Mega 2560



- AptoFun 3.2" TFT LCD Touchscreen

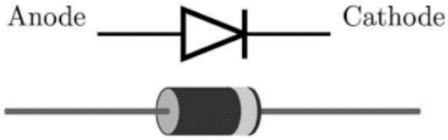


- TFT 3,2 LCD Mega Shield V2.2

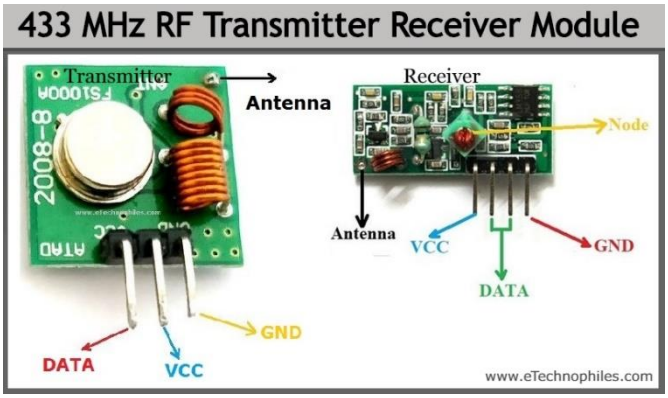


- NPN TIP 120 Darlington Transistor

- Two 1N4001 diodes.



- 433Mhz transmitter and receiver for arduinos.



- Power connectors adapters

- Extra Long Connector Arduino Pins and normal connector pins

- Cables
- Four $1\text{k}\Omega$ resistors and one 100Ω resistor
- LEDs
- Push Buttons
- Soldering Station and Tin wire
- 12V Power supply
- 6 Screws and a screwdriver
- USB 2.0B short extension
- Multimeter for testing