NTP Clock Kit Instructions

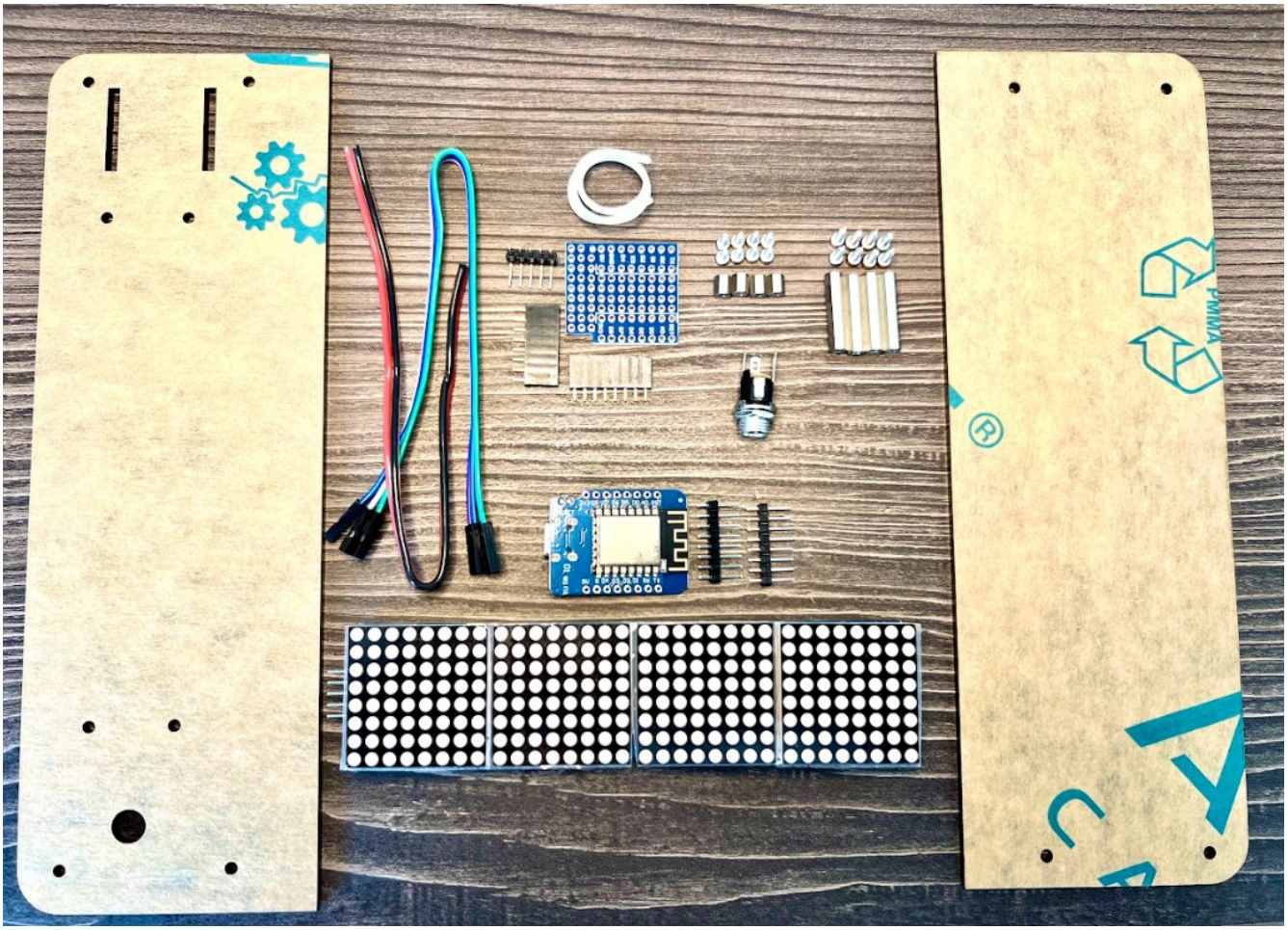
First

Thank you for buying the kit! It is my hope that you get the satisfaction from enjoying putting this kit together. If you take your time, and avoid rushing, you will end up with a finished product that will bring you many years of enjoyment. This kit is designed for the intermediate skill level. Good soldering skill and technique will serve you well. I suggest the following tools to successfully put this kit together:

- Needle nose pliers
- Temperature controlled soldering station & solder
- Diagonal cutters
- Wire strippers
- A precision hex screwdriver set (metric)
- (optional) a lamp with magnifier (helpful when soldering)

Now, time to put on some background music, warm up the soldering iron (I suggest 500F), and let’s begin!

Check All Parts



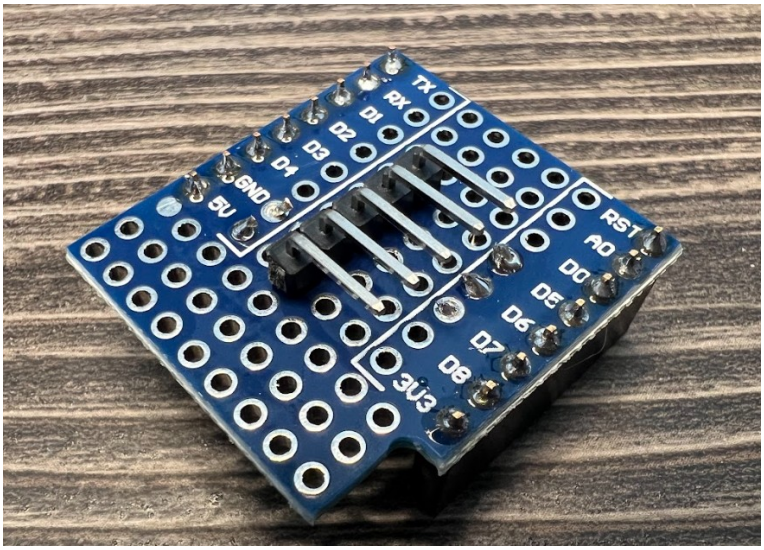
Before we begin, you'll want to inventory the package of parts I sent you. Please refer to the picture above identifying all the components you'll use to make your clock. You should have:

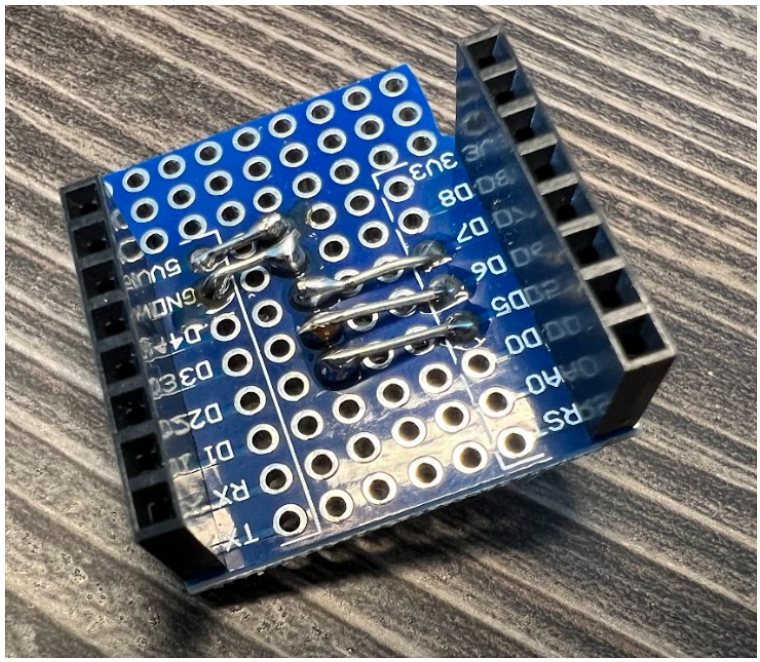
- front and back laser cut plexiglas plates
- 32x8 matrix display
- Wemos D1 Mini esp8266 MCU & two headers
- 2.1mm DC power socket
- length of power wire (red & black)
- length of data wire (5 conductor ribbon)
- length of hookup wire
- (4) M2 x 4mm hex spacers (for display mount) and (8) M2 4mm hex cap screws

- (4) M2 x 20mm hex spacers (front and back plate mounting) and (8) M2 6mm hex cap screws
- wemos prototype board shield with (2) female headers and (1) 5 pin 90-degree male header (This is used to build the wiring harness and MCU mount)

The Wiring Harness/ESP8266 Socket

The first thing we'll want to put together is the socket that the esp8266 (MCU) will sit in. This socket will also have the function of breaking out the connections so that power and data can flow between the MCU and the 32x8 matrix display. Here's what the finished harness looks like: (**please take care to build exactly as shown! This part will not work correctly if the board orientation is not exactly as shown!)** First solder the 5 pin header aligned with the 5V labeled row as shown:

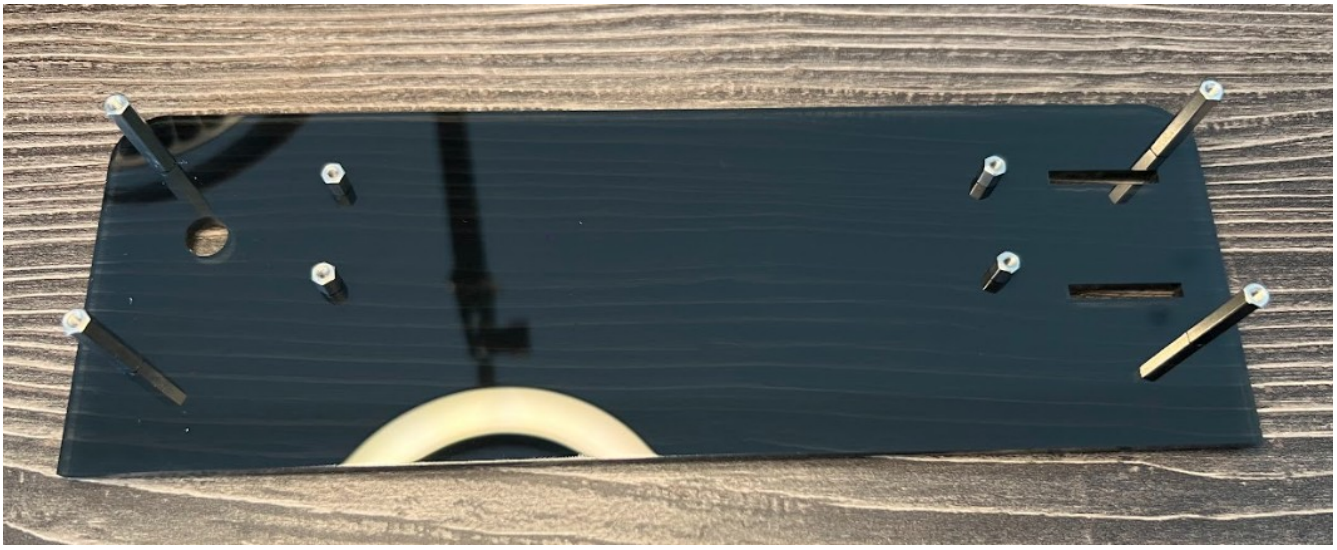




You can see that the bottom exposes the female headers and shows how I created “jumpers” by stripping the hookup wire (strip off a few inches and insert enough through the top as shown and bend it over to the correct pin from the 5 pin header. Do this AFTER you solder the 5 pin header on the top side ALIGNED starting with the “5V row.

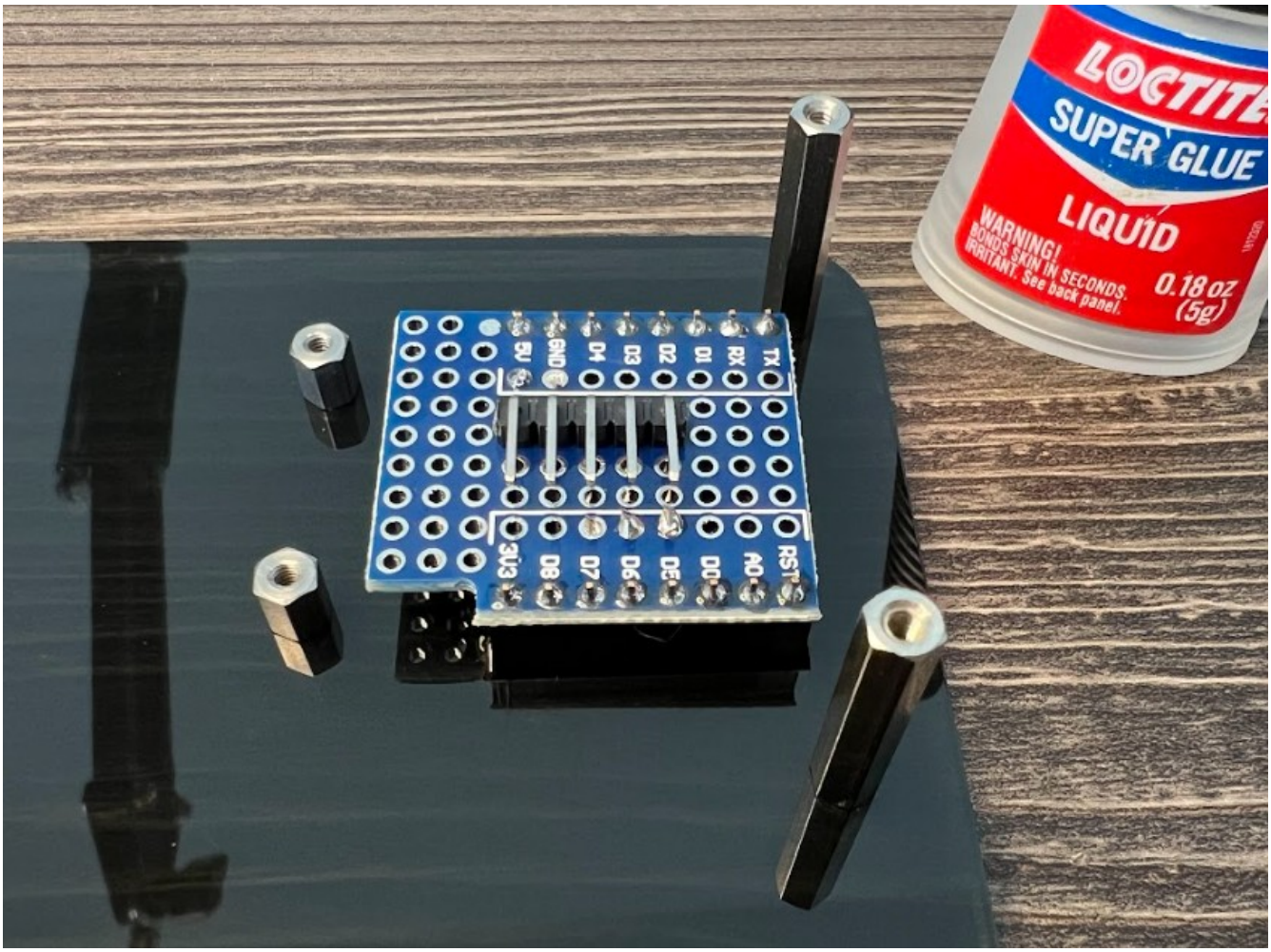
Install 4mm And 20mm Spacers As Shown

Before we can mount the wiring harness to the back plate (using super glue), we need to first install the spacers on the back plate. This helps create a nice gap between the plate and your working surface so air can flow and help cure the glue easier. Install spacers as shown below. Use the 4mm screws with the 4mm spacers and use the 6mm screws with the 20mm spacers. Use a needle nose pliers and hex precision screw driver to tighten the screws and spacers securely to the back plate. **DO NOT OVER TIGHTEN!!!!** take care NOT to scratch the plexiglas in this step.

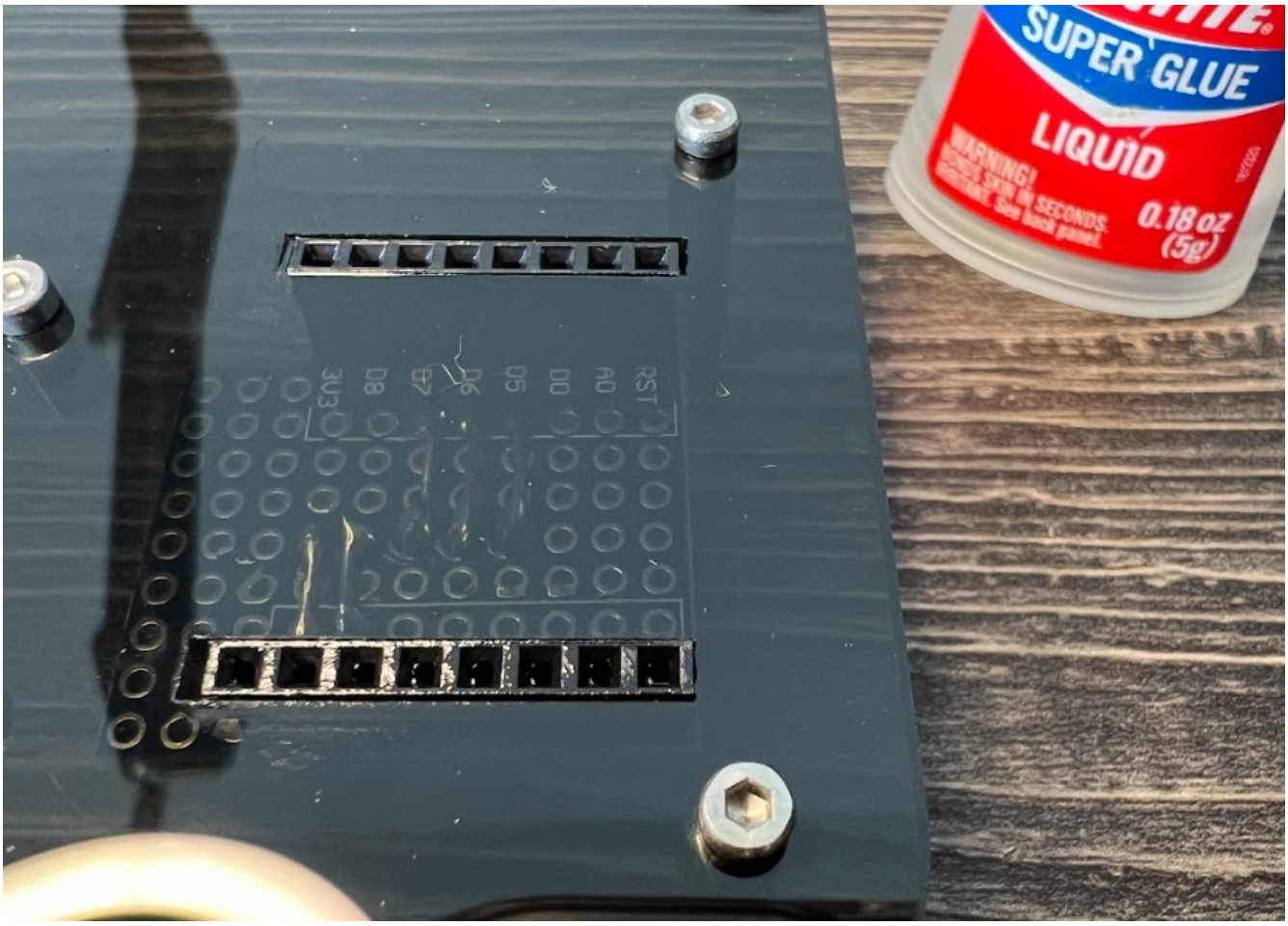


It’s Time To Mount The Wiring Harness

Get your super glue and apply a conservative amount of glue along the inner sides of the female headers – the point that will contact the plexiglas. Take great care NOT to get the glue inside the pin holes! Once you apply the glue, you’ll need to use firm but careful pressure to insert the wiring harness headers into the slots (**as shown**) being careful not to get glue in the header pin holes. You want the insertion to go just deep enough that the harness header holes are FLUSH with the rear surface of the plate. BE VERY CAREFUL TO ENSURE THE ORIENTATION IS EXACTLY AS SHOWN!!



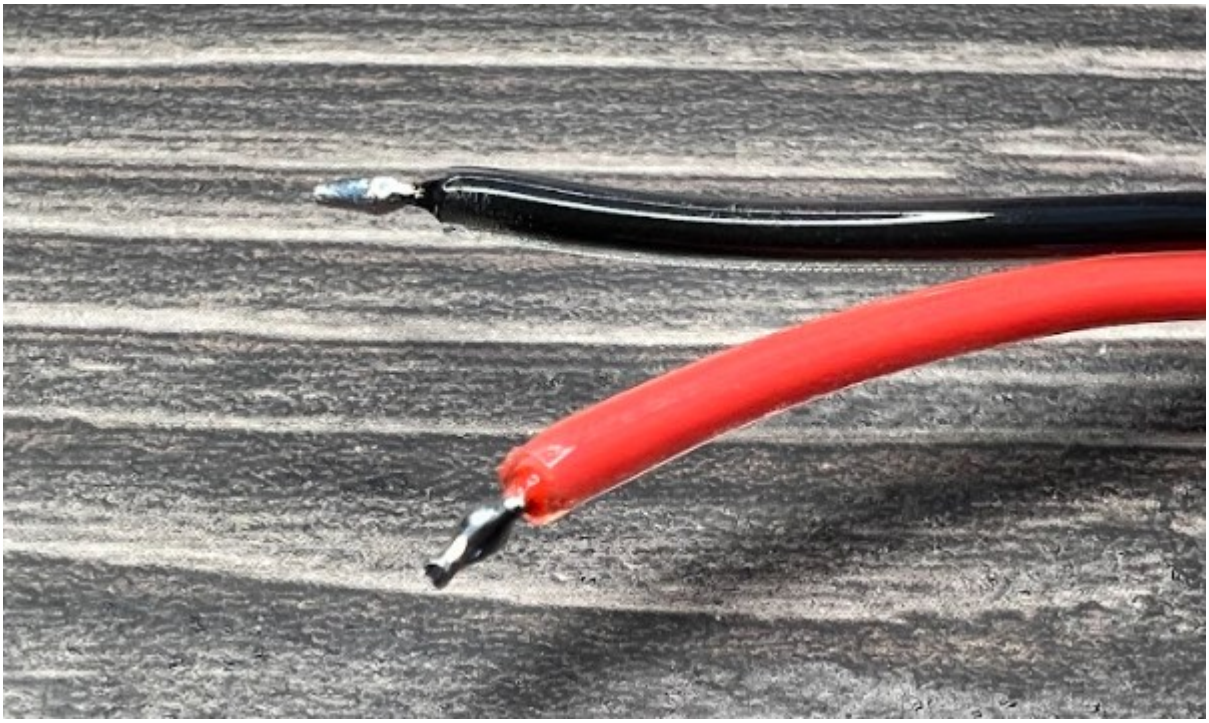
When you’re done mounting the harness, it should look like this on the other side:



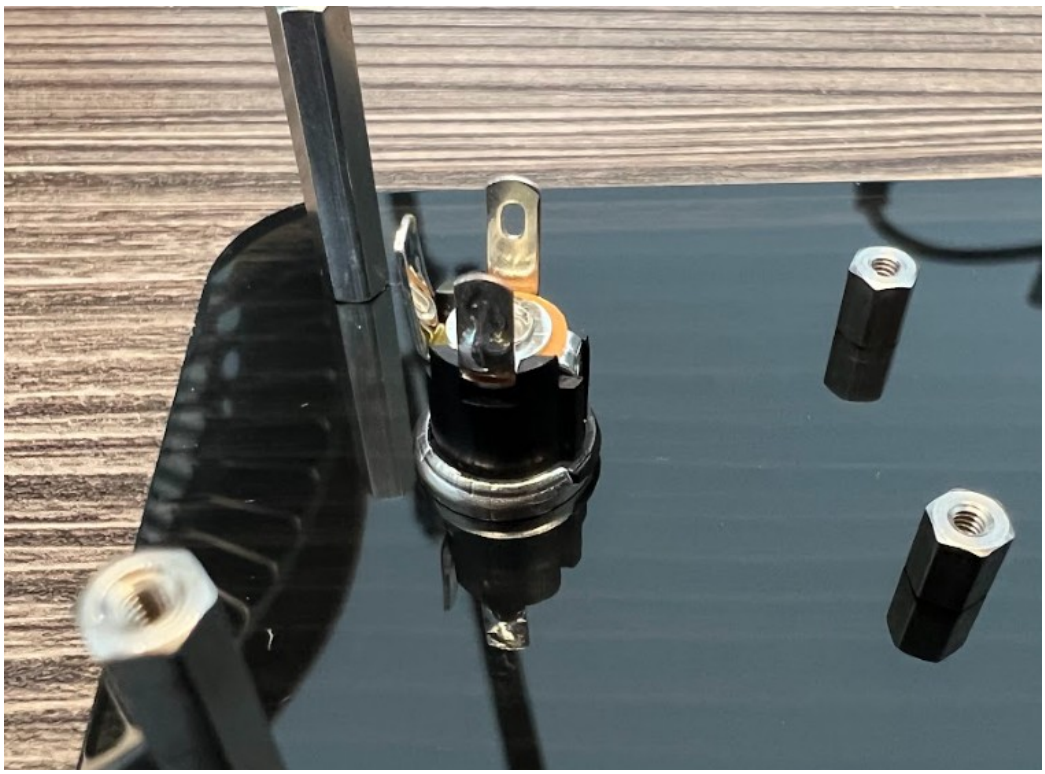
Once successfully mounting the harness, turn the plate over and rest it on your work area and leave for about an hour. After an hour, the glue should be well cured enough to continue building the kit. In the meantime, go enjoy a cup of coffee or whatever you fancy.

Stripping/Preparing The Power Wire

Once the glue has cured from the previous step, we are now ready to strip and tin the power wire. You'll want to strip/tin both ends as shown:

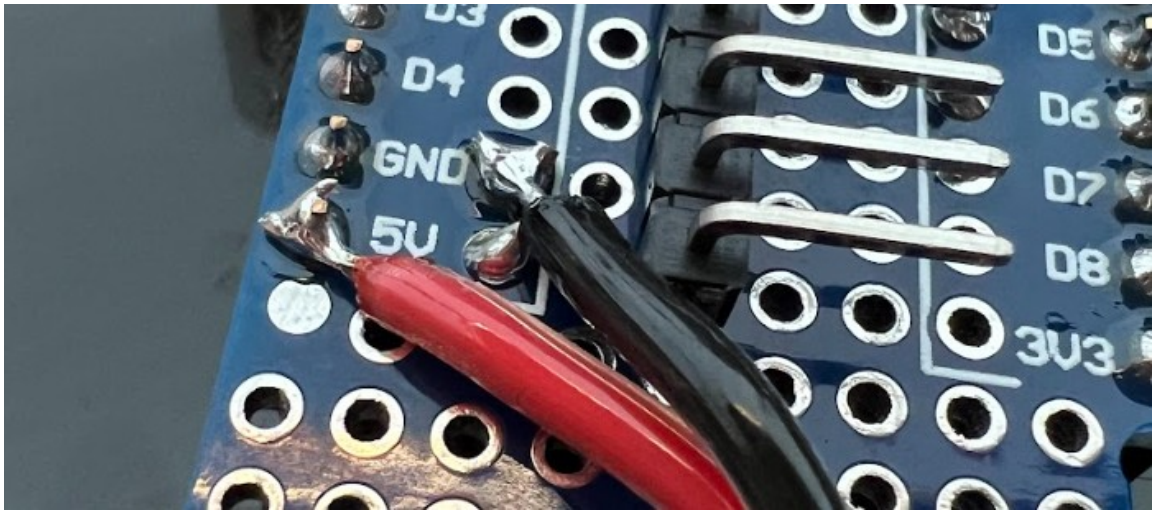


This will make it easy to attach to the harness and the DC power jack. Next, mount and tin the leads of the DC power jack as shown:



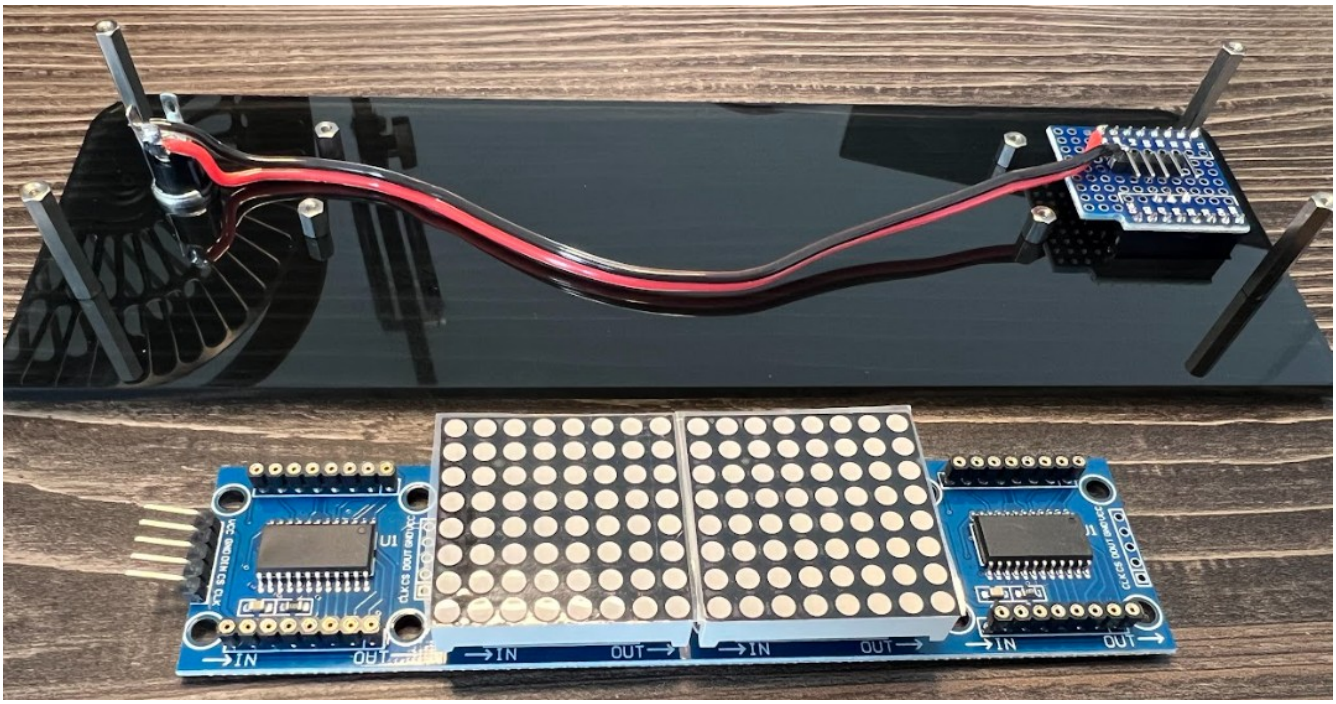
Take care to align the pins just as shown in the photo above. You will now solder the red & black power wire to the DC jack as shown. Take care to ensure the polarity by wiring exactly as shown:

The other end of the power cable then needs to be soldered onto the GND and 5V connections of the wiring harness. Black to GND and Red to 5V:

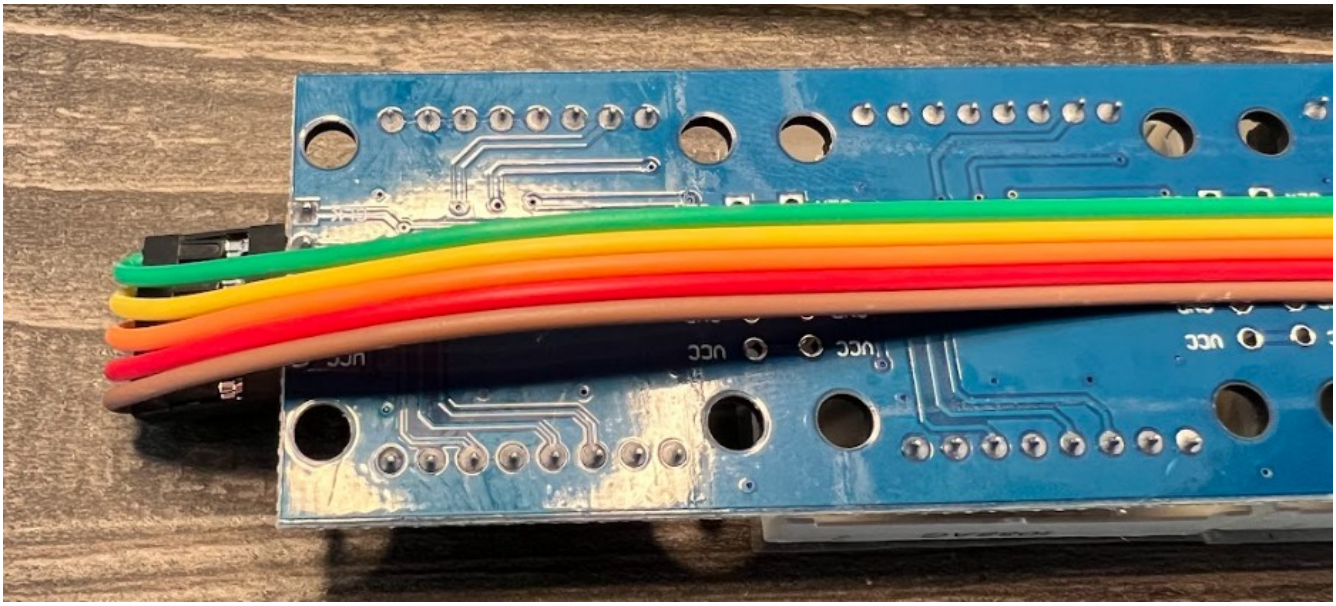


Mounting The Display

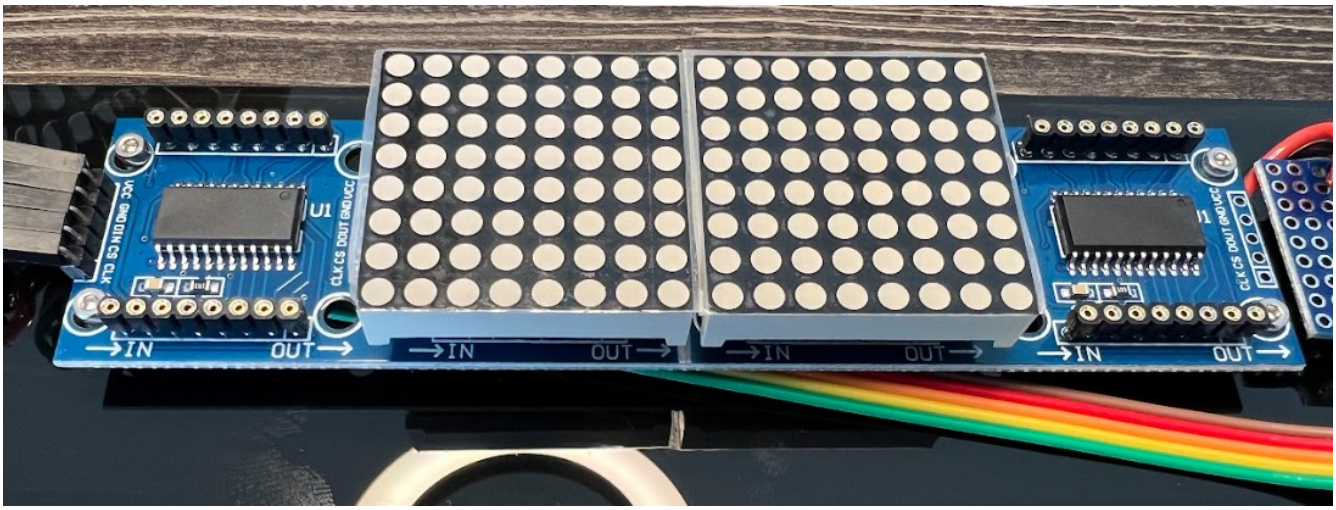
It’s time to mount the display! To do so, first remove the left and right 8x8 modules. This exposes the corner mounting holes. The 5 pins should be on the LEFT of the display near the DC jack.



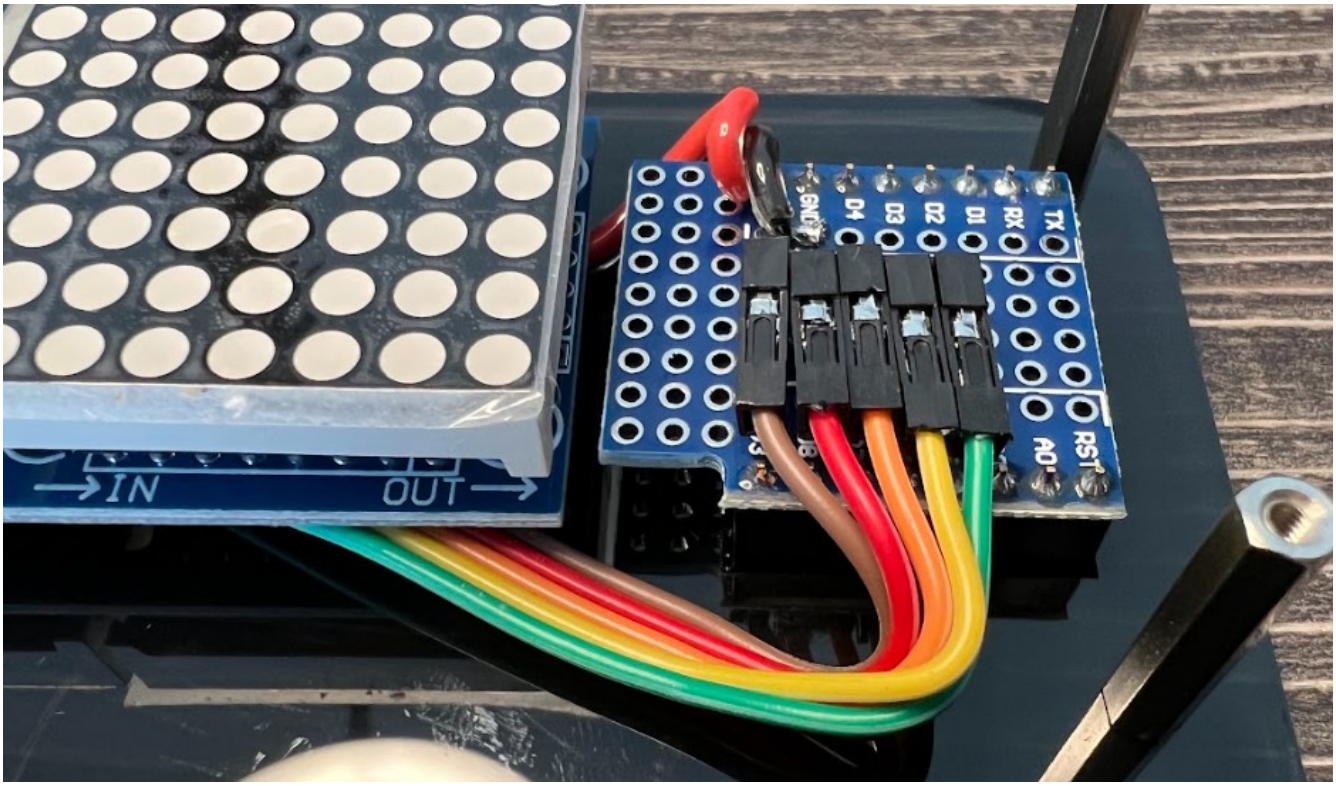
Don’t worry, they’ll be covered up when the data cable is connected. Position the display evenly as possible over the 4 4mm hex spacers. NOTE: you may wish to loosen the hex screws on these on the rear just a tad – as there is some wiggle room. Once you have the holes over the spacers as best as possible, it is time to put the data ribbon cable on the 5 pins on the left, and BEND IT HARD around the back of the display as shown: (**take note what colors go to what pins!**)



You're now ready to secure the display to the 4mm hex spacers as shown below. Pro Tip: Only tighten the screws on BOTH ends of the spacers when you've got all screws started in the threads! Again: DO NOT OVER TIGHTEN!



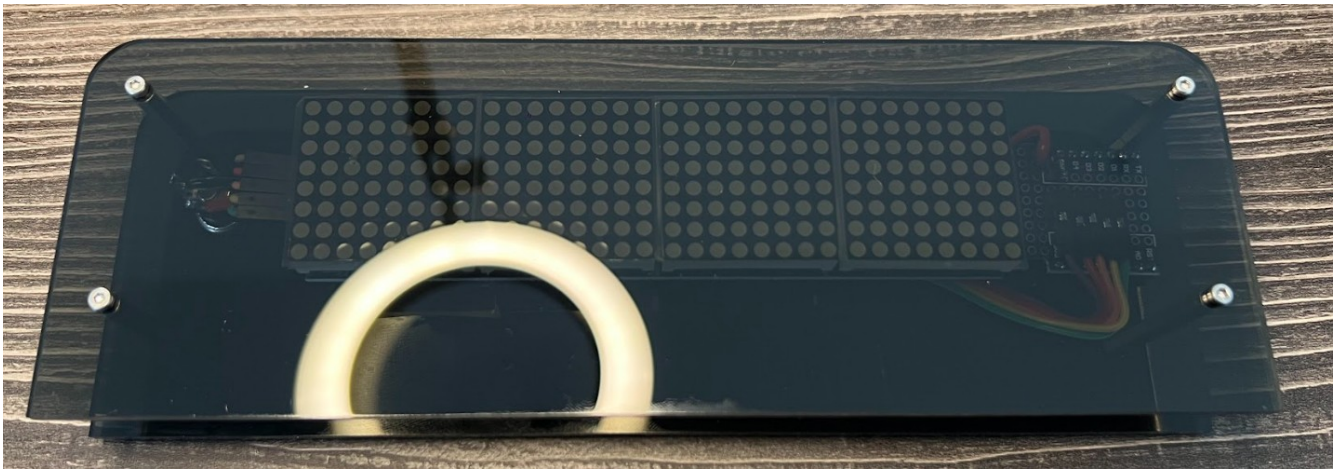
Now, connect the data ribbon to the harness as shown below. Start with the VCC to 5V connection, and then each line should be in the correct order from there. In this picture, the VCC-5V connection starts with the BROWN wire. Your color and mileage may vary. Check all connections first before applying power.



Re-mount the two 8x8 display elements you removed from the previous steps. Note these are polarized. The elements have a little notch/tab in the top middle and they all need to appear as shown:

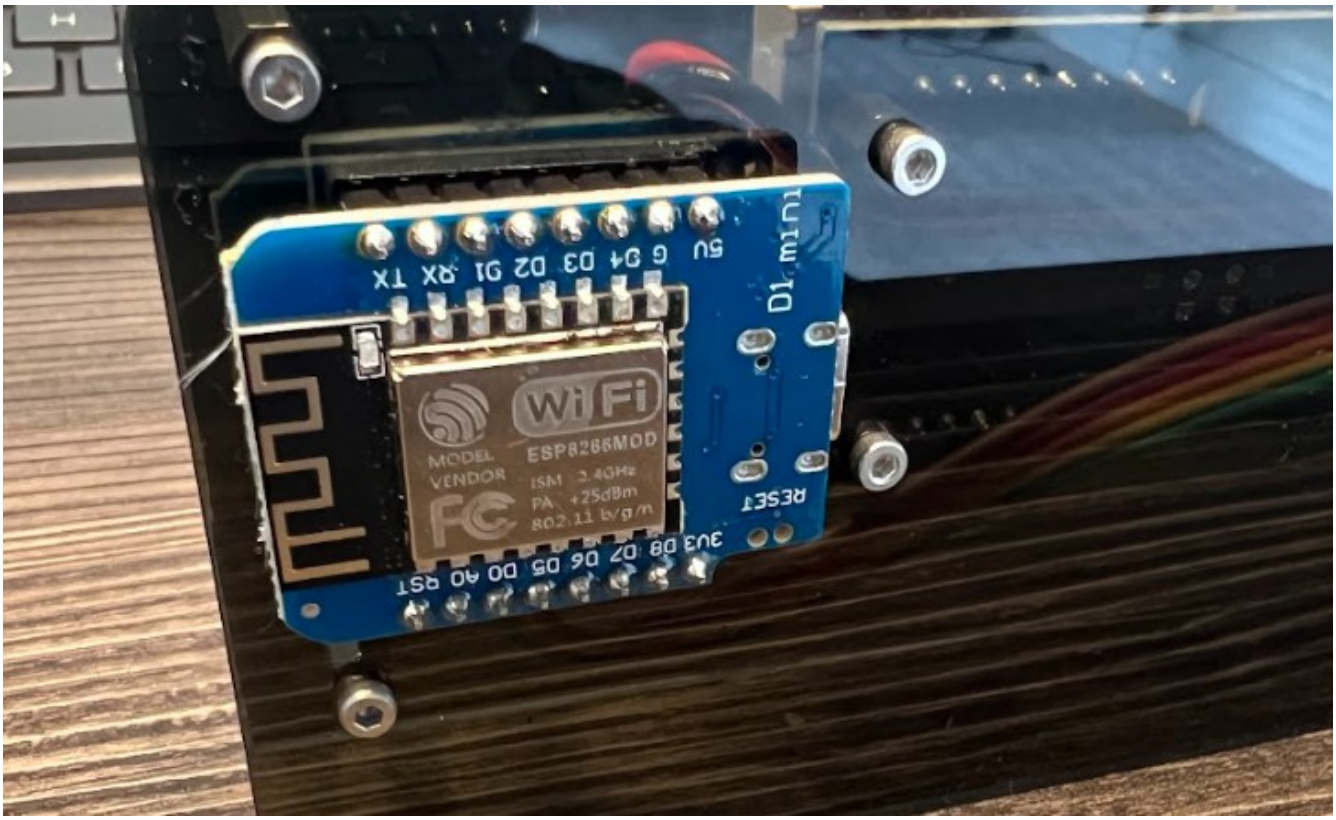
The Home Stretch!

Breathe a sigh of relief! The worst is over! You are now ready to mount the front plexiglas plate. This step completes the build of this kit. Carefully remove the protective paper from both sides of the front plate. Take care to ensure you hold the plate by only the edges. This way you'll avoid fingerprints and smudges on your new clock display. Use the remaining 6mm hex screws to secure the plate to the 20mm spacers. Only tighten after all screws have been threaded. Before final tightening, it is suggested to stand the clock upright on its bottom and hold it against the table while tightening these screws. This ensures that the plates secure evenly and that the clock will not wobble from uneven mounting.



After the front plate is mounted, the last thing to do is to mount the esp8266 MCU. After soldering the header pins provided, onto the MCU, you then plug it in on the rear of the clock as shown on the next page.

NOTE: ONLY insert the MCU in the orientation shown!!!! Failure to do so WILL destroy the module! You've been warned!



Note that the antenna end of the MCU is aligned with the edge of the clock.

Once installed, you can now apply power after checking all connections and begin the WiFi setup!

Instructions on next page

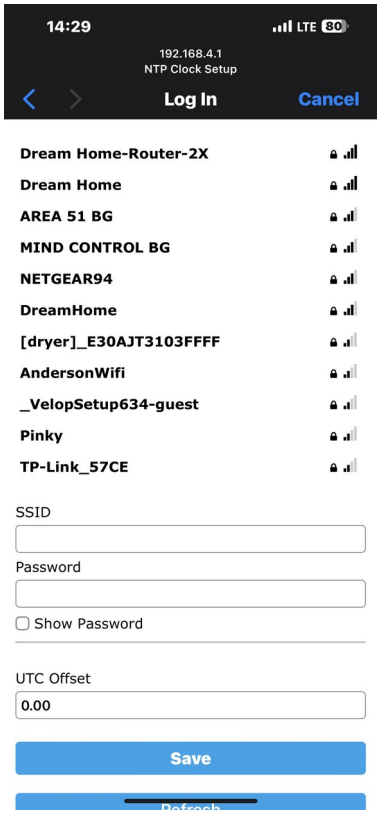
SETUP INSTRUCTIONS

Step 1

Apply 5V DC power via the 2.1mm barrel jack on the rear side.

Step 2

Using your phone or other mobile wifi device, search for the wifi network **NTP Clock Setup**. Once connected, you can scan for available networks (NOTE: only 2.4GHz is supported). Click on your network and enter the network password. Scroll to the bottom and enter your UTC offset for your region (half hour & 45 minute offsets are supported, so for example India, enter 5.5 in the offset. For New Zealand, enter 12.75). For Eastern Daylight: -4. Then click **SAVE**



NOTE

Moving the clock to another wireless network (where the previous network is no longer available) will make the clock begin the setup routine again. This allows the clock to be moved elsewhere and easily setup at a new location. If a move is not intended, but the clock is started in the absence of the original network, simply press the small reset button on the ESP8266 module when the original network is restored. Clock settings are stored in EEPROM. Note that sometimes, a bad NTP packet may be received. In such case, when this happens, you will see garbage on the display. Though this is rare, you can easily correct it by hitting the small reset button on the MCU and allow the clock to connect again. This can be caused by weak wifi signal, or poor internet connectivity.