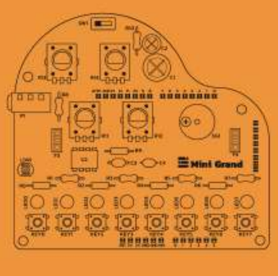


Mini Grand Mega Kit

Getting Started Guide Book

Build an infinitely hackable and fun electro-instrument while mastering the art of electronics, code, and engineering.

Caution

The completion of the Mini Grand requires soldering, a process that if done incorrectly can be dangerous. To ensure your safety, please follow these guidelines.

1. Maintain a Clean Workspace: Set up a clutter-free and well-ventilated area for soldering. Clear away any unnecessary items to minimize distractions and potential hazards.
2. Handle with Care: Treat soldering equipment and materials with care and respect. Avoid rough handling or dropping of components to prevent damage or injury.
3. Supervision for Minors: If you are under the legal consent age, it is crucial to have proper supervision from a knowledgeable adult while soldering. This ensures proper guidance and minimizes potential risks.
4. Protective Eyewear: Wear safety goggles or protective eyewear at all times during soldering. These will shield your eyes from any splashes, sparks, or accidental contact with heated components.
5. Appropriate Attire: Dress in appropriate clothing for soldering, preferably made from natural fibers, to minimize the risk of loose clothing catching fire or interfering with your workspace.
6. Proper Ventilation: Ensure adequate ventilation by working in a well-ventilated area or using a fume extractor. Soldering fumes may contain potentially harmful substances, and proper ventilation helps mitigate their impact.
7. Burn Prevention: Be cautious of hot soldering irons and components. Always place the soldering iron in its holder when not in use, and handle it with the utmost care to prevent burns.
8. Flux and Lead Handling: Handle soldering flux and lead-based solder with care. Wash your hands thoroughly after soldering to prevent accidental ingestion or skin contact.
9. Mindful Placement: Be mindful of the placement of soldering equipment and components to prevent tripping hazards or accidental contact with hot surfaces.
10. Emergency Preparedness: Familiarize yourself with the location of fire extinguishers and first aid kits in your workspace. In case of any mishaps, you should be prepared to respond promptly.

By adhering to these safety guidelines, you ensure a secure and enjoyable soldering experience while assembling the Mini Grand PCB. Your safety is of utmost importance to us, and we want you to confidently pursue your creative endeavors while taking every precaution necessary.

Contents

Introduction

Welcome to the Mini Grand Getting Started manual. This manual will be your guide in transforming your Mini Grand kit from a collection of components into a fully functional and endlessly customizable electronic instrument housed in a beautifully classic piano case. As you progress through the steps outlined here, you will learn how to solder components onto the board, test the completed Mini Grand shield, assemble the case, and upload and experiment with two of our favorite example codes. We're confident that you'll enjoy the process of building and using your Mini Grand, and we can't wait to see the incredible creations you come up with.

Before we dive into assembling the Mini Grand, let's take a closer look at the equipment included in the kit and review the Mini Grand Active Component Diagram.

Mini Grand Electronic Materials

Capacitors

Capacitors are passive electronic components that store and release electrical energy. Electrolytic capacitors (220uF and 47uF) are often used for filtering and smoothing voltage, while capacitors (47nF and 100nF) are typically employed for decoupling and noise suppression in electronic circuits.

Headers

Female headers (3 Pin) and male headers (40 Pin) are connectors used to make electrical connections between the Mini Grand shield and other components, such as the amomii UNO or other shields. They enable easy plug-and-play connectivity.

Tactile Push Button

The tactile push button is a momentary switch that allows you to create user input interfaces in your electronic projects. On the Mini Grand, they are used as the piano keys. **See the appendix for more on this.**

Photoresistor

A photoresistor is a light-sensitive resistor that changes its resistance based on the amount of light it receives, making it useful for light-sensing applications. On the Mini Grand, it can be used to change the sound of your piano, as a light theremin, or any other variable aspect of a project you think up.

LED

LEDs (Light Emitting Diodes) emit light when powered. The red LED is commonly used for indicator lights in electronic projects. On the Mini Grand, the LEDs glow each time a button is pressed, but they can also be controlled through code. **See the appendix for more on this.**

Audio Jack (3.5mm)

The 3.5mm audio jack enables you to connect external audio devices or amplifiers to the Mini Grand, expanding your sound options. **We strongly advise that you do not connect earphones, as the output can be loud, potentially damaging your earphones, or more importantly, your ears.**

Buzzer (Passive)

The passive buzzer is an audio signaling device that produces sound when an electrical signal is applied to it in pulses, suitable for creating audio alerts and tones. On the Mini Grand, this is used as the primary sound source when external speakers are not being used. **More on external speakers in the appendix.**

Resistors

Resistors (220Ω, 10KΩ, 10Ω, 100KΩ) are passive components that limit the flow of electrical current in a circuit. They are often used for voltage division, current limiting, and biasing in various electronic applications. You can tell resistors apart by looking at the color of their bands. **To learn more about resistor bands, refer to the chart in the appendix.**

LM386N-1 (Audio Amp IC)

The LM386N-1 is an integrated circuit used to amplify audio signals, enhancing sound quality in your projects. On the Mini Grand, this IC is used to amplify the signal going to the external speakers, not the onboard buzzer. **More on external speakers in the appendix.**

Potentiometer (10k)

These 10kΩ potentiometers serve as potential dividers, equipped with a user-adjustable knob that alters the voltage of a signal sent to the microcontroller. On the Mini Grand, the top right potentiometer is used for controlling the volume of external speakers, and the other three can be used as input devices to the amomii UNO. They can be used to control the speed of your sequencer, make selections, change the pitch of your piano, or anything else you think up for your project.

Screw Terminal (2P)

The screw terminal is a connector for easily connecting wires to your circuit, providing a secure and convenient way to make electrical connections. On the Mini Grand, it can be used as a connection point for external speakers. **More on external speakers in the appendix.**

Toggle Switch (3-Pin)

This 3-pin toggle switch serves as a versatile control component that enables you to switch between different elements or functions within your electronic projects, providing you with convenient and precise control over your setup. On the Mini Grand, the toggle switch is used to change between audio output devices. When switched to the right, the onboard buzzer is the primary output device, but when switched to the left, external speakers must be used. More on external speakers in the appendix.

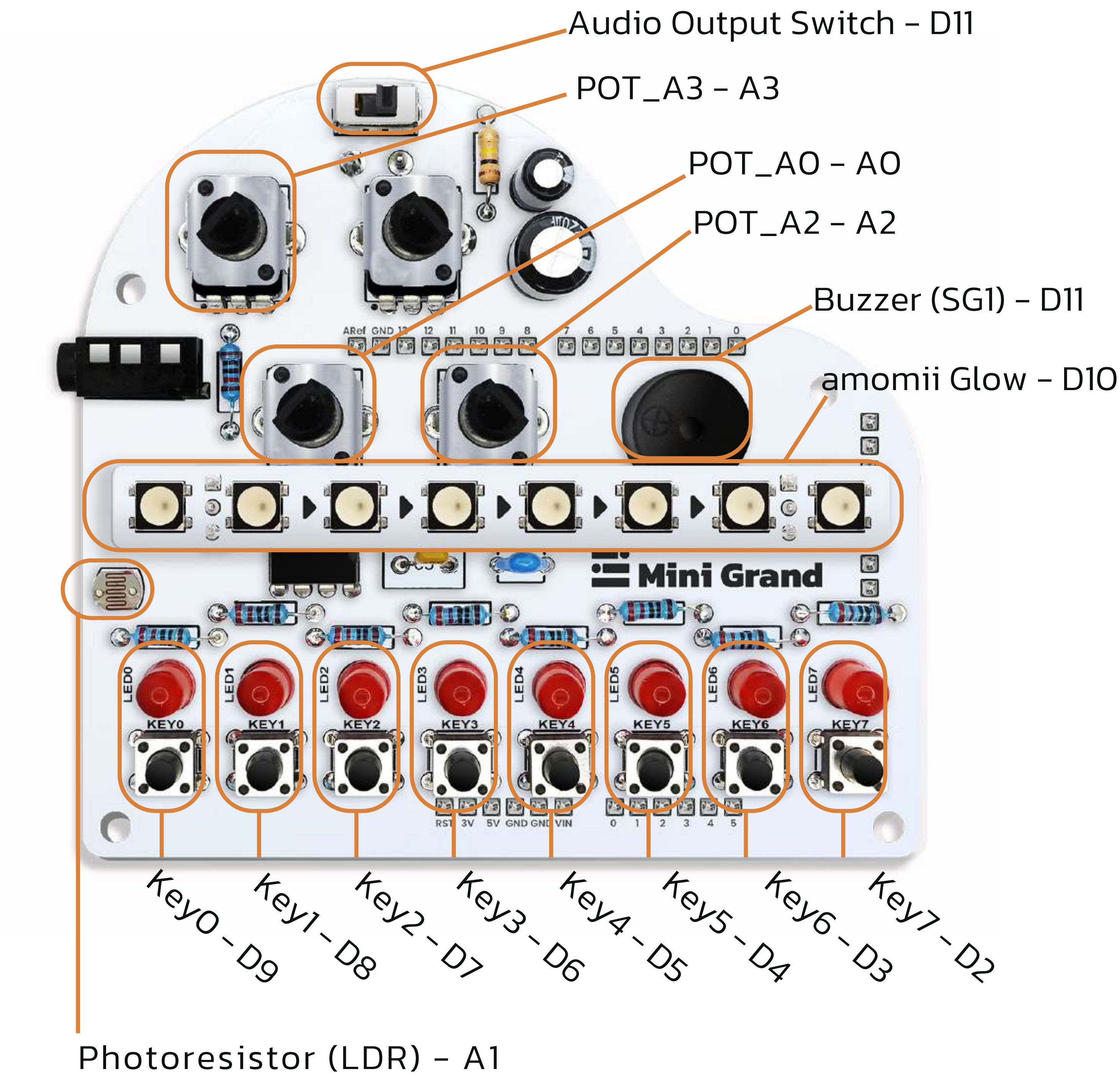
amomii Glow

This addressable RGB strip consists of 8 WS2812B pixels that can be individually programmed to emit various colors and brightness levels. It adds dynamic lighting effects to your Mini Grand, making it ideal for indicating notes, sequencing, drum patterns, or enhancing your project's visual appeal. **For more details, see the amomii Glow section at amomii.com/pages/downloads.**

Mini Grand Active Component Diagram

This diagram highlights the placement of all active components on the Mini Grand shield. It provides vital information, including the corresponding pin connections to your amomii UNO and additional information beneath the diagram.

Active components, in this context, refer to components that actively engage with your microcontroller, such as input and output devices. For details on passive components like resistors and capacitors, please consult the Soldering section of this manual.



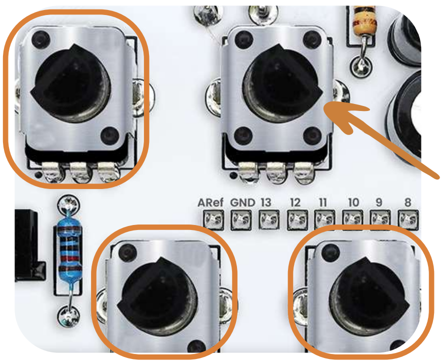
Additional Information

Keys 0 – 7 are connected to amomii UNO pins D9 – D2 respectively.

The word "Key" actually refers to a button and an LED as a group. The reason for this is that they share a pin connection on the amomii UNO and are wired in such a way that each time you press a button the LED next to it turns on; however, the LEDs can also be controlled through code. **For more on this, please see the appendix at the end of this manual.** PAGE 27

The photoresistor is connected to analog pin A1 on the amomii UNO.
For more on this, please see the appendix at the end of this manual. PAGE 31

POT_A3-A3



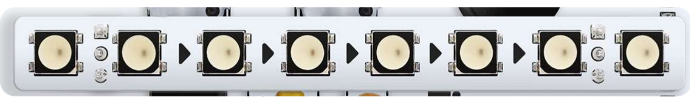
POT_A0-A0 POT_A2-A2

Potentiometers POT_A0, POT_A2 and POT_A3 are connected to analog pins A0, A2 and A3 on the amomii UNO respectively.

The fourth potentiometer (top right of the diagram), is used to control the volume of external speakers when connected. **For more about using external speakers, please see the appendix at the end of this manual.** PAGE 29

The Audio Output Switch is connected to D11 on the amomii UNO.

The switch is used to change the audio output device. When switched to the right, the onboard buzzer can be used to make sounds, but when switched to the left, external speakers must be connected to either the audio jack or screw terminals. **For more about using external speakers, please see the appendix at the end of this manual.** PAGE 29



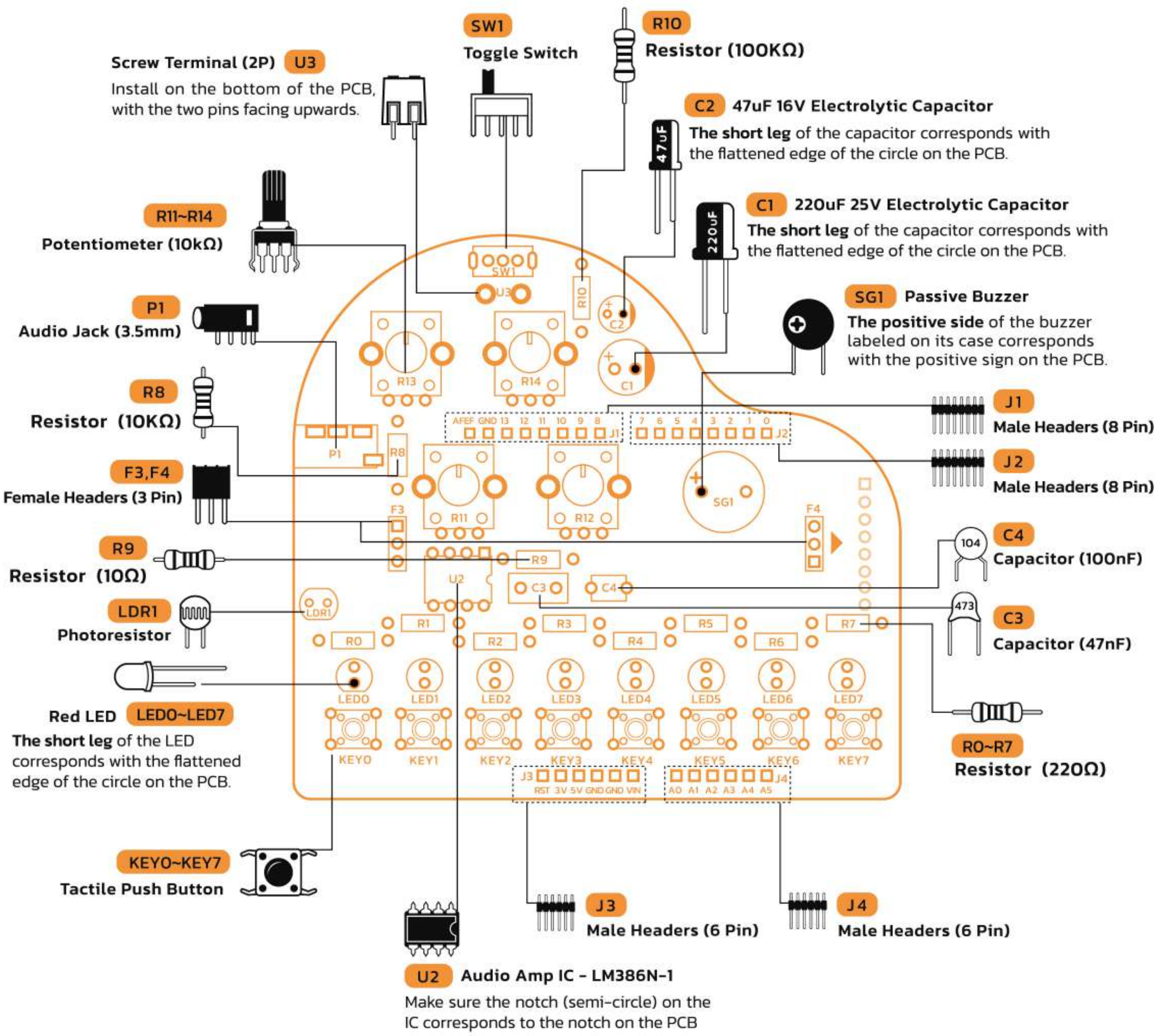
The amomii Glow strip is connected to D10 on the amomii UNO.

It is important to make sure that the arrows across the middle of the amomii Glow strip are pointing to the right as shown in the diagram. If placed the wrong way, not only will the strip not work, the strip could potentially get damaged.
For more details on the amomii Glow strip, see its Datasheet and getting started manual at the amomii Glow section at amomii.com/pages/downloads

Solder the Shield

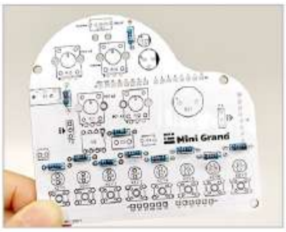
Prepare your soldering tools

Solder Wire | Soldering Iron | Wire Cutters | Goggles | Blu Tack | Thick Cardboard



Step 1

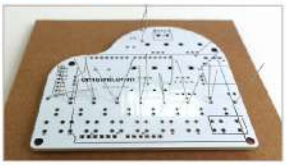
8 x Resistor (220Ω) → R0~R7 (Red-Red-Black-Black-Brown)
1 x Resistor (10KΩ) → R8 (Brown-Black-Black-Red-Brown)
1 x Resistor (10Ω) → R9 (Brown-Black-Black-Gold-Brown)
1 x Resistor (100kΩ) → R10 (Brown-Black-Black-Orange-Brown)



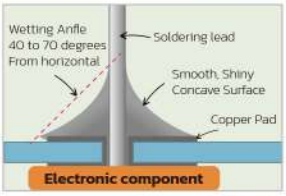
Push all of the resistors in place. Make sure you use the correct resistor by referring to the Materials Diagram on page 1.

Top Tip: It may be helpful to bend the resistors unto U shapes and insert both legs at the same time.

Place a piece of cardboard on top of the resistors to stop them from falling out when you turn over the PCB.



With the PCB lying flat on your table and the resistor legs sticking up towards you, solder each joint, one by one.



When soldering, make sure that the tip of your soldering iron touches and heats up both the leg of the resistor and the solder pad before introducing the solder wire. A joint soldered correctly should have a cone shape from the pad to the leg.

Utilize wire cutters to trim the excess legs of the resistors. Please be aware that the cut-off legs may project forcefully, posing potential hazards. Exercise caution by wearing protective goggles to ensure your safety.

Step 2

1 x Photoresistor → LDR

Repeat the same steps for the photoresistor. Note that the photoresistor, like the regular resistors, are not polarized, meaning you don't have to worry about which leg is which.

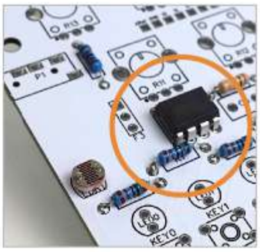
This is not the case for the LEDs as you will see in Step 6.

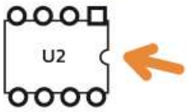
Solder the legs in place.

Chop off the excess.

Step 3

1 x Audio Amp IC - LM386N-1 → U2





Place the Audio Amp IC in position, turn over the PCB and solder each leg one by one. Pay careful attention not to bridge any of the legs (make sure none of the legs get soldered together)

Note: The semicircular notch on the Audio Amp IC needs to correspond to the semicircular notch on the PBC

Step 4

1 x Capacitor (47nF) → C3
1 x Capacitor (100nF) → C4

Put the capacitor in C3, turn over the PCB, and solder it on the underside. It may be helpful to use blu tack to hold this component in place while soldering it.

Repeat the same steps for the capacitor in position C4.

Step 5

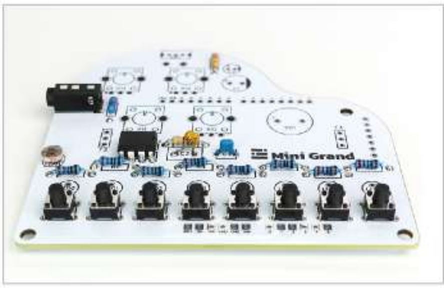
1 x Audio Jack (3.5mm) → P1

Push the Audio Jack in place. It may be helpful to angle it to get the first few legs through.

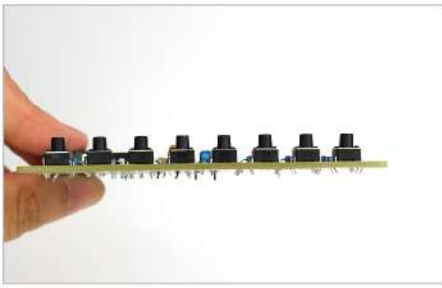
Again, using blu tack to hold the Audio Jack down flat is a good idea before you turn over the PCB and solder it in place.

Step 6.1

8 x Tactile Push Button → KEY0~KEY7 



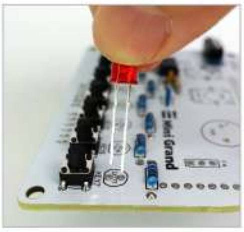
Install the 8 Tactile Push Buttons on the PCB panel



Up until now, slight alignment issues would only be an aesthetic problem, however, if the push buttons are not flat, it could affect performance, so make sure they are all even and flat before proceeding to solder them in place.

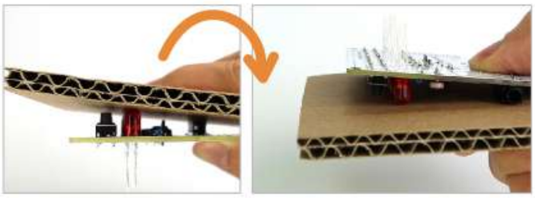
Step 6.2

8 x LED (Red) → LED0~LED7 

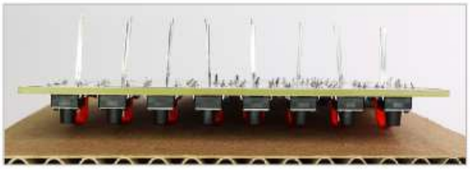


Next, insert the 8 LEDs above the 8 buttons.

Note: LEDs are polarized, meaning that if they are not connected correctly, they will not work. Make sure the shortest leg (cathode) corresponds to the flat edge of the circular LED symbol.



As with the push buttons, to ensure that your finished device works correctly, the LEDs must be soldered flat and evenly. You can use cardboard and Blu Tack to make sure they are.



Use the Blu Tack to help you turn over the PCB without anything falling out, and once it is turned over and lying flat on your desk, look from the side to make sure all of the LEDs are flat. You can make adjustments by using the legs sticking through the bottom.

Once everything is nice and straight, you can hold it all still with Blu Tack and proceed to solder the LEDs in place.

Step 7

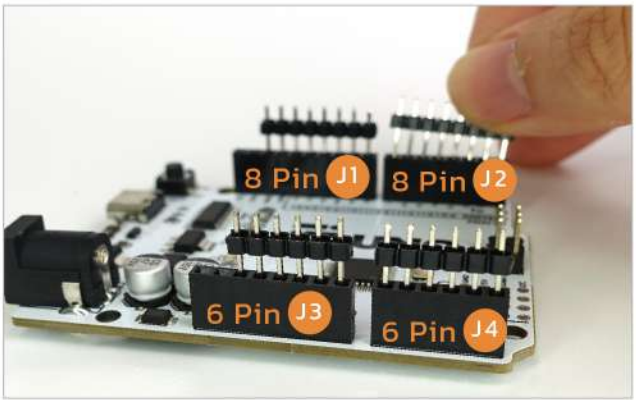
1 x amomii UNO 

Get your UNO ready, it will be a little helper to assist you in welding

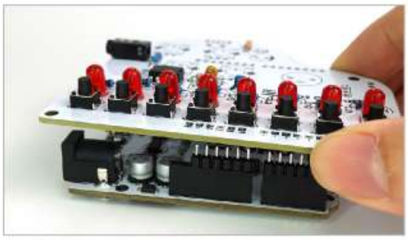
8 Pin-Male Headers → J1
8 Pin-Male Headers → J2
6 Pin-Male Headers → J3
6 Pin-Male Headers → J4

Snap the 40 pin header strip into four sections to create J1~J4

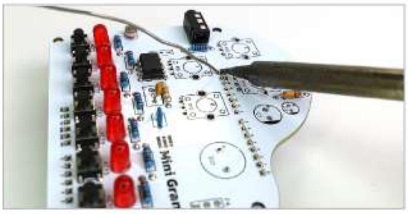
Push the long side of the header pins into the UNO ports as shown in the picture.



Make sure that the long legs are firmly inserted into the UNO ports with the short pins sticking up.

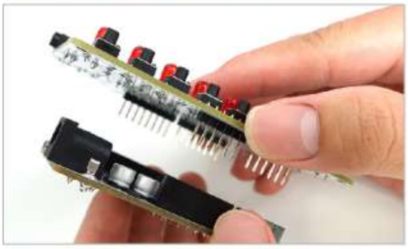


Next, place the Mini Grand shield on top so that the short header pins protrude through the board and stick out of the top of the PCB. It is often easier to push one side through first and then the other, using the first side as a hinge of sorts.



Solder the pins to the top of the Mini Grand PCB, creating your Mini Grand shield.

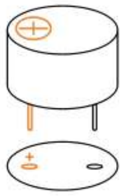
Note: If you have followed the instructions correctly, this should be the first time you have soldered on the top side of the PCB.



Remove the Mini Grand shield from the UNO. When you pull the two apart, the header pins should stay connected to the Mini Grand shield and come out of the UNO ports.

Step 8.1

1 x Buzzer (Passive) → SG1 



Connect the passive buzzer to the shield. Be sure that the positive sign on the buzzer corresponds with the positive sign on the buzzer symbol on the PCB.
Turn it over and solder in place.

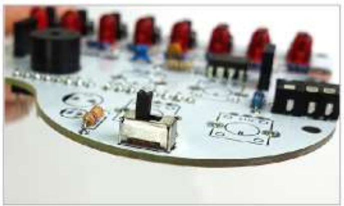
Step 8.2

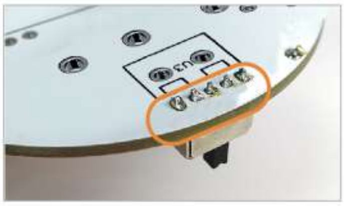
2 x Female Headers (3 Pin) → F3, F4 

Connect the two female 3 pin headers, turn over the PCB and solder them in place.

Step 9

1 x Toggle Switch → SW1 





Put the switch in place, turn over the PCB and solder each leg.

Step 10

1 x Screw Terminal (2P) → U3 

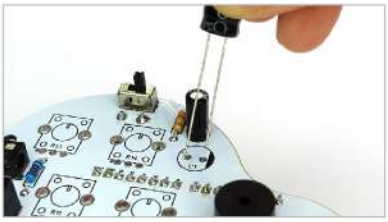
The screw terminal must be soldered to the bottom of the PCB with the legs sticking through the top. Make sure the terminals are facing away from the PCB.

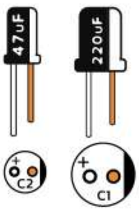
Solder the screw terminal in place.

Note: This will be the last time you apply solder to the top side of the PCB.

Step 11.1

1 x 220uF 25V-Electrolytic Capacitor → C1
1 x 47uF 16V-Electrolytic Capacitor → C2



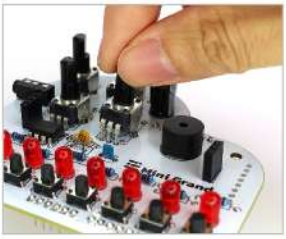


Please note that when installing the 220uF and 47uF capacitors, the short leg must correspond to the blacked out section of the capacitor symbol on the PCB.

When in place, turn over the PCB, solder the legs and cut off the excess.

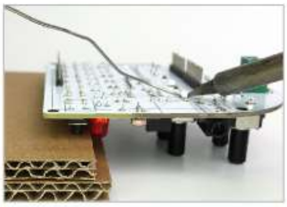
Step 11.2

4 x Potentiometer (10kΩ) → R11~R14 



The final components to solder are the 4 potentiometers (POTs). As before, blu tack can be useful to hold these components in place for soldering.

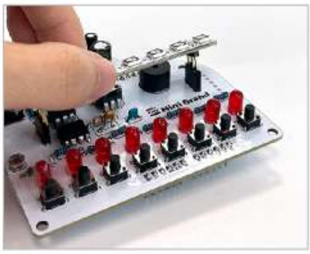
Note: It is important to make sure each leg goes through the solder pad and that the POT is flush with the PCB.

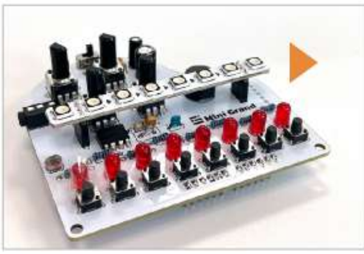


Another technique you can adopt for soldering larger components is making a stack of cardboard to hold the PCB flat while you solder.

Step 12

1 x amomii Glow → G1

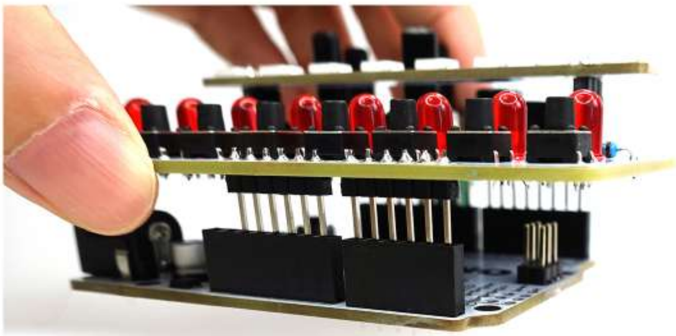


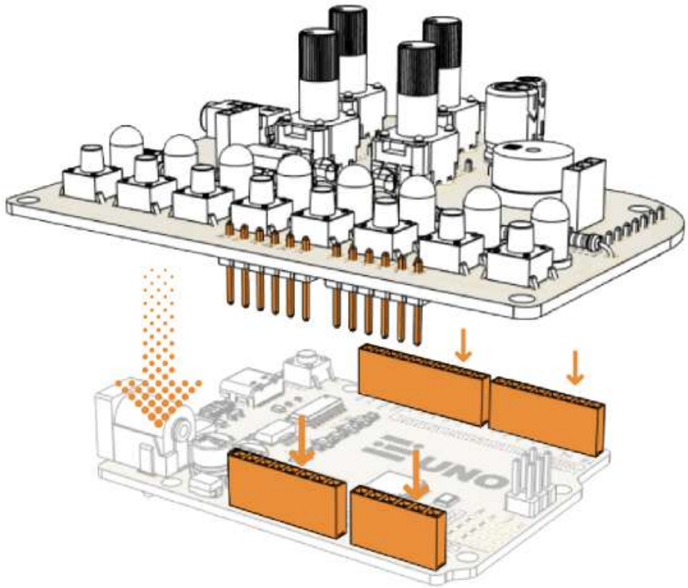


When all materials are assembled and soldered, connect the Glow strip across the top of the shield using the F3 and F4 Female Headers. Make sure the arrows on the Glow strip point to the right.

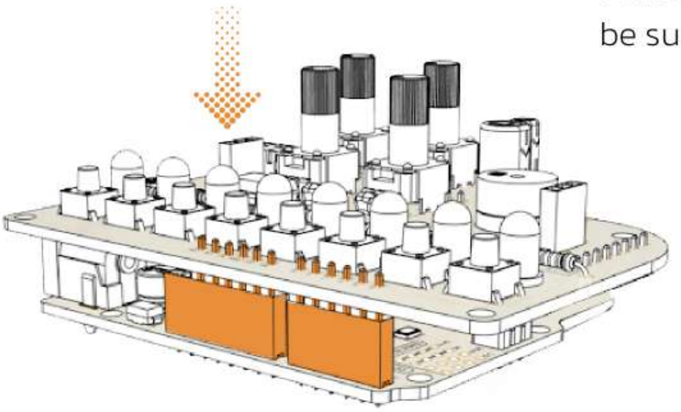
Get Connected

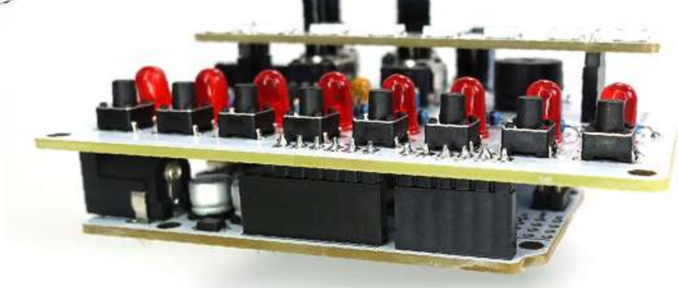
To connect, simply insert the male header pins protruding from the bottom of the Mini Grand into the female header pins on the top of the amomii UNO.





Make sure that all pins are inserted correctly and be sure to push the Mini Grand firmly in place.





Code it to Life

Before you start uploading code to your Mini Grand, you will need to download the Arduino IDE and make sure you are able to use it to upload code to you amomii UNO. If you already have the Arduino IDE and have tested your amomii UNO, you can skip these sections.

NOTE **For testing your amomii UNO, you should remove the Mini Grand shield.**

Download the Arduino IDE

The Arduino Integrated Development Environment (IDE) is the software used to write, upload, and debug sketches (programs) on your amomii UNO.

The IDE can be downloaded for free from the Arduino website **(www.arduino.cc)**. The IDE is available for Windows, Mac OS X, and Linux operating systems. Simply go to the "Software" section of the Arduino website, select the appropriate operating system, and follow the instructions for downloading and installing the IDE on your computer.

Get the Library

You can write code for your amomii Glow strips using various IDEs, but we recommend the Arduino IDE with the FastLED library installed on it. We will go over how to install the FastLED library next, but if you don't have the Arduino IDE, you can download it for free from the official Arduino website – arduino.cc

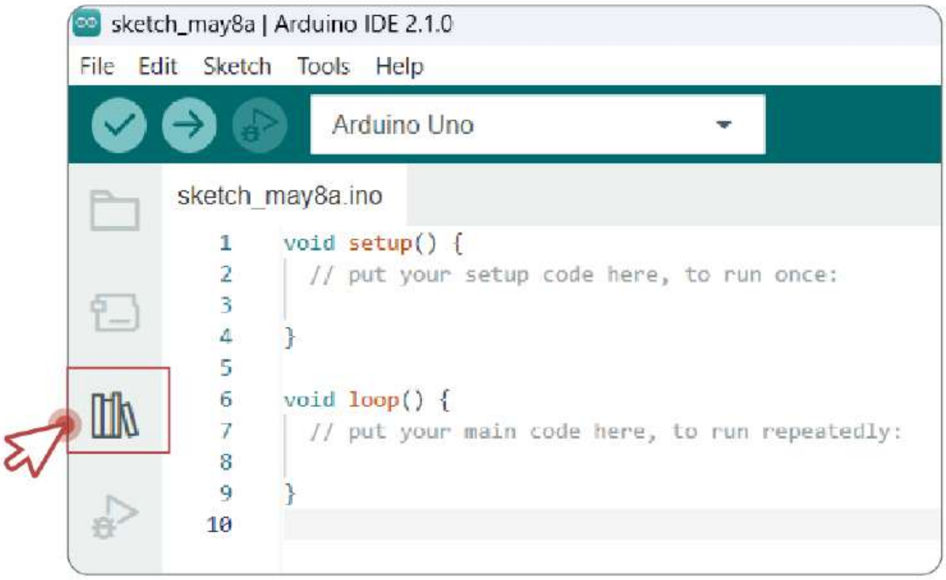
You can also find more details about using the IDE in the Getting Started manual for the amomii UNO. This can be found at amomii.com/products/UNO

Download the FastLED library

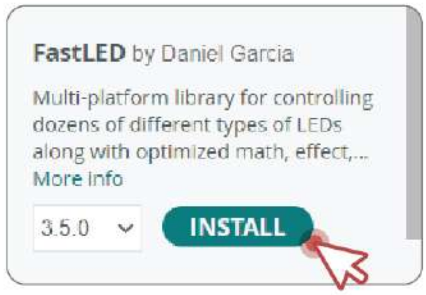
There are various ways to download coding libraries for the Arduino IDE, but the simplest way is to download them directly from within the IDE itself. We will be using Version 2 of the IDE, but the steps for the original are similar.

Click on the library manager shortcut on the left hand side of the IDE.

NOTE **There is no shortcut here on the original Arduino IDE, but the Library Manager can be accessed from Tools > Manage Libraries...**



When the Library Manager pops up, search for FastLED and click INSTALL on the version written by Daniel Garcia.

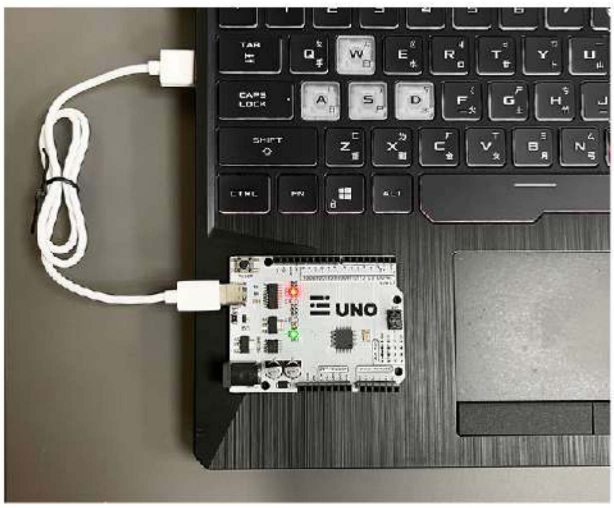


If you are prompted with the question whether you would like to download all the missing dependencies, click "INSTALL ALL".

Test your amomii UNO

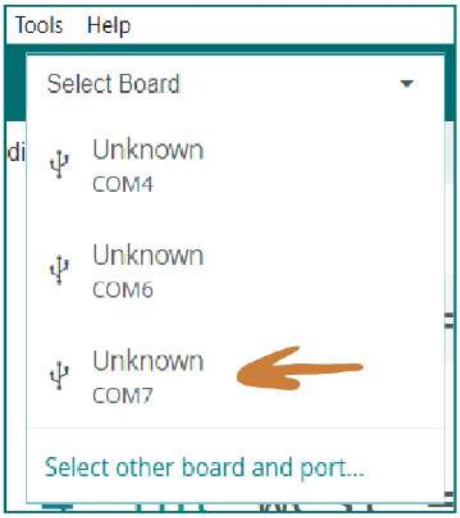
Run the Arduino IDE software and follow these steps to test that your amomii UNO is working with your computer.

STEP 1 **Connect the amomii UNO to your Computer**



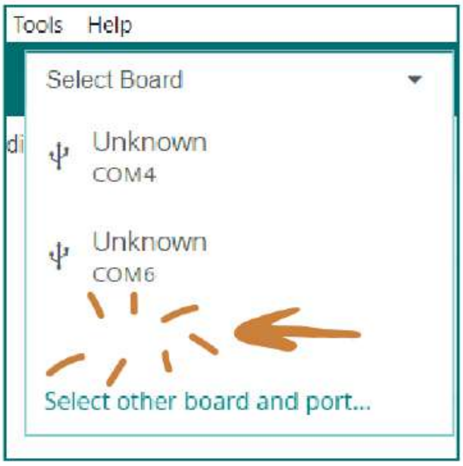
STEP 2 **Make sure the amomii UNO is Recognised**

To do this, click on the **"Select Boards"** dropdown.



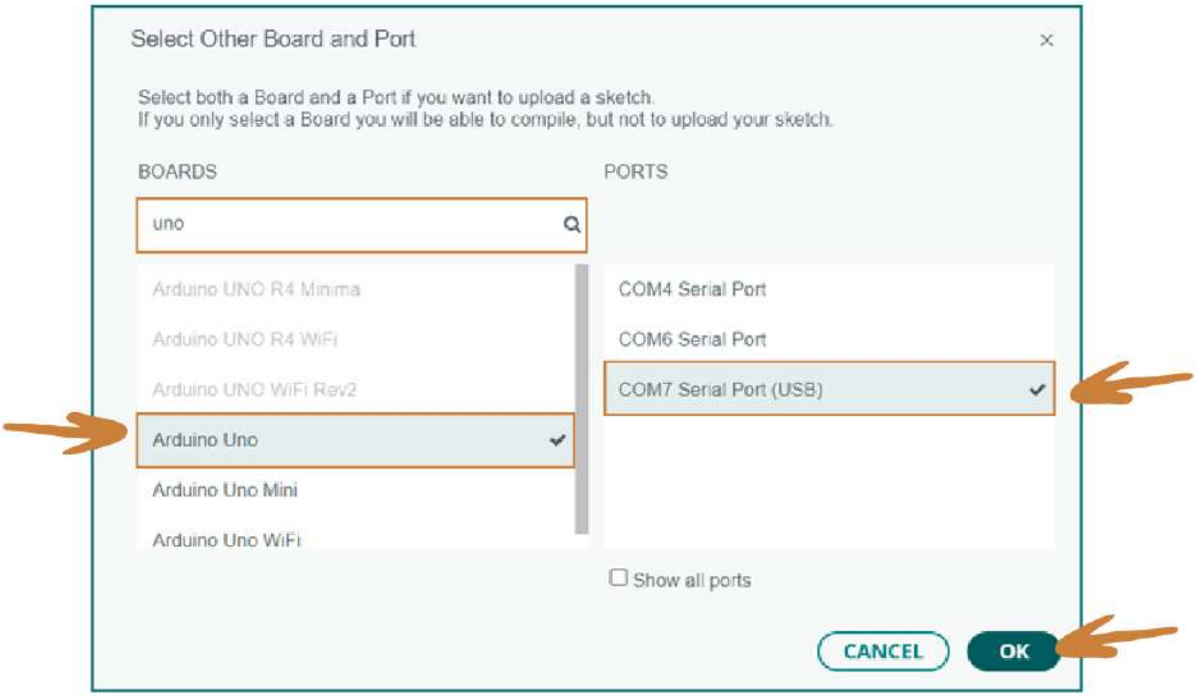
When you click this, a list of COM ports that are currently in use will appear.

Now, you need to figure out which COM port your amomii UNO is connected to. To do this, with the dropdown menu showing, disconnect your amomii UNO and note which COM port disappears from the list.



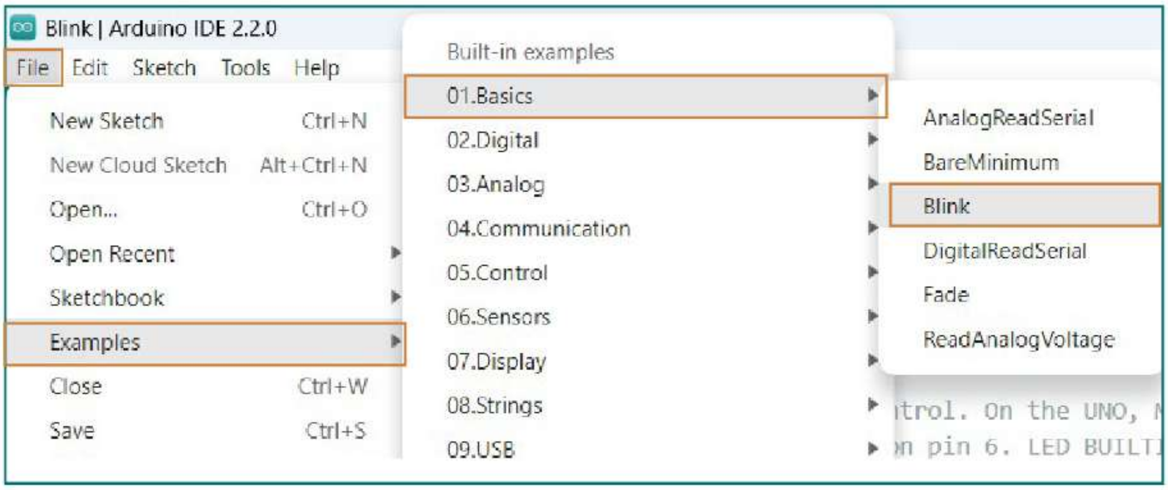
In my case, **"COM7"** disappeared, so I know this is the one. Reconnect your amomii UNO and select the appropriate COM port.

When you have done this, the **"Select Other Board and Port"** window should appear. In the **"Search boards"** section, type **"UNO"**, select the **"Arduino UNO"** option then click **"OK".**



STEP 3 Upload an Example Sketch

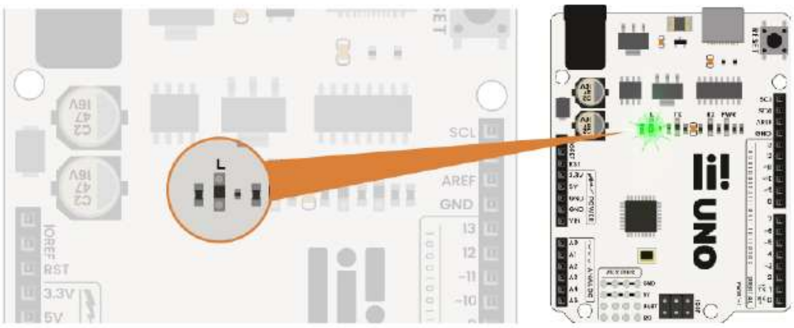
Once you have selected the correct board and port, open the Blink Example sketch. You can find this by going to **File > Examples > 01.Basics > Blink.**



Once the sketch loads up, click the **upload button** to upload the sketch to your amomii UNO.

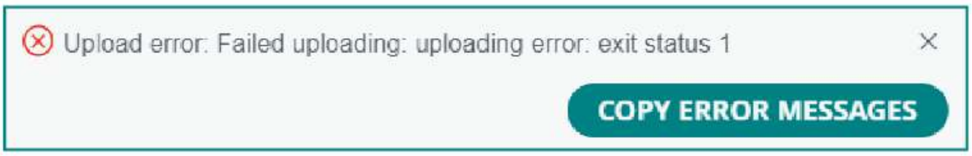
If the upload is successful, you should get a message saying **"Done Uploading"** on the bottom right of the IDE and the built-in LED should start blinking on your amomii UNO.

The built-in LED is the one labeled **L** on the board.



NOTE

If you get an error like this, double check that you selected the correct COM port and board.



If the problem persists, you may need to manually install the drivers for the CH340 chip used on the amomii UNO. You can download the drivers here: **http://www.wch-ic.com/downloads/CH341SER_ZIP.html**

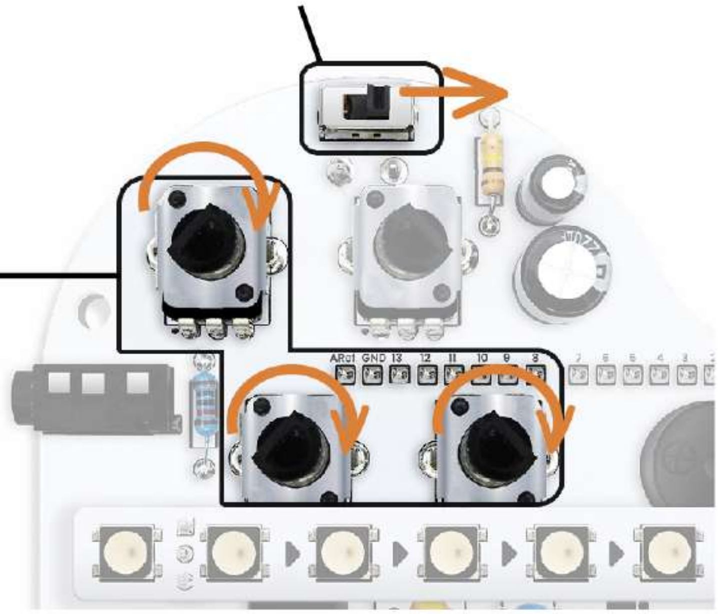
Test your Mini Grand

Prepare the Hardware

Connect your Mini Grand to your amomii UNO **(refer to the Get Connected section if you need to).** Page 27

Make sure the switch is pushed to the right (buzzer side).

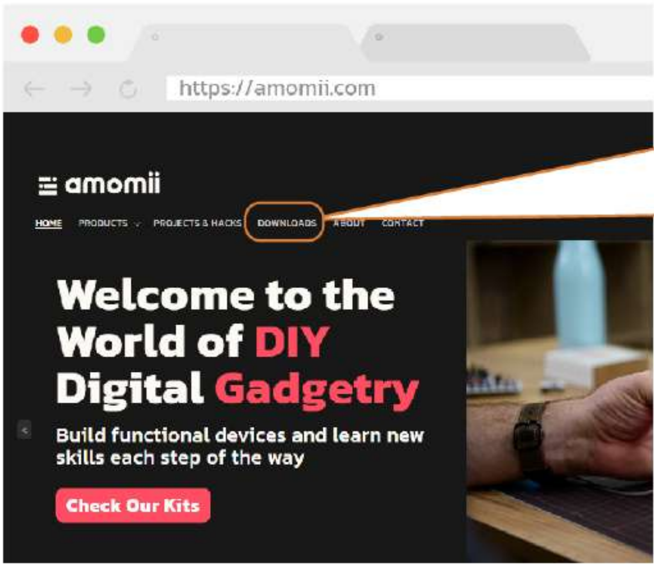
Turn all of the POTs as far as they will turn clockwise.

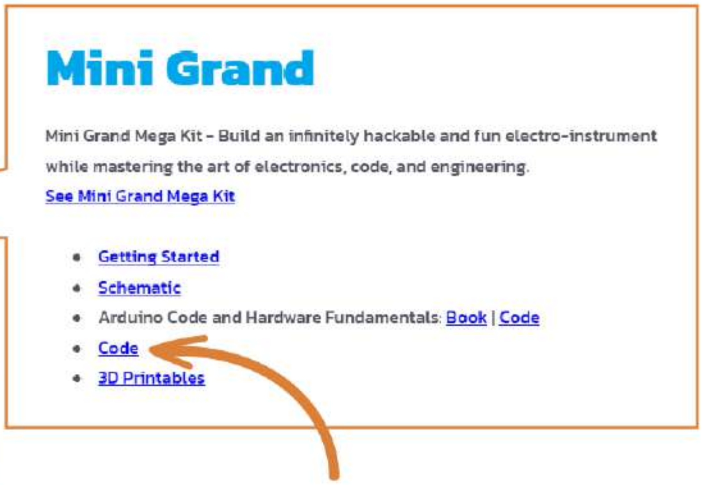


Get the Code

To check that your Mini Grand is working properly, we will run the **MG_test** code which you can find in the **Downloads** section of our website: **amomii.com/pages/downloads**

NOTE You will need to create a free account to access this area.



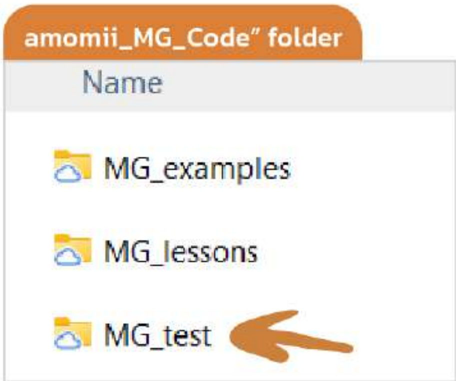


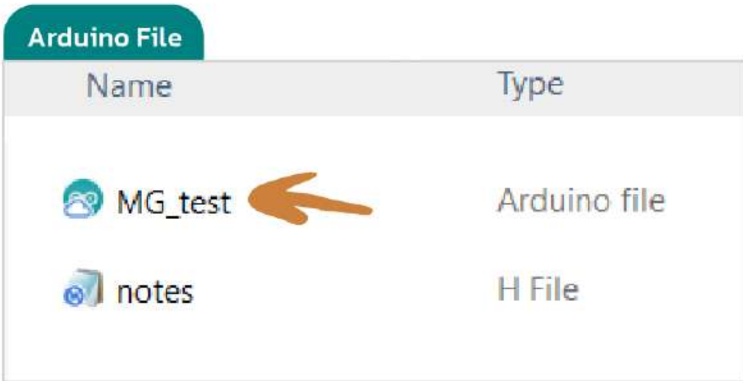
Once you are in the Downloads area, locate the **Mini Grand section** and click on the **"Code"** hyperlink. All of the Mini Grand code should start downloading in a Zip folder.

When the download is complete, extract the Zip folder in your preferred location and you are ready to start using the code.

NOTE **To avoid potential issues, it is best not to remove code from its original folder or rename anything.**

Open the "amomii_MG_Code" folder. Within this folder, you will find another folder called **"MG_test"**. Open it, and then open the Arduino File also called **"MG_test".**





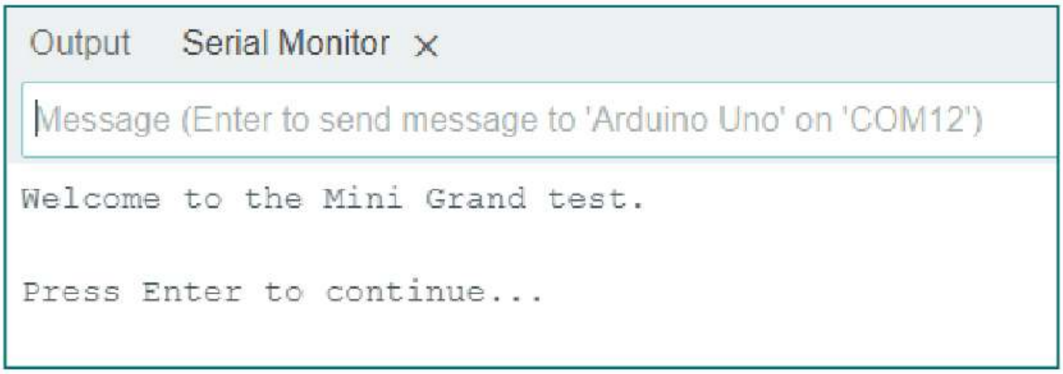
When the sketch loads, upload it to your amomii UNO (with Mini Grand shield connected) by clicking the upload button.

NOTE **Make sure you have selected the correct board and COM port as shown in the 'Test you amomii UNO' section of this manual.**

Next, you'll need to open the Serial Monitor. This tool provides a real-time communication window between your computer and the Arduino board, facilitating project debugging and monitoring.

To open the Serial Monitor, click on the magnifying glass at the top right of the Arduino IDE.

After that, the Serial Monitor will open at the bottom of the IDE.



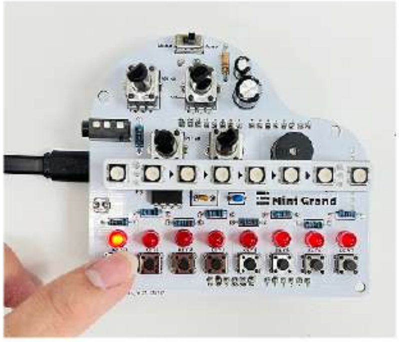
Press Enter on your keyboard to start the test and follow the instructions displayed on the Serial Monitor.

The instructions given on the Serial Monitor should be clear enough to follow, but we have included extra details here just in case you run into an issue.

Check the Buttons and LEDs

After pressing Enter to begin the test, you will be prompted to press each button one by one. The correct button to press should also be indicated on your Mini Grand with a glowing LED.

Press the buttons one by one until all have been pressed and all of the LEDs are turned off.



NOTE

If the LEDs don't glow, or the buttons don't respond to being pressed, check the Mini Grand connection to the amomii UNO. If the connection looks good on all pins but the problem persists, then there may be an issue with the soldering. Check all the solder joints and re-visit the soldering section of this guide to double check everything is correct.

Check the POTs (Potentiometers)

You will now be prompted to turn POT_A0 counter-clockwise. As you do so, you should notice LEDs turning off one by one. When you have turned the POT all the way and all of the LEDs are off, you should hear a beep.

You will then be prompted to turn the same POT all the way clockwise. As you do this, LEDs will turn on one by one until you hear a beep.

You will be asked to repeat these steps for POT_A1 and POT_A2.

NOTE

If the amount of glowing LEDs doesn't change as you turn the potentiometer and you aren't able to move on to the next step of the test, make sure that you are turning the correct POT. The name of each POT is printed on the Mini Grand shield, or you can refer to the Mini Grand Active Component Diagram in the Introduction section of this manual. If this doesn't solve your issue, check the connection to the UNO and check the soldering.

Check the Photoresistor (LDR)

Next, you will be asked to check the photoresistor. A photoresistor is a basic light sensor. Just like turning the POT varies the signal going to the amomii UNO, the amount of light sensed by the photoresistor does the same.

For this test, you will first be asked to press Key 6 (button 6). This will be indicated by the glowing LED next to it. When you press this button, a light reading will be taken; therefore, it is important not to obstruct the photoresistor from light or cast a shadow over it with your hand.

After this, you must take a second light reading, but this time you must block as much light from the resistor as possible. To do this, completely cover the photoresistor with your hand and press Key 7. Again, the LED next to this button will indicate where to press.

After you have pressed the button, quickly move your hand and wait a few seconds. Some of the LEDs should turn on, and you can control the amount of LEDs glowing by moving your hand to and from the photoresistor. To move on to the next test, you must completely cover the photoresistor, turning off all of the LEDs. When the photoresistor test is complete, you will hear a beep.

NOTE

If this test is not behaving as you think it should, there is a possibility that you took a bad reading and the difference in light detected when you pressed Key 6 with no light obstruction and when you pressed Key 7 with your hand completely covering the photoresistor isn't great enough. To ensure it works correctly next time, conduct the test in a well lit room. If this doesn't solve your issue, again, check the connections and the soldering.

Check the amomii Glow

The last component to check is the amomii Glow. To do this, you simply press Enter on your keyboard and the amomii Glow strip should start displaying colours, fading from one color to the next on a continuous loop.

NOTE

If the amomii Glow doesn't display colors as it should, make sure it is connected correctly with the arrows pointing to the right (>>>).

Check the Buzzer

In fact, this should already be finished!

As you went through the various stages of the test, from time to time, you should have heard beeps. If you did, consider the buzzer tested, and you are ready to move on to bigger and better things with your Mini Grand.

NOTE

If the buzzer didn't make any sounds during the test, make sure that the switch on the top of the Mini Grand is pushed to the right hand side labeled "Buzzer". If that doesn't solve the issue, check the connections and the soldering.

Assemble the Piano

Now that the Mini Grand is up and running, it's time to transform it from a project into a finished product by assembling the Mini Grand case.

The Mini Grand case is crafted from a high-quality resin material that not only provides a stunning matte-black appearance but also offers excellent functionality. To ensure the longevity of your Mini Grand, we recommend minimizing disassembly after assembly, unless absolutely necessary. This will help preserve the integrity and beauty of the resin material.

STEP 1

Screw the Mini Grand to the inside of the Main Body.

STEP 2

Connect the Keys to the Key Holder.

STEP 3

Clip the Piano Top to the Key Holder by firmly pressing down on both sides evenly and quickly.

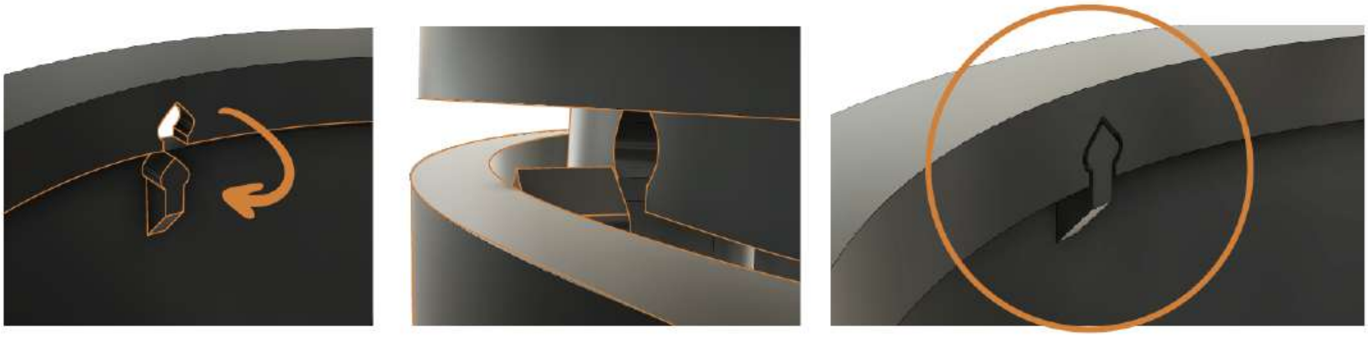
STEP 4

Connect the top section of the piano to the Main Body one side at a time. You may need to gently pull the wall to get the second side in.

STEP 5

Connect the back of the Piano Top to the Main Body using the small latch.

DON'T force the parts together, instead pull the Piano Top into the Main body and release it carefully interlocking the parts.



STEP 6

Attach the lid using the clips on the side of the Piano Top. Once connected **DO NOT DISCONNECT** to avoid damage to the clip.

STEP 7

Carefully lift the lid and hold it open with the stand and your Mini Grand is complete.

Play with your Creation

Now that your Mini Grand is complete, it's time to PLAY!

Discover the endless possibilities of your Mini Grand with these three exciting example projects. While we won't dive into the intricate details of the code, we'll guide you on how to use your Mini Grand once these codes are uploaded.

NOTE **Microcontrollers, like the amomii UNO, can execute only one task at a time. Consequently, you can upload only one code at a time. Uploading a new code will replace the previous one, but you can experiment with different codes as much as you'd like.**

You'll find the example codes we're discussing in the "MG_examples" folder, located within the **"amomii_MG_Code"** directory you downloaded, as explained in the Code section of this manual.

Feel free to explore these examples in any order you prefer, and read the brief descriptions below to help you decide which one to try first:

MG_Recordion Turn your Mini Grand into a sampler, allowing you to play, record, and save your tunes to memory banks for playback.

MG_Sequencer Experiment with preset sequences, controlling loop speed, pitch, and root notes using the Mini Grand POTs and Keys.

MG_Sequencer2 Create custom sequences with the Mini Grand POTs and Keys, adjusting notes, loop speed, and beats per loop in this dynamic instrument.

Recordion

Start by uploading the MG_Recordion code to your Mini Grand.

This code turns your Mini Grand into a cool record-and-play piano with pitch shifting capabilities. Basically, you can play the piano in Free Mode or record what you are playing in Record Mode and save it to one of four memory banks. These recordings can then be played by pressing on the memory bank keys, like a basic sampler. In all modes, the keys are represented by glowing RGB lights giving your classic Mini Grand piano case a very modern electro vibe.

Let's break it down.

After uploading this code, when you first turn on your Mini Grand, it will be in **Recordion Master Mode.** In this mode, all pixels on the Glow strip will shine red, other than pixel 5 which will glow green, and the rightmost keys (Key 6 and 7) will also glow red.

At this stage, you have two options, Free Play Mode, or Record Mode.

To access **Free Play Mode**, press Key 5 (under the green light).

Once in this mode, you can play the piano and practice your skills before laying down a sample.

You can also adjust the pitch of the piano to your liking by turning the POT_A0.

Once you have finished playing in Free Play Mode and are ready to lay something down, you can press the rightmost two keys, returning you to **Recordion Master Mode.**

To access **Record Mode**, from Recorion Master Mode, press the rightmost two keys.

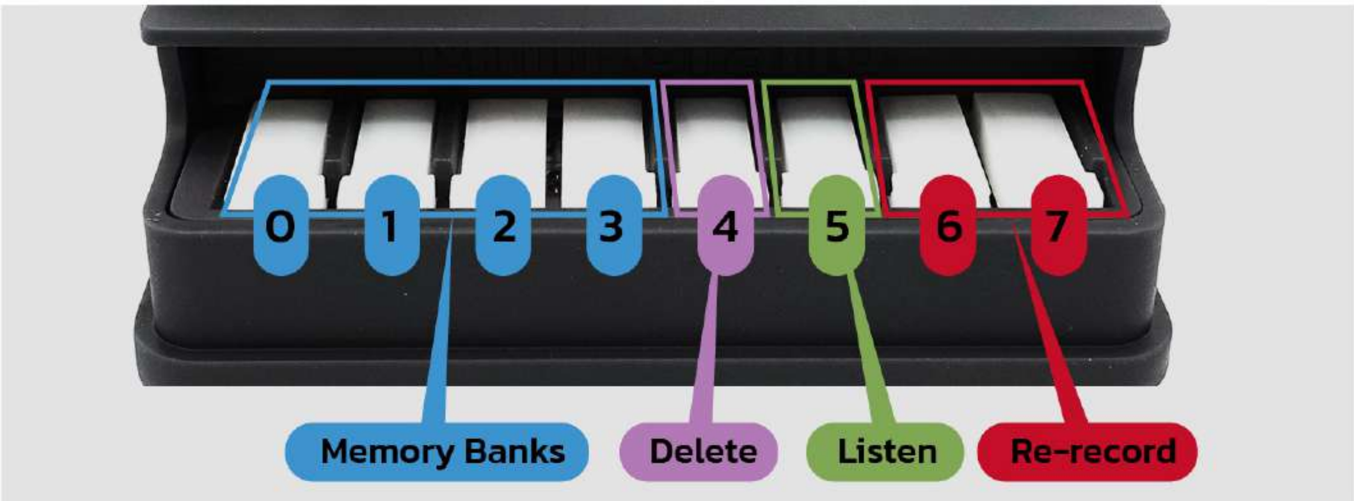
Once in **Record Mode**, a recording will start from the moment you press the first key of the sample you want to record. Both the notes played and the duration of notes and gaps between notes is recorded. Once you have finished playing your sample, again press the rightmost two keys to stop recording.

NOTE

As a microcontroller's memory is limited, a single sample may not exceed 60 key presses. If the limit is surpassed, the recording will stop automatically.

After a sample has finished being recorded, you will enter **Bank Mode**. In this mode, pixels 0 – 3 will glow blue, 4 purple, 5 green, and pixels 6 and 7 red. On top of this, keys 0 – 3 will either be glowing red, or blinking on and off red.

In **Bank Mode,** you have four memory banks that your sample can be saved to. These four memory banks are indicated by the leftmost four keys which are either glowing or blinking red and have blue pixels above them. A flashing key means that the bank is empty and a solid glowing key means that there is already a sample saved to that bank. To save the sample you have just finished playing, you can press the bank you want to save it to, either replacing an existing sample, or saving to an empty spot.



Additionally, in Bank Mode, you have three extra options:

1. Re-record – If you are not happy with your performance and want to try again, press the rightmost two keys (under the red pixels) and start again.

2. Listen – If you want to listen back to your performance before saving it to a memory bank, press Key 5 (under the green pixel) and hear what you played.

3. Delete – If you want to delete the performance you just played, press Key 4 (under the purple pixel) and clear it away.

After you have saved a sample, you will return to **Recordion Master Mode.**

Now, **Recordion Master Mode** will appear as it did when you first turned on the Mini Grand (running the Recordion code), but saved samples will be indicated on keys 0 - 3 with a solid red glow.

Now you have three options:

1. Record - You can press key 6 and 7 to record a new sample.

2. Free Play - You can enter Free Play Mode by pressing Key 5.

3. Playback - You can play one of your samples by pressing Keys 0 - 3 (if a sample is recorded to the corresponding key).

And that's basically it for Recordion. Fill up your memory banks and **GET ROCKIN'!**

Sequencer

Another project we think you'll love is the MG_Sequencer. This can also be found in the MG_Examples folder.

With this sketch, the Mini Grand turns into a sequencer that can loop through a selection of sequences. The users can control the speed, pitch, sequence and root note by using the Mini Grand's potentiometers and keys. On top of this, the Glow strip cycles through various colors using a rainbow effect while at the same time displaying the current position of the sequence.

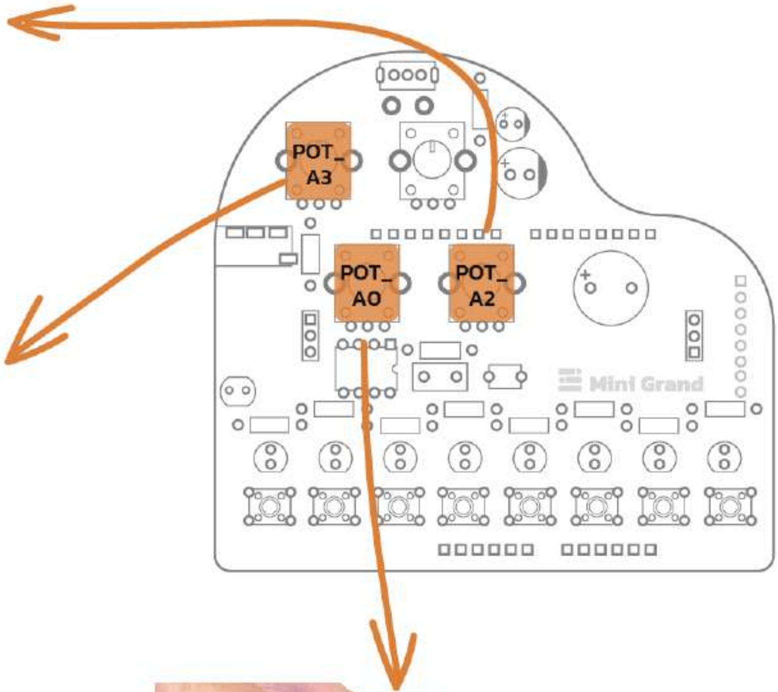
Here's how you can Play with the MG_Sequencer once you have uploaded it to your Mini Grand.

When you first turn the Mini Grand on, you will hear a start sound and the pixels on the Glow strip will display a rainbow effect. To start the sequencer, **press Key 0 (it will be glowing red).**

As soon as you press the button, the sequencer will start.

Pixels on the Glow strip represent the position of the sequence, turning on one by one until reaching the end of a sequence then turning off again and back on one by one (looping). For each new step in the sequence, the buzzer will make a sound.

To change the speed of the sequencer, you can adjust **POT_A2**. Turning it clockwise will slow it down, and counter clockwise will speed it up. If you turn it to full speed, the sequence will be so fast that it will sound like a laser effect rather than a sequencer.



POT_A3 can be used to select from one of twelve different sequences. These sequences are written into the code, but don't need to be understood to be enjoyed. Basically, if you like how it sounds, just leave it at that. However, if you are interested in learning more about the scales/sequences and perhaps want to customize them, see the MG_Sequencer section in the appendix.

To adjust the pitch of the notes played, you can use **POT_A0.**

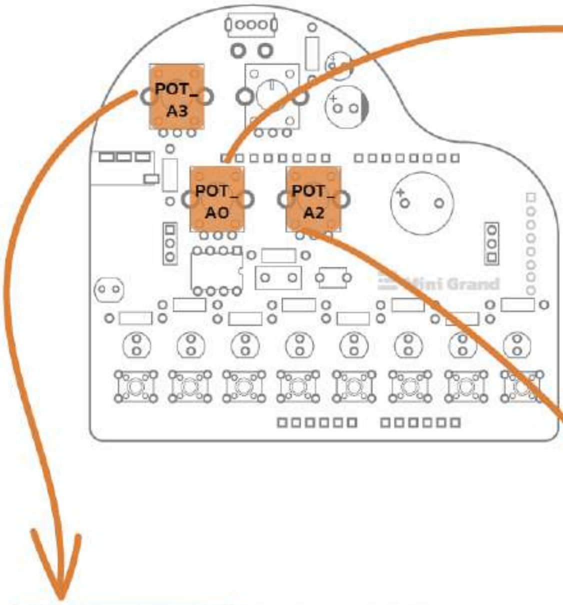
Sequencer 2

The final code we will look at is the MG_Sequencer2 project. This (as the name suggests) is similar to the previous code, but makes your instrument more customizable and leaves more room for creativity.

When you first turn on your Mini Grand, a start sound will play, the Glow strips will display a rainbow pattern, and Key 0 will glow red indicating that you can press it to start. Once started, the sequence will play on a constant loop.

You may notice that although the Glow strip is counting out the sequence, there is no sound. That is because you need to set the sound for each beat in the sequence manually.

Here's how you can control the sequence.



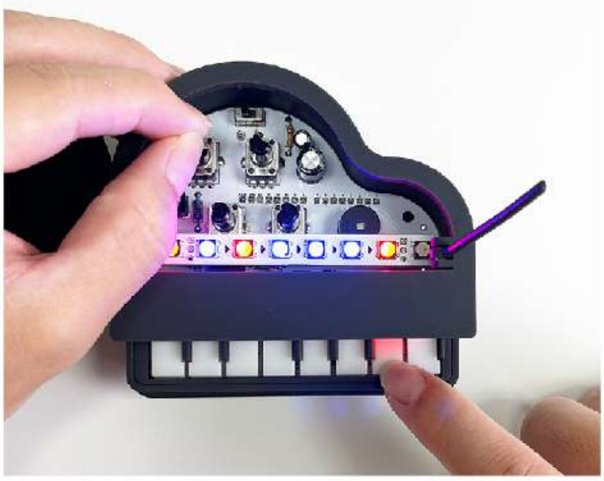
POT_A0 can be used to control how many beats are in the sequence (0 - 8). If you turn the POT all the way counter-clockwise, the sequence has 0 beats, in other words, turns off. If you turn it all the way clockwise, there will be 8 beats per sequence. For the rest of this description, we will presume you have turned it clockwise and there are 8 beats in your sequence.

POT_A3 is used to control the frequency of the Active Beat in a sequence (more about Active Beats below). The frequency can be anywhere between 0 and 5000 (but this can be adjusted in code by changing the minFrq and maxFrq variables at the top of the sketch if desired).

POT_A2 is used to control the speed of the sequence, clockwise slowing it down, and counter-clockwise speeding it up.

The **Active Beat** is the beat that is currently selected and whose note can be adjusted by turning the frequency dial **(POT_A3).** The Active Beat is signaled by the corresponding key. For example, if the 8th key is glowing red, the 8th beat is the Active Beat. Turning the frequency dial will adjust this beat's sound live (while the sequence is playing).

To change the Active Note, you must press and hold the corresponding piano key until the previous Active Note key stops glowing.



Additionally, if you press and hold a key, its sound will loop so you can adjust the sound without having to listen to the full sequence. The sequence will start from the first beat once you release the key you are holding.

To delete a sound from a beat and make it empty, you can simply make it the active beat, then turn the frequency dial counter-clockwise.

The Glow strip is used to help keep track of where you are in a sequence and which beat has a sound set to it.

To keep track of the sequence position, the pixels on the Glow strip light up one by one then turn off at the end of a sequence. This loops continuously. This is also useful when adjusting the sequence length using **POT_A0.**

The colors on the pixels gradually change through all hues unless the corresponding beat has a sound set to it. If a sound is set to a beat, this pixel will glow a solid red when it turns on. This can help you know which beats have sounds set to them and which don't.

That's it. Now you know how, start creating Mini Grand masterpieces! And once you get good at it, and have perhaps customized the code to your liking, why not try plugging in external speakers and blasting your creations for all to hear! (See the appendix for more on external speakers).

We really hope you have fun with your Mini Grand, and would love to hear how you get and to see what you create with yours! Please share your creations, thoughts and ideas on our social media platforms or by leaving us an honest review wherever you purchased your kits from.

Appendix

Key Groups

A basic understanding of Arduino code and hardware is presumed in the following description. If you find this description hard to follow, consider studying the original amomii textbook – Arduino Code and Hardware Fundamentals. Access to this book comes free with any amomii UNO purchase (kits included). Refer to the blue insert in the amomii UNO pack for download details. Contact us if you have trouble accessing the book.

Key 0 – Key 7 consist of buttons and LEDs connected together physically. You can think of LED 0 and button 0 as a group named Key 0. The same is true for 'groups' Key 1 – Key 7. The connections are such that the LEDs can be controlled both **passively** and **actively.**

By **"passively"**, we mean that when a button is pressed, the LED connected to it glows, regardless of the code being used.

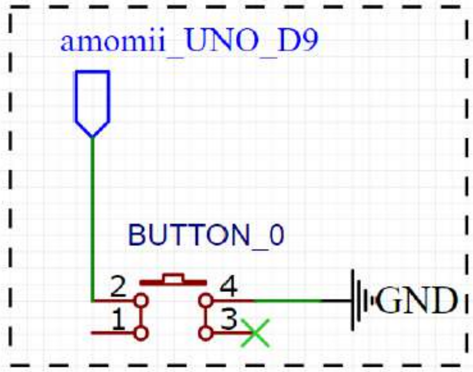
By **"actively",** we mean that the LEDs can also be controlled by the microcontroller through code.

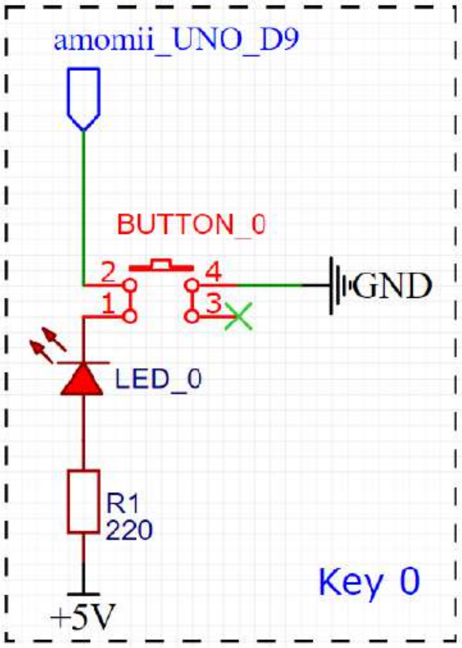
Let's break this down and look at the circuitry and then the code, step by step.

First, consider the buttons. The buttons are connected with one side linked to the amomii UNO IO pins and the other to ground. Take Button 0, for example; it's connected to amomii UNO pin D9 on one side and ground on the other. In other words, when the button is pressed, D9 is connected to ground, and when the button is released, D9 is connected to nothing. Therefore, we must set the pin mode of D9 as an INPUT_PULLUP using the pinMode(9, INPUT_PULLUP) function.

Note: When reading an INPUT_PULLUP pin with the digitalRead() function, a 1 is returned if the pin is disconnected (not pressed), and 0 is returned when the pin is connected to ground (pressed).

With that, it follows that on the Mini Grand, when a button is pressed and its corresponding pin on the amomii UNO is read with the digitalRead() function, a 0 is returned, and a 1 is returned when the button is released. Keep this in mind when coding your Mini Grand.





To understand the LED connection, it's important to note that when a pin on the amomii UNO is set as an INPUT_PULLUP, a 5V potential is present at the pin unless there is a route to ground.

Now, let's look at how the LED is controlled passively.

First, take a look at the schematic of the Key 0 group, which includes Button 0 and LED 0.

As you can see, the cathode of the LED is connected to amomii UNO pin D9, and the anode is connected to a 5V source (via a resistor). As discussed earlier, if D9 is an INPUT_PULLUP, it has a 5V potential. Therefore, if the button is not pressed, there is a 5V potential at both the anode and cathode sides of the LED, meaning no potential difference and no current flow. In other words, the LED will not glow. However, if the button is pressed, the cathode of the LED is now connected to ground via the button, and the LED will glow.

To control LED 0 actively, we must set the pin mode of D9 as an output using the pinMode(9, OUTPUT) function. However, it's essential to consider the orientation of the LED.

Typically, when connecting an LED to a microcontroller, users connect the anode to the microcontroller and the cathode to ground (via a resistor). This way, when the pin it is connected to is written HIGH, the LED glows, and when it is written LOW, it turns off.

With the Mini Grand, the LED is connected in reverse to the typical way. Therefore, it works inversely. When the digital pin is written LOW, the LED glows, and when it is written HIGH, it turns off. This must be taken into consideration when coding the Mini Grand LEDs.

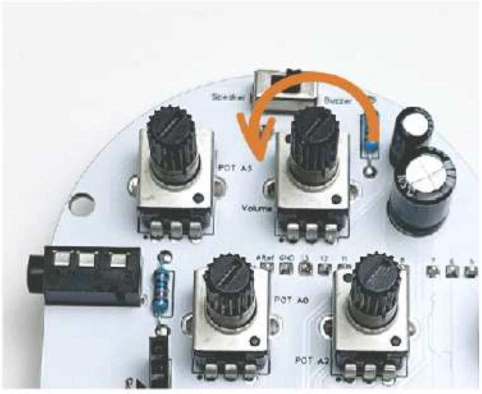
The reason it works in reverse is that when the pin is written HIGH, it has a 5V potential. Consequently, there is a 5V potential at both sides of the LED, meaning no current flows. However, when written LOW, the output pin essentially becomes a ground pin, allowing current to flow through the LED and turning it on.

External Speakers

The Mini Grand comes with an on-board buzzer, but for a richer sound, external speakers can be connected.

To use external speakers, you must switch the Audio Output Device switch to the left.

When in External Speaker mode, the audio is delivered via the LM386N audio IC giving it a nice rich boosted sound. Moreover, in this mode, the top right potentiometer can be used to adjust the volume of the output.



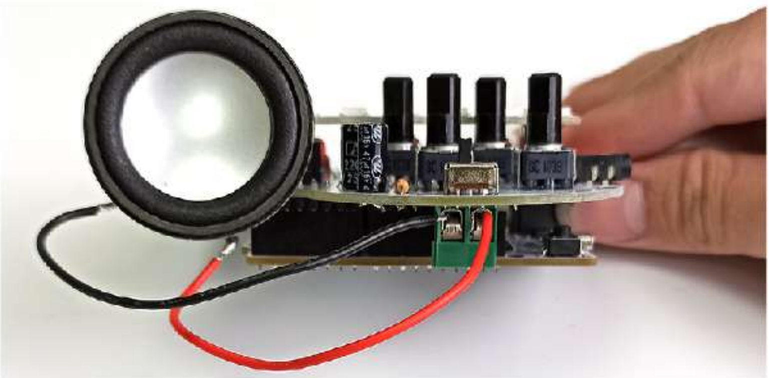
Warning: It is ALWAYS a good idea to turn the volume all the way down (counter-clockwise) before connecting to an external speaker and slowly turning it up to find the right level. On top of this, it is not advised to connect earphones/headphones to the Mini Grand to avoid damage to the headphones and, more importantly, your ears! The output signal, when turned up, is greater than most earphones are rated for.

Now, you have two options for connecting your external speakers - via the screw terminals or the audio output jack.

Screw Terminal

The screw terminal is ideal for connecting small DIY speakers. The one used in the image below is an inexpensive 4Ω 3W speaker, and it sounds great.

The sound it produces is reminiscent of a retro arcade game or fairground attraction.



Audio Jack

Because of its universal size, the audio jack is ideal for connecting your Mini Grand to sound systems allowing you to go BIG! For example, you could attach your Mini Grand to the input of a HiFi system or an amplifier and play your electronic creations at a stadium level!

MG_Sequencer

The sequences for the MG_Sequencer are written into the code. They can be found in these lines:

```
Scale majorScale = {8, {0, 2, 7, 5, 9, 4, 12, 11}};
Scale naturalMinorScale = {8, {0, 10, 3, 7, 2, 12, 8, 5}};
Scale dorianScale = {8, {0, 5, 3, 7, 9, 2, 10, 12}};
Scale phrygianScale = {8, {0, 8, 7, 3, 10, 5, 1, 12}};
Scale lydianScale = {8, {0, 6, 2, 9, 12, 7, 4, 11}};
Scale mixolydianScale = {8, {0, 5, 2, 10, 9, 4, 12, 7}};
Scale melodicMinorAscScale = {8, {0, 9, 2, 5, 11, 7, 12, 3}};
Scale melodicMinorDescScale = {8, {0, 8, 3, 10, 5, 7, 12, 2}};
Scale harmonicMinorScale = {8, {0, 8, 2, 7, 12, 5, 11, 3}};
Scale bluesScale = {7, {0, 5, 3, 10, 7, 1, 12}};
Scale pentatonicMajorScale = {6, {0, 7, 9, 2, 4, 12}};
Scale pentatonicMinorScale = {6, {0, 5, 8, 12, 2, 7}};
```

As you can see from their names, each sequence is based on a musical scale.

Now, let's go over what the numbers mean. We will focus on the first sequence, 'majorScale', but what we discuss is true for the rest, too.

The first number, after the first curly bracket, shows how many beats are in the sequence, and the numbers in the second set of curly brackets represent the notes in the sequence.

Amount of beats **Notes in the sequence**

```
Scale majorScale = {8, {0, 2, 7, 5, 9, 4, 12, 11}};
```

The notes represent how many half steps up from the root note to play. For example, if the root note is C, these are the notes numbers 0 - 12 would be:

- 0 = C (the root note in this example)
- 1 = C#
- 2 = D
- 3 = D#
- 4 = E
- 5 = F
- 6 = F#
- 7 = G
- 8 = G#
- 9 = A
- 10 = A#
- 11 = B
- 12 = C (one octave up from the root note)

The root note is chosen by pressing and holding the keys on the Mini Grand. You must make sure you are pressing the key at the start of a sequence. The Key LED will stay glowing when it has been selected even when the finger is removed.

If you want to change the sequences, you can simply edit the numbers. For the amount of beats, it's best to use a value no greater than 8 (as there are only 8 pixels on the Glow strip).

There is no need to do so, but if you want to change the name of the sequence, you must do so in the array below it too.

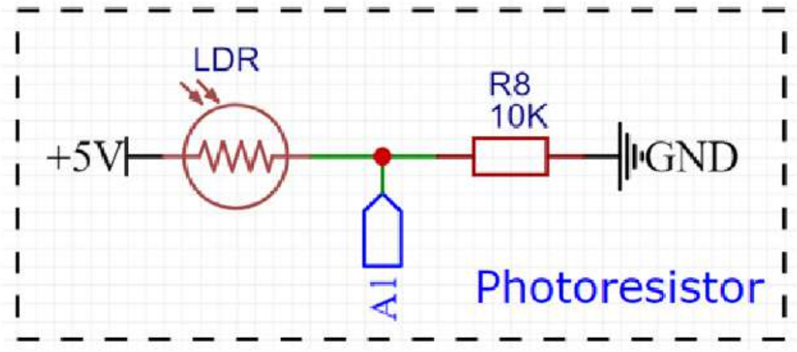
```
// Define scales with intervals in your chosen order
Scale majorScale = {8, {0, 2, 7, 5, 9, 4, 12, 11}};
Scale naturalMinorScale = {8, {0, 10, 3, 7, 2, 12, 8, 5}};
Scale dorianScale = {8, {0, 5, 3, 7, 9, 2, 10, 12}};
Scale phrygianScale = {8, {0, 8, 7, 3, 10, 5, 1, 12}};
Scale lydianScale = {8, {0, 6, 2, 9, 12, 7, 4, 11}};
Scale mixolydianScale = {8, {0, 5, 2, 10, 9, 4, 12, 7}};
Scale melodicMinorAscScale = {8, {0, 9, 2, 5, 11, 7, 12, 3}};
Scale melodicMinorDescScale = {8, {0, 8, 3, 10, 5, 7, 12, 2}};
Scale harmonicMinorScale = {8, {0, 8, 2, 7, 12, 5, 11, 3}};
Scale bluesScale = {7, {0, 5, 3, 10, 7, 1, 12}};
Scale pentatonicMajorScale = {6, {0, 7, 9, 2, 4, 12}};
Scale pentatonicMinorScale = {6, {0, 5, 8, 12, 2, 7}};
Scale scales[] = {
  majorScale, naturalMinorScale, dorianScale, phrygianScale,
  lydianScale, mixolydianScale, melodicMinorAscScale, melodicMinorDescScale,
  harmonicMinorScale, bluesScale, pentatonicMajorScale, pentatonicMinorScale
};
```

Play around with it and have fun!

Photoresistor

A photoresistor, often referred to as an LDR (light-dependent resistor), is a special type of resistor whose resistance changes with varying light levels. It serves as a cost-effective and efficient light sensor, making it a valuable component for creative projects. While we haven't utilized the light sensor in the default Mini Grand example projects, it is included on the Mini Grand shield to encourage experimentation and innovation.

The basic circuitry for the photoresistor is straightforward. In the Mini Grand setup, we have connected the photoresistor to analog pin A1 in conjunction with a 10KΩ resistor, forming a potential divider circuit. Conceptually, a potential divider involves using parallel resistors to divide a signal in a manner that's proportional to the values of these resistors.



Understanding the intricacies of potential dividers isn't crucial for using the photoresistor effectively. If you're familiar with reading input from a potentiometer, you already possess the skills needed to interpret data from the LDR.

In fact, you can use your photoresistor exactly as you would a potentiometer, only Instead of rotating a knob, as you would with a potentiometer, you modify the value at the photoresistor pin by altering the amount of light shining upon the photoresistor.

You can experiment further by customizing the code in any of the examples to incorporate the light sensor in place of one of the potentiometers.

This approach would introduce an element of randomness and environmental influence to your projects, as the sensor's sensitivity would vary with the ambient light conditions and time of day. For instance, you could control the sequencer's speed by opening and closing the piano lid to adjust the amount of light reaching the photoresistor, resulting in a unique and dynamic musical experience.

To make this change in the MG_Sequencer code, you only need to change one character!

First, find the part of the code where the potentiometer pins are declared (close to the top).

```
int pitchPotPin = A0; // Pin for pitch adjustment potentiometer
int tempoPotPin = A2; // Pin for tempo adjustment potentiometer
int scaleSelectPin = A3; // Pin for scale selection potentiometer
```

Next, change A2 to A1, and you're done.

```
int pitchPotPin = A0; // Pin for pitch adjustment potentiometer
int tempoPotPin = A1; // Pin for tempo adjustment potentiometer
int scaleSelectPin = A3; // Pin for scale selection potentiometer
```

Note: It may seem logical to rename "tempoPotPin" to something like "tempoLdrPin", but this is not necessary. However, if you want to do so, you will have to change the variable's name in each instance it is used throughout the code.

As a final point, you may notice that the speed doesn't change much when you open and shut the piano lid at first. This is because the **Key0** LED is situated very close to the photoresistor and shines directly on it.

Therefore, to play around with the photoresistor/lid combo, first press and hold **Key7** until the **Key0** LED turns off.

Resistor Bands

Resistors come in various shapes and sizes, and have different resistances. The ones included with this kit are all 1/4W 5 band axial resistors and are the same shape and size; however, their resistance ratings vary from 220Ω to 100,000Ω (100kΩ). To avoid potentially damaging the Mini Grand and to insure optimal performance, it is vital to use the correct resistors in the correct places.

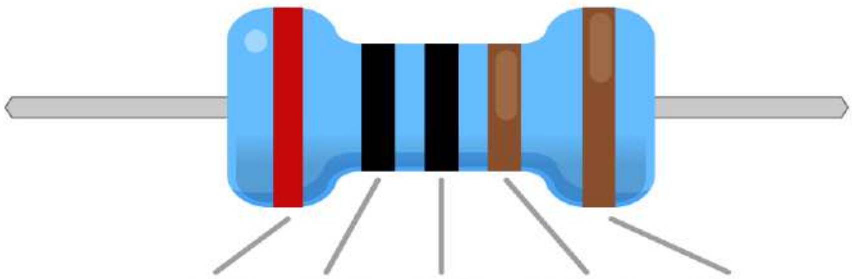
To distinguish 5 band axial resistors, you must look at the color of the bands. When oriented the correct way around, the first four bands starting from the left show the resistance value, and the rightmost band shows tolerance (how accurate the resistor is). For our application, precision isn't so important, so we can generally ignore the tolerance band. The resistance bands (first four bands), however, are very important.

Note: You can tell which way to orient the resistor for reading it because the gap between the resistance bands and the tolerance band is slightly bigger.

Now, to read the tolerance value, we look at the color of the bands and the corresponding value of the particular color on the chart. The first three bands are the first three digits in the number, and the fourth band is the multiplier. Basically, for the forth band, look at the value of the color and add that many zeros to the number.

The resistance bands in the example below are brown, black, black and orange, 1, 0, 0, and orange is 3, so add 3 zeros. The resistor below has a resistance of 100,000Ω (100kΩ).

See if you can figure out the resistance of the resistor used as the example on the chart.



	Digit	Digit	Digit	Multiplier	Tolerance
Black	0	0	0	x 1	
Brown	1	1	1	x 10	± 1%
Red	2	2	2	x 10^{2}	± 2%
Orange	3	3	3	x 10^{3}	± 3%
Yellow	4	4	4	x 10^{4}	± 4%
Green	5	5	5	x 10^{5}	± 0.5%
Blue	6	6	6	x 10^{6}	±0.25%
Violet	7	7	7	x 10^{7}	±0.1%
Grey	8	8	8	x 10^{8}	±0.05%
White	9	9	9	x 10^{9}	
Gold				x 10^{-1}	± 5%
Silver				x 10^{2}	± 10%

You should have gotten 2000Ω

We hope you had a VERY GRAND time putting together and playing with your Mini Grand kit.

We also hope that this is just the beginning of your Mini Grand adventure and we would love to see what creative things you do with yours.

Keep up to date with what we have going on by visiting our website: amomii.com