

Ringo build guide

Introduction

Let the adventure begin



What your phone will look like soon!

Welcome!

Welcome to the CircuitMess Ringo build guide!

In the following 5 chapters, we'll help you build your own mobile phone out of the components you received in your Ringo kit!

Recommended age group

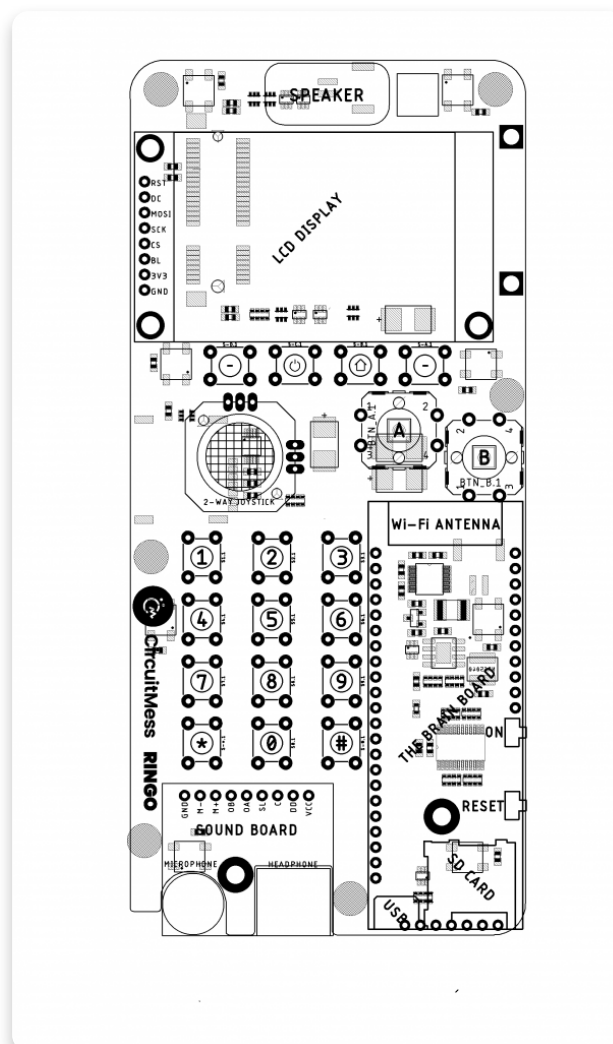
We believe that an 11-year-old child should be able to assemble a Ringo with some help from an adult.

The estimated age group is 11+.

The estimated build time is around 5 hours, but it can vary depending on your skill level.

CircuitMess Ringo was designed to bring the basics of STEM (Science, Technology, Engineering, and Mathematics) to beginners in a fun and interesting way.

Despite that, it is not the simplest kit out there and if you've never soldered before, you should consider practicing your soldering skills or watching a few tutorial videos before you get started.



Detailed sketch of Ringo's main board

Useful skills for assembling the Ringo:

- Basic soldering experience (just a bit of practice beforehand)
- Ability to recognize basic electronic components

If you aren't sure of your skills, don't worry. By following these instructions carefully, you'll be sure to catch up in no time.

What You'll Learn With the Ringo

Ringo's main goal is to educate and motivate you to learn something new or brush the skills you already have.

In the process of assembly, you'll learn:

- How to solder.
- Name basic electronic components and their function.
- How to connect electronic components and why.
- What micro controllers are and some basics of digital electronics

If you go further and follow our coding and hacking guides, you'll learn:

- How to program a microcontroller in C/C++
- How a simple video game works
- How to interface a microcontroller with external peripherals

Basic resources

Schematics:

- [Main board schematics - 4G](#)
- [Main board schematics - 2G](#)
- [Brain board schematics](#)
- [Display board schematics](#)
- [Network board schematics](#)

- [Sound board schematics](#)

What's in the box?

You've got your CircuitMess Ringo kit? Awesome!

Thank you for supporting our project!

First of all, follow the list of components below and make sure you have all of them on your table and ready for soldering.

Your Ringo kit was hand packed with love in Croatia by us (humans), and humans sometimes make mistakes.

If something is missing, please tell us via contact@circuitmess.com.

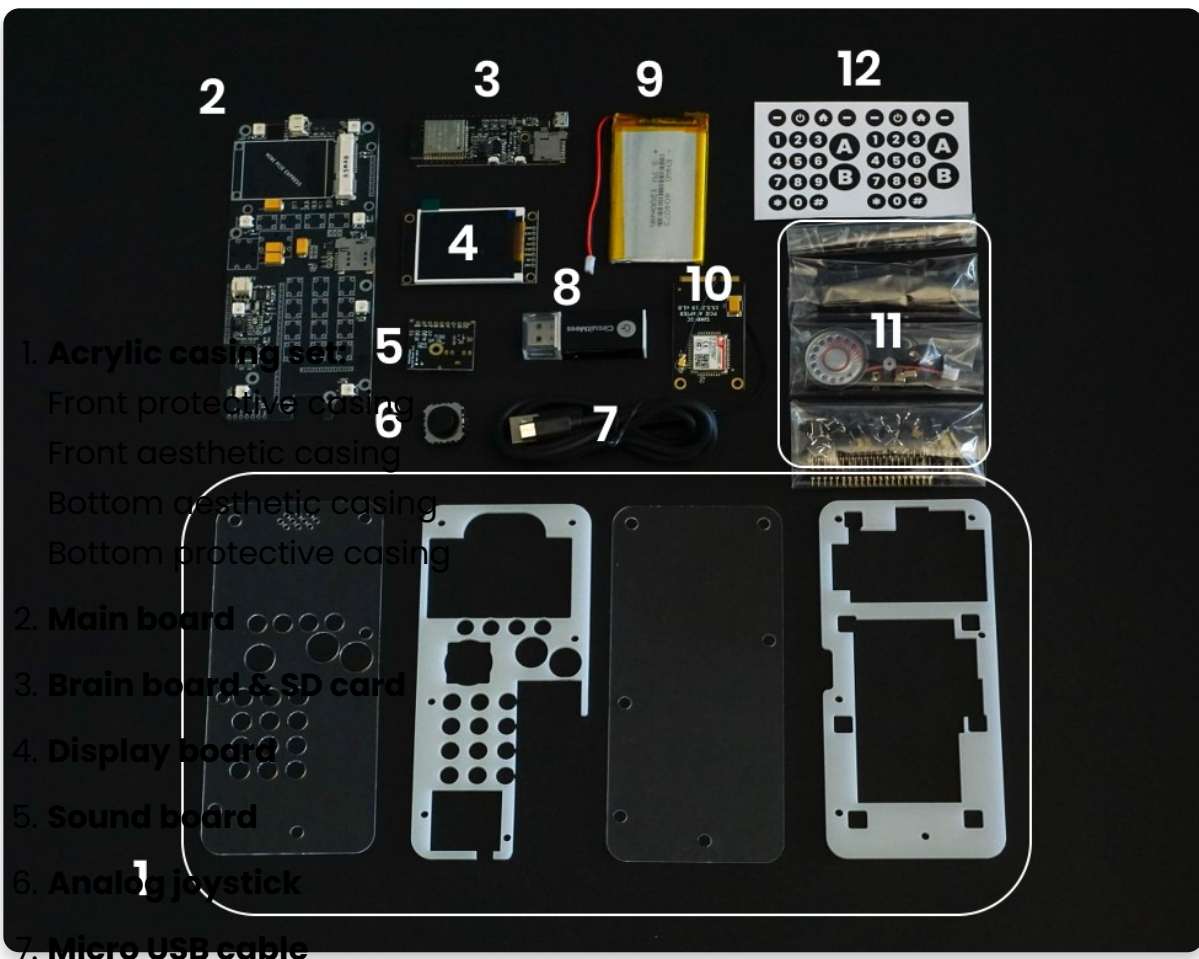


This is the box you should have (closed)



This is the box you should have (opened)

Here's a list of components that you should've received in your box:



1. Acrylic casing set

Front protective casing

Front aesthetic casing

Bottom aesthetic casing

Bottom protective casing

2. Main board

3. Brain board & SD card

4. Display board

5. Sound board

6. Analog joystick

7. Micro USB cable

8. Micro SD reader All of the stuff that are inside the box

9. Li-Po battery

10. Network board (this one can look differently depending on your kit version)

11. FOUR small component bags

12. Button cap sticker set *(only in older versions of the phone)

Following is a section with each component's close up photos and detailed descriptions.

Meet the components

1. Acrylic casing set

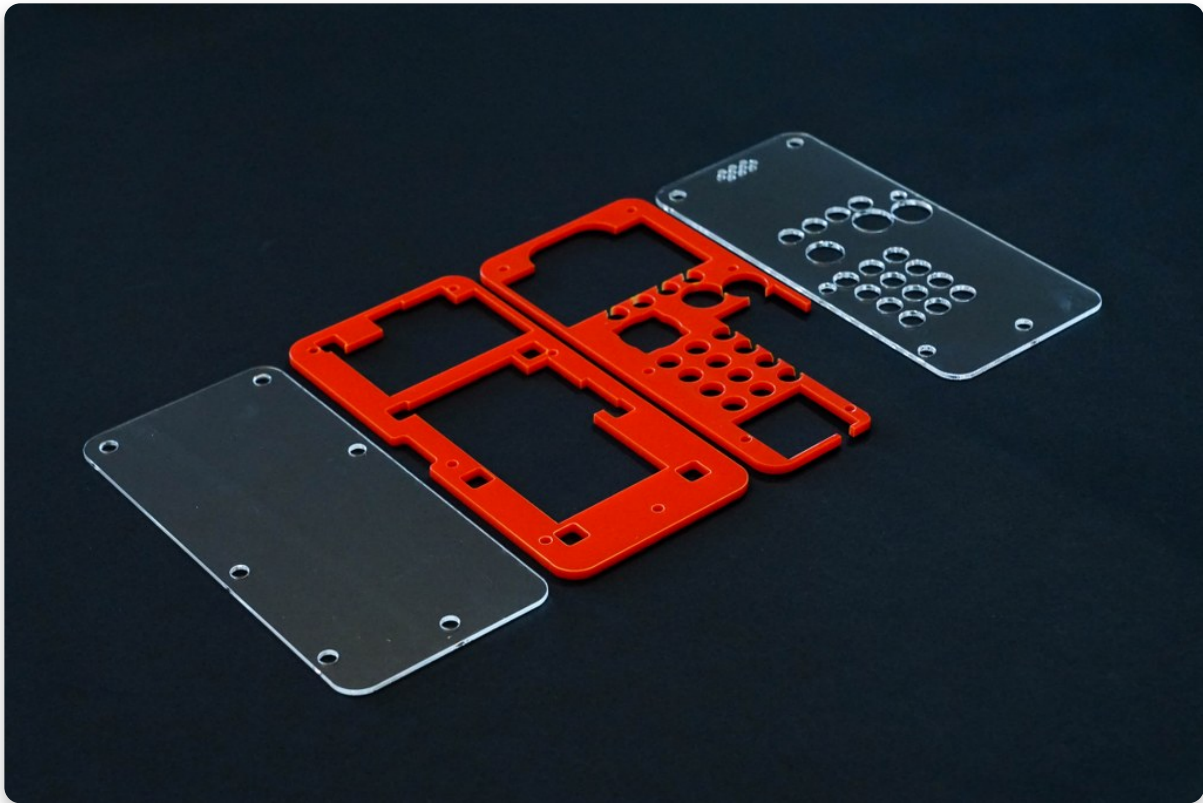
Ringo's internals are protected by a casing made out of CNC laser-cut acrylic plastic.

The casing consists of 4 parts:

1. **Front transparent protective casing**
2. **Front aesthetic color casing**
3. **Back aesthetic color casing**
4. **Back transparent protective casing**

Everything is stacked together using metal bolts and spacers. This style of casings is called “the sandwich design”.

NOTE: Both back and front protective casing come with a protective layer that should be peeled off. You can do this right now or later before putting the casing on the phone. We will also cover this in Chapter 4.



Ringo's protective plastics

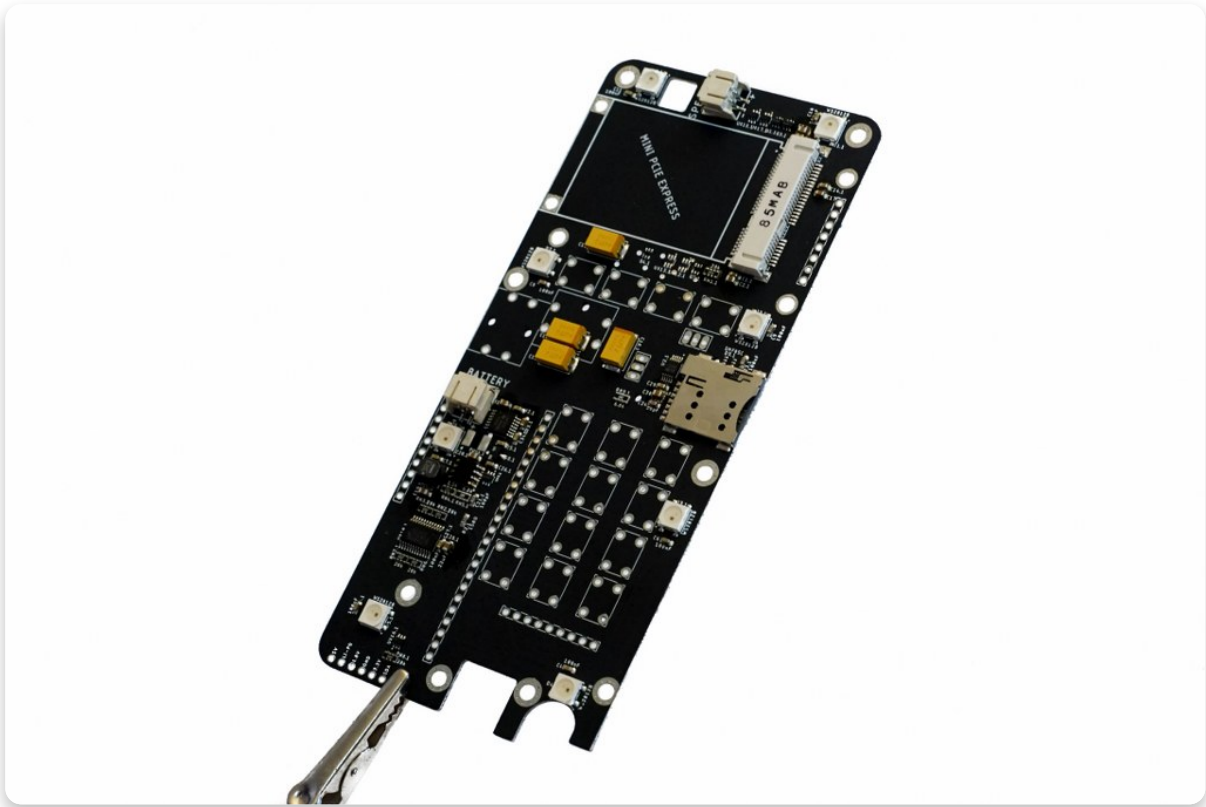
2. Main board (PCB)

“PCB” stands for “printed circuit board”.

Basically, this is a fiberglass board with copper traces on it, along with some protective paint and insulating material.

Copper layers on the board form traces that connect various components on your Ringo phone kit so that they can work together as an electronic device.

This is the equivalent to a PC's motherboard.



The main board - back



The main board - front

3. Brain board & SD card

This board is what makes your phone do smart stuff such as display text on the screen or read the SD card.

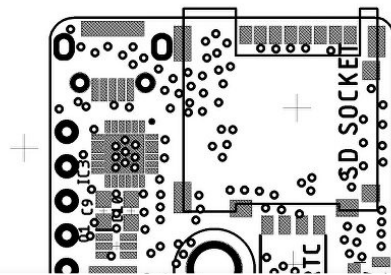
It contains the main microcontroller (the big silver square thing), as well as an SD card slot and an RTC chip.

“RTC” stands for “real-time clock” and it’s the main timekeeping chip on the Ringo. Basically, that’s a chip that counts time and triggers alarms - every microwave has it nowadays.

It also contains the power management and shutdown circuitry that can turn the whole device ON/OFF, charge the battery, measure the battery voltage, etc. The on-board micro USB port is used for both charging and programming the device.

A regular Micro SD card is Ringo’s main storage device and is used for storing media, apps, games, settings and more.

The SD card comes included in every kit and is inserted in your Brain board.



Detailed sketch of King's brain board

4. Display board

This board's main component is, of course, its display.

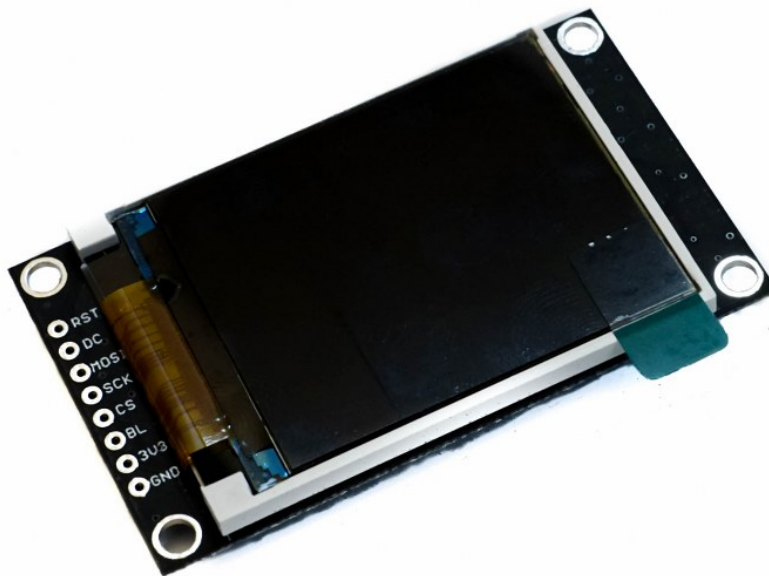
LCD stands for liquid crystal display and when applying a current to the crystal layer inside the display, it changes which color that part of the screen will be.

It features a 160×128 pixels display with 8-bit color depth at a 1.8" screen size.

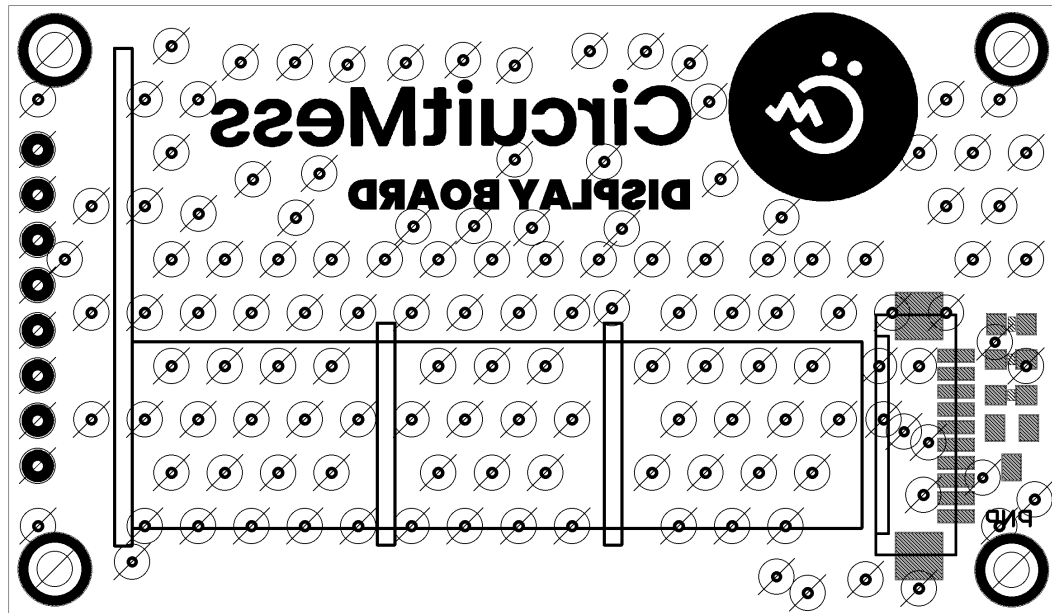
The display should provide you with plenty of possibilities to make some amazing pixel art in your games and apps.

NOTE: 8-bit color is a method of storing image information such that each pixel is represented by one 8-bit byte.

There is a palette map with three colors: red, green and blue (RGB), where each color is represented by a value between 0 and 255, thus creating 16,777,216 color combinations.



The display



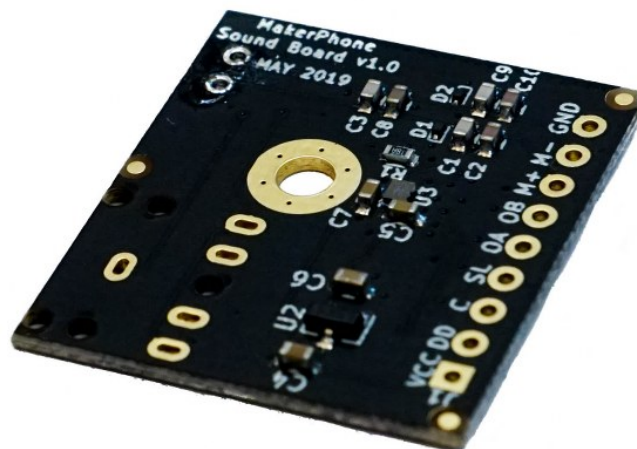
Detailed sketch of Ringo's display

5. Sound board

The Sound board contains a DAC chip, a microphone and a headphone jack that need to be soldered onto the board.

DAC stands for digital to analog converter and it converts the digital data (1/0) to an analog signal (a.k.a. music and sound effects that are played out on the speaker).

The board incorporates a DAC chip with a 3.4W amplifier in a single package!



The sound board

6. Analog joystick

This joystick is the phone's main navigational input, whether it's scrolling through a text message, flying around in a game or navigating down a menu.

The joystick has two axis and cannot be clicked.



The joystick

7. Micro USB cable

This is a standard USB to micro USB cable.

With it, you can charge the Ringo, as well as upload your own programs and games.



The micro USB cable

8. SD card reader

In order to make your life a bit easier, we have also included a handy Micro SD card reader.

Just insert the included Micro SD card in and then you can put all your favorite songs and photos, as well as Ringo-compatible games (.BIN files) onto it.

The USB-like SD card reader

9. Li-Po battery

This rechargeable battery serves as the main power supply for the Ringo.

1300mAh should provide up to 3 days of moderate usage, like playing games or listening to music.

In case you don't know what "Li-Po" means, when it comes to batteries, this indicates its structure and which materials it uses to store electrical energy. (Li-Po stands for lithium polymer.)

It comes with a male JST power connector (the white connector at the end of the red-black cable).

The battery will come connected to the main board. The reason for sending you those components like that is a regulation that doesn't allow us to send the Li-Po batteries via airmail if they are not embedded in some kind of a "device".

Before assembling the Ringo, you will have to disconnect the battery from the main board and then reconnect it when the time comes.

Never solder or modify a device that is "alive". In other words, always unplug the battery or some other power supply from the device's PCB, otherwise, you might make a short circuit with your soldering iron or screwdriver and damage the electronic components.

Electronics 101: the positive pole of any electrical power source (+) is usually marked with a red wire. The negative pole of any electrical power source (-) is usually marked with a black wire (in some cases green and brown colors are used too).



JST cable that connects the battery

10. Network board

Without this module, you can't make calls, send messages, or get the correct time from the cellular network.

Basically, this board has a secondary microcomputer that handles everything related to mobile phone network communication.

These chips come pre-certified and pre-approved and they're used in other products that need to communicate via cellular network.

Every network module has a unique IMEI (International Mobile Equipment Identity) assigned to it and written on its front side.

Depending on which Ringo version you ordered and which version you're located in, your network module may differ.

The 2G standard version comes with a SIM800C module (the black board), and the 4G version comes with a more powerful SIM7600 module (the green board).



Both SIM7600 (4G) and SIM800 (2G) boards

11. FOUR small component bags

The smaller components are divided into 4 smaller bags and we'll go in detail about what's inside them.

As a matter of precaution, we usually put one piece extra for the smaller mechanical components, such as nuts, bolts, and spacers.



Component bags

Bag #1

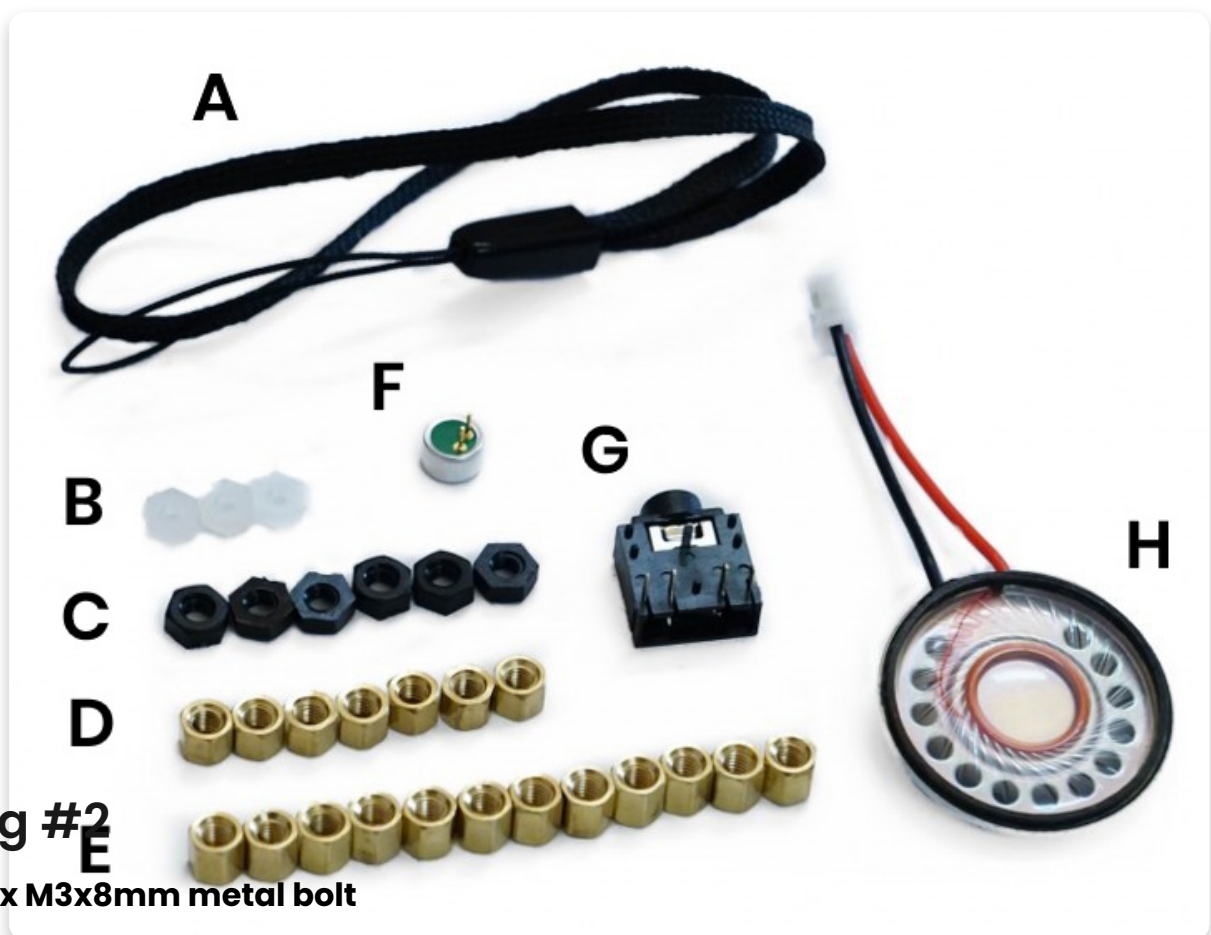
- A) 1x Lanyard (hand strap)
- B) 2x M2.5 white nylon nut
- C) 5x M3 black nylon nut
- D) 6x M3x4mm brass (golden) spacer
- E) 12x M3x5mm brass (golden) spacer
- F) 1x microphone

G) 1x headphone jack

H) 1x speaker with JST connector

You can't have a phone that doesn't ring!

The speaker can be used for all sorts of sound effects, game soundtracks, music, notifications, and ringtones.



Bag #2
E

A) 6x M3x8mm metal bolt

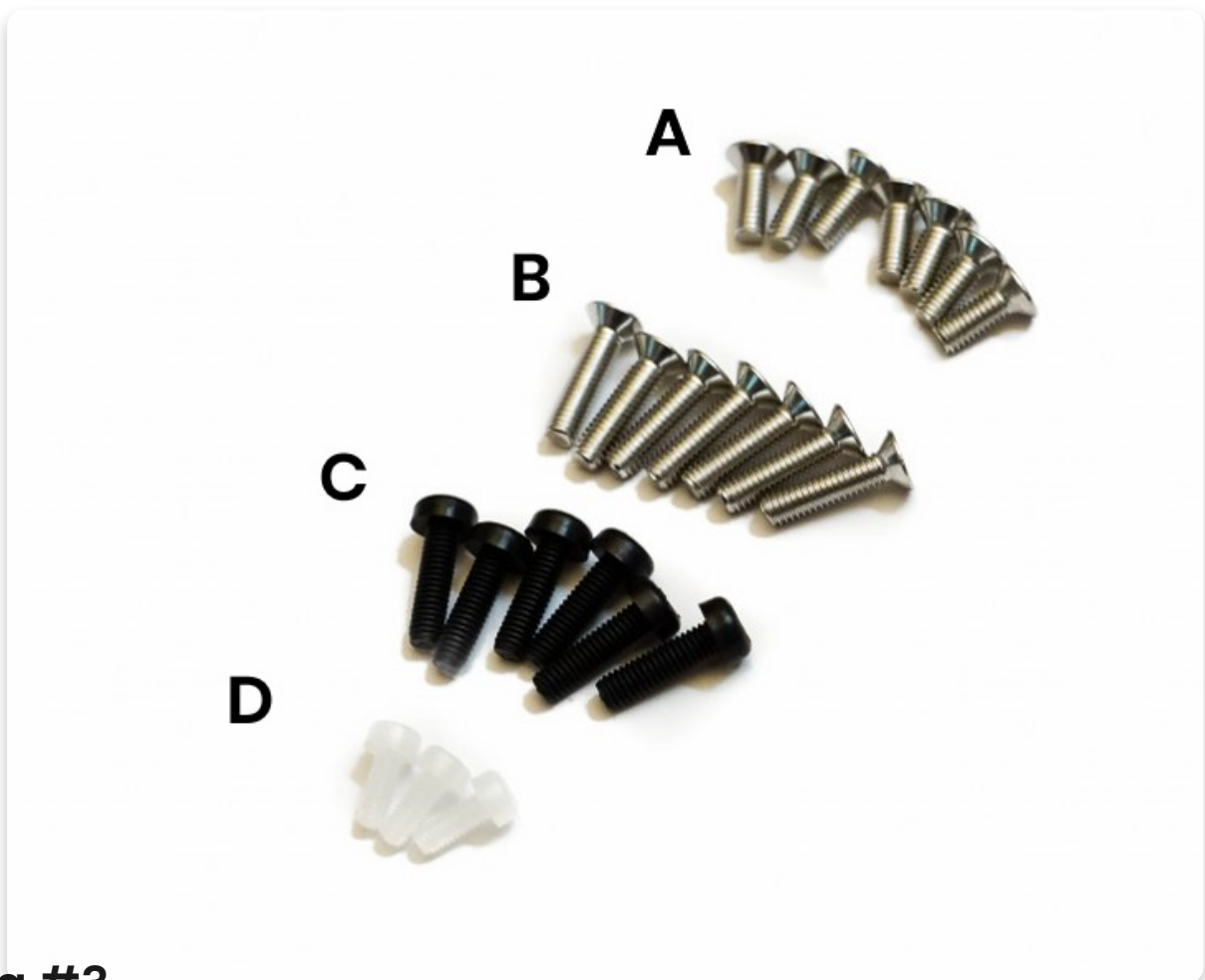
B) 6x M3x12mm metal bolt

C) 5x M3x10mm black nylon bolt

D) 2x M2.5 white nylon bolt

Contents of bag #1

These basic mechanical components fixate the different modules to the Main board and hold the entire casing together.



Bag #3

A) 2x big yellow pushbutton

Contents of bag #2

B) 16x small black pushbutton

C) 3x machined header pin stick

There are two types of buttons on the Ringo: the smaller ones that are used on the numerical keypad for entering phone numbers and the bigger buttons used for navigating through menus.

They're the essential input sources for navigating menus, playing games and using apps.

The pin headers come in long sticks and are used to connect all the different modules to the Main board.

They will need to be cut to appropriate size and soldered onto the other boards.

Contents of bag #3

Bag #4

- **16x small black pushbutton cap**
- **2x big black pushbutton cap**

The button caps are easily attached to the top of the pushbuttons and are also replaceable.

NOTE: Earlier versions of the phone come with empty caps that should be covered with button stickers. However, later versions will come with already printed letters and numbers directly on the buttons so no stickers will be necessary.



Contents of bag #4

Meet the tools

Mandatory tools

The Ringo is a kit designed to educate, but it's far from a toy.

And as such, it requires some real tools.

The equipment and tools required for the assembly are not included in the standard kit.

If you've bought the standard kit (no tools included) and don't have them, now would be a good time to borrow or purchase them.

If you've bought a Ringo kit with tools, you'll get a box with the following contents:

The CM toolbox (closed)

The CM toolbox (opened)

The tools required are essential whenever assembling, fixing or modifying electronic devices and are the tools of the trade for every maker/hardware hacker/modder/electrician.

Many of these are available in a supermarket or a hardware store like Radio Shack, Adafruit, Sparkfun, etc...

All of the tools in the box

1. **Soldering iron**
2. **Desoldering vacuum tool (solder sucker)**
3. **Soldering iron stand**

4. **A small reel of rosin-cored solder**

5. **Cleaning sponge**

6. **Small cross screwdriver**

7. **Diagonal cutter pliers**

8. **Needle-nose pliers**

Soldering iron

This is the most important tool in a maker's arsenal, but for the Ringo's assembly, any entry-level soldering iron will suffice.

If you plan to dive into the world of DIY projects, you should consider getting a more expensive one with more features. There are also many soldering irons with interchangeable tips that can be particularly useful when working with much smaller components.

There are two types of soldering irons you could have received in your tools pack. The first one is white with a temperature regulator, and the second one is blue with a small metal button. Both of them will do the job of soldering the components in place and there is no big difference between them.

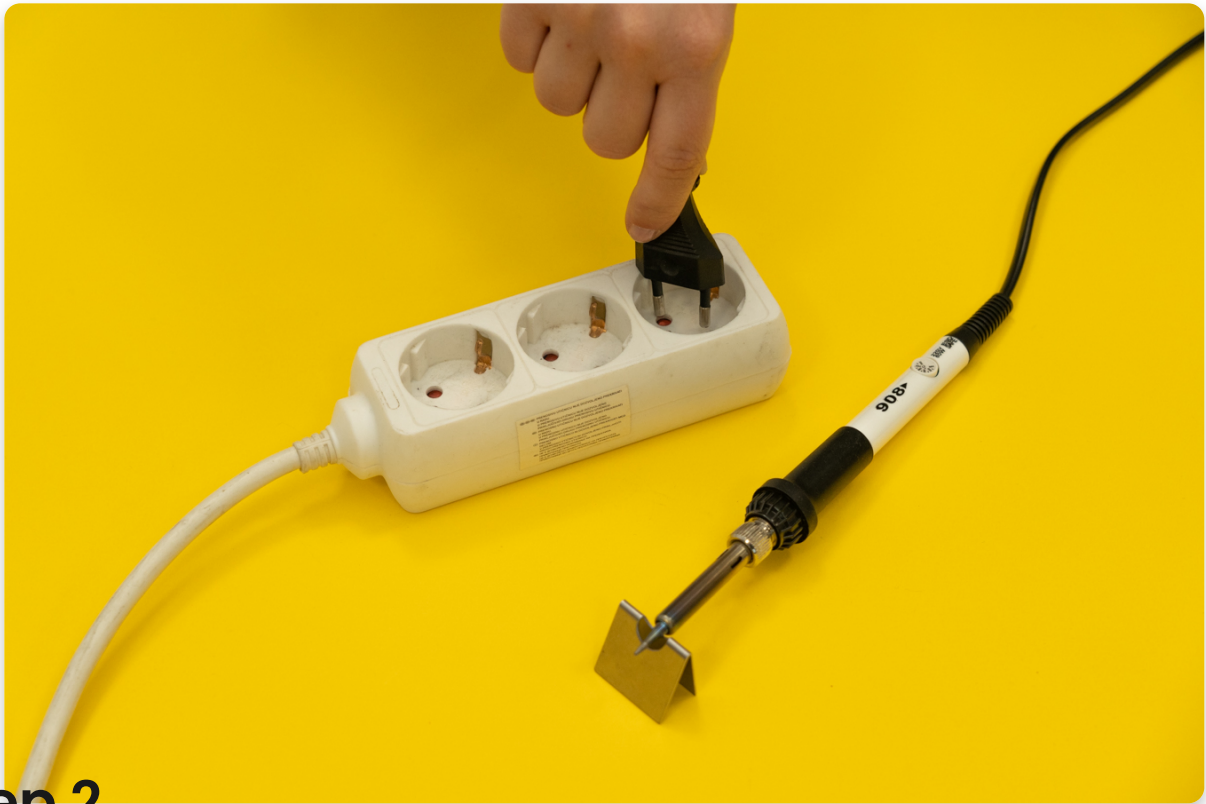
Also, it is good to know that all our soldering irons are lead free!

Let's go over the instructions on how to use the white soldering iron first. In case you have the model with a small metal button, scroll down a bit to see the right instructions.

White soldering iron with temperature regulator

Step 1

Set up your soldering iron so it stands on the stand - as shown in the photo. After that, plug it into a power outlet.



Step 2

Set the temperature to **250°** by turning the regulator. There is a small black arrow next to the regulator wheel, so make sure that it points to the right temperature, like in the photo.

Your soldering iron is now ready to use, but give it a minute or two, so it can heat up. The safest way to let it heat up is to leave it on the stand while you wait!



Set the temperature to 250°

Step 3

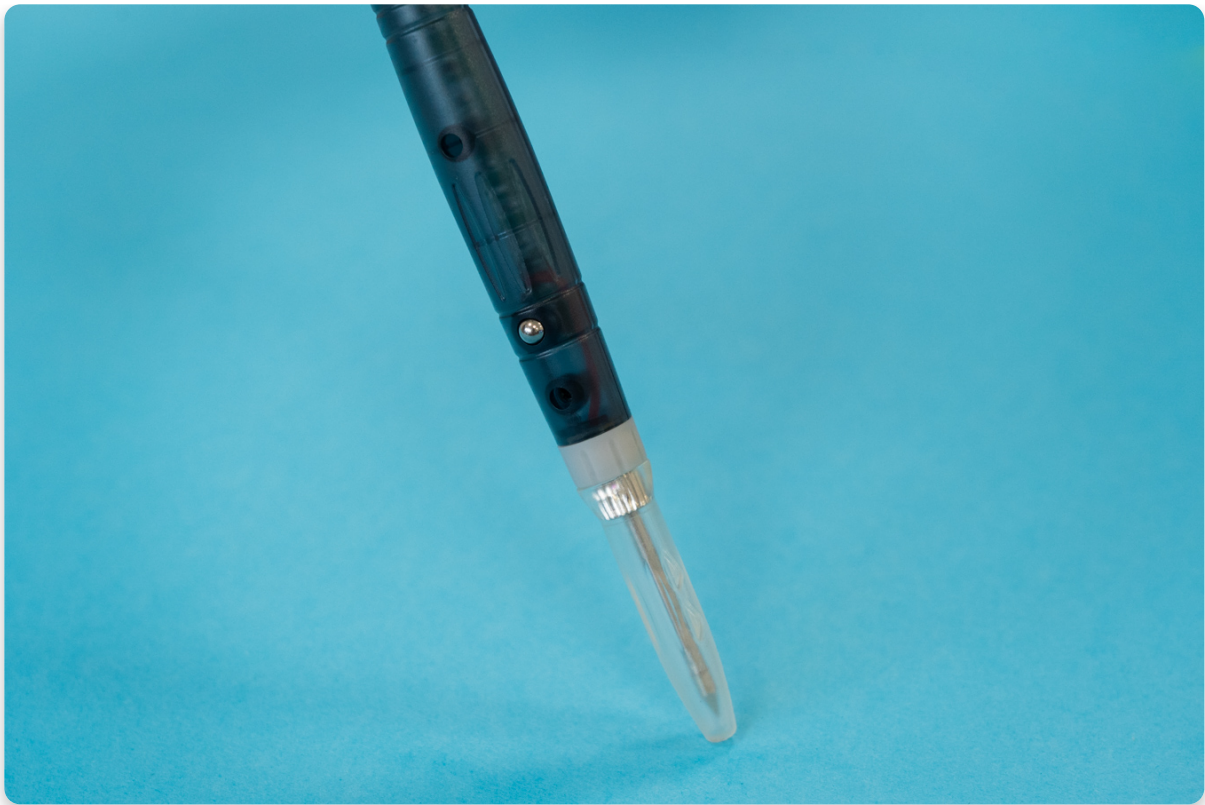
Once you're done with soldering (don't worry, we'll let you know when that time comes), you'll unplug the iron from the power outlet to turn it off.

Please use the soldering iron stand every time you are not using the soldering iron to make sure you don't burn the surface or the circuit board!

Make sure to not touch the soldering iron tip for at least five minutes after you have turned it off.



Soldering iron with a small metal button



Soldering iron with a small metal button

Step 1

Firmly pull the cap off, do not unscrew it!

The correct way of taking the plastic cap off

The metal ring is necessary for the soldering iron to function.

If you accidentally remove the metal ring along with the cap, screw it all back on and remove the cap so the ring stays in its place.

Step 2

Plug the soldering iron's power cable.

Step 3

Plug the power cable into the provided power adapter and then into a power outlet.

Step 4

In case you have this type of soldering iron, all you need to do is turn it on by pressing the small metal button at the top of the iron.

Once you press the button, you should see a blue light signaling that it's turned on.

As long as the blue light is on, your soldering iron is turned on as well.

The blue light means that the soldering iron is turned on

Once you're done with soldering, turn off the iron by pressing the same metal button.

The light will be switched off immediately. However, this does not mean that the iron is cold. **Make sure not to touch the soldering iron tip for at least five minutes after you have turned it off.**

If the blue light is off, this means that the soldering iron is turned off as well

Solder

This is the metal material you will be melting with your soldering iron in order to connect two components together.

We highly advise buying a rosin core, 60/40 solder. This type of solder is commonly used in the DIY electronics community for similar soldering projects.

Be careful when buying solder, because bad solder can lead to a lot of complications like bad solder joints and unwanted bridging.

Solder used for soldering

Diagonal cutter pliers

With pliers like these, you'll be able to trim leads of soldered components, cut wires and pin headers.

We prefer this type shown in the picture (Plato, model 170), but any other type will do.

Diagonal cutter pliers

Needle-nose pliers

You're going to need pliers like these when assembling the casing, or when plugging in some tricky connectors!

They're generally useful when doing some fine mechanical work.

Needle-nose pliers

Standard cross screwdriver

You'll need this cross (Phillips) screwdriver to screw down all the modules to the Main board and to assemble the entire casing together.

A standard 2.0mm cross screwdriver should do the trick.

Standard cross Phillips screwdriver

Desoldering vacuum tool (solder sucker)

This tool is useful when cleaning up soldering mistakes, but it isn't necessary for assembly.

If you plan on doing some hacking, modding, or hardware repairs in the future, having this is always a good idea.

Solder sucker

Cleaning sponge

This piece of sponge doesn't seem like much, but put it under some water and see how it turns into a solder-cleaning super-sponge.

Use it after soldering a couple of joints to remove excess solder from the tip of your soldering iron.

Don't use it when it's dripping wet, but also don't use it when it's completely dry – damp is just right.

Cleaning sponge

Additional useful tools

Helping third hand with magnifier

This could make your soldering experience a little bit more enjoyable, especially when doing some more complicated projects.

Helping hand with a lot of additional tools

Multimeter

A multimeter can be used for many things: testing tricky connections, measuring battery voltage, testing resistors & capacitors, measuring the current consumption, and more.

It's a useful tool when you're trying to figure out what went wrong with any electronics kit.

Multimeter

Solder wick

You can use solder wick along with the desoldering vacuum tool to clean up any soldering mistakes. Just put it on the wrongly soldered joint and press on it with a hot soldering iron, then it will soak up the excess solder like a sponge!

Useful for fixing solder joints when they cannot be easily reached with a solder sucker.

Solder wick

Time to get makin'

Soldering basics

Have you ever soldered before? If the answer is "yes", you'll probably know what you're doing and you can just quickly skim through this intro paragraph.

In case you've never soldered before, please take 10 minutes of your time and look at one of the following how-to-solder guides:

- [Adafruit's video tutorial featuring Collin Cunningham](#) – a tutorial featuring Collin Cunningham, a super charismatic electronics guru
- [Adafruit's standard soldering tutorial](#) – A great and thorough video tutorial. An absolute must-read, even if you know how to solder. Make sure to check the

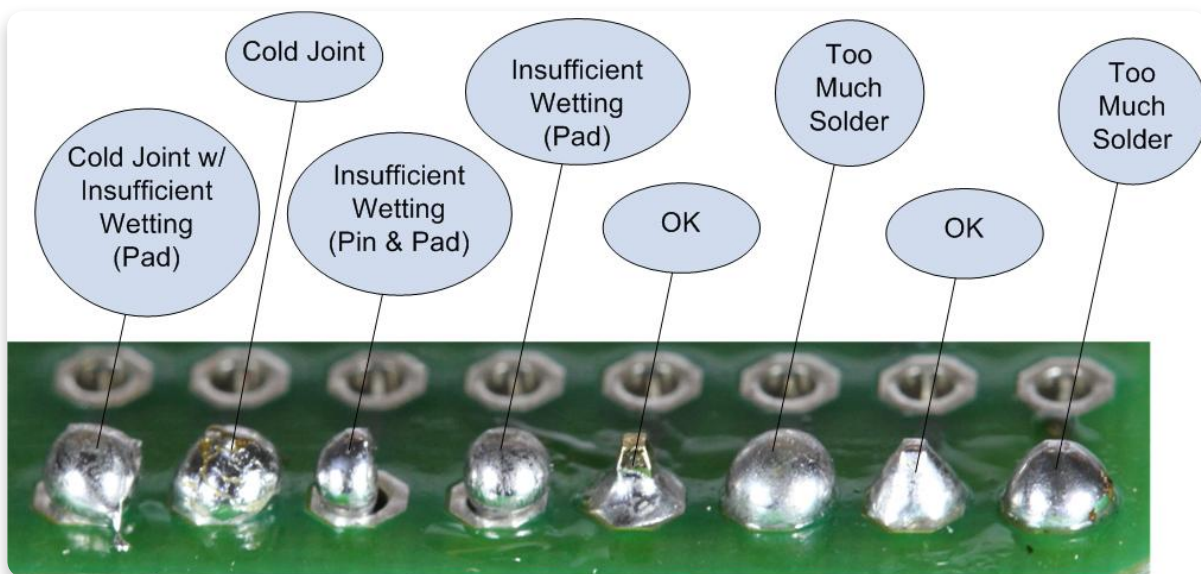
“common soldering mistakes” section at the end.

- [Sparkfun's video soldering tutorial](#) – Another well made how-to-solder video tutorial.
- [Sparkfun's standard soldering tutorial](#) – A well written tutorial made by Sparkfun

To sum all of these tutorials up, making a good soldering joint is very important and can be quite easy if you follow this simple rule:
your soldering joint has to look like a small **“volcano”** and mustn't be a tiny ball or blob of soldering.

A bubbly blob-like soldering joint is a sign of too much solder or a need of more heat (you have to resolder the joint).

All of this is shown on this awesome picture by Adafruit industries (thank you Adafruit!):



Your solders need to look like ones marked "OK"

Motivational tip from Albert (Ringo's hardware designer)

Soldering is an essential skill if you want to dive into the world of DIY electronics.

Your soldering iron is your best companion when it comes to creating something new. It gives you the power to create unique electronic devices from scratch.

Nobody is born a soldering genius. It's a skill just like any other and you need to practice it in order to become better at it.

Also, I know how frustrating it can be when something doesn't work from the first try. The truth is, you'll have to get used to it because DIY electronics is all about the trial-and-error process, all while learning something new.

And please, don't worry, In the worst-case scenario (something not working) we'll make it work together.

Good luck and keep making!



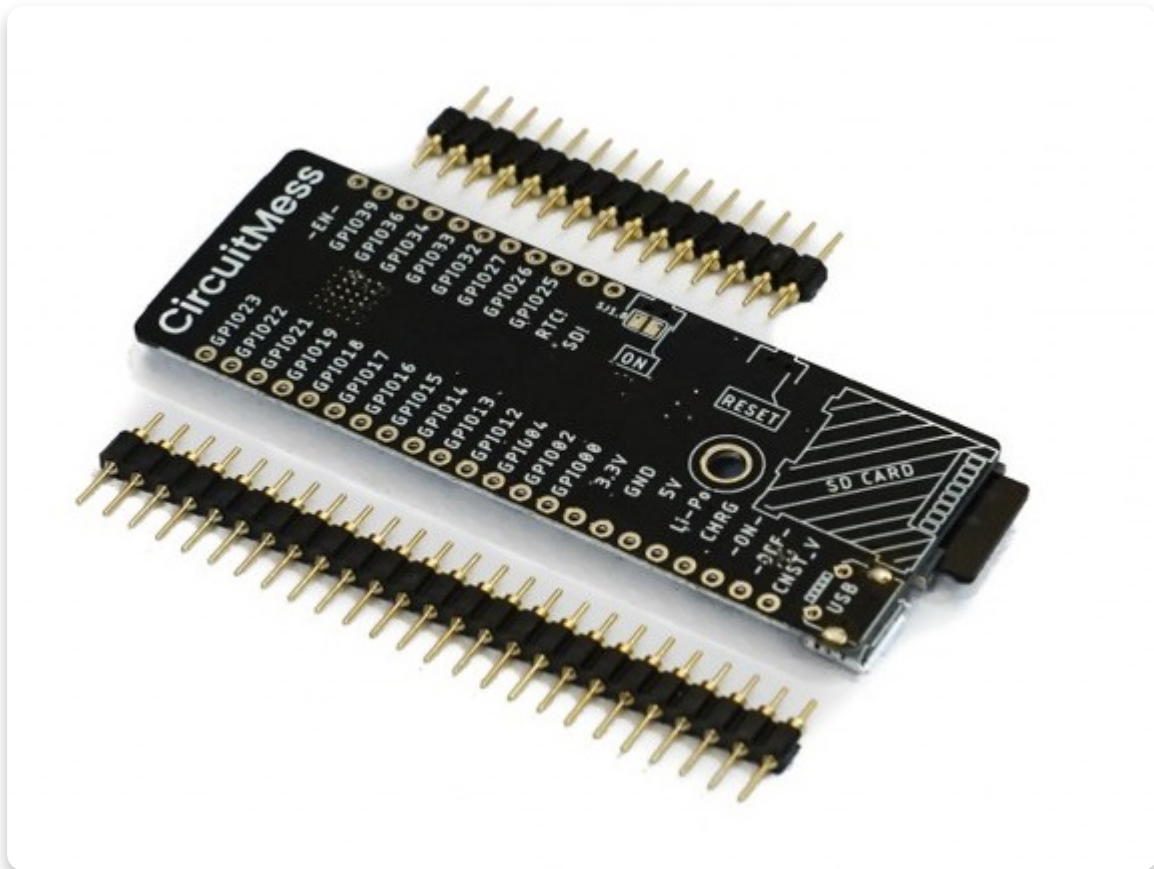
Pro tip



We suggest that you start assembling the Ringo when you're fresh because the process of assembly can take up to 5 hours depending on your soldering skills. (In other words, don't start building it at 2 AM.)

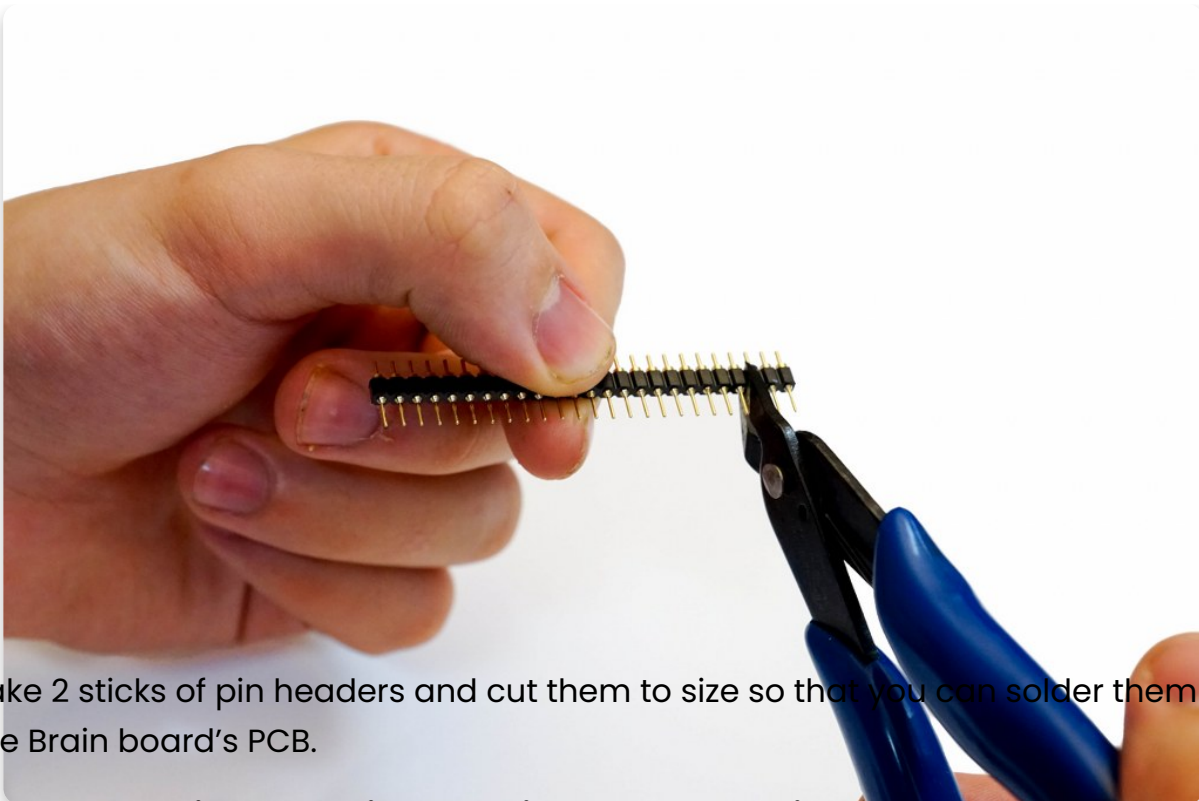
If you're using your soldering iron for the first time or need help with cleaning its tip, check our [video tutorial](#).

Soldering the components



Step 1 – The Brain board

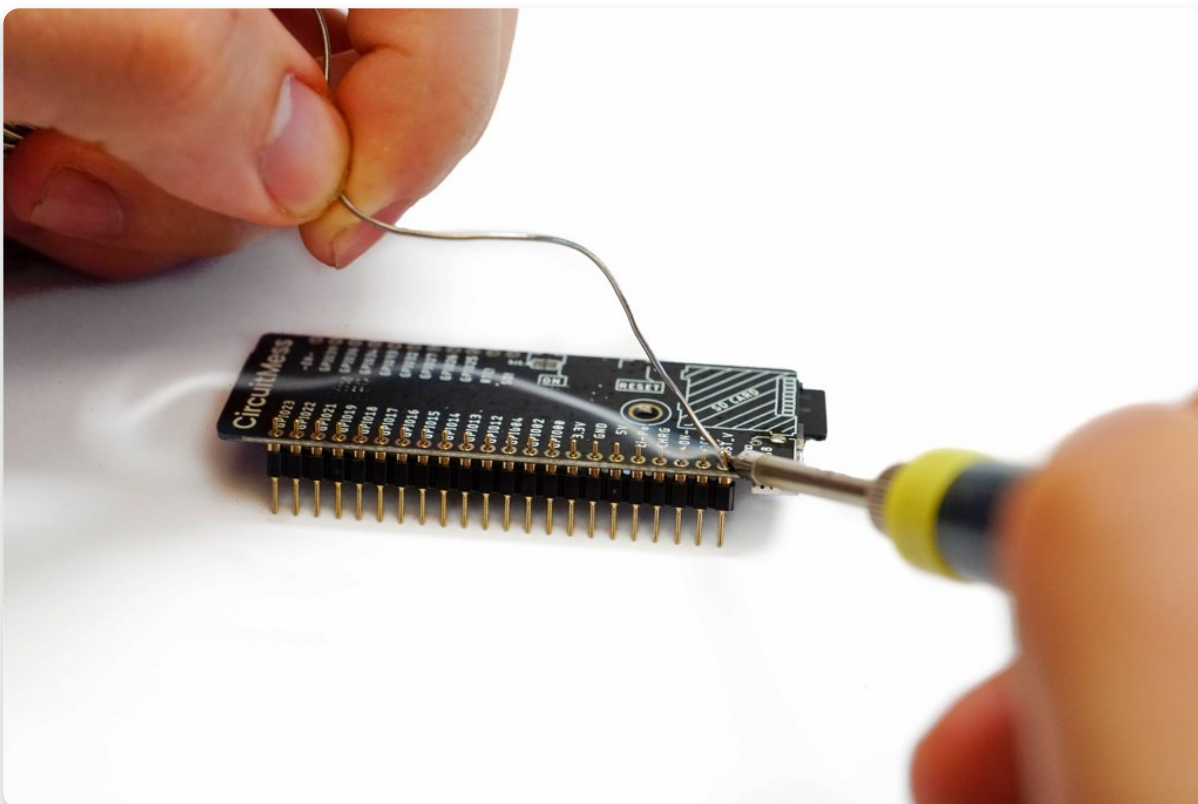
Let's begin with the Brain board.



Take 2 sticks of pin headers and cut them to size so that you can solder them onto the Brain board's PCB.

You need to trim them with your diagonal cutter pliers.

In the end, you need to have one 22-pin header and one 11-pin machined header.

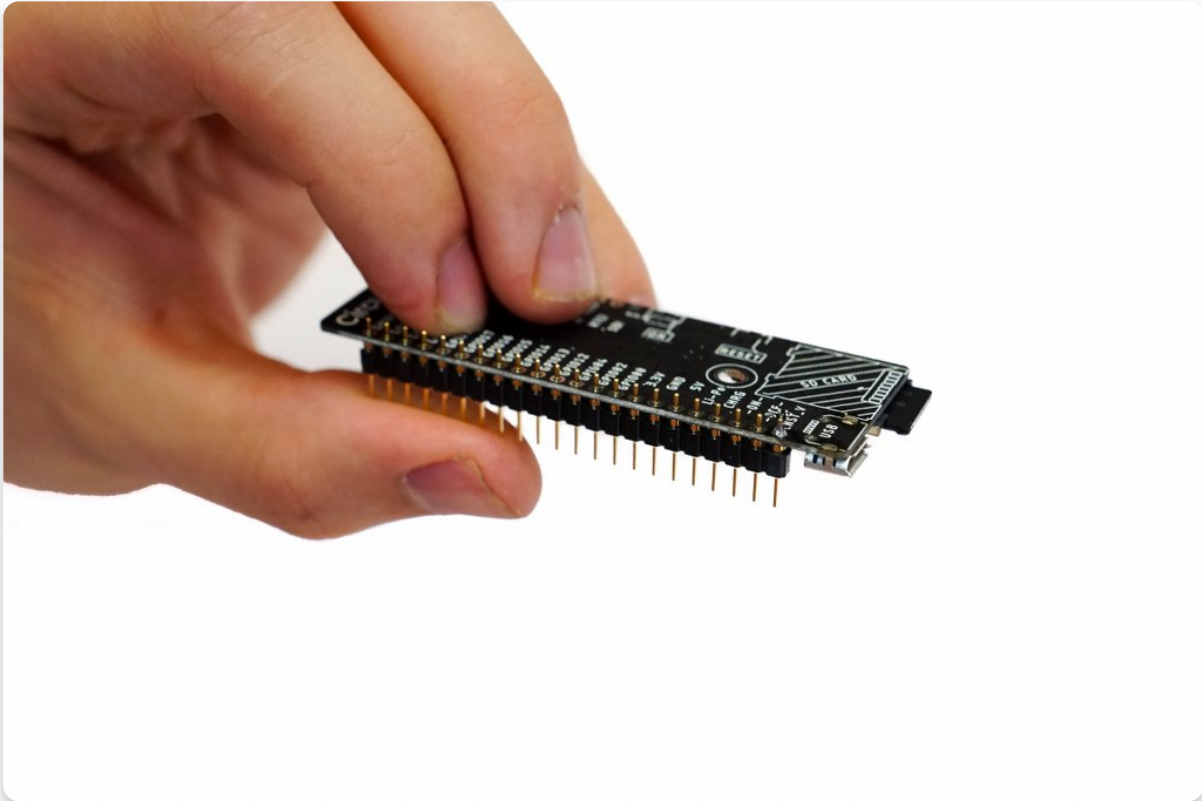


The pin headers need to be soldered so that they're vertical to the board.

- You'll notice that one row of pins is shorter than the other. Make sure that that you're soldering the row with the shorter pins to the board.

Luckily there is a nice technique for doing just that

1) Solder just the first pin of one row of headers

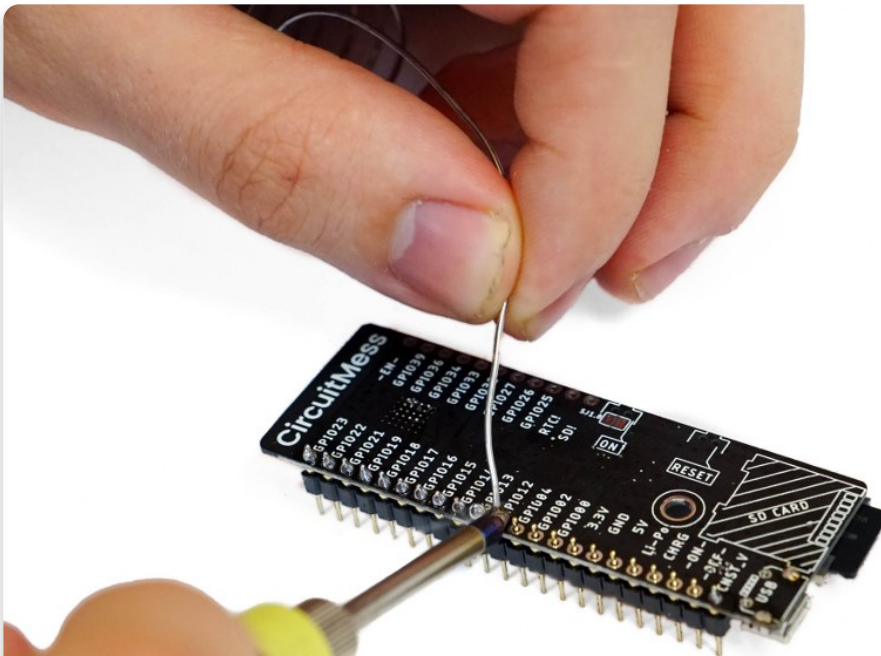


2) Check that the pin header is perpendicular.

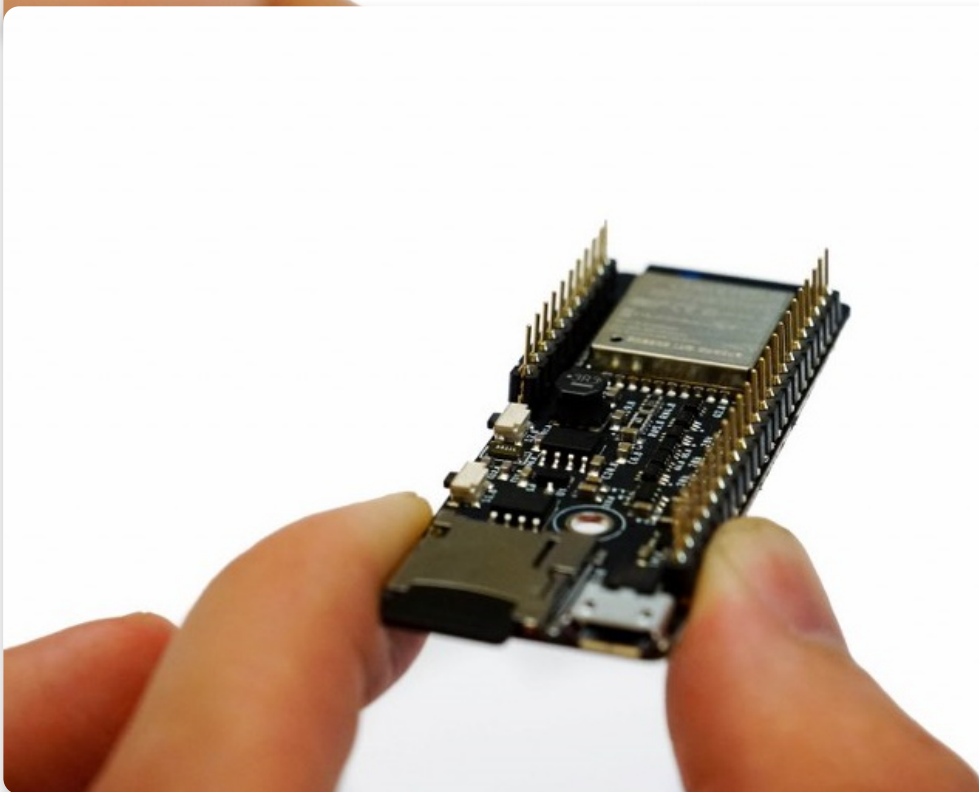
3) If the header is slightly skewed and needs adjusting, melt the solder and tilt the headers with your fingers.

(Watch out not to burn yourself.)

4) Check if the headers are aligned correctly, if not then repeat the process



If the header is vertical to the board, you can solder the rest of the pins.



Solder the second row of the headers as well.

Make sure that they're vertical to the Brain board!

The results should look like the photo on the left.

Step 2 – Attaching the Brain board onto the Main board



For this, you will need:

1 x M3x10mm black nylon bolt

1 x M3x5mm brass (golden) spacer

(WATCH OUT – there are two similar types of brass spacers in your kit and you need the bigger brass spacer here!)

1 x M3 black nylon nut

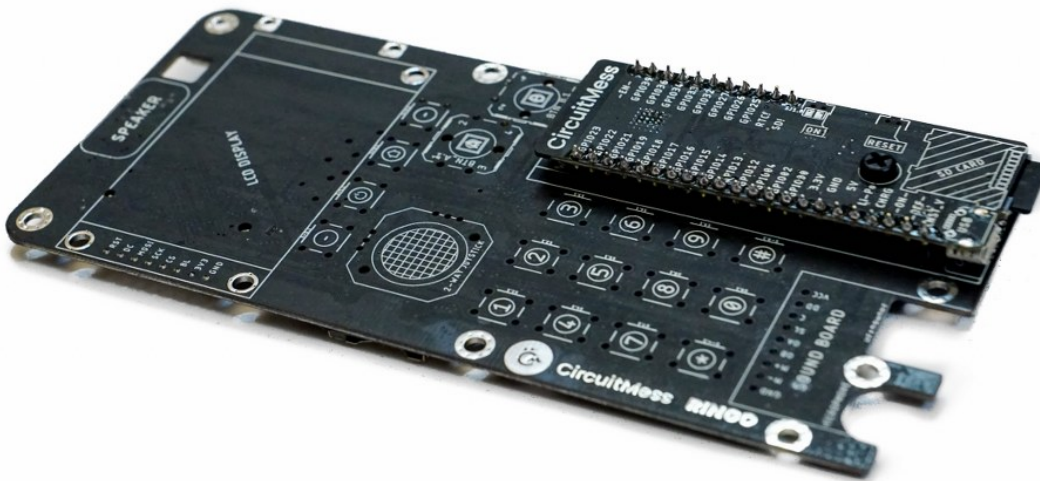


Put the bolt through the Brain board so it faces out in the direction of the pins.
Then screw the brass spacer on top of it.

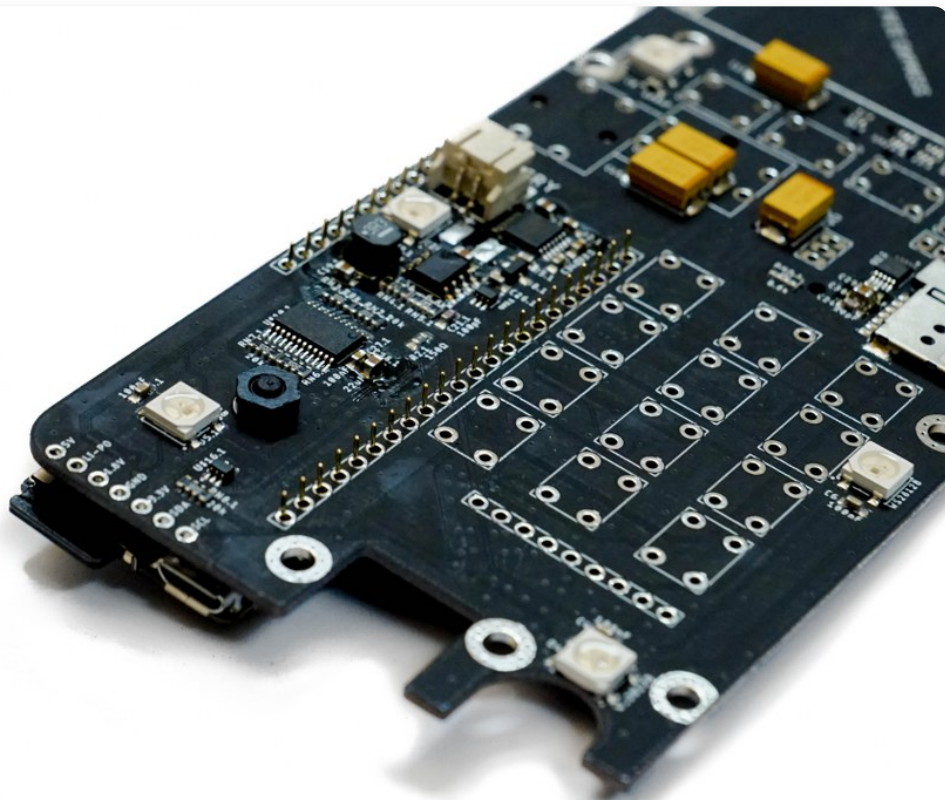
Use a small screwdriver for this!



Your Brain board should look like this now.



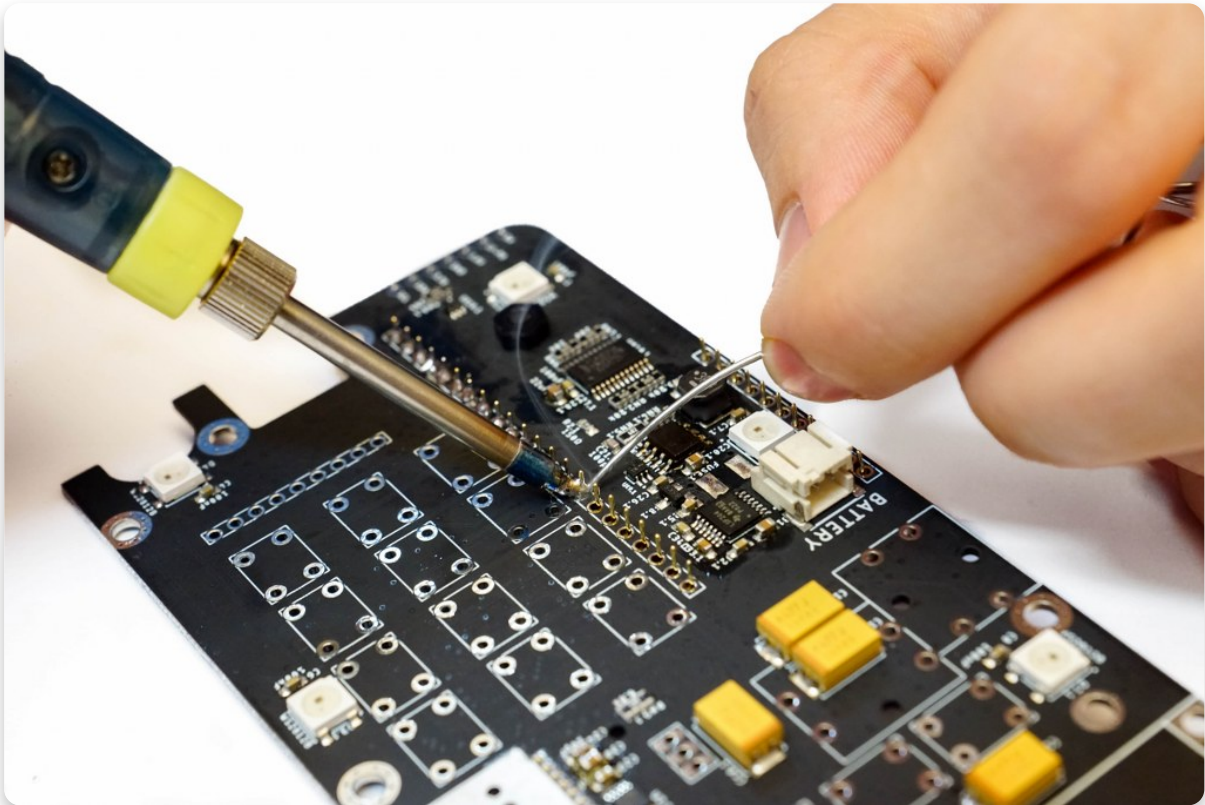
Then, you can place the entire Brain board onto the Main board where it says “the Brain board”.



Put the plastic nut onto the bolt on the back side of the Main board.

Now that they're fixed together, we can solder the Brain board onto the Main board.

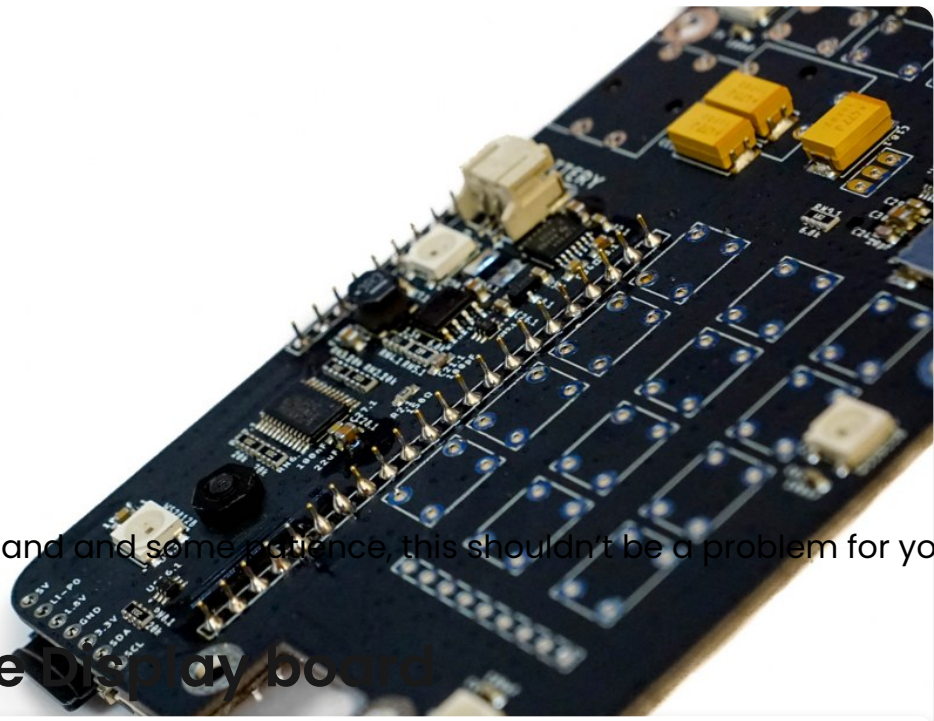
Step 3 – Soldering the Brain board to the Main board



Remember the headers you had to cut and solder to the Brain board?

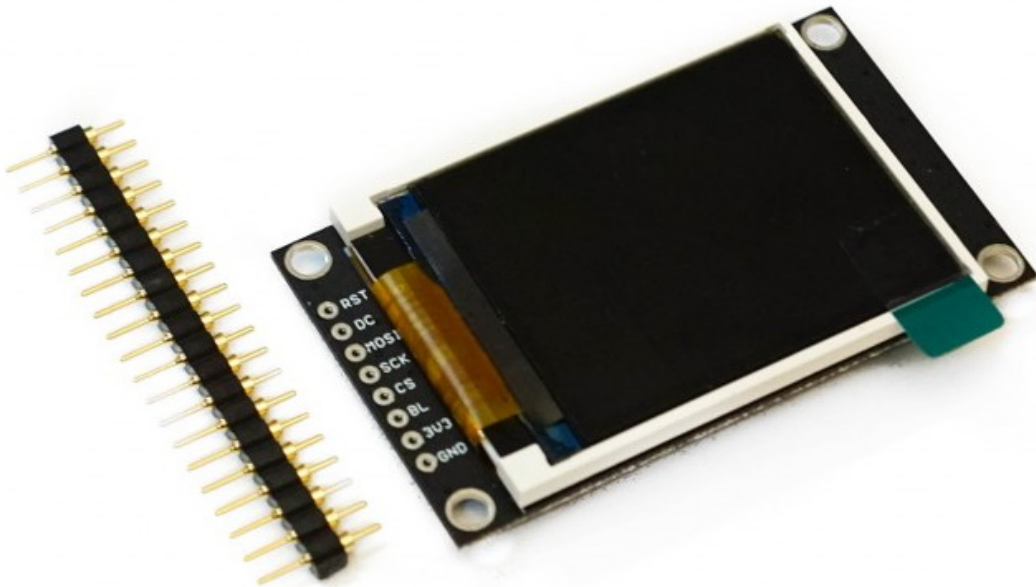
We're not done with them yet! You need to solder them to the Main board too.

We need to do this in order to establish an electrical connection between the Brain board and the Main board.



But with a steady hand and some patience, this shouldn't be a problem for you.

Step 4 – The Display board

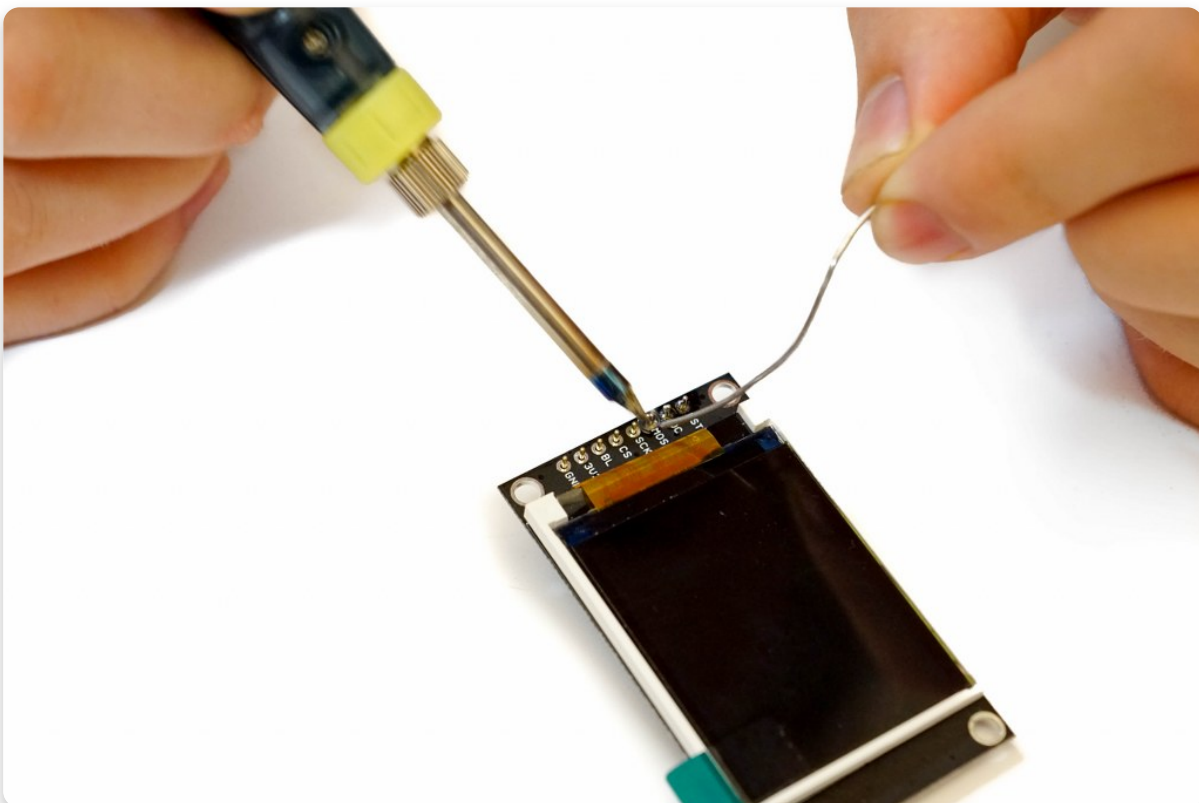


Next, we have the Display board...



Again, you'll have to cut the header pins to the appropriate size so that they can fit the pins on the Display board.

You need an 8-pin header row for this.



With the same technique used when soldering the Brain board's pin headers, soldering this shouldn't be a problem.

Again, be careful in how you insert the header pins since the top and bottom parts are slightly different. **The part you want to insert into the screen is the shorter side!**

Step 5 – Mounting the Display board onto the Main board



For this, you'll need:

3 x M3x10mm black nylon bolt

3x M3x5mm brass (golden) spacer

(WATCH OUT – there are two similar types of brass spacers in your kit and you need the bigger brass spacer here!)

3x M3 black nylon nut

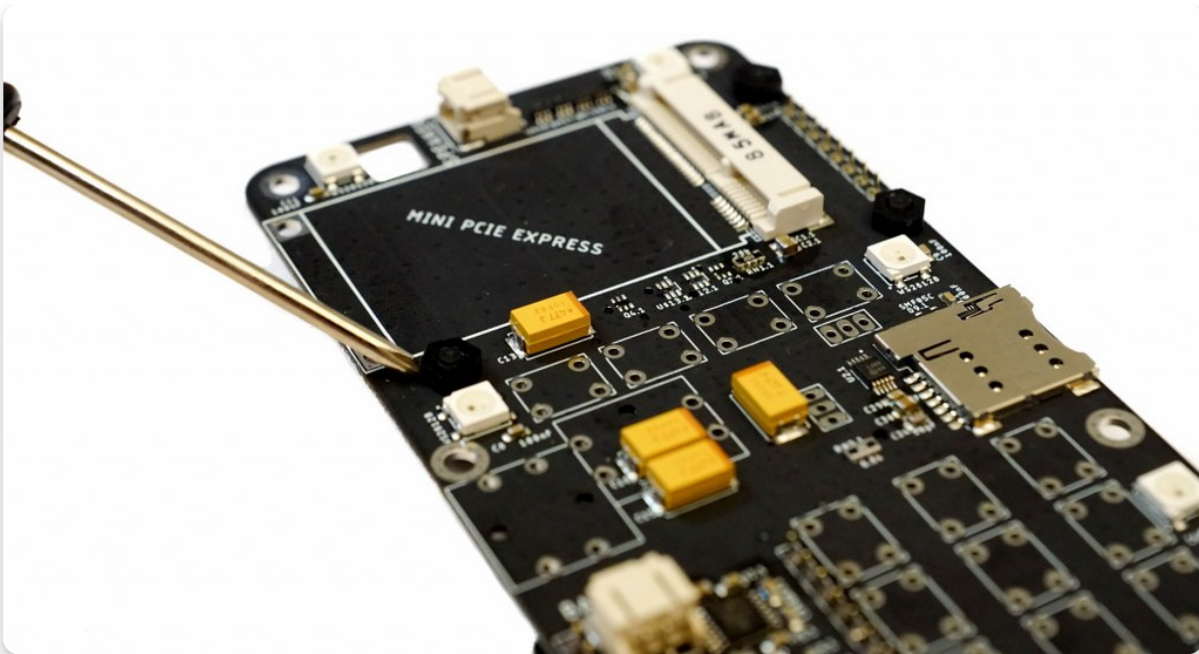
Put the bolts through the holes so that they face the same direction as the pins.



Then, put the spacers on top of them and screw them on.



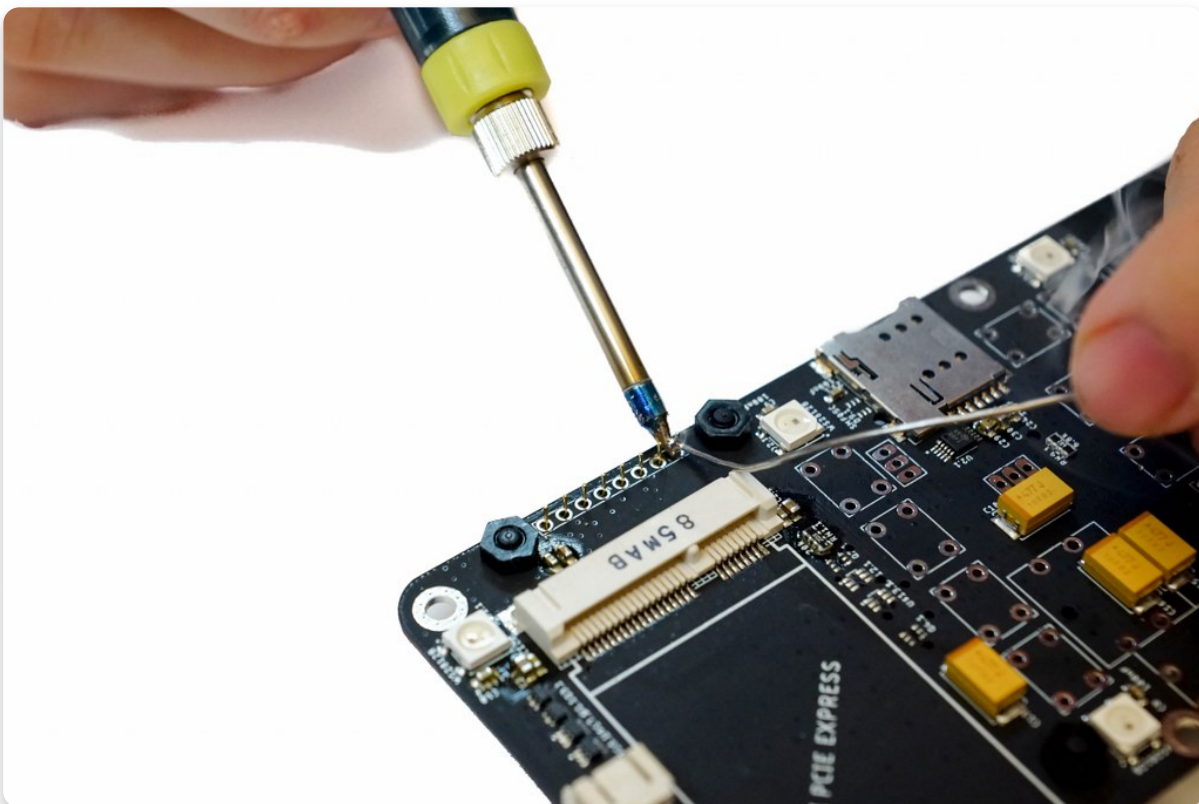
Place the Display board on the Main board where it says "LCD display".



Then tighten the three nuts from the back side of the Main board.

NOTE : You can't tighten the nuts with a screwdriver from underneath, only from above!

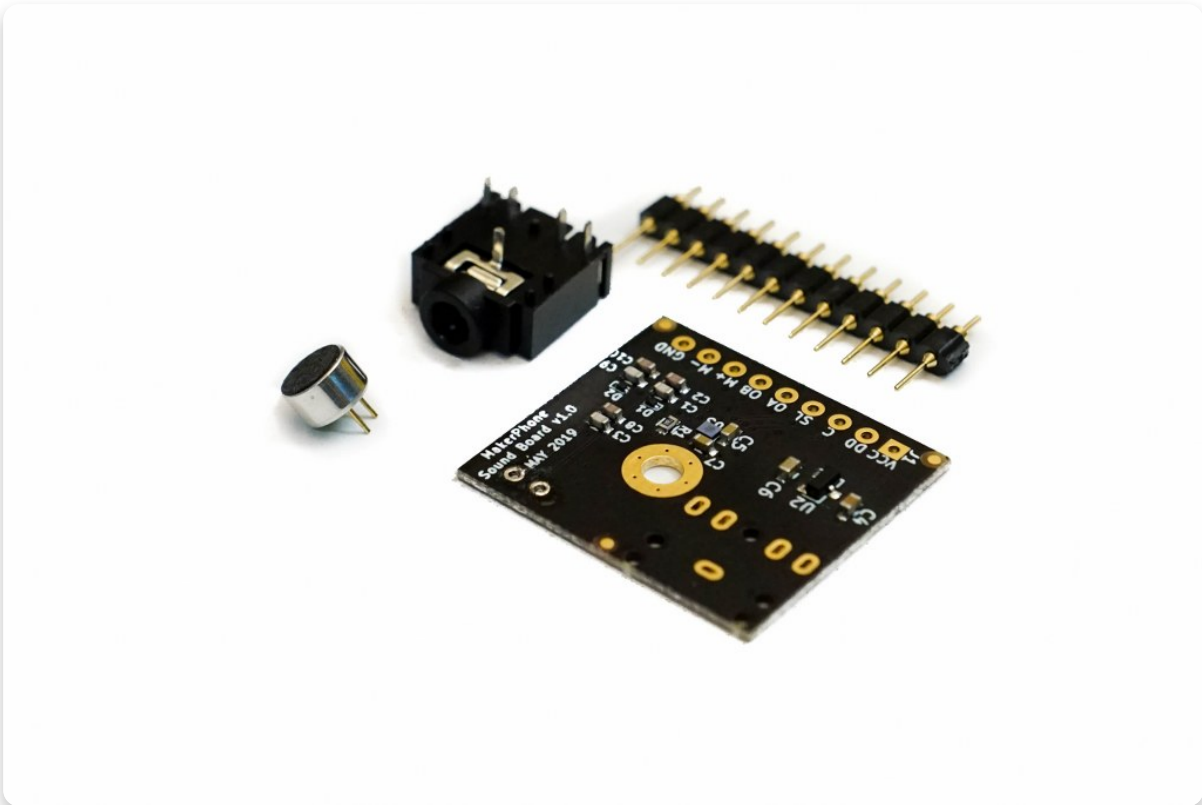
Step 6 – Soldering the Display board



Now let's go ahead and solder the Display board pins onto the Main board.

Through these pins, the Brain board will be able to push all the images to the Display board, so it's important to solder them properly.

Step 7 – The Sound board



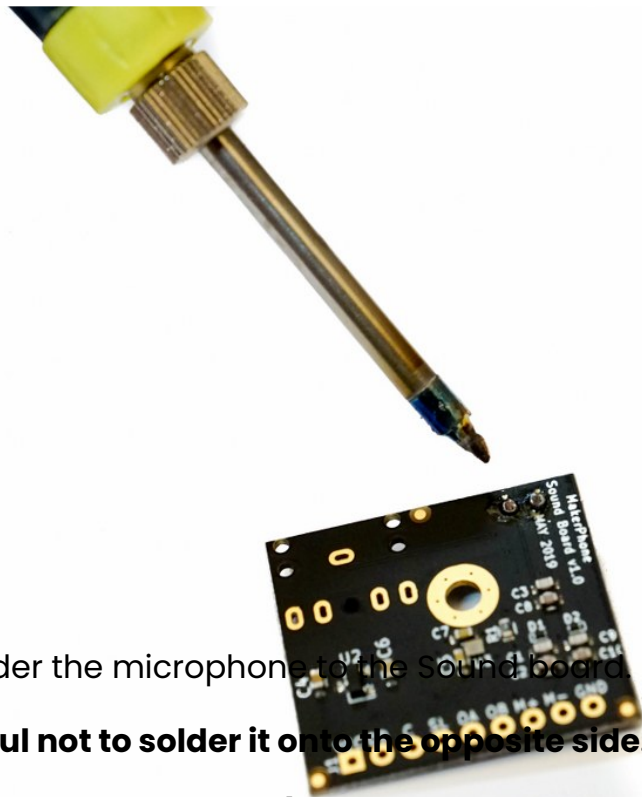
With the Sound board we're going to have to do a bit more soldering than with the other boards.

For this step, you'll need:

1 x pin header row

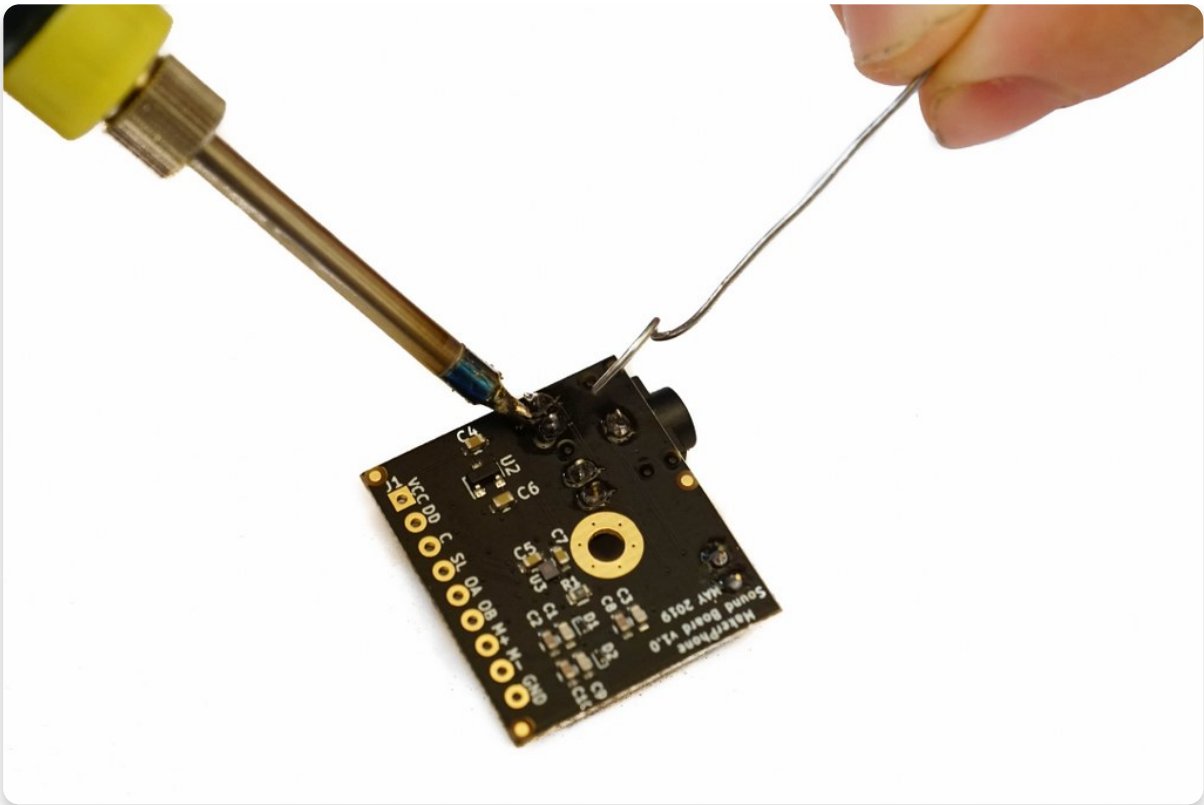
1 x microphone

1 x headphone jack

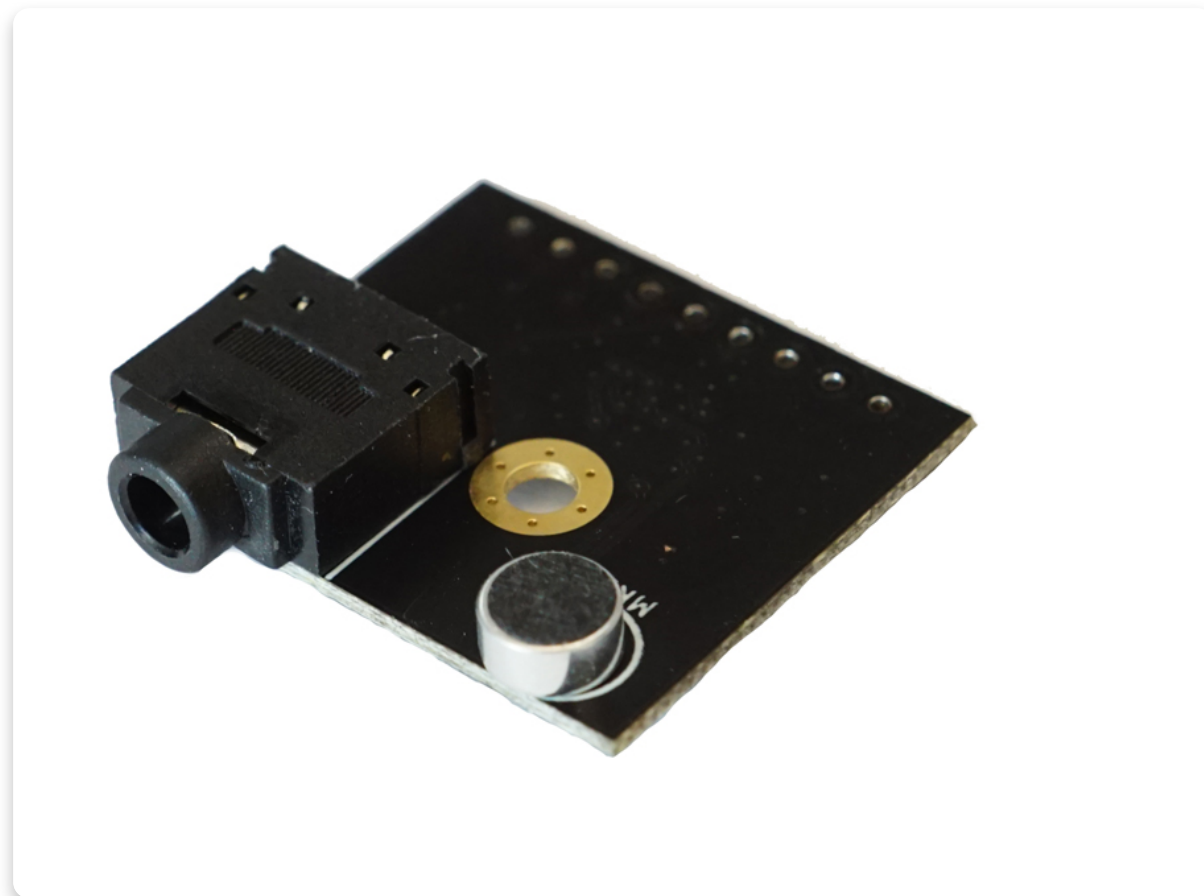


First, solder the microphone to the Sound board.
Be careful not to solder it onto the opposite side.
(Check the picture below.)





After that, solder the headphone jack, too.

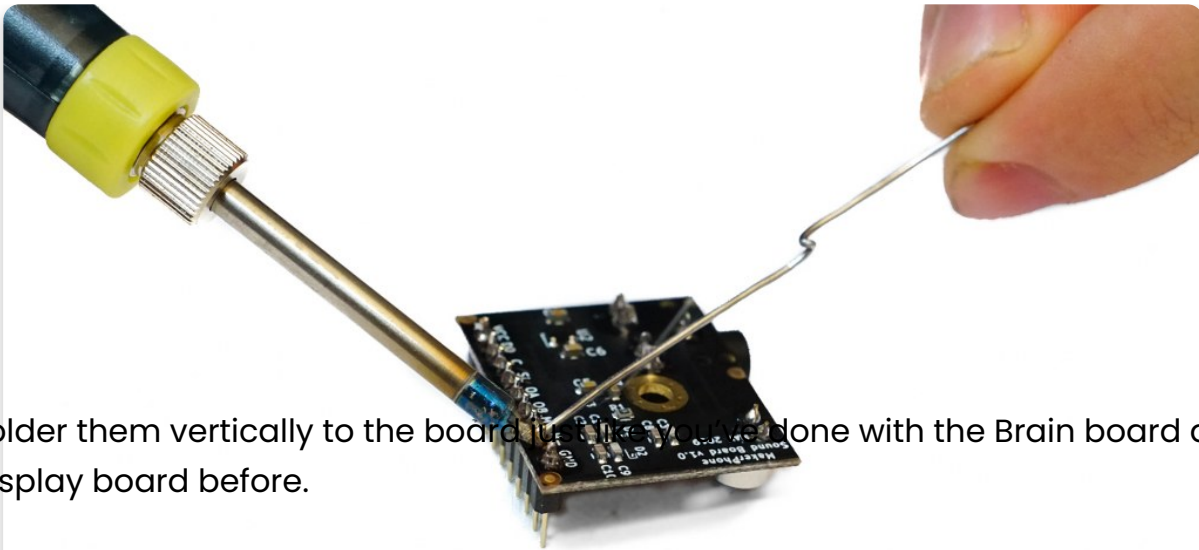




As before, you need to trim the pin headers to the right size using your diagonal cutter pliers.

You'll need a 9-pin header for the Sound board.

Again, make sure that the pins you are soldering into the board are the shorter ones.



Solder them vertically to the board (this was done with the Brain board and Display board before).

Step 8 – Attaching the Sound board



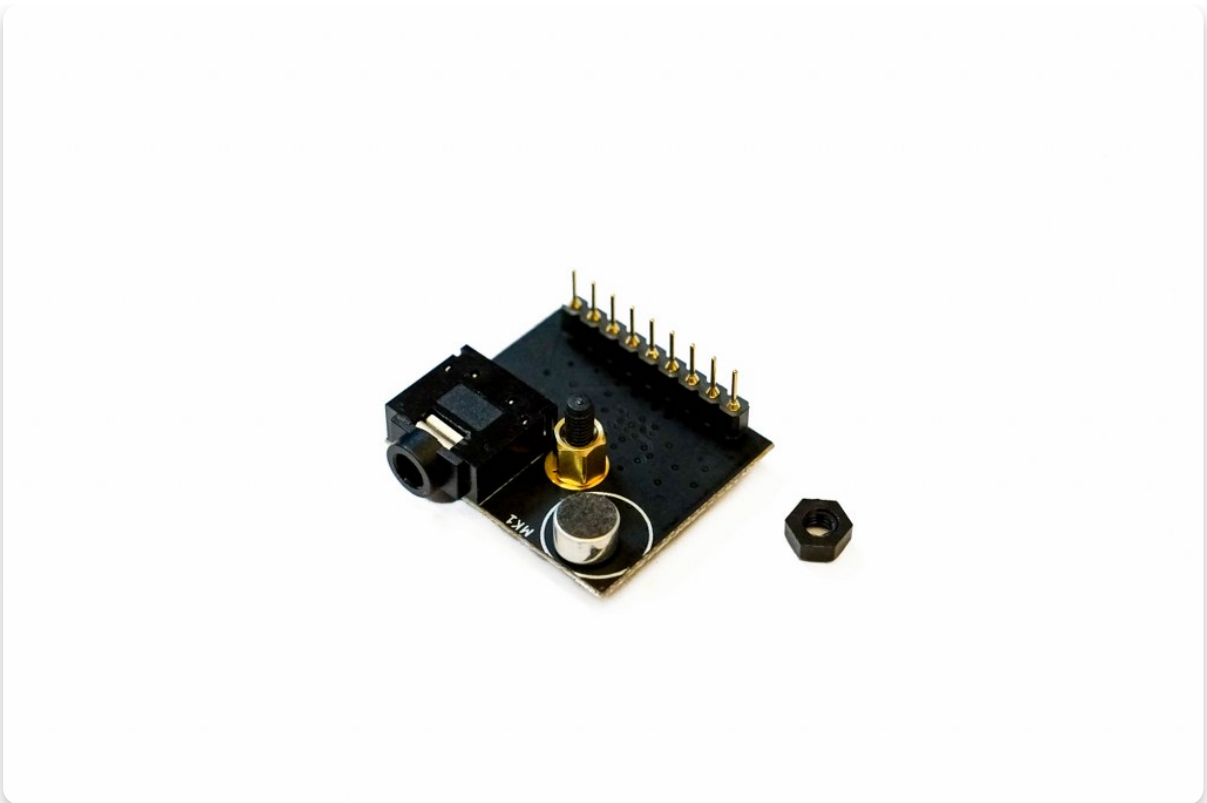
For this step, you'll need the following components:

1 x M3x10mm black nylon bolt

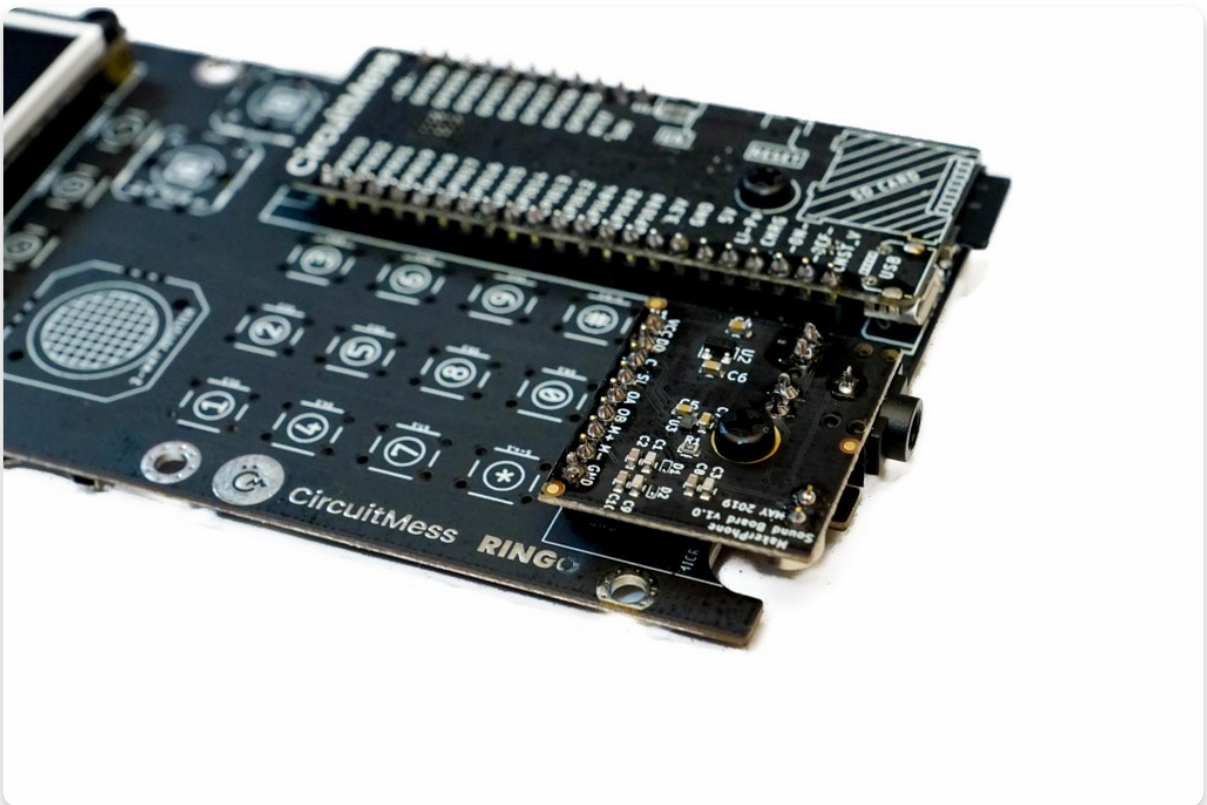
1 x M3x5mm brass (golden) spacer

(WATCH OUT – there are two similar types of brass spacers in your kit and you need the bigger brass spacer here!)

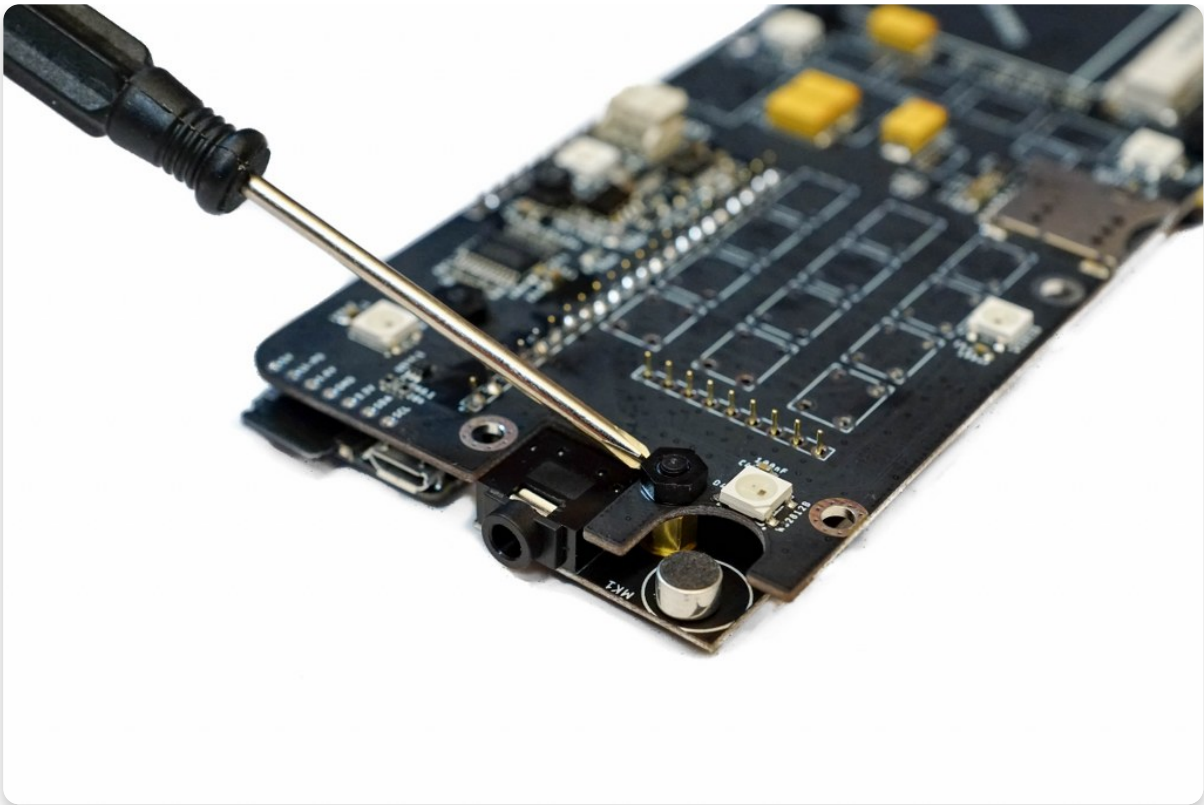
1 x M3 black nylon nut



Put the screw through the board as we did with the other boards, then screw down the spacer.

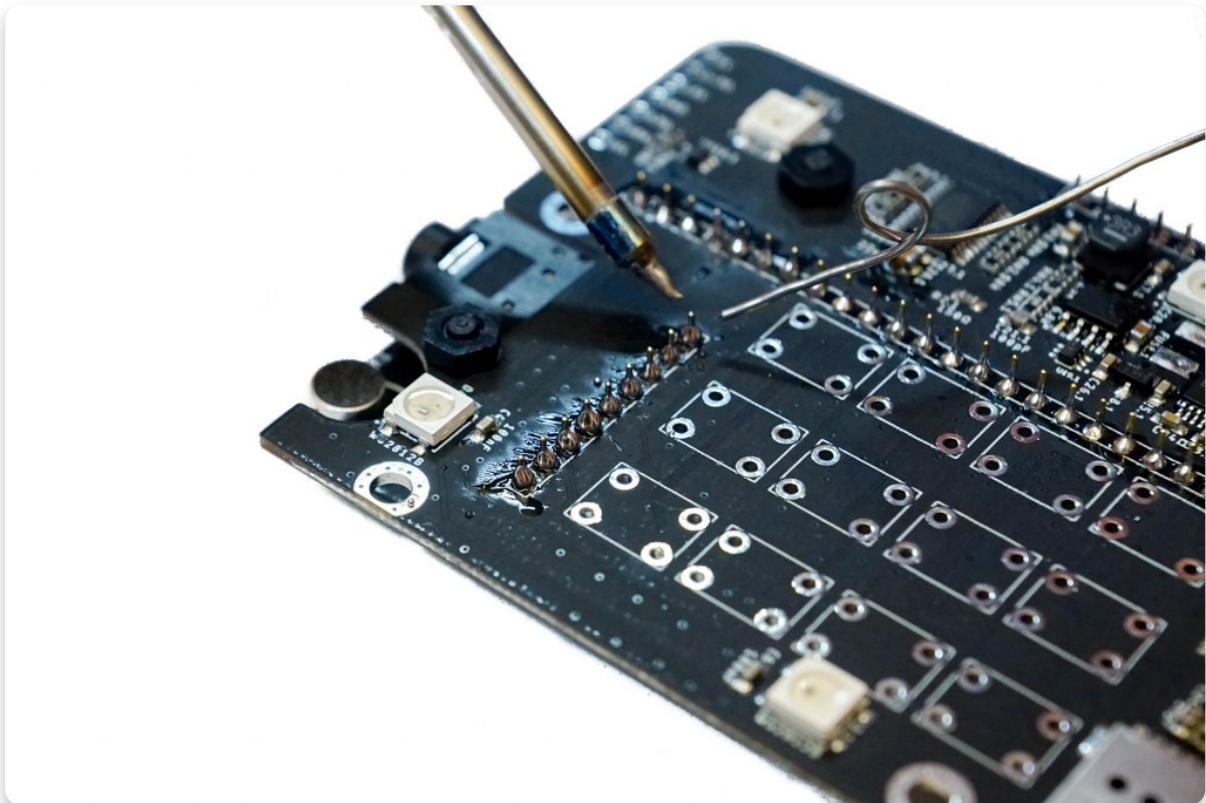


Place the Sound board onto the Main board where it says "Sound board".



Fasten the nut from the back side.

Step 9 – Soldering the Sound board

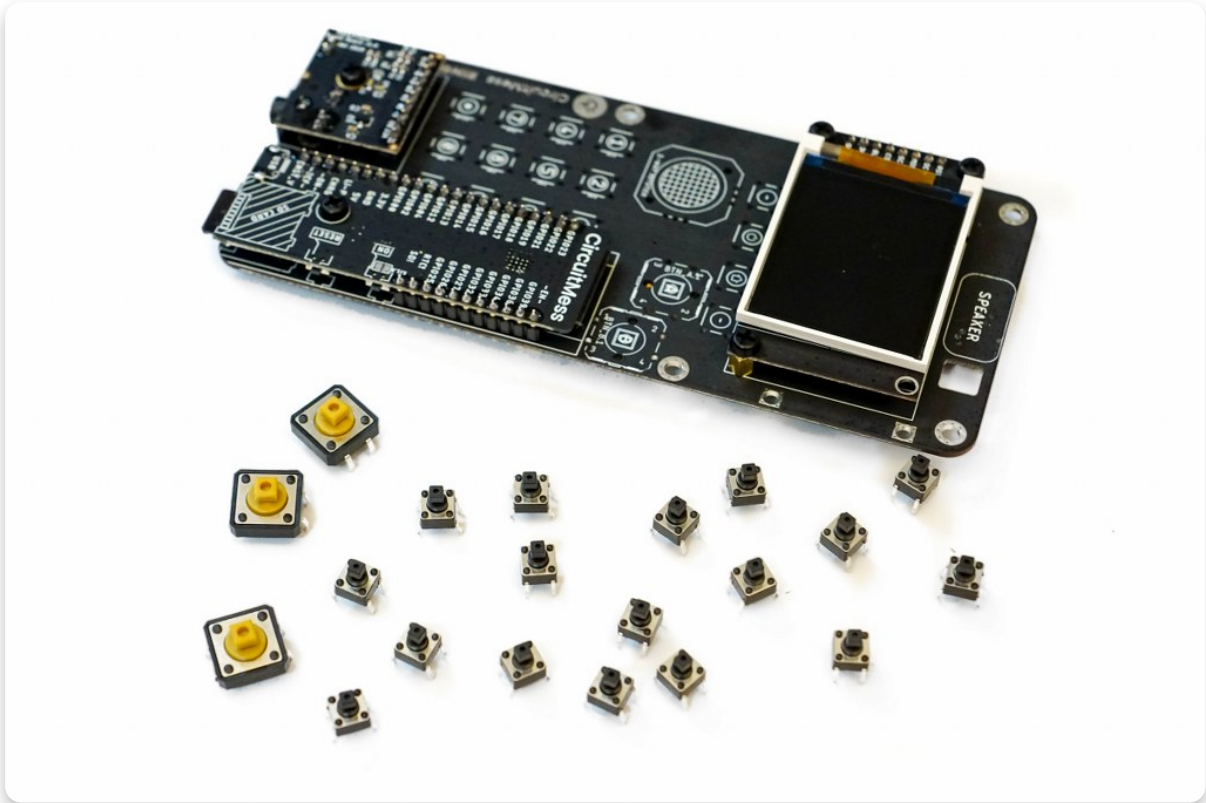


The Sound board shouldn't pose any problems since it doesn't have that many pins that need to be soldered.

Plus, by now you should be getting a grip on how soldering works if you didn't already have the experience.

Solder the pins to the Main board and we're done with that.

Step 10 – A lot of buttons...



All of these buttons may seem overwhelming, but trust us, after you solder a couple of them, the rest will be a breeze!

The smaller buttons are placed where the numerical keypad is, and just below the display.

The bigger buttons are placed where it says A and B.

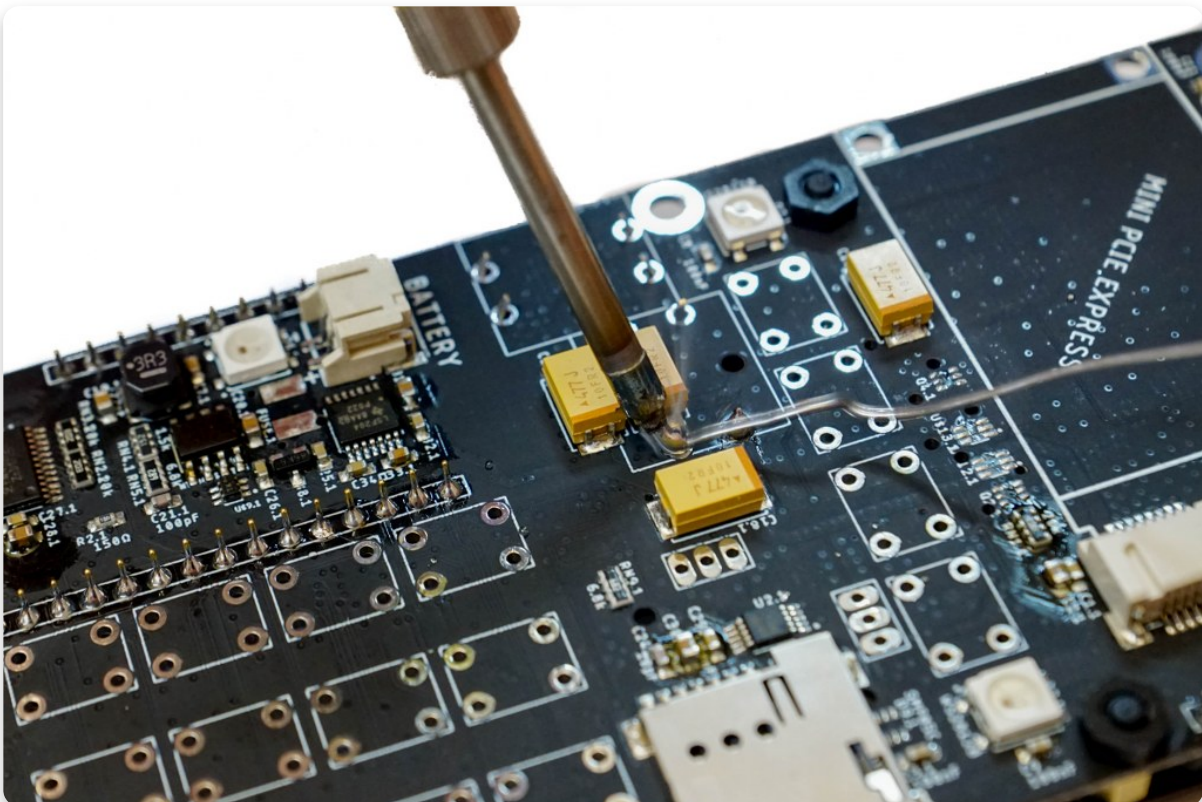


Let's start with the big yellow ones.

Push them into the Main board so that they sit firmly on the board.

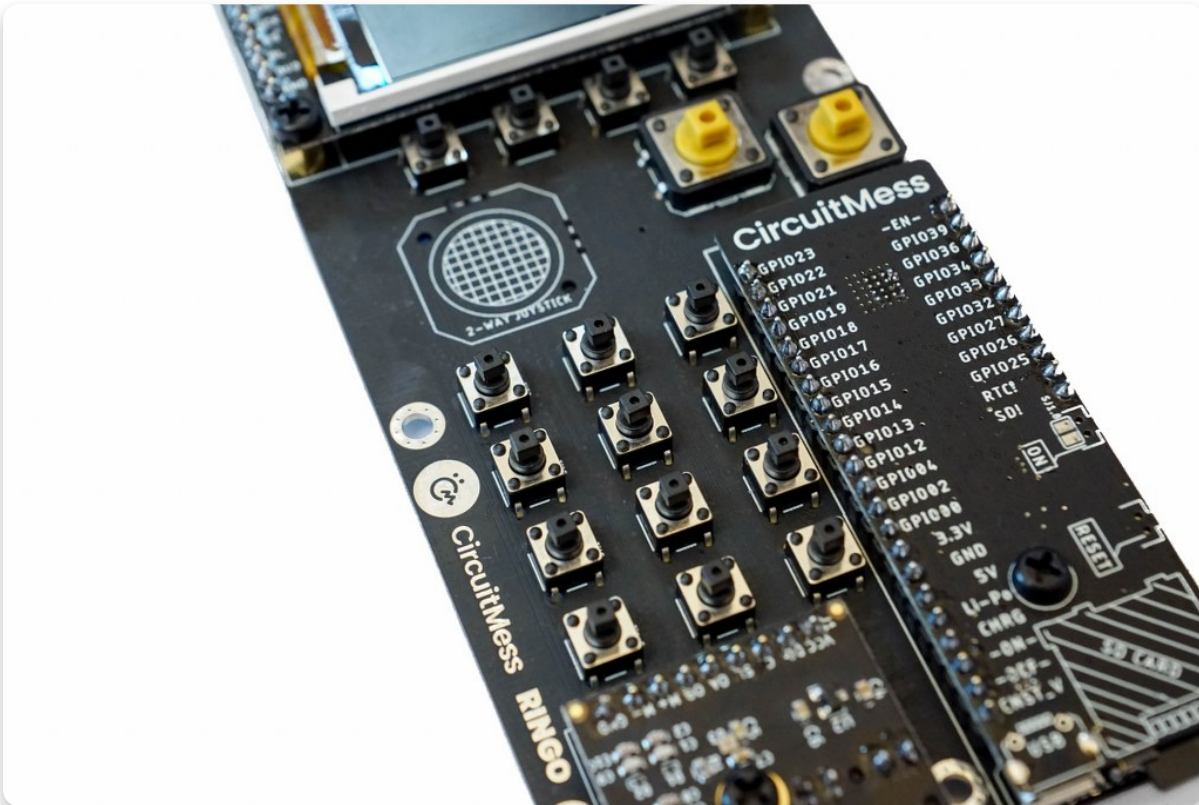
Before soldering the push buttons, make sure that they're perpendicular (vertical) to the board.

This is very important as you'll have trouble putting the protective casing on the device if the buttons are tilted!



The soldering pads are quite big for these buttons, so you'll need to hold your iron

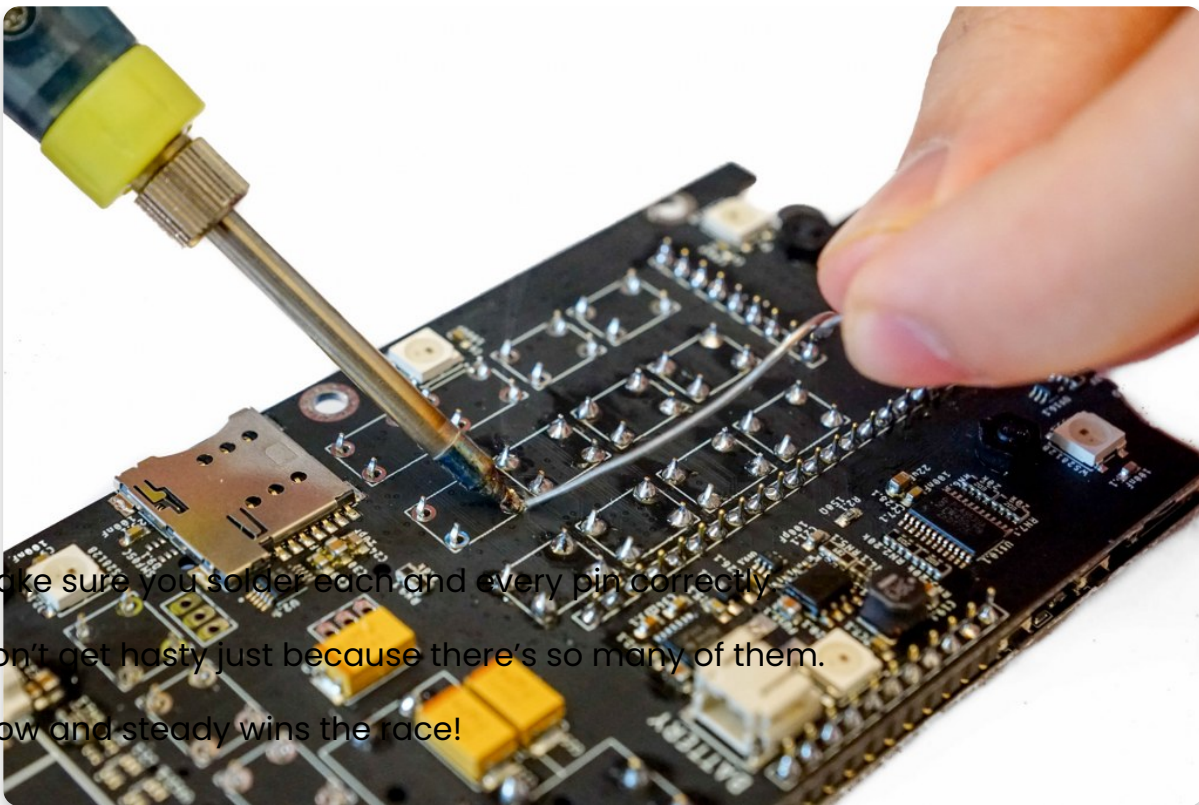
on them a bit longer.



Soldering the smaller pushbuttons is mostly the same as soldering the big yellow ones.

Please make sure that the pushbuttons are sitting firmly on the board and that they're not tilted before soldering them.

As we said in the previous paragraph, you won't be able to mount the casing if the buttons are tilted!

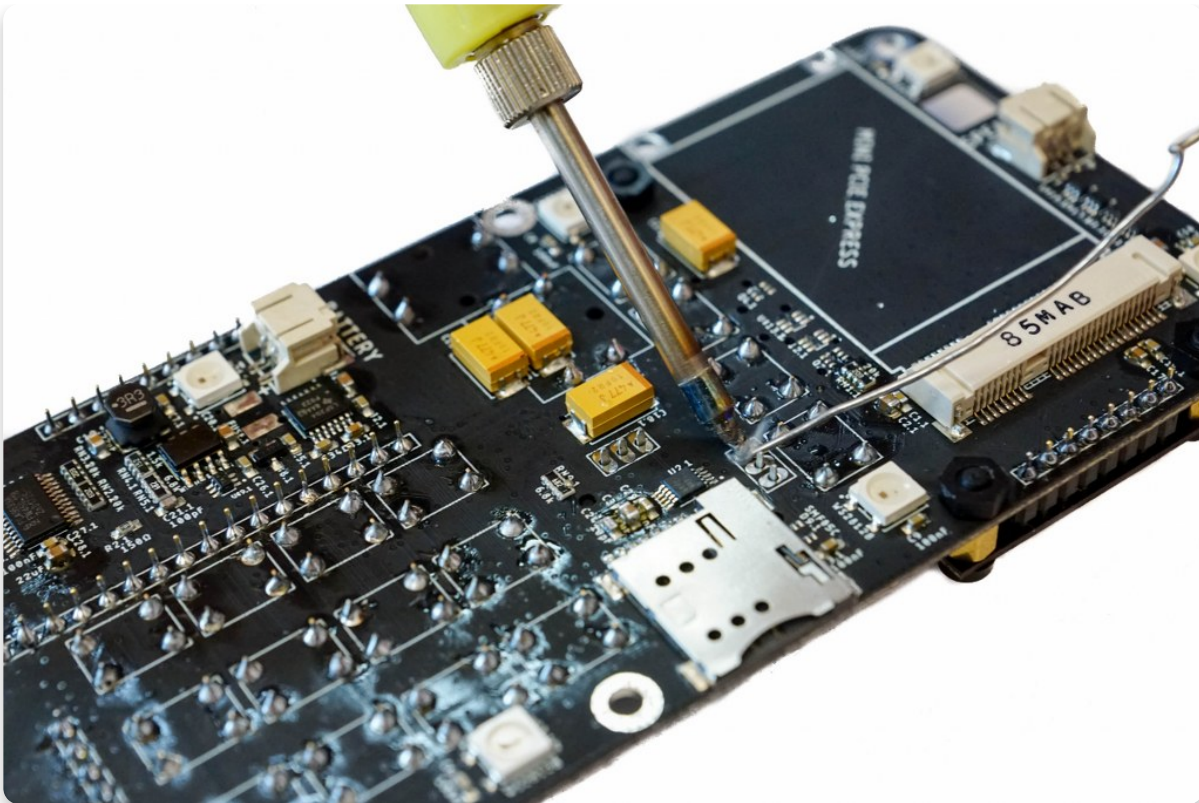


Make sure you solder each and every pin correctly.
Don't get hasty just because there's so many of them.
Slow and steady wins the race!

Step 11 – The joystick



The joystick is still left to be soldered, but after all those pushbuttons, it shouldn't be an issue.



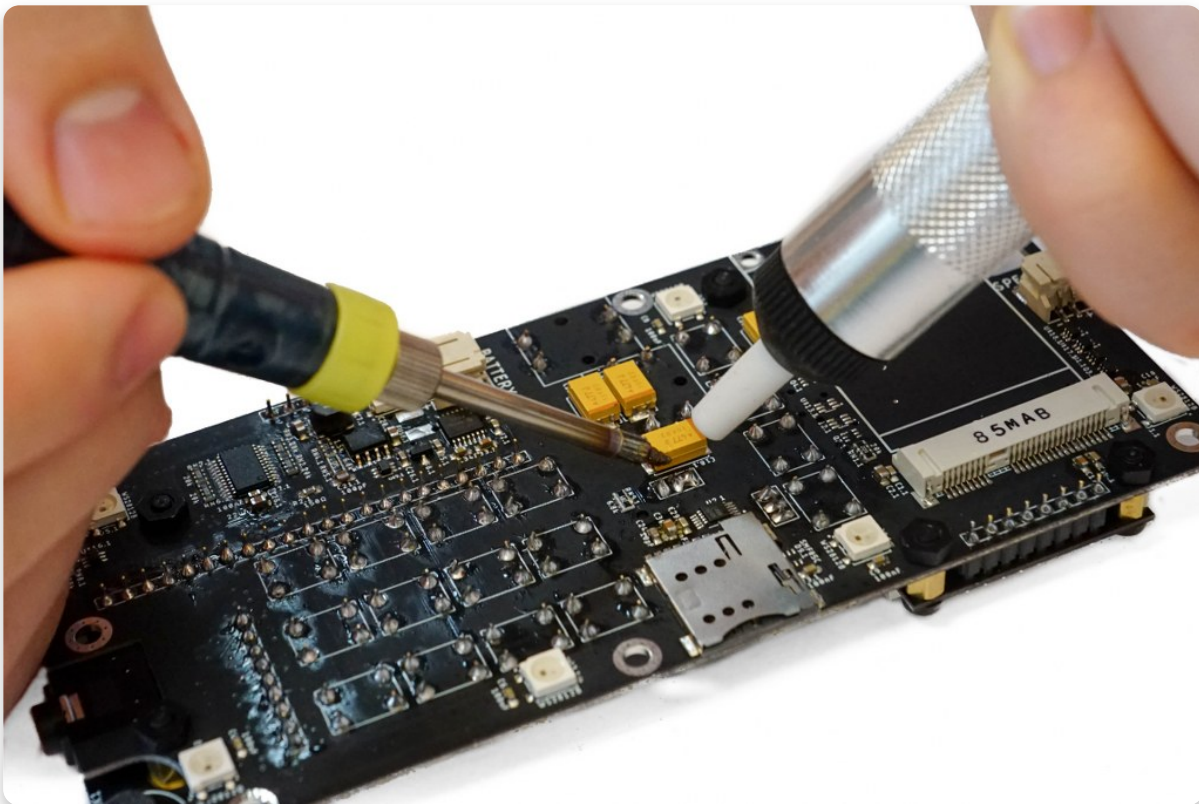
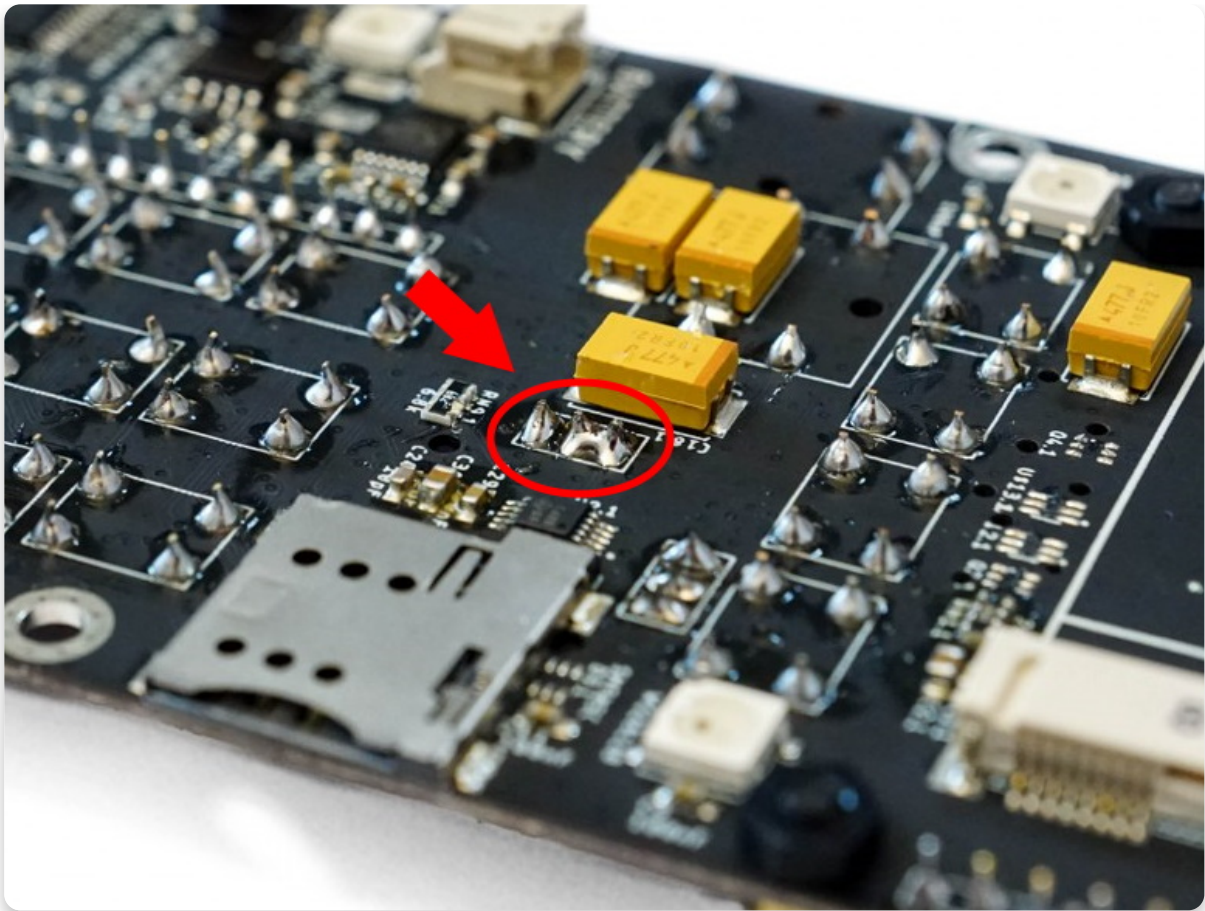
Once you're done with that, feel free to **turn off your soldering iron and take a breather, because soldering time is over!**

Nice job so far, but unfortunately we're not done yet. There are still a few steps ahead.

Oh no! It seems we've made a mistake during the soldering process!

As you already know, soldering joints **must not be bridged** as the device won't work correctly (signals or voltages will get mixed or shorted).

This is a perfect moment to demonstrate how to fix bridged solder joints with a desoldering vacuum pump:

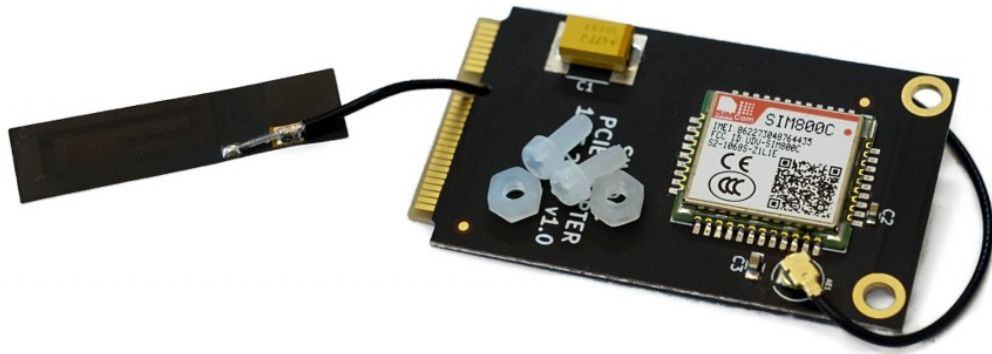


- Push down the plunger button on the desoldering pump
- Place the soldering iron on the bridged joint until it melts
- Place the desoldering pump directly on the melted solder joint

- **Press the release button on the desoldering pump, that should suck up the molten solder**
- **Repeat the process if needed**

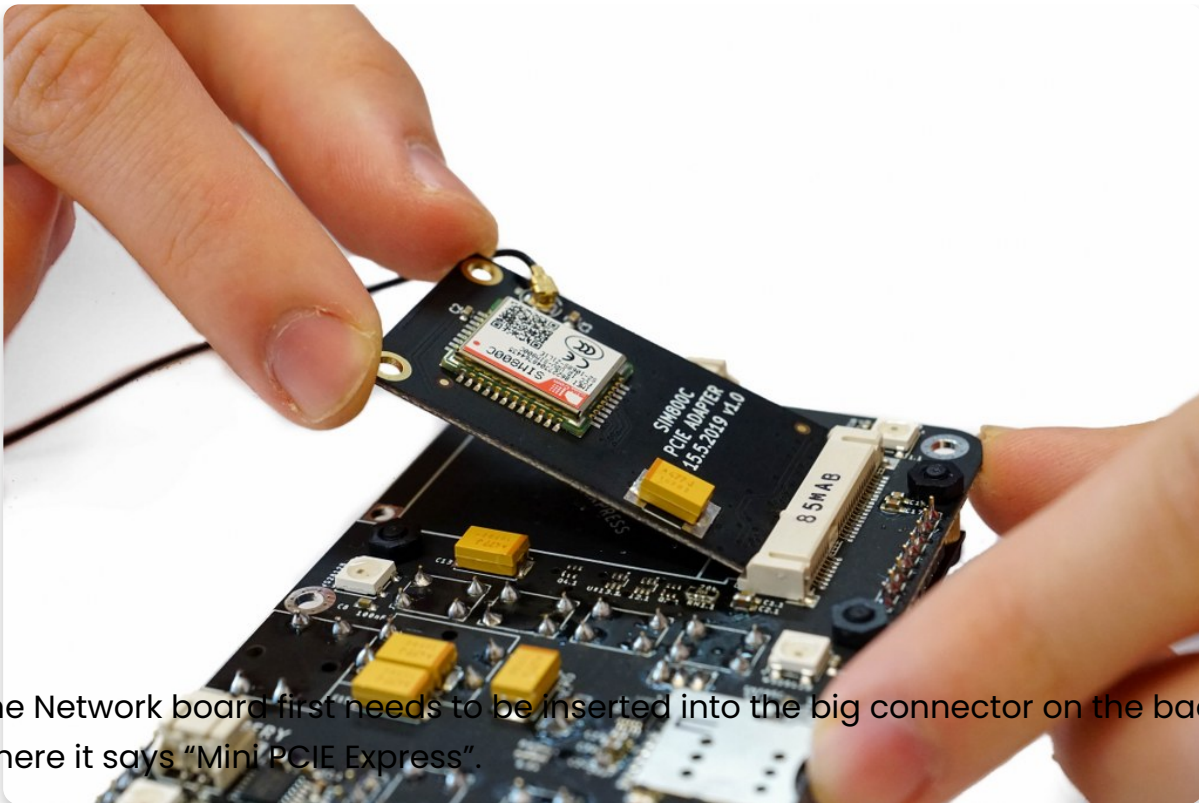
This will require some practice, but it isn't impossible to learn!

Step 12 – The Network board



In order to attach the Network board to the Main board, you'll need the following components:

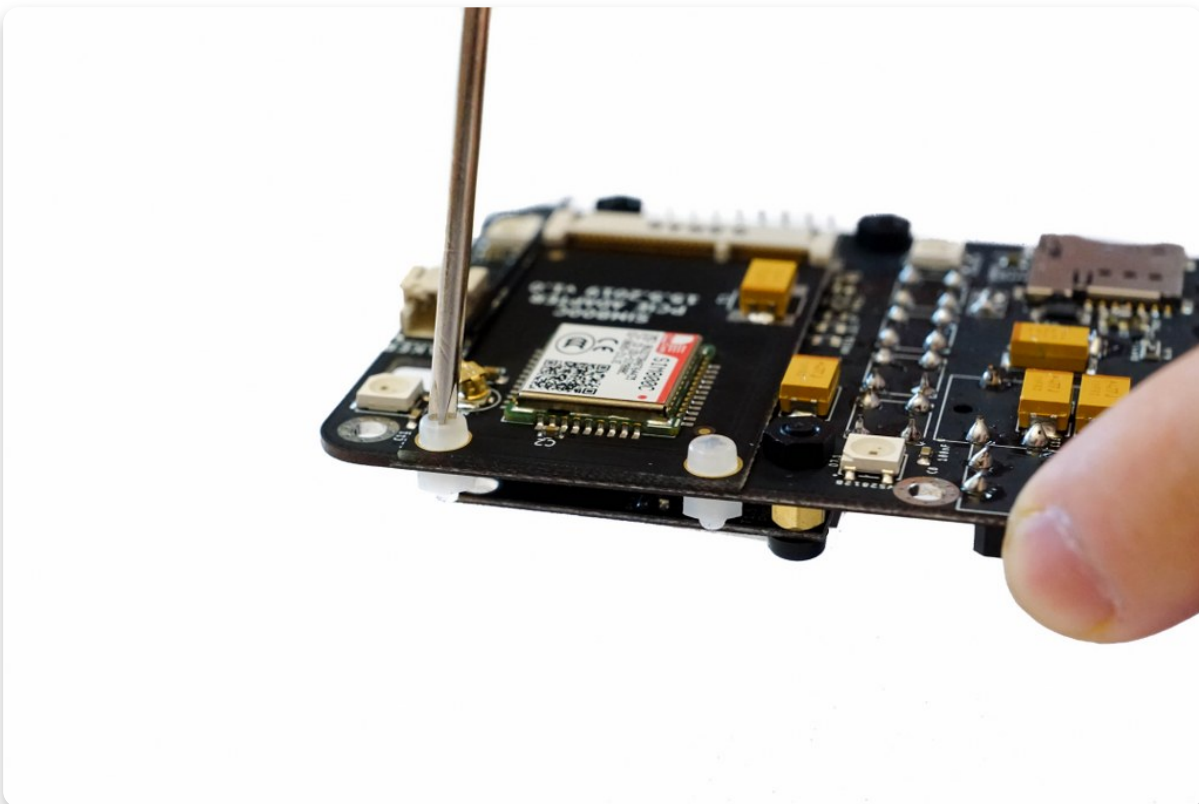
2x M2.5 white nylon bolt
2x M2.5 white nylon nut



The Network board first needs to be inserted into the big connector on the back where it says "Mini PCIE Express".

The network module needs to be inserted at an angle like this.

Then you need to push it down until it's horizontal with the Main board.

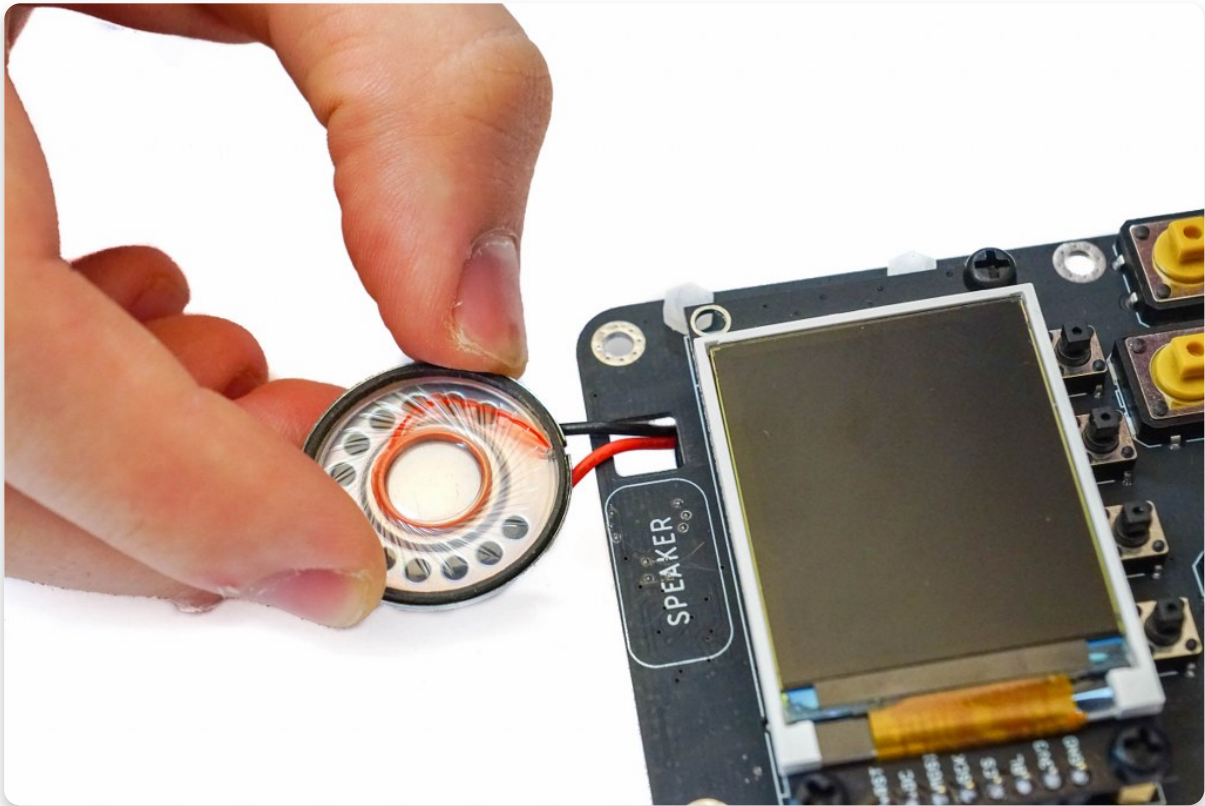


Keep holding it down and put one bolt through the Network board and the Main board.

Fasten it with a nut from the other side.

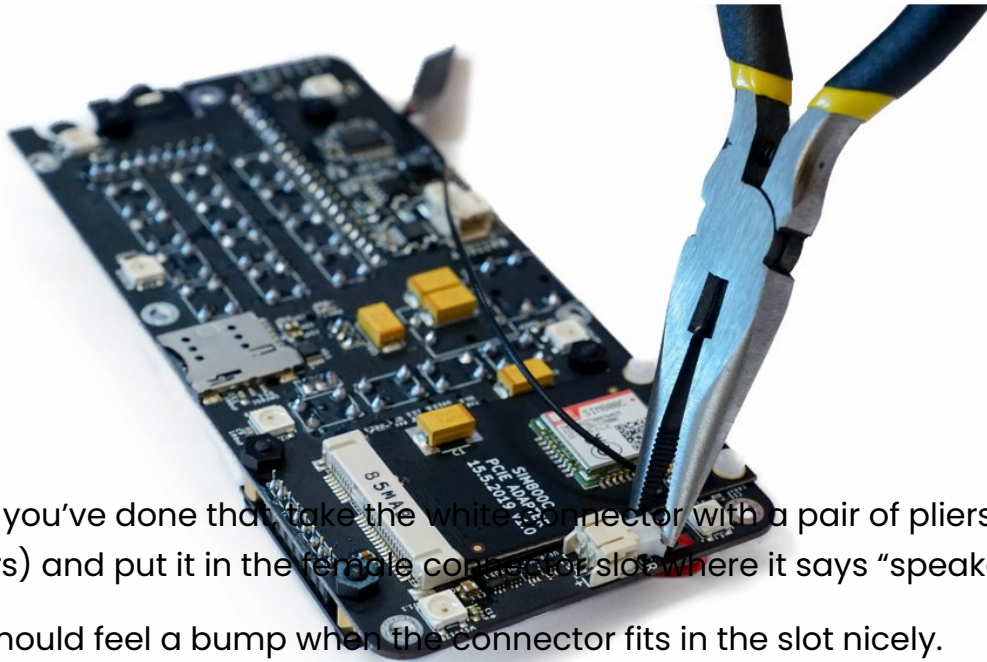
Then put the other bolt and fasten the other nut too.

Step 13 – The speaker



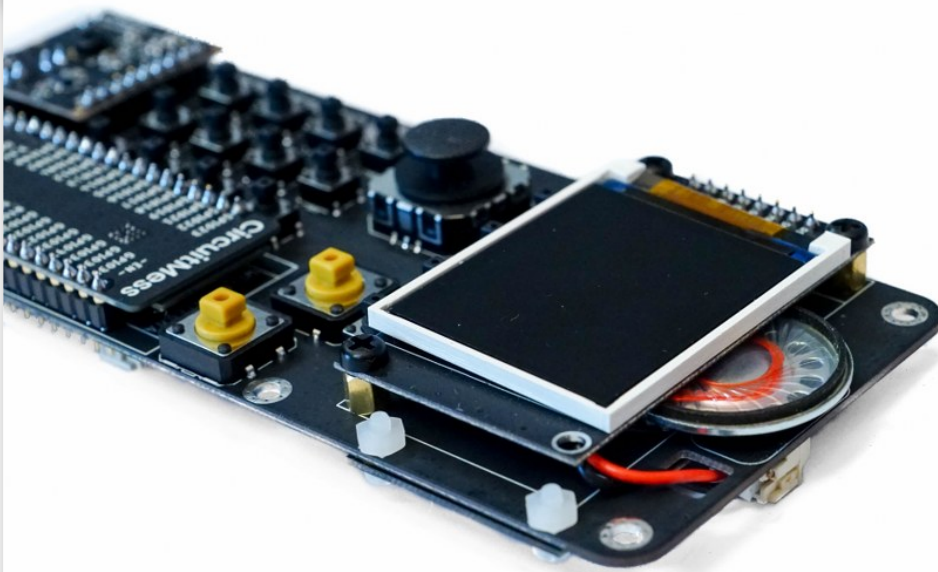
Connecting the speaker is easy!

First, you need to insert the speaker's wire connector through the large hole on the top of the Main board.



Once you've done that, take the white connector with a pair of pliers (or your fingers) and put it in the female connector slot where it says "speaker".

You should feel a bump when the connector fits in the slot nicely.



Now, place the speaker so it fits snugly between the Display board and the Main board.

That's about it for the electronics of your Ringo phone, but we're not done yet!

We still need to place the whole device in a casing and place the button caps.

If you need help with cleaning the tip of your soldering iron, please check our [video tutorial](#).

Finishing touches

Buttons

The soldering part is finally done, and now it's time to do the mechanical assembly.

Step 14 – The button caps

Pressing those pushbuttons without button caps on would be really tough, wouldn't it?

Well then, let's take out all the button caps and place them on the buttons.

Same as with the pushbuttons, there are two types: the bigger ones are for the A and B buttons and the smaller ones make up the rest.

***NOTE: You will receive the buttons with UV printed symbols.**

Place them on top of the buttons and push down firmly.

They should make a "click" when they fit into place.

Peeling and casings

Plastic peeling

Before starting to screw anything together, make sure to take off the protective peeling that we mentioned earlier.

There are total of 4 layers you need to peel off, two on each plastic case.

Make sure to use your nails or a wooden pick to start with the peeling process.

Do not use anything sharp or made out of metal as it may permanently damage the protective plastic.

When it's all done, it should look something like this.

Both protective plastics should be completely transparent. If there are any blue layers left on them, make sure to remove it completely.

Step 15 – The front casing

Since we don't want anything to happen to your Ringo, it's best to put it in its plastic casing.

Let's start with the front side.

For this, we're going to need:

6x M3x8mm metal bolt

(WATCH OUT – there are two versions of metal bolts that look similar; you need the shorter bolts here)

6 x M3x5mm brass (golden) spacer

(WATCH OUT – there are two similar types of brass spacers in your kit and you need the bigger brass spacer here!)

1 x Front protective casing 1 x Front aesthetic casing

Put the bolts in from the front side and tighten the metal spacers from the back side.

Don't tighten them too much, because you could damage the casing!

The front part should look something like this now

When you put the bolts through the back side, don't screw down the spacers all the way through.

This will prove useful up ahead when we'll connect both sides of the casing.

Step 16 – The back casing

Take the rest of the components:

6x M3x12mm metal bolt

(WATCH OUT – there are two versions of metal bolts that look similar; you need the longer bolts here)

6x M3x4mm brass (golden) spacer

(WATCH OUT – there are two similar types of brass spacers in your kit and you need the shorter brass spacer here!)

1 x Bottom aesthetic casing 1 x Bottom protective casing

The process is pretty similar to assembling the front casing.

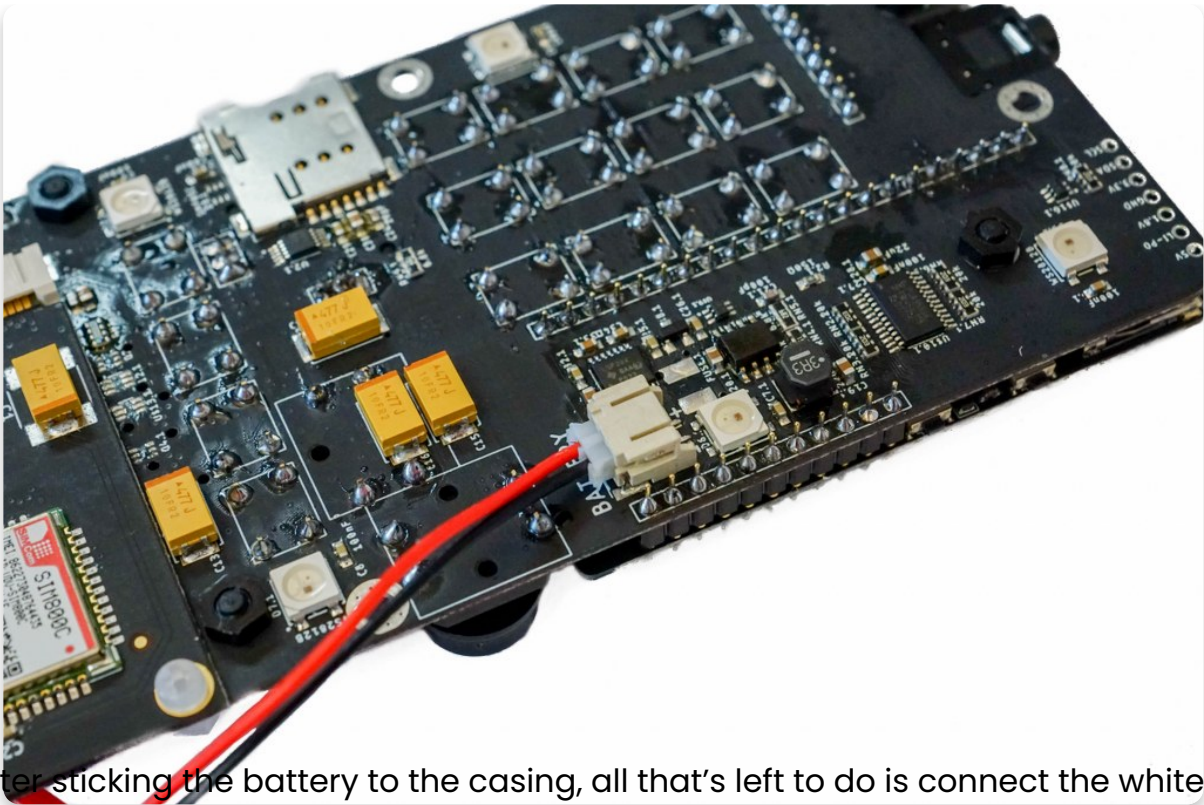
Step 17 – The battery

The battery comes with pre-applied two-sided sticky tape, so you'll need to peel off the paper layer from the back of the battery.

Be careful not to peel off the whole tape, just the protective paper layer.

Place it inside the largest slot on the back casing, and make sure the battery's cable is facing right.

Press down on the battery firmly to ensure it's stuck to the casing nicely.



After sticking the battery to the casing, all that's left to do is connect the white connector into the slot on the Main board where it says "battery".

Step 18 – The antenna

You were probably wondering what's that dangling black wire connected to the network module.

That's the Ringo's antenna and it is impossible to connect to the mobile network without it.

Like with the battery, you'll need to first peel off the paper layer from the end of the antenna.

Be extra gentle with it as it can be damaged if stucked wrongly!

Then stick it to the casing right next to the battery, with the antenna wire facing up.

Be careful when tugging on the antenna because the antenna connector on the network module is a bit fragile and might even break if you put too much strain on it!

Now you should have the back casing connected to the Main board with the battery and antenna as shown on the photo on the left.

Step 19 – Combining the front and back casing

Place the back casing onto the back of the Main board.

Watch out for the cables as they might get in the way. Make sure they stay within the casing and away from the screws so they don't stick out or get damaged.

Flip the phone so that the screen is facing up.

Now place the front casing onto the front side of the Main board.

Tighten the six bolts on the BACK SIDE.

Squeeze the bottom and top pieces of casings together with your fingers while tightening the bolts.

Keep in mind that you don't tighten them too much when assembling the casing because you might damage it.

And voilà, you've just assembled your very own mobile phone!



Make sure you turned off your soldering iron! Unplug it from the power source, place it on the soldering iron stand and let it cool off for at least 5 minutes before you put it away in your tools box.

Check out the following chapter for further instructions on how to set up your Ringo.

Finishing up

Minor details

Firstly, if you have received a SIM card with your CircuitMess Ringo kit, take it out and pop it out at the 2nd smallest size (micro SIM).

If you didn't receive a SIM card with your kit, or if you don't have one that you can use, don't worry, your Ringo can function just fine without a SIM card (except for calls and messages, duh!).

Still, we advise that you should insert a SIM card if you have one before going further.



You need Micro SIM – make sure to get the right adapter

The SIM card slot is located on the left side of the device, and you need to insert it so that the notch on the SIM card faces upwards (check the picture).

When inserting it you should hear a click when it sits in the slot.

The Micro SIM slot has a push-push mechanism (push when inserting and push when removing).

NOTE: SIM can be inserted in multiple ways but it will only work if it's inserted the right way. After inserting the SIM card, restart the phone so that the SIM module can reload the card.

IMPORTANT: Before turning your Ringo on, we recommend charging your phone for at least one hour.

The batteries come discharged in order to preserve their chemical composition.

After it had been charging for a while, press the ON button on the bottom right side of the phone.

Your Ringo should power on and boot into the Startup wizard.

Follow the on-screen instructions of the startup wizard to check if everything works right.

In case something is wrong or you have any questions about the assembly process, please feel free to let us know at contact@circuitmess.com. Also, any feedback that you give is extremely useful to us so we can make this guide and the Ringo kit even better.

Your phone is now up and running! Bravo!

So, you've built your Ringo...now what?

If you're unsure how to use your Ringo, check out the **Ringo usage guide** that will show you all Ringo's functions and how to use them:

- [Check it out here!](#)