# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>3</td>
</tr>
<tr>
<td>• Parts mentioned in this guide</td>
<td>4</td>
</tr>
<tr>
<td>Feathers and FeatherWings</td>
<td>5</td>
</tr>
<tr>
<td>• Feather Boards</td>
<td>5</td>
</tr>
<tr>
<td>• FeatherWings</td>
<td>6</td>
</tr>
<tr>
<td>• Extra FeatherWings</td>
<td>6</td>
</tr>
<tr>
<td>• Types of Headers</td>
<td>7</td>
</tr>
<tr>
<td>Male Headers</td>
<td>8</td>
</tr>
<tr>
<td>• When to Use Male Headers</td>
<td>8</td>
</tr>
<tr>
<td>• Cutting Male Headers to Size</td>
<td>8</td>
</tr>
<tr>
<td>• Soldering Male Headers</td>
<td>9</td>
</tr>
<tr>
<td>• Prepare the header strip:</td>
<td>9</td>
</tr>
<tr>
<td>• Add the breakout board:</td>
<td>10</td>
</tr>
<tr>
<td>• And Solder!</td>
<td>10</td>
</tr>
<tr>
<td>• Now What?</td>
<td>12</td>
</tr>
<tr>
<td>Female Headers</td>
<td>12</td>
</tr>
<tr>
<td>• When to Use Female Headers</td>
<td>12</td>
</tr>
<tr>
<td>• Cutting Female Headers to Size</td>
<td>13</td>
</tr>
<tr>
<td>• Soldering Female Headers</td>
<td>14</td>
</tr>
<tr>
<td>• Tape In Place</td>
<td>14</td>
</tr>
<tr>
<td>• Flip &amp; Tack Solder</td>
<td>15</td>
</tr>
<tr>
<td>• And Solder!</td>
<td>16</td>
</tr>
<tr>
<td>Stacking Headers</td>
<td>17</td>
</tr>
<tr>
<td>• When to Use Stacking Headers</td>
<td>17</td>
</tr>
<tr>
<td>• How to Solder Stacking Headers</td>
<td>18</td>
</tr>
<tr>
<td>• And Solder!</td>
<td>19</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>21</td>
</tr>
</tbody>
</table>
Overview

Headers are like the duct tape of electronics. They're great for connecting things together, using breadboards (https://adafru.it/MDP) to build up a circuit, soldering to perf-boards, or preparing boards for plug-in components like servos or sensors.

Using headers with your microcontroller can make your life much easier, but soldering them on can be a little intimidating to beginners. There are a lot of ways to get it wrong, and once a header is soldered onto a board it's difficult or impossible to get it off again.

This guide will teach an easy and reliable way to attach your headers, with tips for getting them on straight and accurate, so you can move on with your project with confidence. It will also give advice about pitfalls to avoid, and what to do when you get them on wrong.

You might also enjoy a look through Adafruit's Guide to Excellent Soldering (https://adafru.it/dxy), if you're just getting started.
Parts mentioned in this guide

Extra-long break-away 0.1" 16-pin strip male header (5 pieces)
Breakaway header is like the duct tape of electronics, and this header is one better with extra long pins on both sides. This makes it great for connecting things together that...
https://www.adafruit.com/product/400

36-pin 0.1" Female header - pack of 5!
Female header is like the duct tape of electronics. Its great for connecting things together, soldering to perf-boards, sockets for wires or break-away header, etc. We go through these...
https://www.adafruit.com/product/598

Shield stacking headers for Arduino (R3 Compatible)
“How could something so simple be so useful?” We heard once that in the 4th millennium B.C. some guy asked the person...
https://www.adafruit.com/product/85
Half-size breadboard
This is a cute half-size breadboard, good for small projects. It's 2.2" x 3.4" (5.5 cm x 8.5 cm) with a standard double-strip in the middle and two power rails on both...
https://www.adafruit.com/product/64

Adjustable 30W 110V soldering iron
This 'pen-style' soldering iron is just about the best entry-level tool I've seen. It's not as powerful as a Weller WES51 but it is self-contained and easy to...
https://www.adafruit.com/product/180

Feathers and FeatherWings

Feather Boards

We'll be focusing the Feather line of boards, but the process is the same if you're using an ItsyBitsy, Trinket, Metro/Arduino Uno or any other microcontrollers, breakout boards, etc.

Adafruit Feathers are a complete line of development boards that are both standalone and stackable. There are over a dozen different boards with varying specialties, and each can be paired with a host of different FeatherWing add-on boards, so there's a combo for just about any project.

Don't know where to start? The Feather M4 Express is a great basic board to begin with.
Adafruit Feather M4 Express - Featuring ATSAMD51
It's what you've been waiting for, the Feather M4 Express featuring ATSAMD51. This Feather is fast like a swift, smart like an owl, strong like an ox-bird (it's half ox,...
https://www.adafruit.com/product/3857

FeatherWings

FeatherWings are boards with fancy add-on features that attach to your chosen Feather board. Some FeatherWings have sensors, or extra memory, or NeoPixel LEDs - the list goes on and on. All the FeatherWings work with any Feather board, so there are thousands of combinations available. My favorite is the NeoPixel FeatherWing. Search the store (https://adafruit.it/C1) to see all the options.

NeoPixel FeatherWing - 4x8 RGB LED Add-on For All Feather Boards
A Feather board without ambition is a Feather board without FeatherWings! This is the NeoPixel FeatherWing, a 4x8 RGB LED Add-on For All Feather...
https://www.adafruit.com/product/2945

Extra FeatherWings

You can use just one FeatherWing, or you can get a little extra and use Adafruit's FeatherWing doublers or Triplers to add multiple wings to your project. The sky's the limit.
FeatherWing Doubler - Prototyping Add-on For All Feather Boards

This is the FeatherWing Doubler - a prototyping add-on and more for all Feather boards. This is similar to our https://www.adafruit.com/product/2890

Types of Headers

Once you've chosen your Feather and your FeatherWing, it's time to decide how to attach them together. This is where the headers come in. This guide will cover three main types of headers: male, female, and stacking headers. Some feathers also ship with specialty headers for attaching servos, connectors, or screw terminals. Once you've got the basics, those will be a snap to figure out.

Male headers are the "standard" headers that ship with most boards. They attach to the underside of the board so the plastic spacers are flush with the surface, and the solder joints go on the front of the board.

Female Headers have plastic sockets with short legs coming out one side. They attach to the top side of a board, with the plastic flush with the board and the solder joints underneath, on the back side of the board.

You can then plug a board with male headers into the female sockets and the two boards will be connected.
Stacking Headers are kind of a combination of male and female. They have a socket with long pins coming out. They sit on top of the board with the long pins sticking through the holes. The solder joints go underneath the board, and the long pins can extend down into another stacking header or female socket, or into a breadboard or perf board. As the name implies, you can stack multiple boards one on top of the other with these headers.

**Male Headers**

**When to Use Male Headers**

Male headers are the simplest type and generally ship with any board that uses them.

Use male headers if you want to build your project into a breadboard - solderless or permanent. They are also used in conjunction with female headers if you want to stack your boards together.

They are standardized in size at 0.1" spacing, with a few exceptions, so in general you can use any header with any microcontroller, FeatherWing, or shield.

Adafruit even stocks them in [fancy colors](https://adafruit.it/Oje)!

**Cutting Male Headers to Size**

Most Feather boards ship with the correct size of header already included. If you need to cut these down, it’s pretty easy to do. Use a pair of flush cutters to carefully snip the plastic right between the pins.
It's also possible to "break" these to size like a kit kat bar, but this is generally less accurate and you'll sometimes miss and get the wrong number of pins -- so always double check your count.

**Wear eye protection when cutting header parts. Often pieces fly through the air and could injure someone if not careful.**

---

**Soldering Male Headers**

Prepare the header strip:
Cut the strip to length if necessary. It will be easier to solder if you insert it into a breadboard - long pins down
Add the breakout board:
Place the breakout board over the pins so that the short pins poke through the breakout pads

And Solder!
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out our Guide to Excellent Soldering (https://adafruit.it/aTk)).
Solder the other strip as well.

You're done! Check your solder joints visually and make sure they all look shiny, and that nothing is bridged.
Now What?

From here, you can connect your board to a breadboard for prototyping, or plug it in to a board that has female headers or stacking headers soldered on.

It's also possible to solder a FeatherWing directly to the other end of these pins if you're looking for the tiniest possible package for your project.

Female Headers

When to Use Female Headers

Female headers make it easy to connect two boards together.

If you want to stack a Feather and FeatherWing, or to attach a LiPoly backpack charger onto an ItsyBitsy or Pro Trinket, female headers make this easy. Use female headers on the bottom board and male headers on the top, and they'll plug right in.

If your project will be built on a breadboard, it may be easier to use Stacking Headers. If you just want to stick the boards together and go, female headers are the best choice.
Cutting Female Headers to Size

Most of Adafruit's Feather boards ship with the correct sizes of headers. If you need a custom solution, sometimes you need to trim down a female header to fit.

Wear eye protection when cutting header parts. Often pieces fly through the air and could injure someone if not careful.

Carefully count out how many pins you need on the female header. Go to the next pin in line and grab it with a pair of pliers and pull it straight out.

Take your flush cutters and snip through the plastic header right through the gap you just made. You may need to file down the edges of the header for neatness, but often these cutters give a pretty beautiful cut.
Soldering Female Headers

Tape In Place
For sockets you'll want to tape them in place so when you flip over the board they don't fall out.

Blu Tack or other removable putty works well also.
Flip & Tack Solder
After flipping over, solder one or two points on each strip, to 'tack' the header in place.
And Solder!
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out our Guide to Excellent Soldering (https://adafruit.it/aTk)).
Stacking Headers

When to Use Stacking Headers

Stacking headers are basically just larger, taller female headers. They come in handy when you want to be able to take your Feather and FeatherWing boards apart, or if you want to plug them into a solderless breadboard.

They're great for prototyping, and sturdy enough for permanent use in most projects.

Wear eye protection when cutting header parts. Often pieces fly through the air and could injure someone if not careful.
How to Solder Stacking Headers

Place the stacking headers into the board so that the long pins poke through the two rows of breakout pads. Make sure the long pins are sticking out the bottom.

To make it easier to keep these in place, you can use some tape to hold down the two header pieces. Tacky clay also works, whatever you've got handy!
And Solder!
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out our Guide to Excellent Soldering (https://adafruit.it/aTk)).

Start by soldering the first row of header.
Now flip around and solder the other row completely.

When you are finished, check that your soldered joints are nice and shiny.

Solder male headers to your topmost board and they will plug right in to the stacking headers, which you can then plug in to another stacking header or into your solderless breadboard.
Troubleshooting

Sometimes, in spite of all your efforts, things don't go right. Headers might end up crooked, or you may accidentally solder to the bottom of the board when you should have soldered to the top, or vice versa.

Getting headers back off again can be difficult, but it's not impossible. You'll need a few tools and a lot of patience, but it's most definitely do-able - once, at least. If you get them on wrong a second time it's very likely the copper pads will be damaged or the pins will get bent beyond repair, so take your time and double check before you solder all the pins.

It's much easier to fix a mistake if you've only soldered the end or corner pins down, so do a test-assembly of your project before you commit fully.

For headers that are on crooked, it can sometimes help to use the side of your soldering iron to heat all the pins at once, then gently nudge the header so it straightens out while the solder is soft. Be gentle - you can damage your board or break the headers if you push too hard.
To un-solder just one or two pins, you can use solder wick. Solder wick is a braided copper strand that comes in a coil. If you place it next to your solder joint and melt the solder with your soldering iron, the molten solder will soak away from your electronic components and into the wick.

The wick will get saturated with solder, so be sure to move to a clean spot each time you use it.

For more intense jobs (like removing fully soldered headers), upgrade to a solder sucker. This little sucker will vacuum up molten solder and leave your pins and board clean.

Depress the plunger, then heat up your solder joint until it's molten. Place the head of the solder sucker over the molten pin and press the button. The plunger pops up, sucking the solder with it. Voila! Repeat on all the pins and your headers can be wiggled loose and reattached.