How to Build a Testing Jig

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https://learn.adafruit.com/how-to-build-a-testing-fixture

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Overview

If you’re a first time product designer and you’re spending all your time on the product itself, you might forget just how much time and effort it can take to set up a good test jig. A test jig is essentially a contraption that allows you to test many components of a board all at once.

There are a lot of things to consider when creating a test jig, ranging from test coverage to operator fatigue, and of course throughput and reliability. In some cases, a product designer may spend even more time designing a test jig than they spend designing the product itself!

This guide will take you through the basics of soldering a generic type of electronics testing fixture and serves as an update to this original How to Make a Pogo Pin Test Jig (https://adafruit.it/INA) guide.

We've previously posted some time lapse videos showing how we create testers for the Perma Proto Pi HAT (https://adafruit.it/oje), and ADXL326 accelerometer (https://adafruit.it/rPb).

This guide provides a more in depth description of the process and how to get things right the first time.

The impact that a well-designed test jig can have on manufacturing efficiency is huge. These are extremely important for large scale manufacturing, as reputable factories will test 100% of every product shipped. It is easy to lose sight of the potential pitfalls of hardware manufacturing and the magnification of those issues at scale; if you can cut a product's testing time from 4 minutes to 1 minute the time savings will pay off exponentially as thousands of units are tested.
Materials

For this project you will need:

- Soldering iron
- Solder
- PCB
- Pogo pins
- Metro
- Rubber feet for metro
- Headers
- Through-hole LED
- Piezo buzzer
- Tweezers or needle nose pliers
- Kapton tape
- Tactile button
- Panavise or PCB holder
- Flush diagonal cutters
- Standoffs and screws
- 9V power and power switch
Pogo Pins "Spear Head" (10 pack)
Pogo pins are little spring-loaded contacts, very handy for making jigs, or making momentary (but electrically solid) contacts. We use them by the dozen for making programming and...
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Adafruit METRO 328 Fully Assembled - Arduino IDE compatible
We sure love the ATmega328 here at Adafruit, and we use them a lot for our own projects. The processor has plenty of GPIO, Analog inputs, hardware UART SPI and I2C,...
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Piezo Buzzer
Piezo buzzers are used for making beeps, tones and alerts. This one is petite but loud! Drive it with 3-30V peak-to-peak square wave. To use, connect one pin to ground (either one) and...
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Fine tip straight tweezers - ESD safe
When soldering small surface-mount (SMD/SMT) components, one thing you'll need is a good pair of tweezers. These tweezers are a great pair of every-day tweezers. They're...
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Tactile Button switch (6mm) x 20 pack
Little clicky switches are standard input "buttons" on electronic projects. These work best in a PCB but
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Diffused Green 3mm LED (25 pack)
Need some indicators? We are big fans of these diffused green LEDs, as featured in the LoL shield. They are fairly bright so they can be seen in daytime, and from any angle. They go...
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Break-away 0.1" 36-pin strip male header - Black - 10 pack
Breakaway header is like the duct tape of electronics. It's great for connecting things together, soldering to perf-boards, fits into any breakout or breadboard, etc. We go through...
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Adafruit Proto Shield for Arduino Unassembled Kit - Stackable
This prototyping shield is the best out there (well, we think so, at least), and now is even better with Version R3 - updated for the most compatibility with just...
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Heavy Stainless Steel Circuit Board Holder
Are you still looking for that perfect PCB holder? The hefty yet portable Heavy Stainless Steel PCB Holder will rock out when you rework out. These were initially...
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Panavise Jr.
The best mini-vise for working on smaller PCBs (2.875" or less in one dimension)!
The jaws are strong plastic that won't damage the PCB and doesn't mind if you hit it with the...
https://www.adafruit.com/product/151

Flush diagonal cutters
These are the best diagonal cutters, large super-comfortable grip to use and have strong nippers for perfect trimming of wires and leads. I've used my pair every day for years.
https://www.adafruit.com/product/152

High Temperature Polyimide Tape - 1cm wide x 33 meter roll
Polyimide Tape (sometimes referred to by the brand name Kapton Tape) is an interesting addition to your toolbox!
Polyimide Tape remains stable across...
https://www.adafruit.com/product/3057
Soldering iron stand
A real stand with sponge and solidly-built sheet metal holder prevents your iron from 'rolling away' or burning a hole in the table. If you're starting out and have a...
https://www.adafruit.com/product/150

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

Mini Solder spool - 60/40 lead rosin-core solder 0.031" diameter
If you want to make a kit you'll need some solder. This 100g (about 1/4 lb) spool is just the right amount, not too much (like 1 lb spools) and not too little (like those little...
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Little Rubber Bumper Feet - Pack of 4
Keep your electronics from going barefoot, give them little rubber feet! These small sticky bumpers are our favorite accessory for any electronic kit or device. They are sticky, but...
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Black Nylon Machine Screw and Stand-off Set – M2.5 Thread
Totaling 380 pieces, this M2.5 Screw Set is a must-have for your workstation. You'll have enough screws, nuts, and hex standoffs to fuel your maker...
https://www.adafruit.com/product/3299

9 VDC 1000mA regulated switching power adapter - UL listed
This is a really nice power supply. It's a switching DC supply so it's small and light and efficient. It is thin so it fits in power strips without blocking other outlets. The...
https://www.adafruit.com/product/63

In-line power switch for 2.1mm barrel jack
Add a power switch to any project simply by plugging this between the power supply. This is the most useful thing you never knew you needed! You'll want to pick up a bunch...
https://www.adafruit.com/product/1125

"Wire Wrap" Thin Prototyping & Repair Wire - 200m 30AWG Blue
This stuff is called "wire-wrap wire" because it used to be used for wire-wrapping high-speed digital circuits on a special kind of contact board. It's pretty rare to see wire-wrapping in...
https://www.adafruit.com/product/1446
Making a PCB

The PCB, or Printed Circuit Board, is where all the tester bits get placed and assembled. There are a couple of different options to consider here.

Option 1: Outsource the PCB

The first option would be to order the PCB through a manufacturer like OSH Park (https://adafruit.it/e2G).

Just send them the files and they make and send you the PCB(s).

For the purposes of this guide we will be showing off mainly this method.

Option 2: Use a milling machine to mill your own PCB

Another option is use a desktop milling machine such as the Bantam Tools desktop CNC (https://adafruit.it/Cg-).
Option 3: The Proto Shield

The Arduino proto shield ([https://adafruit.it/eUM](https://adafruit.it/eUM)) is a great option if you don't have the right files to send to a PCB manufacturer or you don't have access to a milling machine.
Adafruit Proto Shield for Arduino
Unassembled Kit - Stackable

This prototyping shield is the best out there (well, we think so, at least), and now is even better with Version R3 - updated for the most compatibility with just... https://www.adafruit.com/product/2077

For mounting standoffs with this method, you will have to drill holes where you'd like the standoffs to go.
Soldering

Once you have your PCB, the next step is to place the "pogo pins".

What are these pogo pins anyway?

Pogo pins are basically spring-loaded metal sticks. They are used to test specific pins on each board.

The pogo pins in this guide are about 0.5" long and have a spear point. They also fit snugly into 'standard' 0.035" (0.9mm) drill holes so they are easy to insert and stand up straight. We carry these pogo pins in the Adafruit shop! (http://adafru.it/394) They're called "P75-LM" type, you can also pick them up on ebay. If you're building something that will be used for a long time it's probably a good idea to use socket holders.
Pogo Pins "Spear Head" (10 pack)
Pogo pins are little spring-loaded contacts, very handy for making jigs, or making momentary (but electrically solid) contacts. We use them by the dozen for making programming and...
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Place pogo pins

Use tweezers to push pogo pins into the designated holes in the board.

The pogo pins may be skewed all over the place at this point. That's ok, we're going to fix it!
• Attach standoffs to the board.
• The screws go underneath the board and attach to the standoffs on top.

Screw down board that will be tested
Straighten pins

Repeat this process for all pogo pins
Examine your work. Pins should all now be straight!
Step 3: Solder on components

Solder on resistor.

For comfort, you may want to switch the position of your PCB to a stand.
Install LED, making sure it's oriented correctly (longer leg is the anode).

Clip off any excess from the LED with snips.
Solder piezo buzzer into place.

These little buzzers are great for adding an auditory element to any test procedure.

Solder in reset button.

This button is a handy way to re-start a test.
Step 4: Solder headers

- Break up your headers into (1x) 6 pin, (1x) 10 pin, and (2x) 8 pin headers.
- Place accordingly on Metro.
- Now place the PCB on top of the headers, pushing down the PCB into place in needed.
- Now solder the header pins to the PCB.
Give it some rubber booties!

These little adhesive rubber feet will prevent your tester from slip-sliding all over the place while you're trying to use it.
Step 5: Programming

Load your test program onto your Metro board (shown here using TinyUSB).

You're now ready to start testing!

Testing

Now the fun part! When a board is ready to test, find the right orientation and press down to make contact with the pogo pins. If all is good, it will beep and the LED will flash with a green light!
FAQ

Answers to some frequently asked questions

What elements should I include in my tester design?

You will want some easily identifiable way to tell that your board has passed test. For standalone testing jigs, including a piezo buzzer and LED light are a simple way to indicate when a test has completed successfully.

Piezo Buzzer
Piezo buzzers are used for making beeps, tones and alerts. This one is petite but loud! Drive it with 3-30V peak-to-peak square wave. To use, connect one pin to ground (either one) and...
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Need some indicators? We are big fans of these diffused green LEDs, as featured in the LoL shield. They are fairly bright so they can be seen in daytime, and from any angle. They go...
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Do I need a clamp on my test jig?

For tests that take longer than a few seconds, adding a clamp to your tester design can greatly speed up your process by freeing up your hands to do other things while your board is undergoing test.

Adafruit carries a variety of the same clamps that we use in our own tester designs, including a variety of sizes and styles depending on the size and shape of the board being tested.

Toggle Clamp - Large Size
*Ka-thunk* Pin down that PCB with our Toggle Clamp, a sturdy and reliable way to quickly press and release with precision! A pogo-pin bed is a great way to connect and...
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Toggle Clamp - Small Flip-down Style
*Ka-thunk* Pin down that PCB with our Toggle Clamp, a sturdy and reliable way to quickly press and release with precision! A pogo-pin bed is a great way to...
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Toggle Clamp - Medium Flip-up Style

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Fixture Clip - Short

Doesn't this fixture clamp look like a character in a Pixar movie? If you just drew two little eyes on it then you could just imagine it hopping around on nifty,...

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Should I order my PCB, mill it, or use a proto shield?

Order PCB: If you have the PCB design, want a longer-lasting tester, and don't mind waiting for a bit.

Mill PCB: If you have access to a milling machine and want to quickly and accurately create a prototype of your tester design.

Use proto shield: If you don't have the exact design for your PCB but have the general direction of how your tester will work.
Adafruit Proto Shield for Arduino Unassembled Kit - Stackable
This prototyping shield is the best out there (well, we think so, at least), and now is even better with Version R3 - updated for the most compatibility with just...
https://www.adafruit.com/product/2077
What happens if some copper breaks off from my milled PCB?

- Sometimes when placing pogo pins in a milled PCB, this can happen.
- The copper film is quite delicate which can cause the copper layer to rip off sometimes. If this is the case don't fret it!
- Just grab some thin, solid core wire (https://adafruit.it/diJ).
- Next, expose some wire on each end.
- Now use some tweezers and create a small loop on one end. This end will be for the pogo pin.
- Re-place the pogo pin in the affected area going through this wire.
- Solder wire to pogo pin.
- Later when soldering pins to the pcb, make another loop with the wire, place around the adjacent pin, and solder in place.
"Wire Wrap" Thin Prototyping & Repair Wire - 200m 30AWG Blue

This stuff is called "wire-wrap wire" because it used to be used for wire-wrapping high-speed digital circuits on a special kind of contact board. It's pretty rare to see wire-wrapping in...

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