Soldering Workshop

Presented by Terrapin Works

^ENES100 Sign-in Only!

TERRAPIN WORKS

Soldering Workshop

Students please sign in for the TW Workshop!

https://go.umd.edu/TWSP25

What is Terrapin Works?

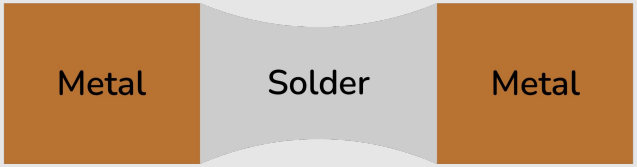
Our **MISSION** is to empower the members of the community to reach their highest creative and technical potential by connecting them with cutting edge fabrication equipment, safe spaces, and knowledgeable personnel.

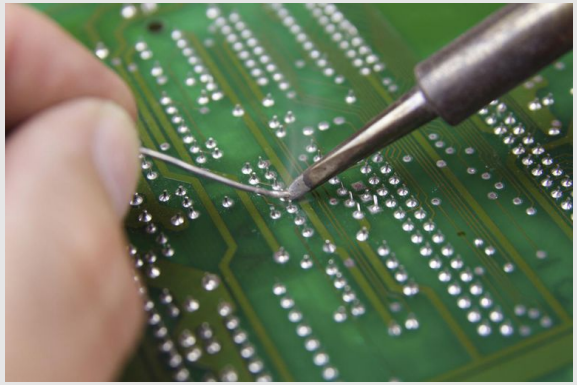
Our **VISION** is to accelerate the adoption of advanced manufacturing methods, engineering design processes, and experiential learning by the campus community.

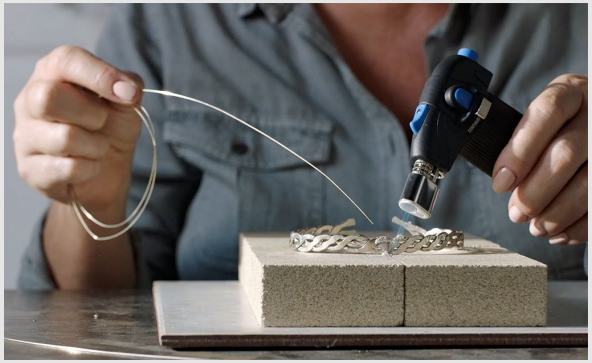
Part 1: Background

What is Soldering?

Fusing non-ferrous metals by melting a soft filler metal (solder) between them.







What is Solder?

An alloy with a **relatively (400 - 800°F!)** low melting point that bonds well with non-ferrous metals.

We use **unleaded solder.**

Rosin-core solder has flux inside it to help solder flow.

The Soldering Iron

The Soldering Iron

Safety - Dress Code

- Long pants
- Close-toed shoes
- Tie back long hair
- Remove/tuck loose layers
- Safety glasses

Safety - Habits

- Turn off iron immediately when finished
- Return iron to stand when not in use
- Work on designated non-flammable surfaces
- Be patient and don’t rush!

Part 2: Basics with solid core

Oxidation

The iron tip oxidizes **very quickly** while hot!

This builds up an **oxide** layer on the tip surface that blocks heat transfer and repels solder.

The Sponge

Strengths:

- Removes light oxidation quickly

Weaknesses:

- Cools tip down
- Struggles with removing heavier oxidation and debris

Brass Wool

Strengths:

- Removes excess solder and debris thoroughly

Weaknesses:

- Higher solder flick risk
- Takes longer

Tip Tinner

Strengths:

- Removes the most stubborn oxidation

Weaknesses:

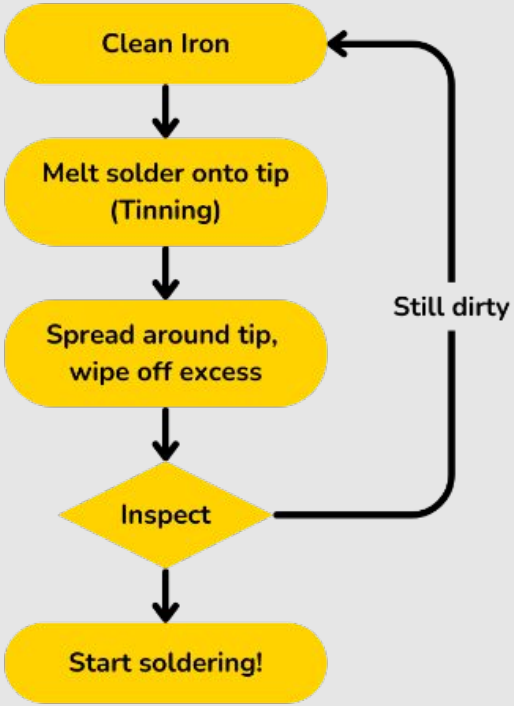
- Uses harsh chemicals
- Expensive

Tip Tinning

Coating the tip with melted solder improves heat transfer and slows oxidation.

Tip tinner is **NOT** the primary tool for tip tinning.

Cleaning and Tinning

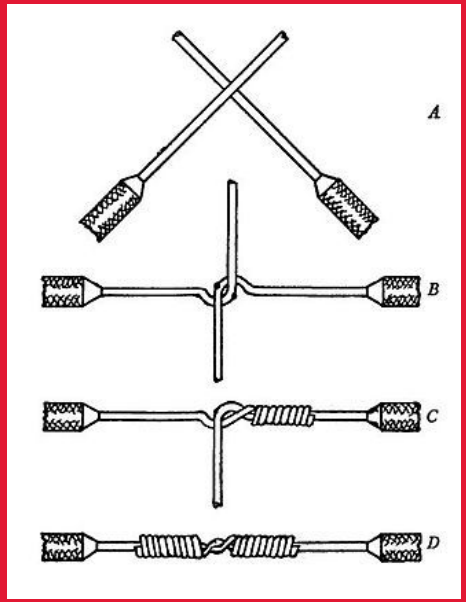


Terminology

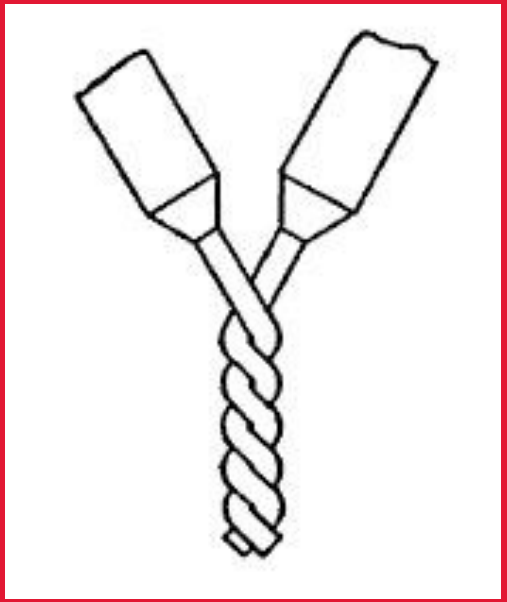
Work Piece	The entire assembly of wires to be soldered
Joint	The intended point of contact between wires
Helping Hands	Hands that help B)

Mechanical Joining

Western Union Splice



Rat Tail Splice



Using Flux

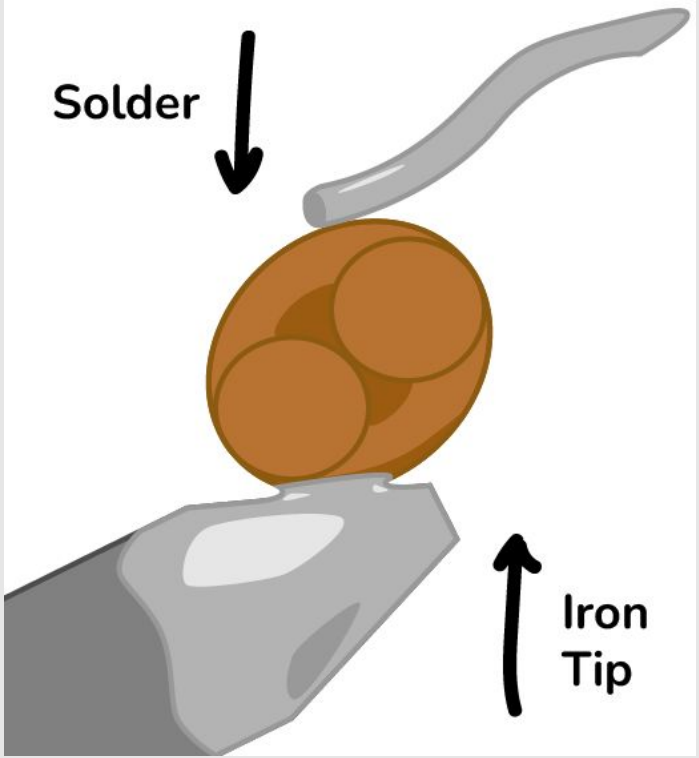
Flux is a liquid applied to joints **before soldering** with three jobs:

- To remove oxidation from joint
- Seals joint from air during heating
- Eases solder flow (“wetting”)

Heating The Joint

- **Wet** the tip by melting extra solder onto it
- Touch the iron and solder to **opposite sides** of the joint
- Heat from the **center** of the joint lengthwise

Hold still!!!



Keeping a Steady Hand

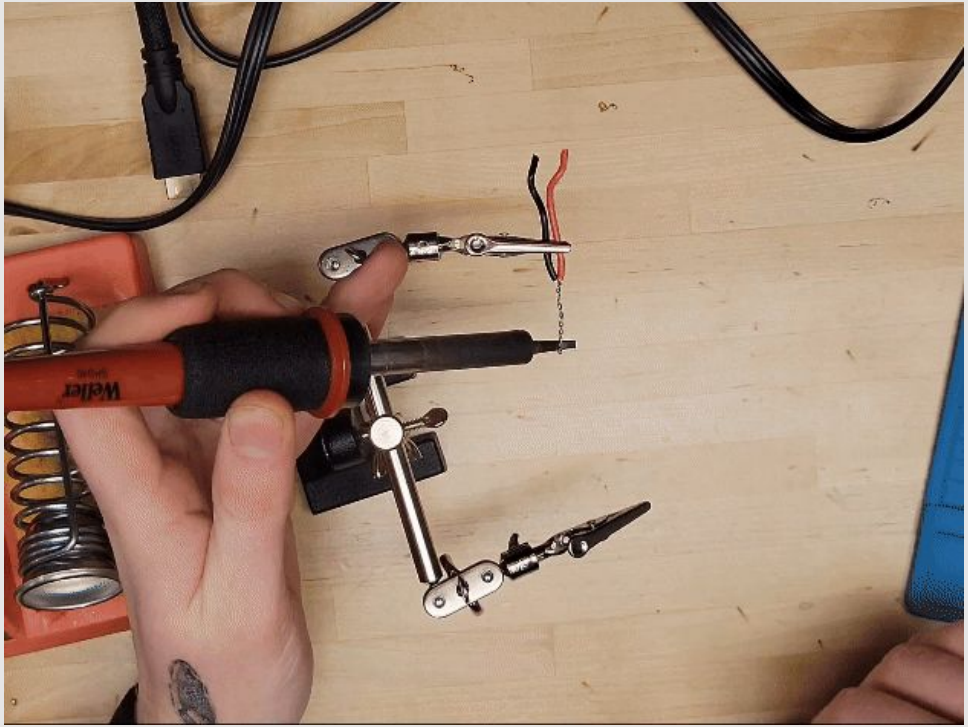
Good heat transfer demands steady contact between the iron and the joint, but many people's hands shake! What do we do??

Apply light pressure on the joint with the iron.

Steady off of the helping hands or other parts of the workpiece.

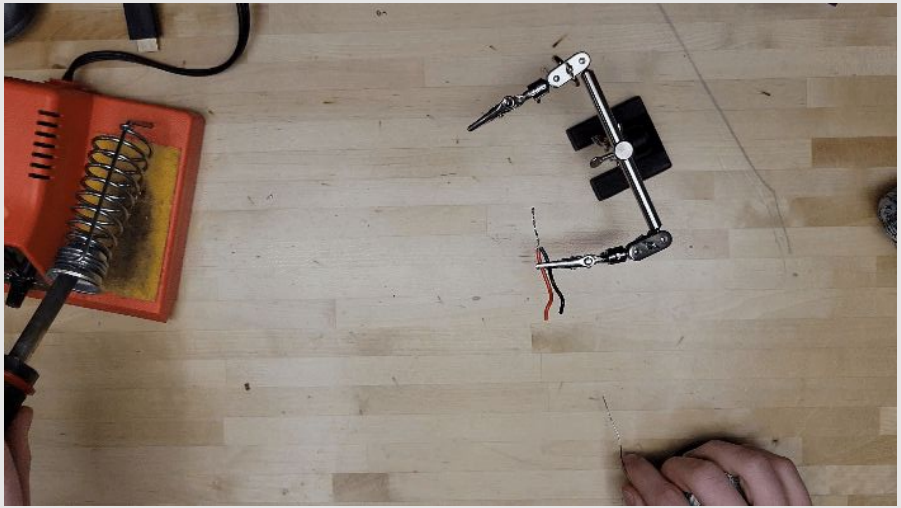
Take a deep breath! Relax your muscles as much as you can.

Keeping a Steady Hand



“The Spider” (???)

Keeping a Steady Hand



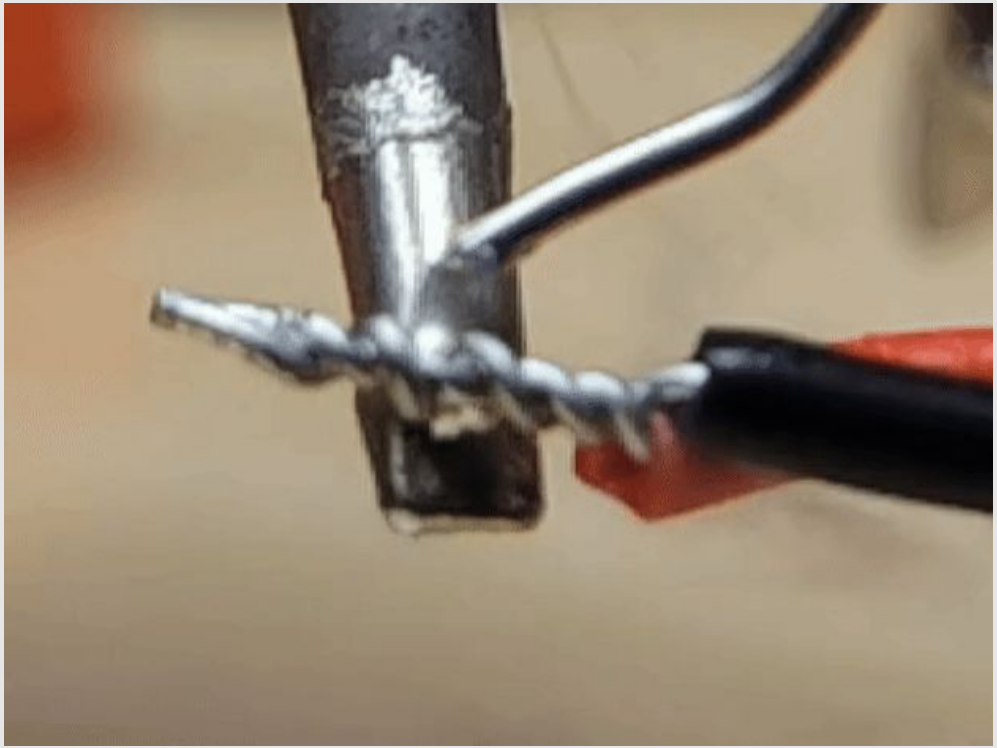
“The Seesaw”

Solder Wicking

When the solder **melts** and **flows** into the joint.

This should happen after **1-5 seconds** of heating.

Feed the melting solder wire into the joint until it stops wicking into new areas.



Enough is Enough

Only add enough solder to **coat the joint** - it's like tightly wrapping seran wrap around a churro!

Rule of thumb: **Shiny = Good Connection!**

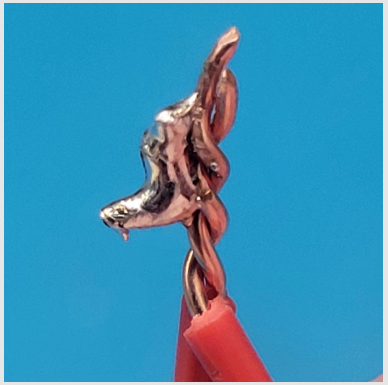
Finishing Up

Once the joint is **saturated** with solder...

- Pull the solder away **BEFORE** the iron
- Replace your iron in the holder
- Wait a couple seconds to let the joint cool

If your solder gets stuck, don't panic! Touch your iron to the solder wire to melt it off and free it.

Temperature Regulation



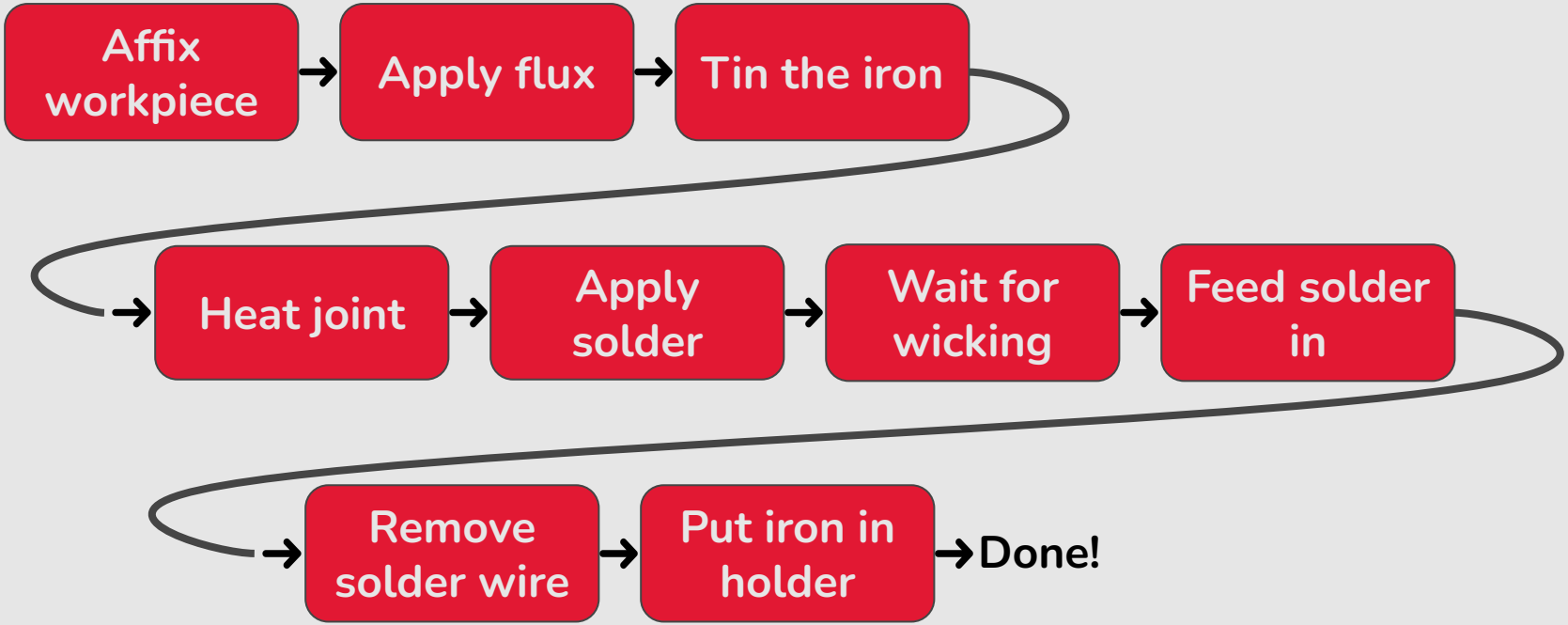
Cold Joints

- Solder gets hot enough
- Joint does NOT get hot enough

Overheated Joints

- Heat transfers to rest of workpiece
- Joint gets too hot and quickly oxidizes

Solid Core Demo!



Part 3: Stranded Soldering

Types of Wire

Stranded

Higher Resistivity
Flexible

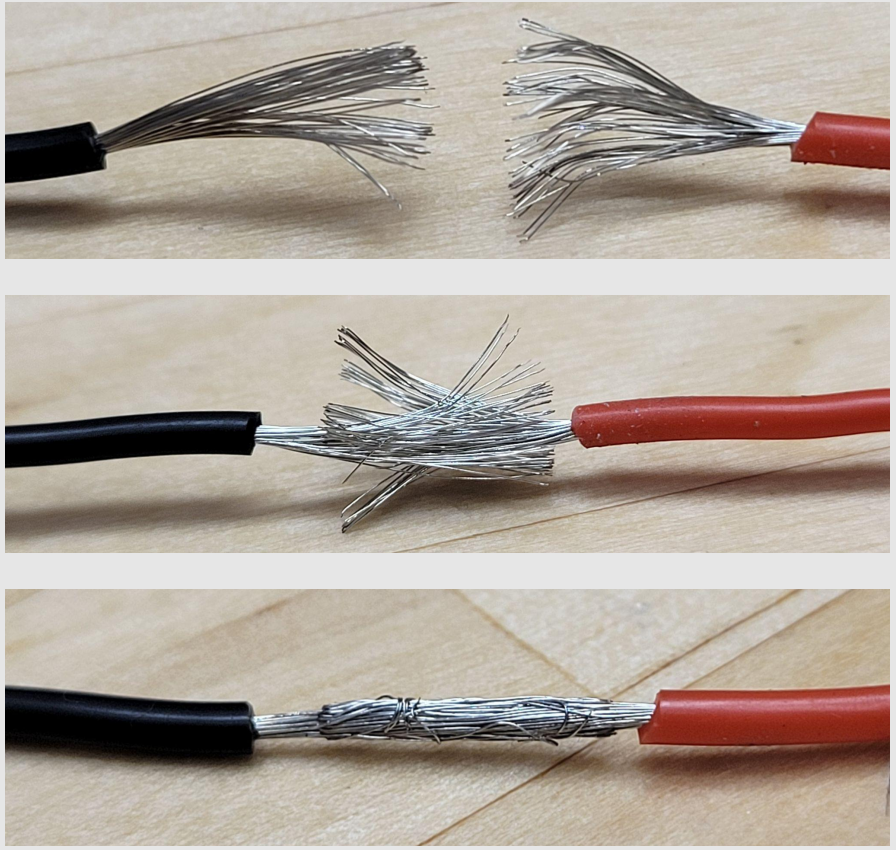
Solid-core

Lower Resistivity
Rigid

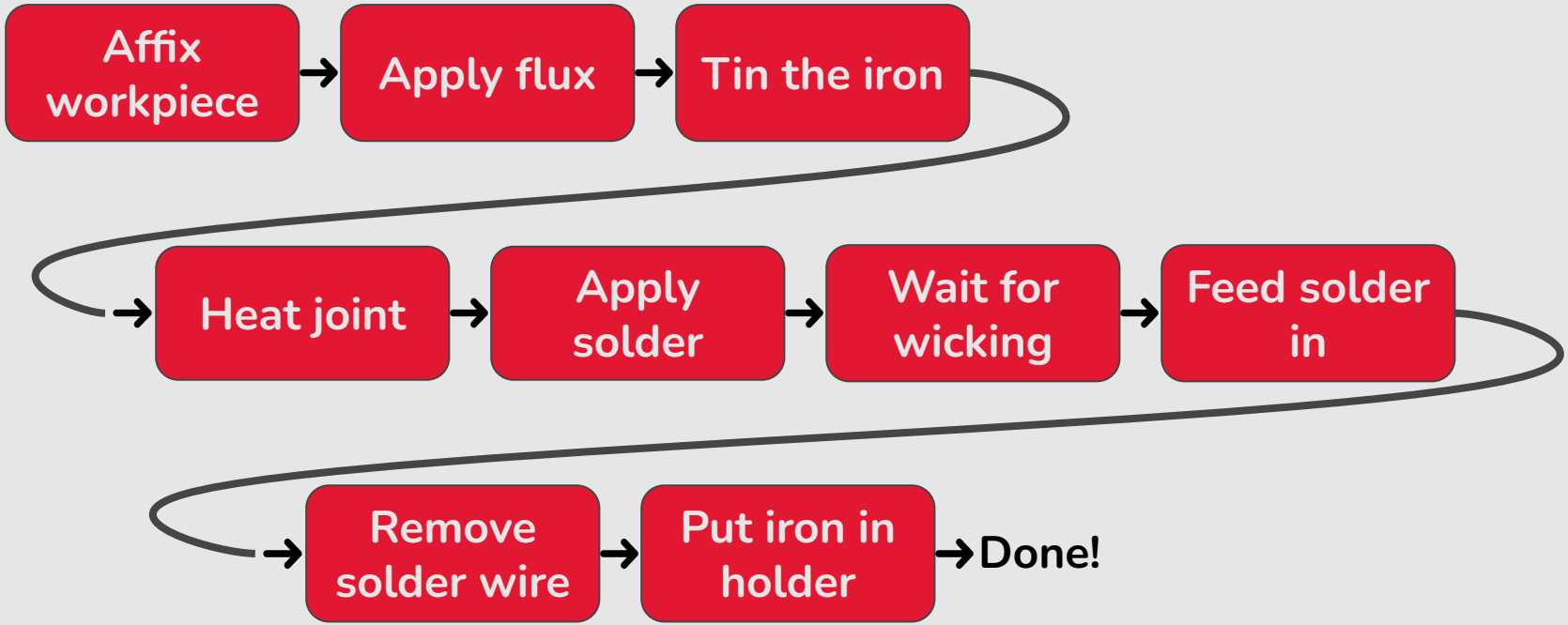
Feathering

This is an **in-line** alternative to the twist.

It is stronger than twisting for **low-gauge wires**.



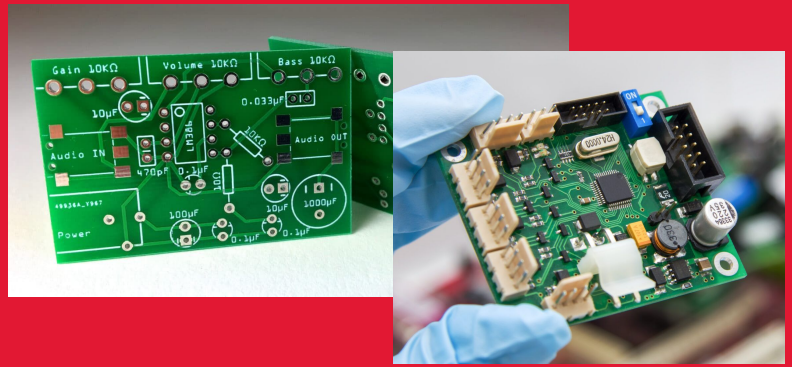
Stranded Demo!



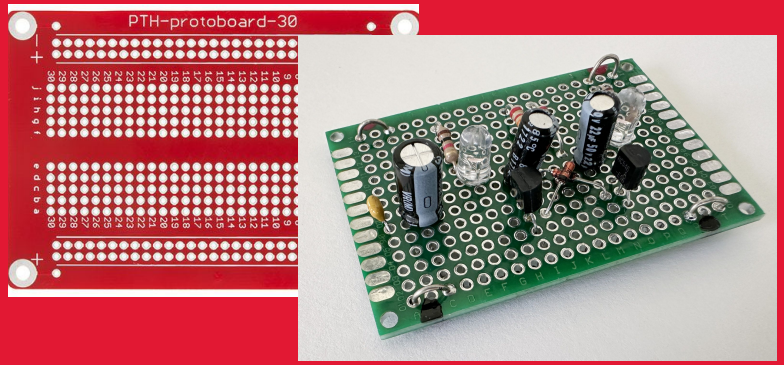
Part 4: THT (Thru-hole tech) Soldering

Circuit Boards

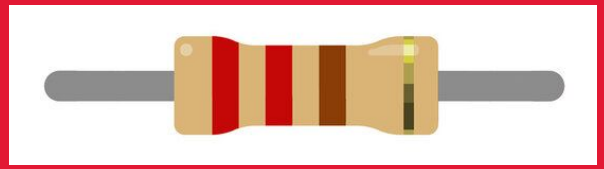
PCBs (printed circuit boards) are mass-produced to make repeatable, high-quality circuits.



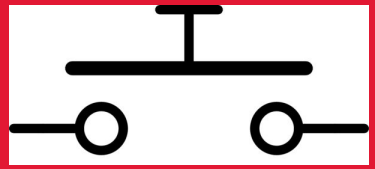
Perfboards have a generic grid of through-holes that you can build your own circuit on and are handy for prototyping.



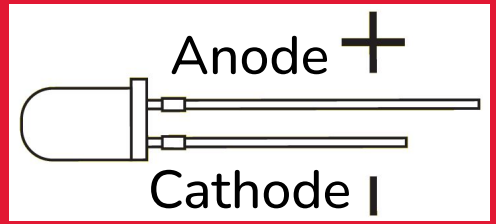
Passive Circuit Components



Resistors
Regulate electric current



Buttons
Open and close circuits

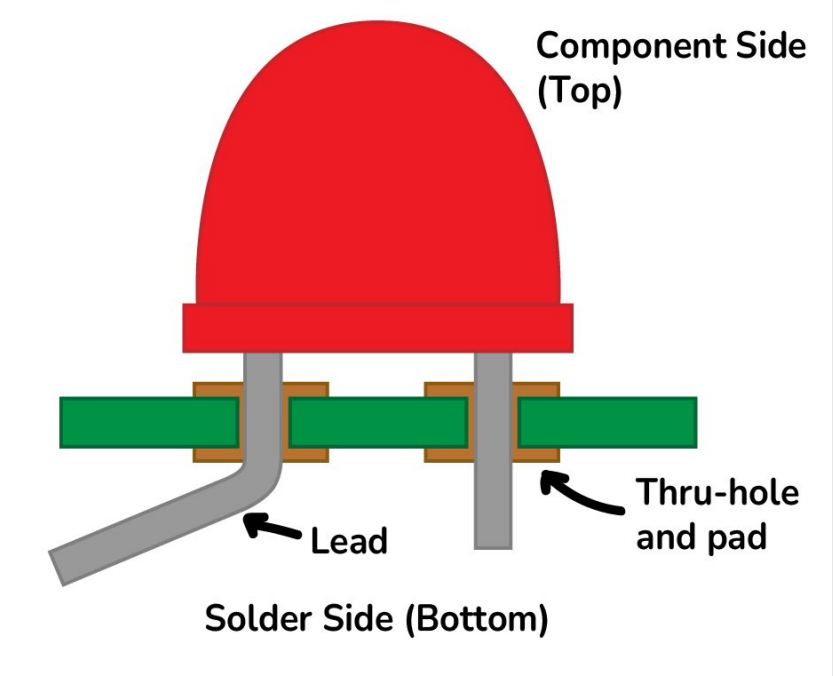


LEDs (Light Emitting Diodes)
Emit light from current flowing in ONE direction (cathode to anode)

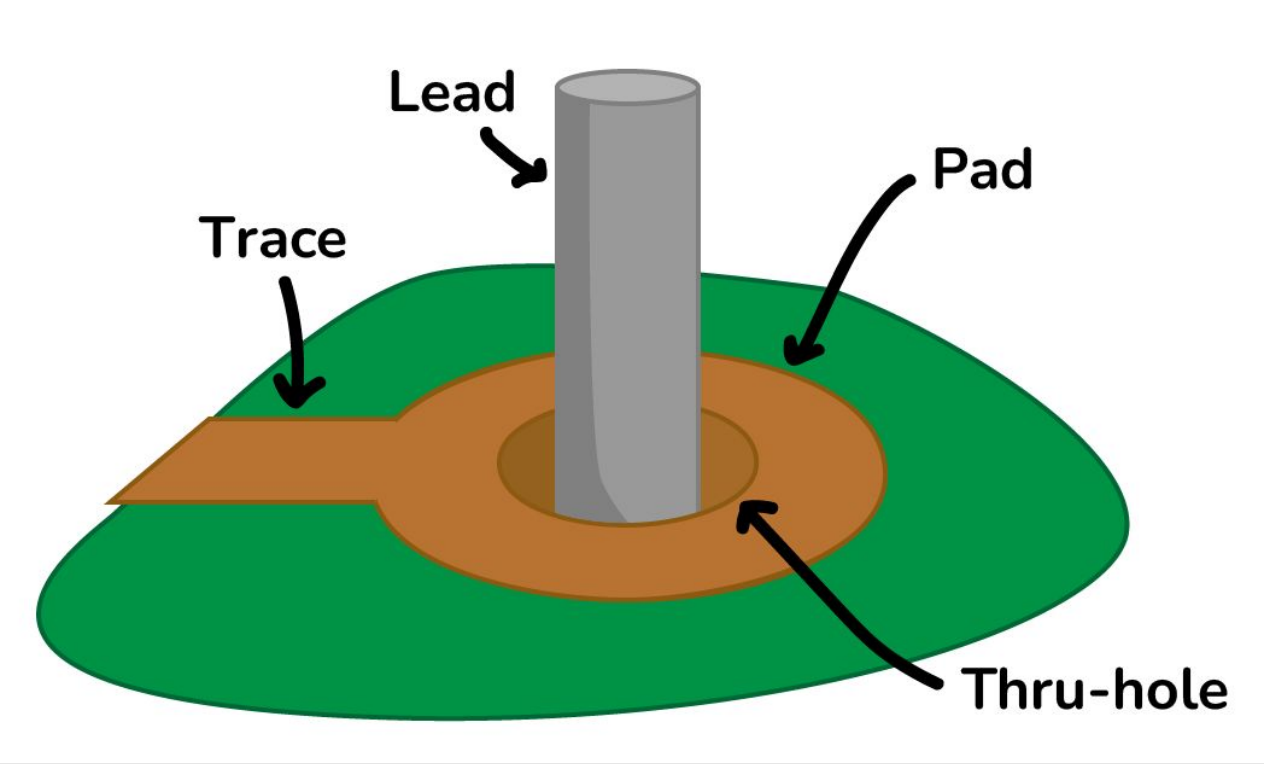
Affixing Components

Insert component leads into the circuit board’s thru-holes.

Keep the component in while soldering by **bending one lead**.

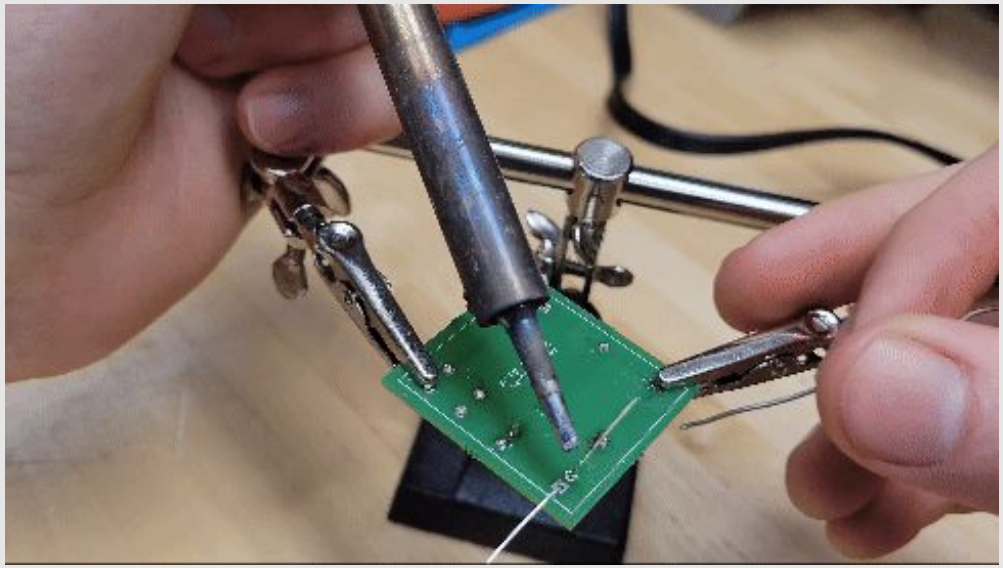


THT Joint Anatomy



Holding The Board

Hold two **opposite corners** of the board with the helping hands.

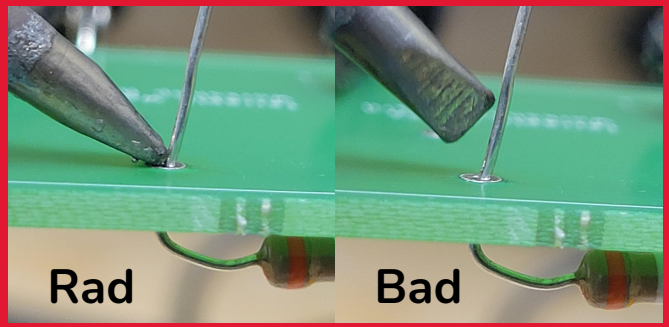


Tip: Stabilize off the board /helping hands with your pinky!

Tip Geometry

Size

Chosen based on joint size and required precision.



Orientation

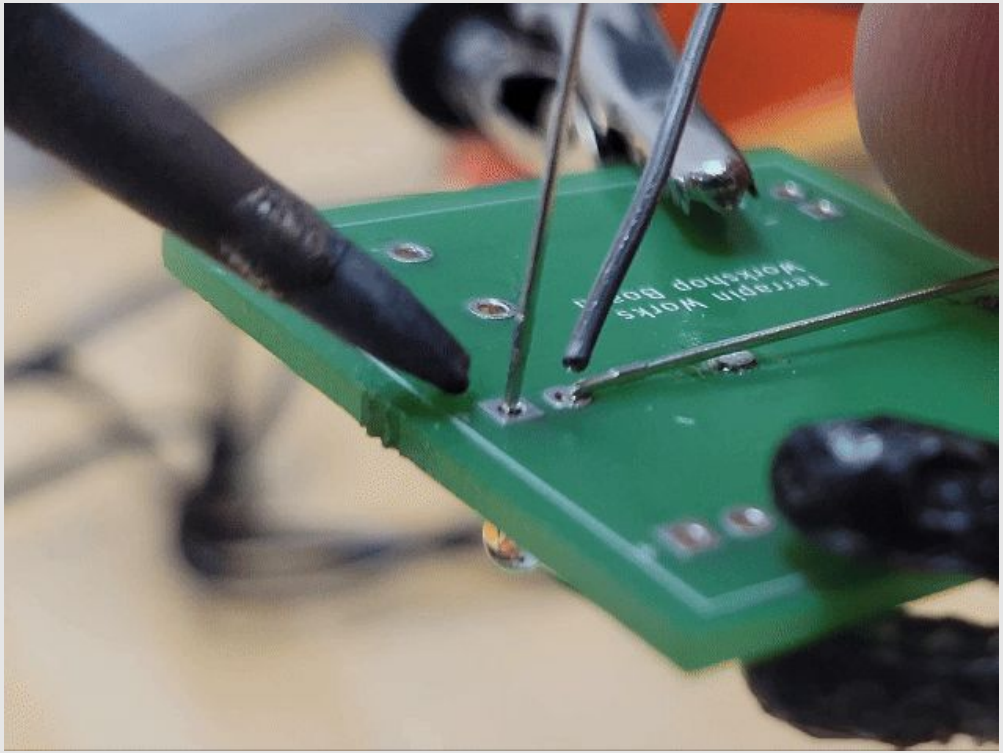
Maximize contact between the tip and ALL parts of the joint (the **pad** and the **lead**).

Heating: Timing

Because the joint is so small, it heats up **FAST!**

Heating the joint for too long causes **burning**.

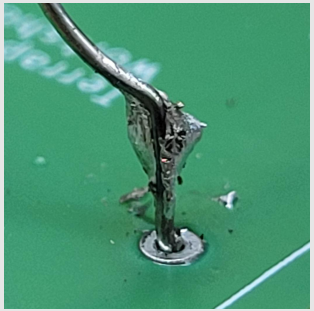
Heat time < 5s!



Mistakes

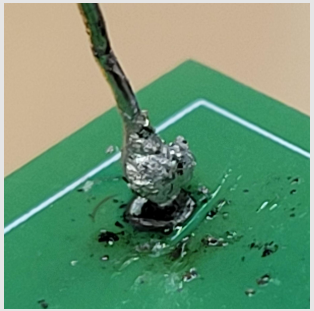
Temperature regulation is challenging in THT!

- Joints heat **faster** and less controllably
- Demands **precise** tip placement for uniform transfer



Cold

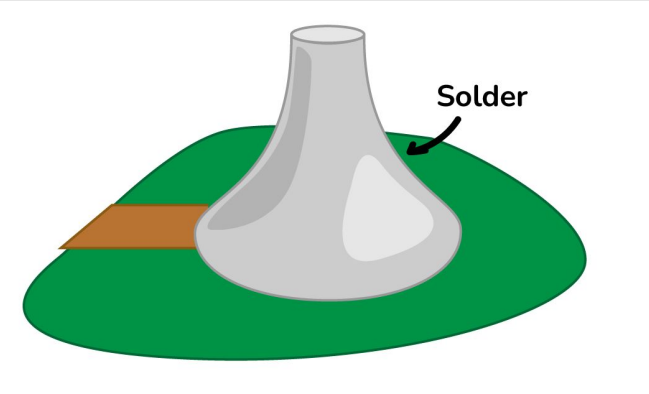
Overheated

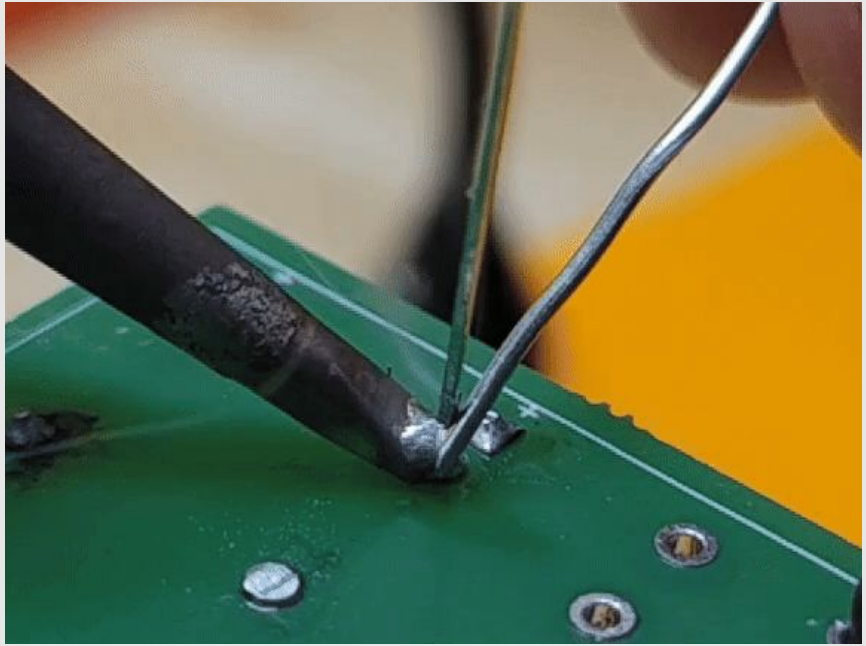


Both??

The Perfect Joint

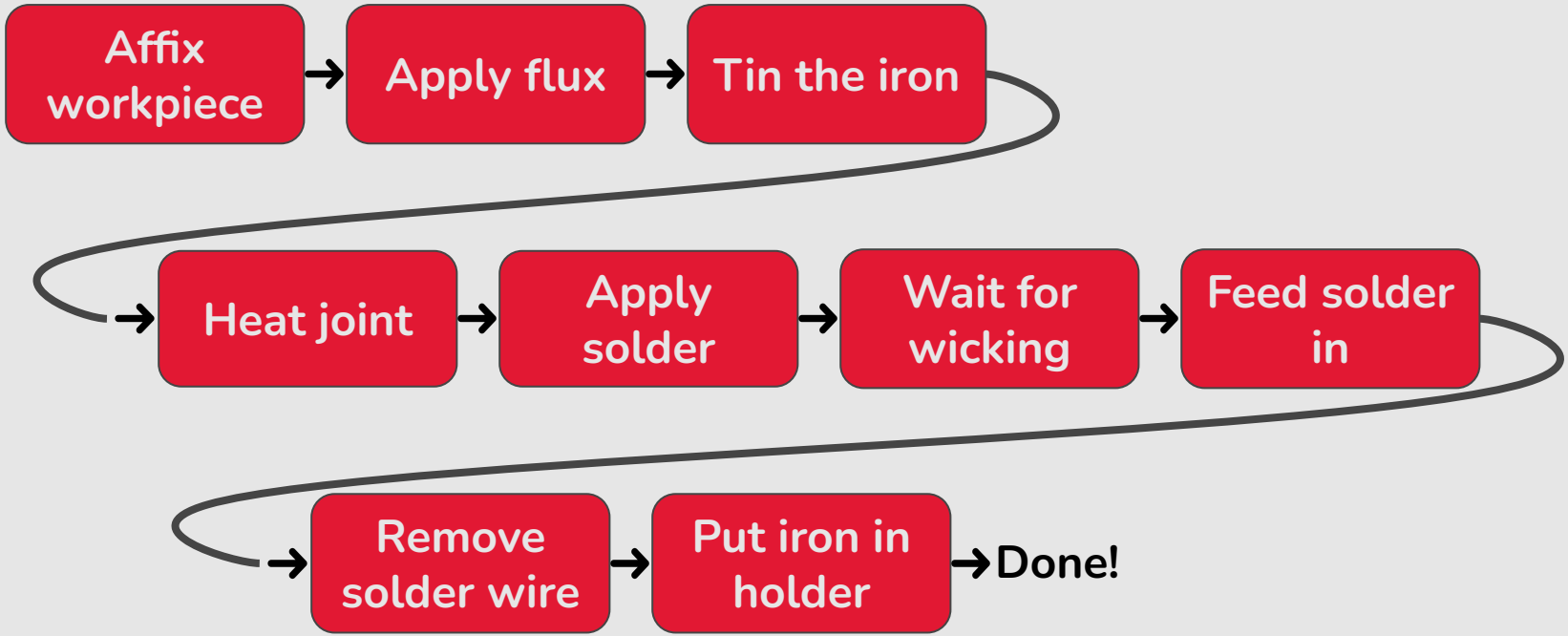
A perfect joint will look like a **shiny, silver hershey kiss**!





Tip: Drag excess solder up the lead when finishing!

THT Demo!


Affix workpiece
Apply flux
Tin the iron
Heat joint
Apply solder
Wait for wicking
Feed solder in
Remove solder wire
Put iron in holder
Done!

Part 5: Wrapping Up

Next Steps

Check our our other **introductory workshops**!

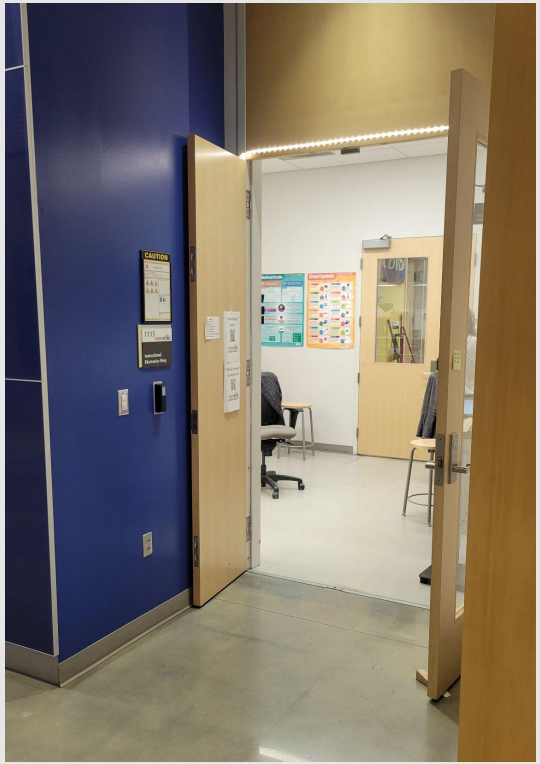
- Arduino
- Motors & Servos
- Basic Electronics
- Sensors

OR come into open lab hours and start on an **intermediate project**!

- Dorm LED controller
- Make an ADC

...and more!

Come visit the IES!



1115 AJC

Open Lab 2:00- 7:00 PM Weekdays