

Design4Practice (D4P) Program

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Re: Self Learning 2

Introduction

For the second self learning project, I learned about soldering and soldering techniques. During this, I built myself a number pad consisting of mainly through hole parts to solder. Soldering is used in nearly every product to connect battery terminals, electric components, and wires. Learning how to solder and good soldering techniques is a skill that can transfer into prototyping and small quantity projects. This memo will consist of soldering iron selection, the project made, and soldering techniques learned during the process.

Soldering Iron Selection

Soldering irons come in many different styles and range in price greatly. The most basic soldering irons consist of a cord running to the hot end with no switches or temperature control. I knew from the start that I wanted a soldering iron that could last me a long while without needing to upgrade. I also wanted to spend less than \$150 on a setup. The two main irons I considered were the TS-80 soldering iron (fig1) and the Hakko 70 Watt soldering station (fig2). The main difference between these two are the base station. The TS-80 has no base station and is smaller and more portable than the Hakko. The downside to this is having a longer heating time as well as having less of a temperature range. The Hakko has a base station that mediates the power from the wall to the hotend. Because of this, the Hakko has a better temperature range and can heat larger wires and parts compared to the TS-80. I chose the TS-80 as most projects I am doing are small scale and not at home so the portability is quite convenient and the size limitations do not restrict me much.



Figure 1: Hakko Soldering Station



Figure 2: TS-80 Soldering Iron

Project Selection

For my soldering project, I have been looking into custom mechanical keyboards recently and decided to pick something related to that. I chose to do a 4x4 macro pad from 1upkeyboards [1]. This kit includes diodes, switches, and keycaps along with the pcb for the board. The board uses a Pro Micro board to allow the keys to be programmed to anything the user wants. Building the board started with the diodes ensuring that they were in the correct orientation. after the diodes, the switches were soldered on all with through hole components. Finally, the Pro Micro was soldered on and QMK, a keyboard software, was flashed onto it. The completed board can be seen in figure 3 with an image of some solder joints seen in figure 4.



Figure 3: 4x4 Macro Pad Completed

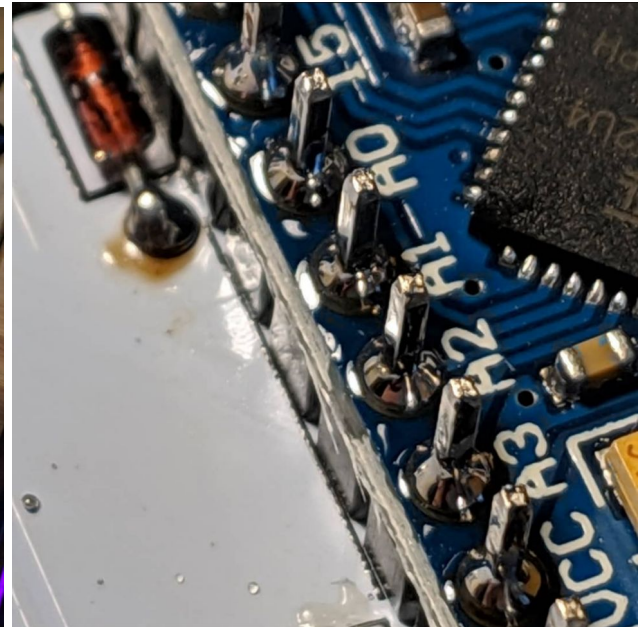


Figure 2: Solder joints on the Pro Micro

Solder Techniques

Through hole soldering is the technique used the most in this project. This is a method of soldering where the component to be soldered is pushed through a copper ringed hole and solder is applied to hold the components together. This technique is easier to do with a soldering iron compared to on board soldering where a component is applied directly to a pad on the board. Using this technique, if some basic methods are not followed, it is possible to get a poor mechanical and electrical solder connection. The most important rule of soldering is to be in and out quick ideally. If you leave the hotend on the board for too long, you risk burning the board or lifting a pad. If these happen, a new board is normally needed. The second most important rule is to heat up both components at the same time, the board and the diode. If this step isn't done, solder will only stick to the heated part and no connection will be formed. Finally, enough solder needs to be applied to create a strong mechanical and electrical connection. This amount of solder, as seen in figure 2, will create a small cone or sphere on the prongs of the piece. Following these rules, with some practice, it is quite easy to create solid mechanical and electrical connections multiple times.

Final Thoughts and Applications

Soldering is used in many projects and devices everyday. Learning such a skill can give more options in an engineering toolbox compared to simply running wires. There are many budget options for soldering irons now making it easy for anyone to pick up a kit and try their hand at it. Combining this with resources such as videos make it easy to pick up a new skill. While through hole soldering requires more space for holes to be punched and larger components, it is cheaper and easier to DIY compared to soldering directly to the board.

Given my experience with the TS-80 soldering iron, I can recommend it for those who deal with small parts and need the small form factor. If projects involve more heat or larger components, I would recommend a full soldering station to work with.

References

[1]"Sweet 16 Macro Pad - 1Up Keyboards", *1upkeyboards*, 2020. [Online]. Available:
<https://www.1upkeyboards.com/shop/keyboard-kits/macro-pads/sweet16-macro-pad-white/>.

[2][Online]. Available:
<https://www.homedepot.com/p/Hakko-70-Watt-Digital-Soldering-Station-FX888D-29BY-P/204215981#:~:text=The%20Hakko%20FX%2D888D%20is,Temperature%20stability%3A%201.8%C2%B0%20F.> [Accessed: 29- Aug- 2020].