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**Methods**:

As this lab experiment was to develop soldering skills for use throughout later labs and the design project, the main focus of the lab was to properly solder all provided components onto the board using surface mount techniques. Because there were many different parts of the device to be soldered on (the kit required resistors, capacitors, LEDs, diodes transistors, ICs, wires, and buzzers all to be soldered), the method for soldering was slightly different, although all joints did provide electrical connection to all ends of the device that required it. Components that were very close together, or had pins that were close as well (the two ICs are good examples of this) required extra care as to not leave excess solder covering multiple pins at once or bridging incorrect devices together, creating a solder short. This would result in the device either malfunctioning, or not working at all, so all joints were examined using a microscope (as soldering shorts can be any width, even microscopic) and cleaned up using solder wick. Four extra resistors were provided with the kit for extra practice before soldering on the components.

The soldering iron is first held to the pad that the first joint will be soldered onto to bring it up to temperature, facilitating the solder sticking to the pad. After a few seconds of direct contact, the solder is introduced where the tip touches the pad, melting it to the pad. Then, the surface mount device is placed next to the pad at the contact, the solder at the first pad is melted once again, and the device is placed using tweezers or the roll of solder itself while the solder is still hot. When the component is in place, the solder is allowed to re-solidify again. Solder is added to the other joint(s) in the same way it was added to the first, but without needing to move the component. For soldering the two ICs, electrolytic capacitors, LEDs, and diodes, orientation is important, and is labelled in the manual. If the orientation is incorrect, it can result in the SM-200 malfunctioning, not working, or even being damaged. For the ICs, as they both had multiple pins, the orientation was found (which initially resulted in installing them backwards and needing to de-solder and turn them around), and solder was applied to pin 1 and the pin at the opposite corner to ensure it would not move (similarly to other SMD components).

The ICs were then soldered on similarly to the rest of the components, taking very special care the precision required with amount of solder; too much solder could result in pins being bridged (almost always requiring soldering wick to remove the excess), and too little solder could leave a pin “floating,” or not connected at all to the pad.

The wires (battery snap) and buzzer were the final parts to be soldered on, with very large spaces given on the left-hand side of the board. Because the pads for the snap were so large, a more generous amount of solder was used to ensure the wires wouldn’t snap off, and the buzzer similarly received slightly more solder than the other components. Although the red wire that connects from the buzzer to the board was surprisingly difficult to solder on (and too much solder was used), the buzzer did in fact work after the wire was connected.

**Conclusion**:

This lab was designed to be a relatively simple introduction to the class, focusing on soldering various surface mount devices to a board and ensuring the finished system works. The lab was run by test driven design, providing experience in using testing procedures for better understanding on how the finished device will actually work as opposed to building first and troubleshooting from there with no prior reinforcement. As scenarios not described in the manual arose, problem solving became more important than ever, forcing the team to make educated decisions on how to get the system working. This lab provided the fundamentals of creating an embedded system even though the finished product was a far cry from something like a climate control device.