



# SOLDERING

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## Abstract

In this SOP, the principle of operation of electrical soldering and the comparison of Surface Mount Technology and Through Hole Technology are discussed. The available soldering equipment at the lab and working procedure are documented.

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<sup>1</sup> Footnote 1 etc.

<sup>2</sup> Footnote 2 etc.

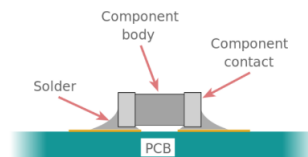
# 1 Electrical Soldering Principle of Operation

## 1.1 Definition of Electrical Soldering [1]

Electrical soldering is a technique that connects two or more electrical components using solder, it is commonly used to connect electronic components to a circuit board. The solder is made of tin, lead, cadmium, zinc and indium, forming strong electrical bonds between the electronic components.[5]

## 1.2 Surface Mount Technology (SMT) [2]

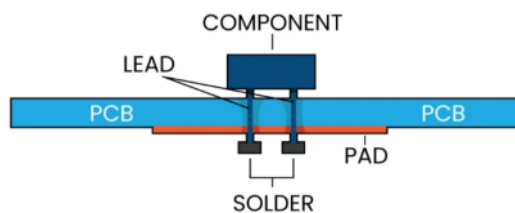
Surface mount technology was created due to the high costs and difficulties with fitting the electronic components' leads through the holes on the circuit board. Since it is not necessary for the components' leads to pass through the circuit board holes, surface mount technology is widely used for printed circuit board (PCB) assembly, it allows the SMT components to be designed smaller, which reduces the cost of materials and time.



The advantages of surface mount technology include low spurious capacitance and inductance, lower power ratings, and creating smaller/more dense circuits. These advantages allow the technologies to adapt quickly with more capabilities.

## 1.3 Through Hole Technology(THT) [3]

Through hole technology refers to connecting the pin-through hole electronic components to the printed circuit boards by mounting the leads of the components to the opposite side of the holes.



## 1.4 SMT vs. THT

**Table 1.**[\[6\]](#)

SMT	Versus	THT
Low power	Board Application	High power
May fail in high stress	Environment	Good for high stress
Less expensive at scale	Manufacturing Cost	More expansive in general
Prototyping or production	Development Level	Proof of concept or prototyping
Double sided, small	Board Layout Area	Single-sided, large

Based on the characteristics of surface mount technology and through hole technology, decisions regarding which technology to use could be made. For example, through hole technology will be ideal for military grade PCB or critical system design that has physical and thermal requirements, and surface mount technology will be ideal for tiny consumer electronics devices with a limited cost.

## 2 Electrical Soldering Tools

### 2.1 Types of Solder

The three main types of solders are lead based solder, lead free solder, and flux core solder. The different types/ratios of metals that make up the solder result in different melting points and bonding strength.

**Table 2. Comparison between Solders**[\[3\]](#) [\[7\]](#) [\[8\]](#)

Lead Based Solder	Lead Free Solder	Flux Core Solder
<u>Base components:</u> lead + tin  <u>Melting point:</u> 180-190°C  <ul style="list-style-type: none"> <li>- Shock resistant</li> <li>- Flow well</li> <li>- The lead eliminates tin whiskers</li> <li>- Creates environmental hazards and health hazards</li> </ul>	<u>Base components:</u> copper + tin + silver + nickel + zinc + bismuth + antimony  <u>Melting point:</u> 217°C  <ul style="list-style-type: none"> <li>- Requires proper board layout and imperative component selection to prevent damage to electronic components</li> <li>- Better for the environment and human body compared to lead based solder</li> <li>- The cost increases as the concentration of tin increase</li> </ul>	<u>Base components:</u> metals + flux (typically rosin)  <u>Melting point:</u> 183°C  <ul style="list-style-type: none"> <li>- May contain lead depending on the product itself</li> <li>- Allows for cleaner electrical connection</li> <li>- The flux reduces metal oxidation and promotes the formation of electrical bonds</li> </ul>

## 2.2 Types of Soldering Iron [4]

The different types of soldering helps to perform different tasks with varied size and temperature. The common types of soldering iron are regulated soldering stations, simple regulated soldering irons, and simple unregulated soldering irons. The regulated soldering stations offer a large variety of interchangeable tips and a wide range of temperatures. The regulated soldering irons have adjustable knobs to adjust temperatures. However, due to their lack of flexibility with the shape of the tips, it is not ideal for complex tasks. The unregulated soldering irons are cheap and effective. However, due to its lack of flexibility with changing tips and temperatures, it is not widely used for beginners or to complete complex tasks.

## 3 Electrical Soldering in CaYPT Lab

The CaYPT lab operates Lytool BK71 Soldering Station along with YAETEK 493 Smoke Absorber and Alpha NRG+ 60Sn/40Pb lead solder.

User Manual: [how to use soldering iron](#)

Soldering Station Order link: [Amazon Link](#)

Smoke Absorber Order Link: [Absorber Order Link](#)

Solder Order Link: [Amazon Order Link](#)

## 4 General Procedure of Operation

**Soldering Station [9] :**

1. Prepare all material needed.
2. Select a suitable tip for the soldering project.

3. Heat up the soldering station to a selected temperature.
4. Tin the soldering iron tip with solder.
5. Melt the solder and connect the electrical components.

**Precaution :**

1. Wear Proper PPEs.
2. Do not use sold with acid unless specifically directed.
3. Place the Soldering iron back to the station stand immediately after using it.
4. Hold small electronics piece with clamps.

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