

## **PCBs AND SOLDERING**

This mobile revision pdf is based on detailed work found in the PCB section of the website.

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# PCBs AND SOLDERING

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CIRCUIT BOARDS?

2. DESIGNING A CIRCUIT

3. MANUFACTURING  
PRINTED CIRCUIT BOARDS

4. ADDING COMPONENTS  
TO THE PCB

5. INDUSTRIAL  
PRODUCTION OF PCBs

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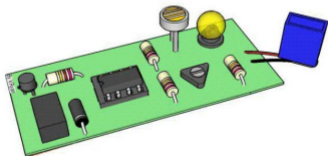
7. VIDEO – SOLDERING  
A PCB

# WHAT ARE PRINTED CIRCUIT BOARDS?

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Electronic circuits in schools and industry are normally manufactured through the use of PCBs (Printed Circuit Boards). The boards are made from glass reinforced plastic with copper tracks in the place of wires. Components are fixed in position by drilling holes through the board, locating the components and then soldering them in place. The copper tracks link the components together forming a circuit.

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COMPONENT SIDE



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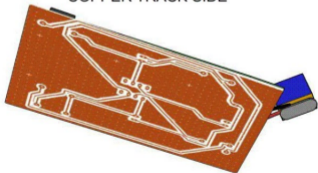
# WHAT ARE PRINTED CIRCUIT BOARDS?

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The diagram below shows the underneath of the PCB. The copper tracks join the components, forming the 'electrical' circuit.

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COPPER TRACK SIDE



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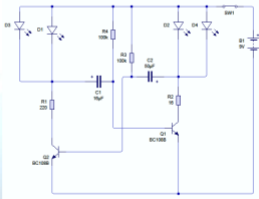


# DESIGNING A CIRCUIT

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A circuit such as the one shown below, can be drawn using software such as 'Circuit Wizard' or 'Yenka'. This allows individual components such as resistors, integrated circuits and capacitors to be dragged onto the computer screen and connected together, forming a complete circuit. The finished circuit can then be simulated on screen. If the circuit is not correct it can be altered until it works in the desired way.

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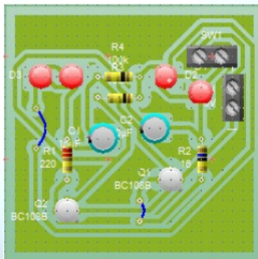


# DESIGNING A CIRCUIT

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Once a circuit has been designed and simulated by the software, the completed circuit is converted to a PCB layout. The software (Circuit Wizard or Yenka) automatically arranges the components, producing an efficient layout.

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# DESIGNING A CIRCUIT

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The circuit layout is converted to an 'artwork' layout. It is printed on a transparency and becomes known as a PCB mask and is ready for the manufacture of the PCB

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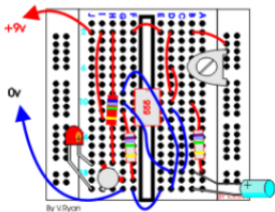


# DESIGNING A CIRCUIT

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Circuits can also be built on a breadboard using real components. This is a time consuming method and often mistakes occur as many components are small and it is easy to connect components incorrectly, causing a circuit to fail. Also, breadboards are prone to damage as the small connections on the boards are quite delicate.

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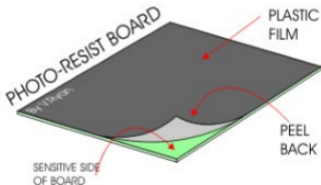


# MANUFACTURING PRINTED CIRCUIT BOARDS

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PHOTO-RESIST BOARD is a piece of glass reinforce plastic. One of the sides is copper clad and this copper has a photosensitive coating. When the plastic film is peeled back this sensitive coating is revealed.  
After processing this will be the PCB

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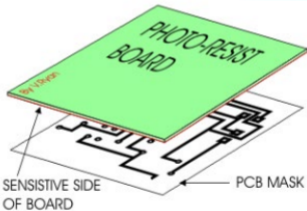


# MANUFACTURING PRINTED CIRCUIT BOARDS

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The PCB mask (now on a transparency) is placed underneath the photo-resist board, touching the sensitive surface. Remember the plastic film must be removed. PCB mask and board are then transferred to the UV light Box.

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# MANUFACTURING PRINTED CIRCUIT BOARDS

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The lid is shut and the box switched on.  
The photo-resist board, with PCB mask  
are left underneath the lid for 2 ½  
minutes.

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# MANUFACTURING PRINTED CIRCUIT BOARDS

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The photo-resist board is then placed in a tank filled with developer (using plastic tongs). It is important that the board is only left in the developer for approximately ten seconds. When the board is taken out of the developer it must be washed in clean water.

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an exercise



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# MANUFACTURING PRINTED CIRCUIT BOARDS

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The etchant is held in a 'bubble etch tank' and is heated. This solution slowly etches away the unwanted copper, leaving the tracks only. At this stage it is important to keep checking that the PCB is completed (time - 15 to 45 minutes). If it is left in the tank too long the copper tracks will also be removed or damaged.

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information / an  
exercise



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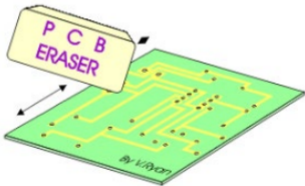


# ADDING COMPONENTS TO THE PCB

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When removed from the etching solution, the PCB is washed and a PCB eraser is used to remove any film from the tracks. This must be done carefully because the film will prevent good soldering of the components to the PCB. The tracks can be checked using a magnifying glass. If there are gaps in the tracks, sometimes they can be repaired using wire but usually a new PCB has to be etched.

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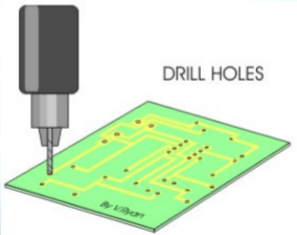
# ADDING COMPONENTS TO THE PCB

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The last stage is drilling the holes for the components. A small PCB drill is used for this purpose.

Again care is needed as a good PCB can be ruined by careless drilling.

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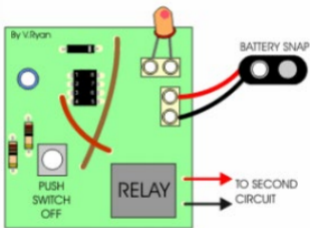
# ADDING COMPONENTS TO THE PCB

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This completed Printed Circuit Board (PCB) has all its components soldered in position.

It has been manufactured through the processes described in the information sheets.

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# INDUSTRIAL WAVE SOLDERING

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Wave soldering of circuits / PCBs (Printed Circuit Boards), is an industrial mass production process, capable of soldering high numbers of circuit boards in a short time. It also produces a high standard of solder joint, which results in a reliable, working circuit.

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## FLUX APPLICATION

'Mist' of flux sprayed by flux applicator.



## HEATING ELEMENT

Temperature of the underneath, of the circuit board raised to the optimum soldering temperature.



## SOLDER - WAVE TANK

Circuit board moves through solder wave tank, resulting in the application of molten solder to the component pins and the circuit board tracks, producing an effective, permanent, conductive joint.



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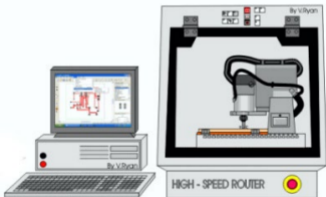
# MANUFACTURE OF PCBs

## CNC MACHINES

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PCBs can be cut to shape on a CNC router. The router below is similar in size to existing machines that are used to manufacture PCBs. They are safe to use because the waste produced can quite simply be brushed up and thrown away in a normal dust bin. This is because copper clad board is used instead of photo-resist board. Chemicals are not needed.

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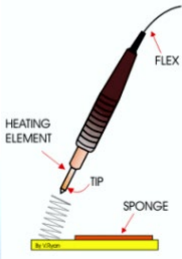


# SOLDERING

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1. Use a soldering iron in good condition. Inspect the tip to make sure that it is not past good operation. If it looks in bad condition it will not help you solder a good joint. The shape of the tip may vary from one soldering iron to the next but generally they should look clean and not burnt.

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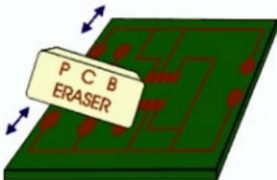


# SOLDERING

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2. A PCB eraser is used to remove any film from the tracks. This must be done carefully because the film will prevent good soldering of the components to the PCB. The tracks can be checked using a magnifying glass. If there are gaps in the tracks, sometimes they can be repaired using wire but usually a new PCB has to be etched.

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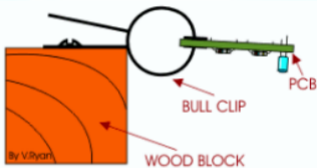


# SOLDERING

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3. Place the PCB, with its components in position, in the bull clip. This will steady the PCB when you try to use the soldering iron.

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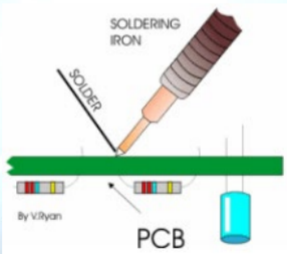


# SOLDERING

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4. The heated soldering iron should then be placed in contact with the track and the component and allowed to heat them up. Once they are heated the solder can be applied. The solder should flow through and around the component and the track

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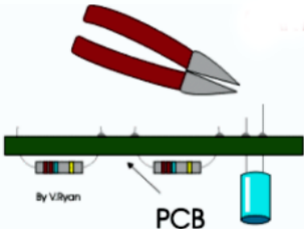


# SOLDERING

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5. Having completed soldering the circuit the extended legs on the components need to be trimmed using wire clippers. The circuit is now ready for testing.

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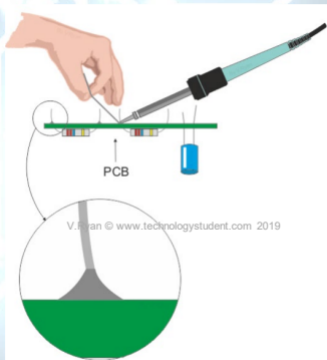
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**Tap the image** for much more detail on soldering, including good and bad soldering joints AND an exercise



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**Tap the image** for a video on soldering a PCB

## SOLDERING COMPONENTS TO A PCB



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