

## Unit R114 – Simulate, construct and test electronic circuits

### Practical safe PCB manufacture

#### *Instructions and answers for teachers*

*These instructions should accompany the OCR resource ‘Practical safe PCB manufacture’ activity which supports OCR Cambridge Nationals in Engineering.*



#### **The Activity:**

This resource comprises of 1 task.



*This activity offers an opportunity for maths skills development.*

#### **Associated materials:**

'Practical safe PCB manufacture' activity sheet

#### **Suggested timings:**

**Tasks 1:** 1 hour

## **Task 1 – Charging a capacitor in series with a resistor**

The purpose of this activity is to give learners an opportunity to investigate different methods available for manufacturing printed circuit boards (PCBs). It is expected that this will form an introduction to the processes involved, and that learners will then have the opportunity, with teacher guidance, to practice one or some of these with their own circuit board design layout.

Learners have been provided with internet video sources showing examples of each of the main methods of PCB manufacture in action: photo-resist, etch resist and milling/engraving.

Photo-resist method:

<http://www.youtube.com/watch?v=tWnfnt2rNO0>

Etch resist method:

<http://www.youtube.com/watch?v=rvpUp7-dwh8>

Milling/engraving method:

[http://www.youtube.com/watch?v=w4Ypo\\_4zHvo](http://www.youtube.com/watch?v=w4Ypo_4zHvo)

The teacher might get learners to research these individually or in pairs, or could use these or similar as part of a group discussion.

Teachers and learners might use any other sources available to investigate each of the methods, or concentrate on one particular method in more detail if that is the method they will use practically.

The teacher might wish, however, for learners to have an appreciation of all of the different methods available.

As supplementary activities, teachers could ask learners to compare the advantages and disadvantages of each method, and to consider the associated health and safety issues involved with each.

	<b>Photo resist method</b>	<b>Etch resist method</b>	<b>Milling/engraving method</b>
Explain how it is done:	<ul style="list-style-type: none"> <li>• Perhaps the most common method</li> <li>• Circuit board has a substrate, a copper layer and a photo-resist layer (sensitive to light)</li> <li>• PCB design (track design) is printed onto clear film</li> <li>• Film (with design) is placed in contact with photo-resist layer of PCB</li> <li>• PCB is exposed to UltraViolet (UV) light (or even normal fluorescent light)</li> <li>• PCB is then 'developed' in chemical leaving an image of the design on the PCB</li> <li>• PCB then etched (usually with Ferric Chloride) – which leaves copper where image of design is (resistant to etching) but removes other areas of copper</li> <li>• PCB then cleaned and drilled ready for soldering of components</li> </ul>	<ul style="list-style-type: none"> <li>• PCB is not sensitive to light in this case</li> <li>• Design is transferred directly to the copper layer of the PCB</li> <li>• Methods of transferring design include printing directly onto PCB, using a printed transfer or even drawing on PCB with an etch-resist pen</li> <li>• Printed designs and transfers also use an etch resistant ink</li> <li>• PCB is etched (usually using Ferric Chloride) – which leaves copper where the design is (etch resistant) and removes copper from other areas</li> <li>• PCB then cleaned and drilled ready for soldering of components</li> </ul>	<ul style="list-style-type: none"> <li>• This method does not involve the use of a printed design at all</li> <li>• Data from the PCB design package is sent to a computer-controlled milling or engraving machine</li> <li>• The PCB is firmly clamped in place</li> <li>• Copper is removed from the PCB by milling or engraving to leave the finished PCB design</li> <li>• For simple designs the milling or engraving could be done manually</li> <li>• There are no etching chemicals involved with this method</li> <li>• PCB then cleaned and drilled ready for soldering of components</li> </ul>

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**OCR Resources: *the small print***

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