

Wiring for an Intercom...

Look at the engineering drawings at the end of this assignment. You're going to write a production plan and make a prototype of the printed circuit board (pcb) for an intercom system. You're then going to think about the manufacturing process required to mass-produce the pcb.

Plan of action

You need to draw up a plan for manufacturing a prototype pcb. The plan - called a production plan - should map out all the things you need to think about and the steps you'll take in making the prototype.

Your plan should include information about:

- Materials, parts and components to be used. You'll have to think about the properties each material, part or component must have. For example, does it have to have a particular type of strength? Does it need to be treated by heat or chemicals? Will it have a surface finish applied?
- Processes to be used. For example, you should think about how materials and components will be cut, joined, manipulated, shaped and finished. You need to consider both functional reasons for using processes (for example, you may apply a surface finish to provide protection against the elements) and aesthetic reasons for using processes (for example, you may apply a surface finish to make the product look better). Also, joints may be visible, or they may be hidden.
- Tools, equipment and machinery to be used. You have to select the appropriate tools for the job. This might depend upon their ease of use, availability and cost.
- The sequence of production including critical production and quality control points. This is, arguably, the most crucial aspect of your plan. When you know what 'bits' you'll use, and how you'll use them, you have to work out the order in which you're going to do everything. For example, will you apply your finishes before joining components, or after? Will you make one section in its entirety before starting another section?
- Production scheduling including realistic deadlines. You've decided on a sequence of production, but how long do you think it will take? Make sure you're realistic - it's all too easy to say you'll have something done in a week, before realizing the job will take a fortnight! You may want to do trial runs for bits of the schedule. For example, test how long it takes to cut materials.
- How quality will be checked and inspected. At various stages of production you should conduct tests. For example, you need to be sure things are working the way they should, components are joined securely and the timescales are being followed (you wouldn't want to miss your deadline!). You also need to make sure measurements are checked, so components will fit together properly.
- Health and safety factors. These include:
 - Carrying out risk assessments for all aspects of the production plan;

- Wearing appropriate eye protection and protective clothing;
- Following appropriate health and safety procedures and instructions when tools and equipment are used;
- Making sure tools, equipment and machinery are well maintained, stored correctly and fit for use;

In short, make sure you keep a safe, clean and tidy workplace.

To help with the production plan you could conduct research using a number of resources, such as the internet for information about intercoms and electronic circuitry, or data bases to find out about properties of materials. You may also want to conduct tests on some possible materials.

One way of displaying the information would be a flowchart. These show the plan in a chronological order.

Now make it

When the production plan's been drawn up, check it with your teacher. Once you've been given the go-ahead, make your prototype. Provided your production plan is thorough, you should have your own "step-by-step" instructions telling you how to do this!

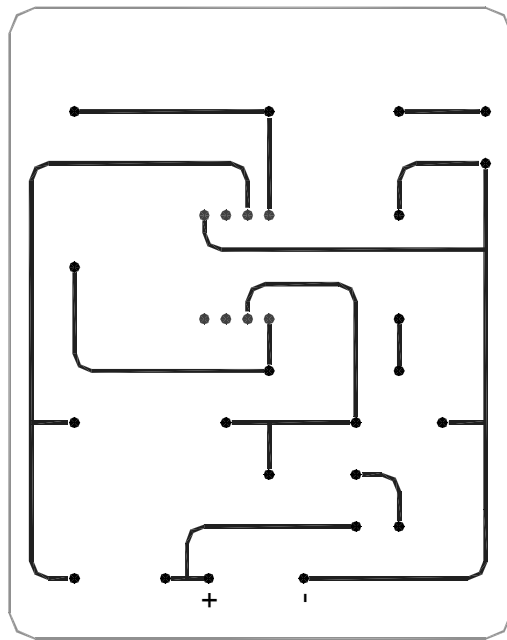
We need more!

You've made a prototype pcb. But if you wanted to manufacture lots of pcbs, the process is likely to be different. Think about the differences and draw up a new production plan. The new plan should be for the mass-production of your pcb.

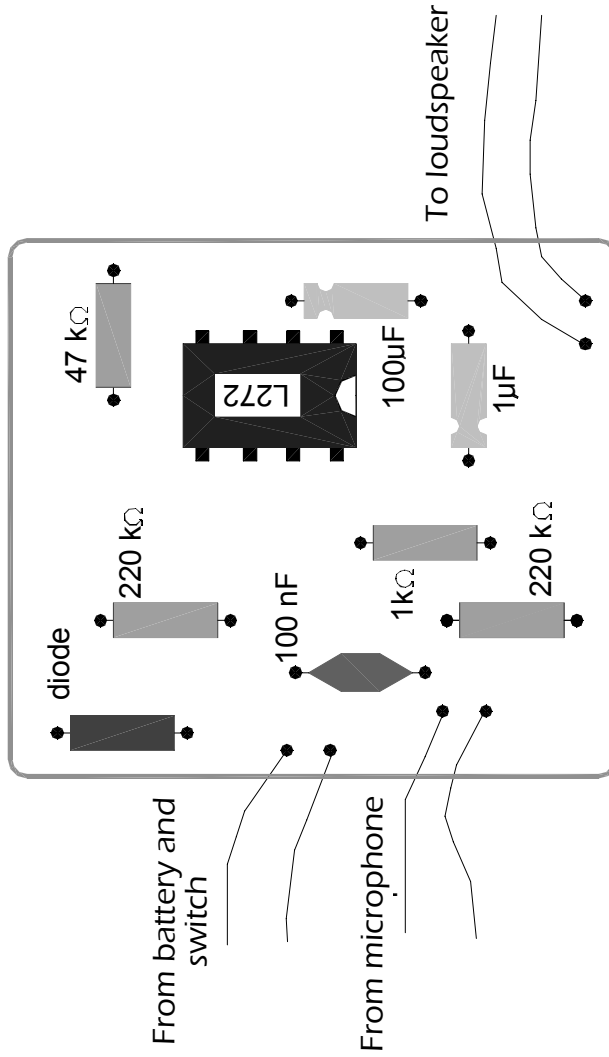
The following points highlight some of the things you may want to consider:

- How many pcbs should be made in each batch? This may depend upon time and cost; how many pcbs would you have to make to significantly decrease the cost of one pcb?
- Could you automate any of the processes? For example, could you use a conveyor belt system that moves parts of your product?
- How could CAM be used to improve the process? For example, could it be used to program machines so they automatically cut materials to a certain size?
- What different safety issues would you need to consider? For example, in mass-production you may use machine-operated tools (as opposed to human-operated), which would require different safety checks.
- Are there better ways of testing the product? Perhaps you'll conduct checks at different stages in mass-production.

pcb mask and components

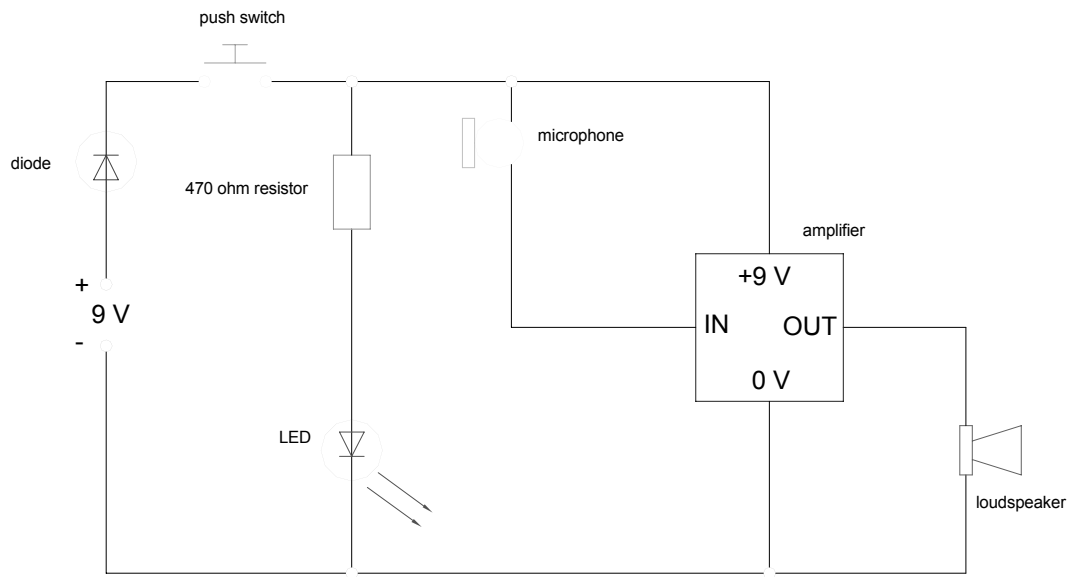


pcb mask showing connections

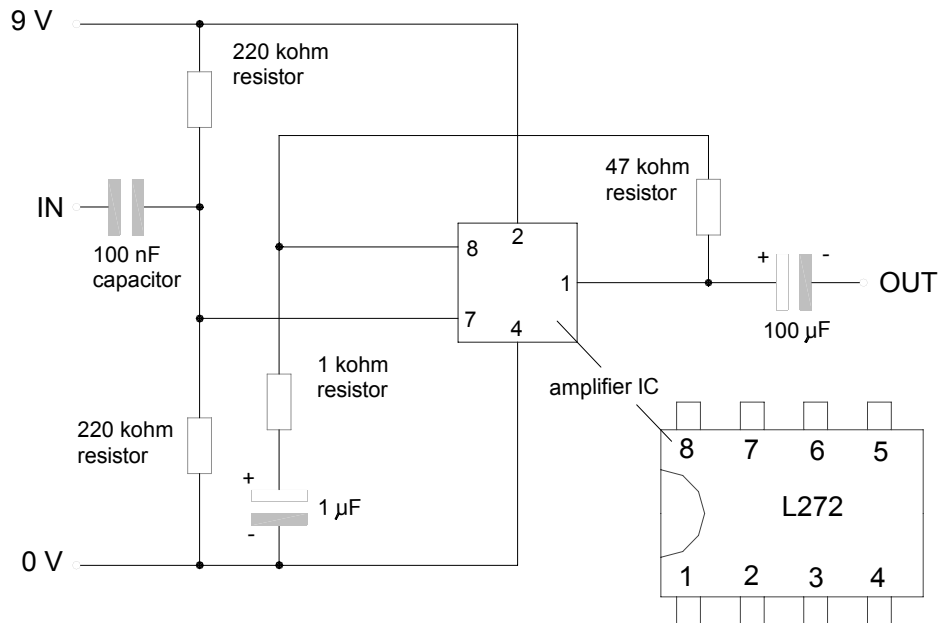


pcb drawn for clarity. Size of pcb mask to fit in component box 71 mm long x 30 mm wide

not to scale



Circuit diagram for intercom system



Integrated circuit for intercom system