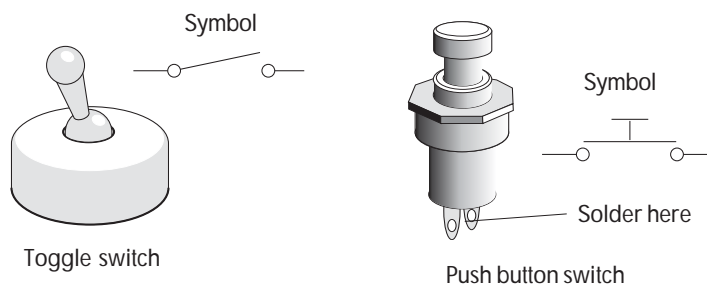


MEMBRANE SWITCHES

In most circuits we require a convenient means of switching something ON or OFF. 'On' means completing (or closing) the circuit 'loop'. 'Off' means breaking (or opening) it. A **mechanical switch** is a convenient way of doing this. They come in many shapes and sizes. Most **push-button** switches complete the circuit only while you hold them down - like a doorbell push-switch. **Toggle switches** will stay in the 'on' or 'off' position - light switches. Many of the types available need to have wires soldered to them.

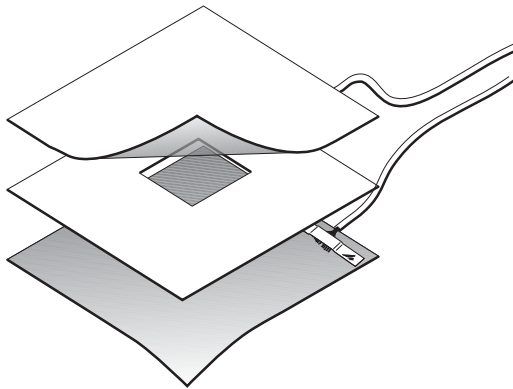


MEMBRANE PANEL SWITCHES

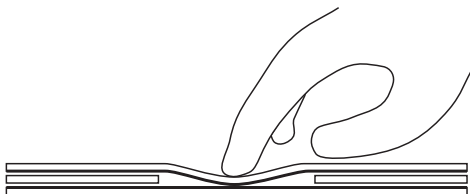
Membrane panel switches are a relatively new type which consist of thin plastic layers with conductor tracks printed on. They are very thin (e.g. 0.5 mm) and have made credit card calculators possible. They are cheap to manufacture and with their bright graphics can be designed as part of a product. Although the **membrane panel** principle is used in many high technology products such as calculators and photocopiers, it is one of the easiest to make using just thin card (or paper) and aluminium foil.

Task: Make up a membrane panel switch by following the instructions below. There is a thin card template in the kit from which you can make the switch. Also included is an identical sheet from which you can make photocopies.

One of the most useful paper membrane panels consists of just three layers of thicker paper or thin card stacked together as shown. The outer layers are covered with foil stuck on with 'Pritt Stick', dilute PVA (white glue) - or even 'Spraymount'. The centre layer - acting as an insulator between the other two - has an opening somewhere on its surface known as a *window* and in a position known as the *switch site*.



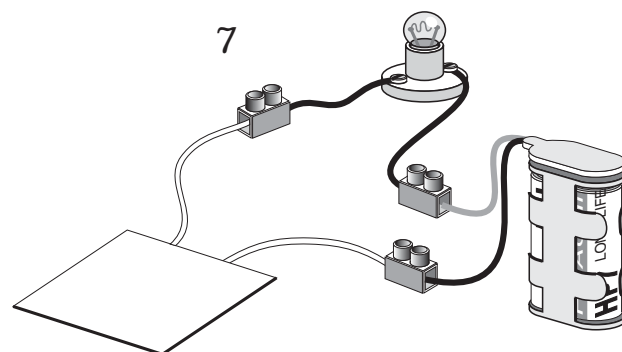
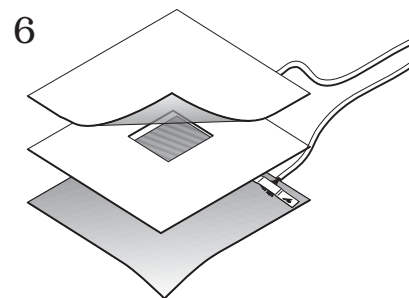
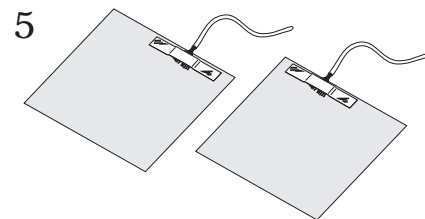
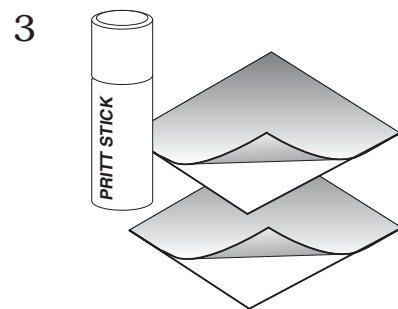
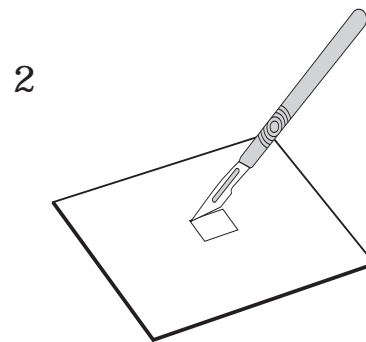
When the membrane layers are sandwiched together, the foil surfaces are kept apart by the middle layer. However, when the top is pressed down over the switch site, it dips down through the window and the two foils touch. When pressure is removed, the top springs back out of contact.



The only real difference between this switch and a commercial membrane equivalent is in the materials used. The commercial ones use thin plastic sheets (polycarbonate) often with conductors printed on. Also, commercial membrane panels usually do more than just one switching operation and so have a number of separate switch sites and conducting surfaces divided up into tracks.

CONSTRUCTION METHOD

- 1 Cut out the three sections marked 'TOP', 'MIDDLE' and 'BOTTOM'.
- 2 Using scissors, cut out the window, 'W', from the 'MIDDLE' section.
- 3 Using a pair of scissors, cut two pieces of foil large enough to cover the areas marked on the 'TOP' and 'BOTTOM' sections. Stick the foil in place using 'Pritt Stick' glue, dilute PVA or 'Spraymount'.
- 4 Trim the foil around the edges of the 'TOP' and 'BOTTOM' sections.
- 5 Cut two lengths of stranded wire (about 10cm each) and spread out the strands at one end. Using sellotape, attach the wires to the foil on the 'TOP' and 'BOTTOM' sections in the area shown.
- 6 Assemble the sections as shown ensuring that the foil covered surfaces of the 'TOP' and 'BOTTOM' sections are facing each other. Use a dab of glue at the edges to tack the switch together.
- 7 Connect the switch up to the test circuit as shown.



Materials and Equipment

- Thin card
- Foil
- Scissors/scalpel/craft knife
- Cutting mat/board
- PVA, Pritt Stick or Spraymount
- Sellotape
- Stranded wire

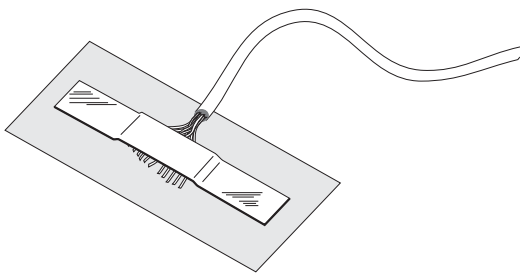
The bulb, battery and switch are connected using segments cut from the terminal block.

If the circuit does not work when connected:

- Check that the insulation has been completely removed from the ends of the wires.
- Also check that the wires in the switch are making good contact with the foil.

There are just a few rules to remember in making up this switch:

- *Make the window about 10mm square if (eg.) cartridge paper is used - and larger if the centre layer is thin card.*
- *Make the centre layer slightly larger than the other two to prevent the foil accidentally touching at the edges. (Using 'Pritt Stick the three layers can be tacked together.)*
- *Use only stranded wire for making connections to the foils; stick the bared strands down with Sellotape.*



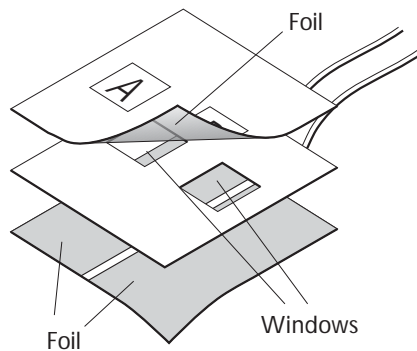
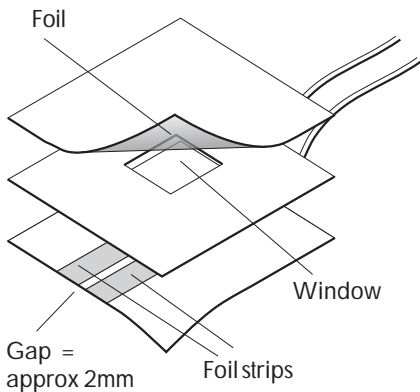
Other Membrane Designs

There are many variations on the membrane switch theme.

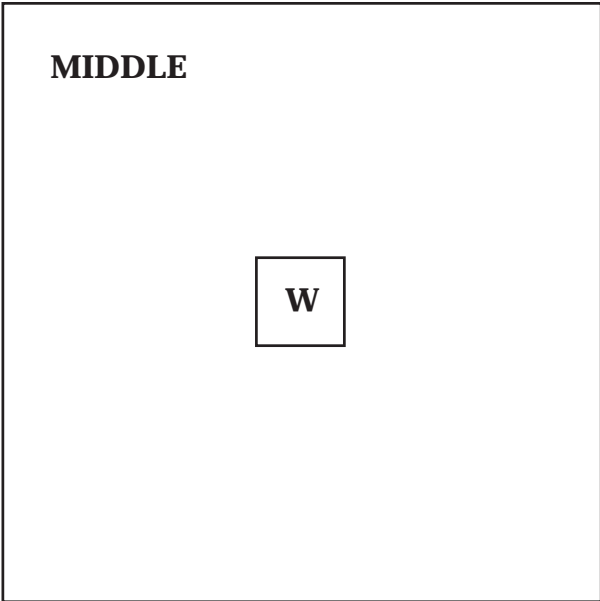
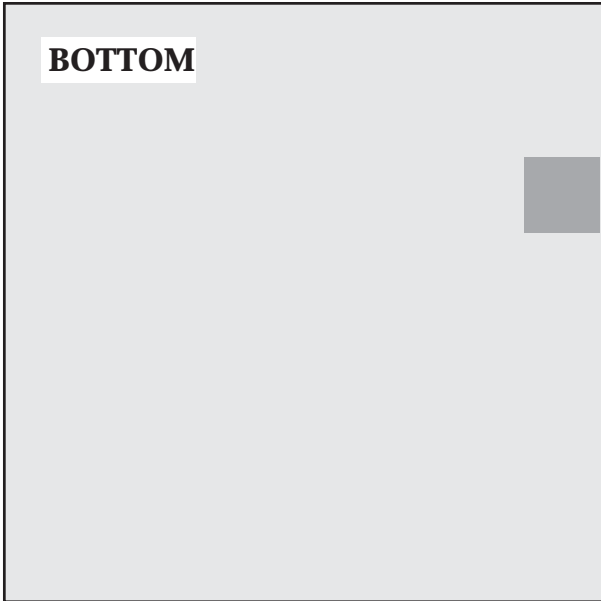
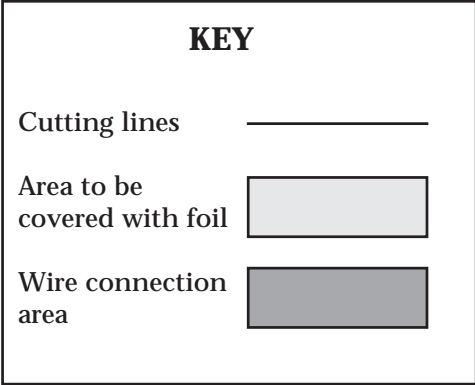
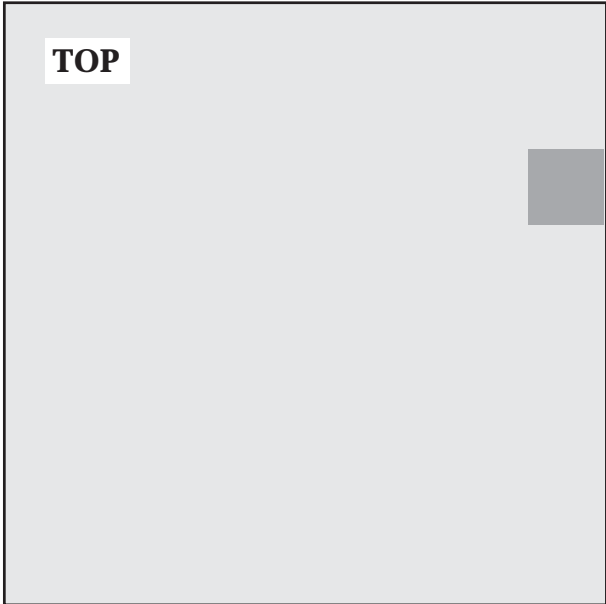
1. Simple on/off switch

2. Logic switch

You have to press points 'A' and 'B' to turn switch on.

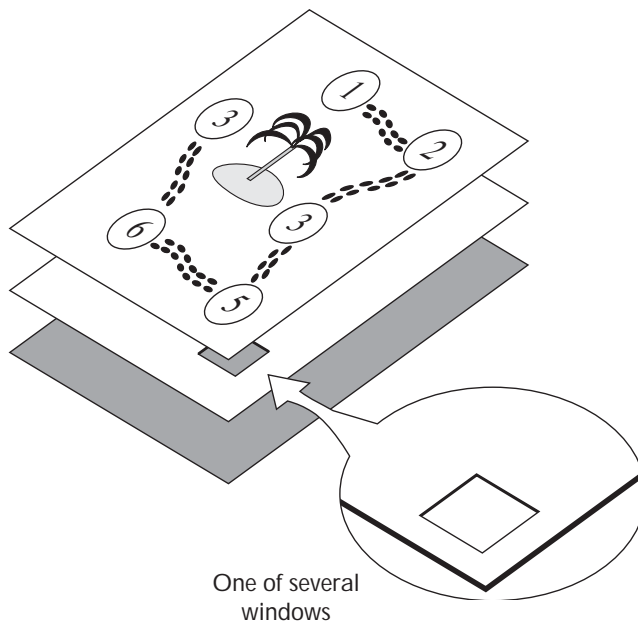


MEMBRANE SWITCH TEMPLATE SHEET



IDEA FOR AN APPLICATION

The membrane panel is especially suitable for games where players have to guess or work out the position of one or more switch sites. In a game called 'Treasure Island', for example, players might press on numbered squares according to the throw of a dice or random numbers generated on a calculator. The first player to sound a buzzer once or more wins. The game can be *re-programmed* either by inserting centre layers with different window positions or by cutting the windows to leave flaps that can be open or closed.



It is one of the great advantages of membrane panels that graphics, instructions etc. can be printed on the top. On a paper version this can be done with any graphics media: felt tip pen, crayons, application of found pictures, and many more. If necessary, the graphics top can be an additional fourth layer.