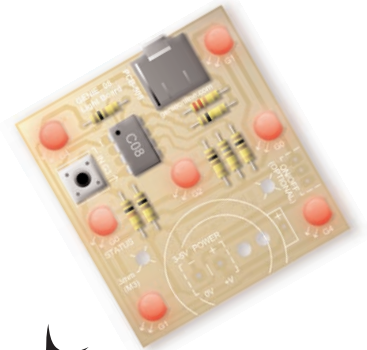




Welcome to the magical world of GENIE!

The GENIE Light Kit is ideal for introducing simple lighting projects, such as an electronic die, a wearable badge or a night-time warning system.

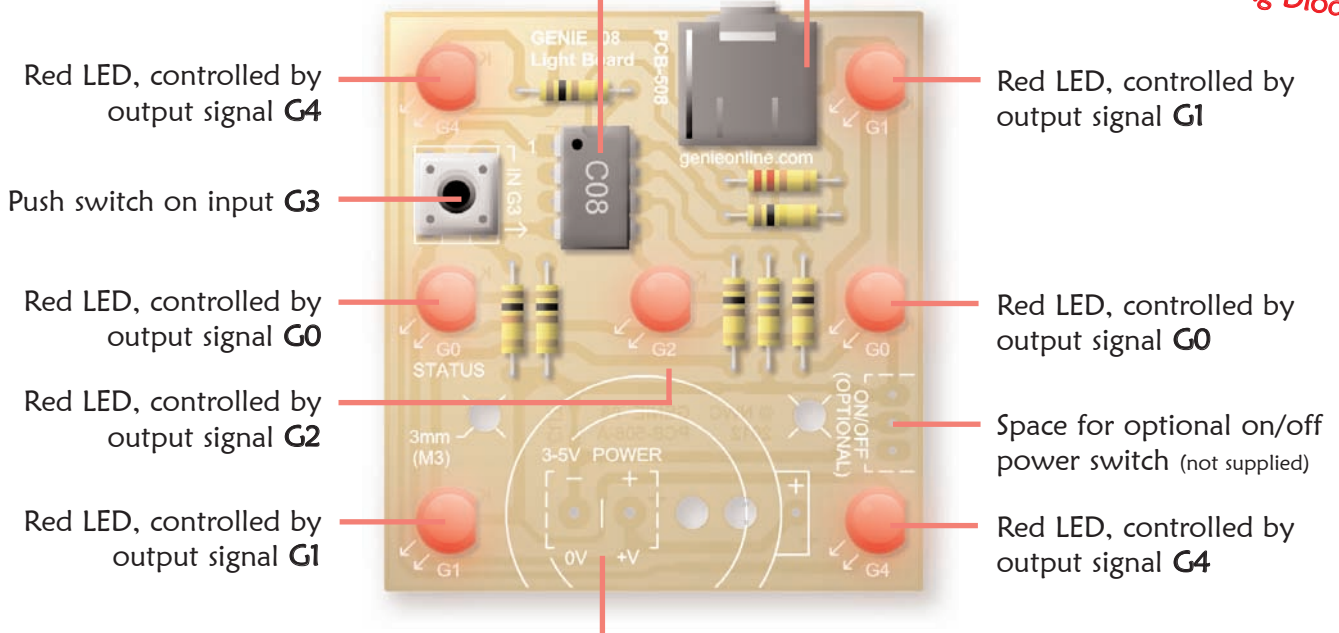


Three of the outputs, **G0**, **G1** and **G4** control two LEDs each. Output **G2** controls a single LED.

GENIE C08 microcontroller (the magic bit!)

Download socket (the cable plugs in here so that the GENIE microcontroller can talk to the computer)

'LED' is short for 'Light Emitting Diode'



Battery connects here (red wire to '+V', black wire to '0V'). You can feed the wires through the two larger strain-relief holes to the right.

**Battery power must be between 3 volts and 5 volts...**

**...that's 2 or 3 AA-sized batteries!**

Tip: The PCB allows a 3V watch-style cell battery (not supplied) to be used instead of AA or AAA batteries. See page 2 for details.





## Making the GENIE 2

Switch on the soldering iron. It will only take a few minutes for the iron to reach operating temperature. Once the soldering iron is hot, clean the soldering iron tip with a moist sponge.

Melt some solder at the chamfered end of the soldering iron tip. This is called 'tinning' and it will aid the flow of solder from the soldering iron to the copper track on the printed circuit board and component pins.

Fit each component onto the board. When fitting components such as resistors, you should use long-nosed pliers to bend the legs through 90 degrees. This will make them easier to fit.

Some of the components need to be fitted the correct way around:

- ◆ The GENIE microcontroller should be positioned so that the notch points towards the download socket and the dot next to pin 1 is at the same corner as the '1' shown on the board.
- ◆ The LEDs should be fitted so that the flat edges of the LEDs line up with the flat edges shown on the board.

To solder a pin, hold the soldering iron onto the board for a few seconds, then quickly touch the tip with a small amount of solder.

You should always remember to replace the soldering iron back into the stand after soldering and repeat cleaning the tip of the iron with the moist sponge before the start of each soldering operation.

Finally, cut off any excess wire or component legs for a tidy finish.

### Fitting a watch-style cell battery (optional)

The PCB allows you to fit an on-board 3V CR2032-type cell and holder (not supplied) as an alternative to AA or AAA batteries.

When using a cell, it is recommended to also fit an on/off power switch as described below.

### Adding an on/off power switch (optional)

You can include an on/off power switch by soldering an SPDT switch (not supplied) to the three pads on the right-hand side of the PCB.

When adding a power switch you will also need to cut the exposed track marked 'CUT' on the PCB's solder side.

Take care when using a hot soldering iron!



### Magic Ingredients!

This is what you will need:

Component	Quantity
GENIE C08 microcontroller	1
GENIE 08 light board (PCB508)	1
Download (3.5mm stereo) socket	1
8-pin DIL socket	1
Battery clip	1
3 x AA battery holder	1
6 x 6mm switch	1
Red LED	7
100 ohm resistor (brown, black, brown, gold)	4
180 ohm resistor (brown, grey, brown, gold)	1
10k ohm resistor (brown, black, orange, gold)	1
22k ohm resistor (red, red, orange, gold)	1
100k ohm resistor (brown, black, yellow, gold)	1

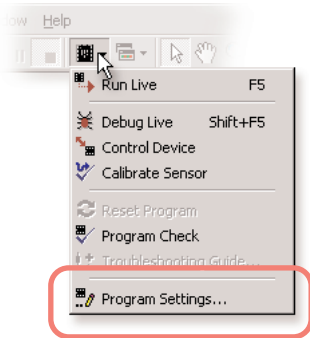




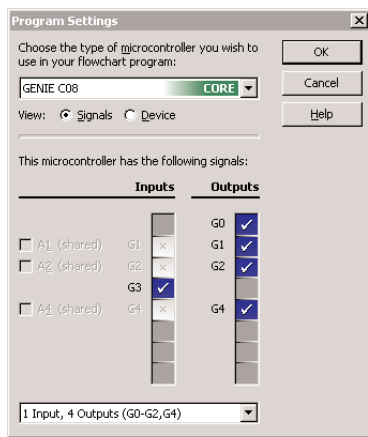
## Telling the GENIE your wishes 3

For your project to work, you need to tell the GENIE microcontroller what it should do.

This involves writing a sequence of commands in a **flowchart**. Your flowchart is then sent down the cable and stored on the GENIE chip. By changing the flowchart, you can vary how the GENIE behaves.



First of all, you need to tell GENIE which type of chip you are using. To do this, click on the **Microcontroller** button on the toolbar and choose **Program Settings**.



Select a **GENIE C08** chip.

In the same window, choose the **'1 Input, 4 Outputs (G0-G2, G4)'** setting to tell GENIE which inputs and outputs you need. Click on **OK** when you are ready.

### Magical Effects!

These are the **input and output signals** available in your flowchart:

Input	Description
G3	Push switch
Output	Description
G0	Centre left/right LEDs
G1	Top right/bottom left LEDs
G2	Central LED
G4	Top left/bottom right LEDs



You can now decide which commands you want your GENIE to perform. To do this, drag commands from the **Gallery**.

See the next worksheet for flowchart ideas.





## Telling the GENIE your wishes 4

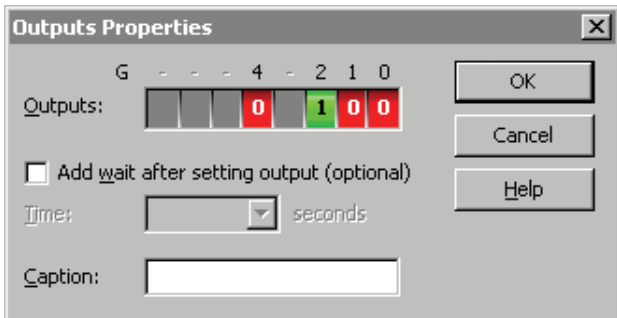
### Turning LEDs on and off

You can use GENIE to turn the LEDs on and off.

- High** Use the **HIGH** command to turn a single output on.
- Low** Use the **LOW** command to turn a single output off.
- Outputs** Use the **OUTPUTS** command to control several outputs.

There are seven LEDs on the kit and these are connected to outputs **G0**, **G1**, **G2** and **G4**. Each output controls two LEDs, except for **G2**.

Double-clicking on an output command allows you to control a light (or several in the case of the **OUTPUTS** command), for example:

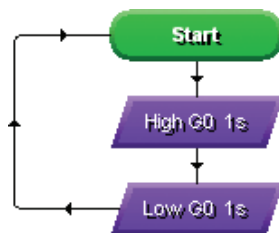


This will light the single, central LED that is connected to output **G2**.

In addition to changing the output, you can also add a delay (GENIE programs run very quickly and without a wait, sometimes the lights change too fast for you to see!).

The flowchart on the right uses the **HIGH** and **LOW** commands to turn the two LEDs on **G0** on and off.

It loops back to make the flashing repeat.



### Responding to the push switch

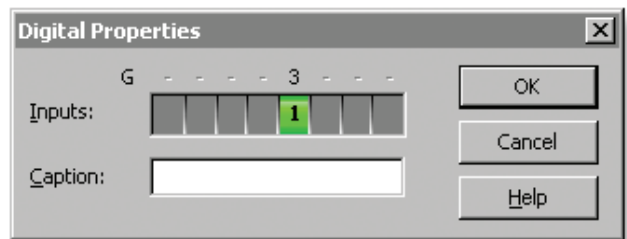
Some types of input signal, such as push switches, can only be either on or off. These are known as **digital** signals.

- Digital** Use the **DIGITAL** command to respond to a digital signals.

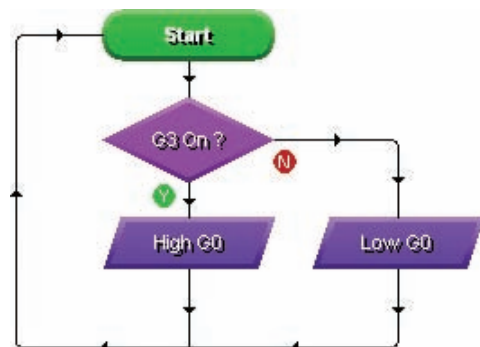
The **DIGITAL** command allows you to make a decision based on whether a digital signal is either on (pressed) or off (not pressed).

When a digital signal is on, it has the value '1' whereas when it is off, it has the value '0'.

Double-click on the command to select which digital inputs you wish to check. GENIE will follow the 'Y' (yes) path when the digital signal matches the chosen pattern, otherwise it will follow the 'N' (no) path.



The above pattern will test if the switch on **G3** is pressed. You can see below how to use this in a flowchart: the two LEDs connected to output **G0** will light whenever the switch is pressed.





## Telling the GENIE your wishes

# 5

### Creating an electronic die

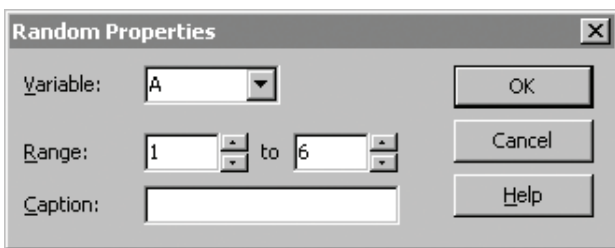
Whenever you roll a die, a number between one and six will appear face-up. This behaviour is known as random because you cannot predict beforehand which number will appear.



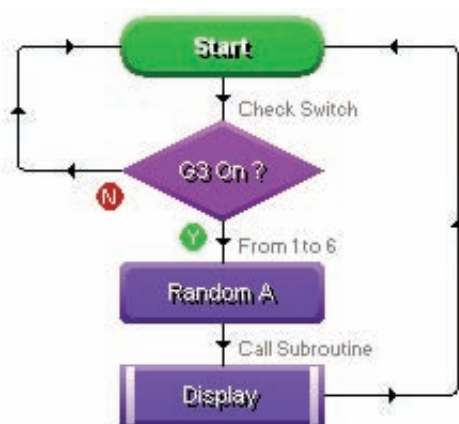
You can use GENIE's **RANDOM** command to simulate the effect of a die roll.

Double-clicking on the **RANDOM** command allows you to select the variable in which the random number will be stored.

You can also decide on the range of numbers that will be generated. For a die roll, the range should be set to **1** through **6**.



To start a die roll, you should generate a random number whenever the switch is pressed:



A subroutine named **Display** outputs the die roll held in variable **A**. This subroutine is not shown here but appears in full on page 6.

### Displaying the numbers 1 to 6

The following list shows how to display numbers.

**1** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input type="checkbox"/>	<input type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
									G4	G2	G1
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G0	G2	G0
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G1	G4	G4

To display the number 1, make output **G2** high and all of the other outputs low.

**2** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input checked="" type="checkbox"/>	<input type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G4	G2	G1
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G0	G2	G0
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G1	G4	G4

To display the number 2, make output **G4** high and all of the other outputs low.

**3** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input type="checkbox"/>	<input checked="" type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
									G4	G2	G1
									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
									G0	G2	G0
									<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G1	G4	G4

To display the number 3, make outputs **G1** and **G2** high and all of the other outputs low.

**4** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G4	G2	G1
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									G0	G2	G0
									<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									G1	G4	G4

To display the number 4, make outputs **G1** and **G4** high and all of the other outputs low.

**5** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
									G4	G2	G1
									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
									G0	G2	G0
									<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									G1	G4	G4

To display the number 5, make outputs **G1**, **G2** and **G4** high, leaving output **G0** low.

**6** ➔

G	-	-	-	4	-	2	1	0			
Outputs:									<input checked="" type="checkbox"/>	<input type="checkbox"/>	
0	1	2	3	4	5	6	7	8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									G4	G2	G1
									<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									G0	G2	G0
									<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									G1	G4	G4

To display the number 6, make outputs **G0**, **G1** and **G4** high, leaving output **G2** low.

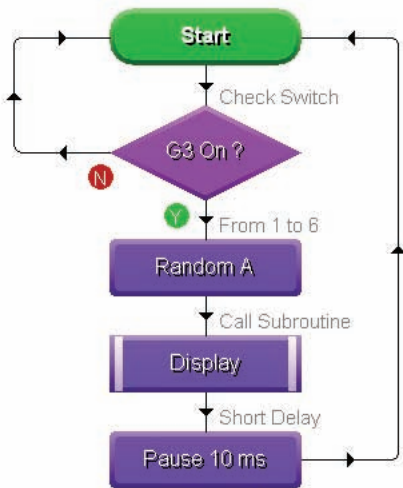




## Telling the GENIE your wishes 6

### A complete electronic die flowchart

The following flowchart puts together the different elements of a die roll program, namely (1) detecting when a switch is pressed, (2) generating a random number, (3) outputting that number as a pattern on the LEDs, and (4) stopping the die roll once the switch has been released.



The main flowchart first checks to see if the switch (connected to input **G3**) is pressed.

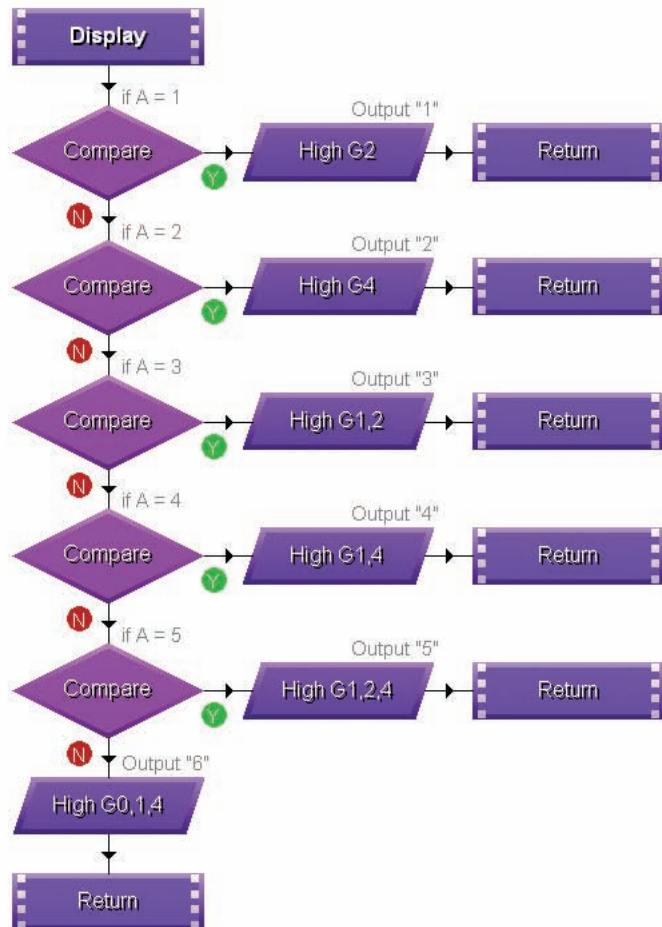
When pressed, a random number is then generated that lies within the range of **1** to **6**.

This number, representing the die roll, is stored in variable **A**.

Next, the number is used to output the appropriate LED pattern by calling the **Display** subroutine (shown on the right).

A short delay of 10 milliseconds is introduced so that you can see the lights changing (without the delay they would change too quickly).

Finally, the whole sequence repeats from the beginning.



The **Display** subroutine outputs a different pattern to the LEDs depending on the value of variable **A**.

A series of COMPARE commands checks the possible values of **A**. When the value of **A** is **6**, the last COMPARE command ("if A = 5") will be false, resulting in the flowchart taking the 'N' (no) path.

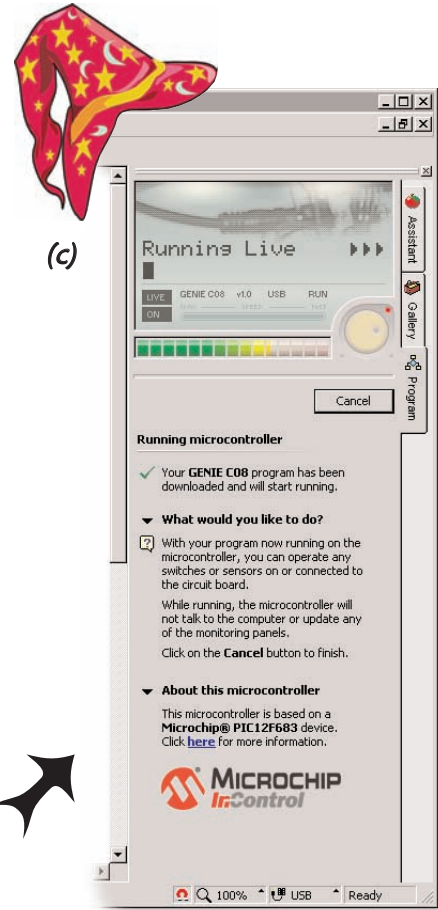
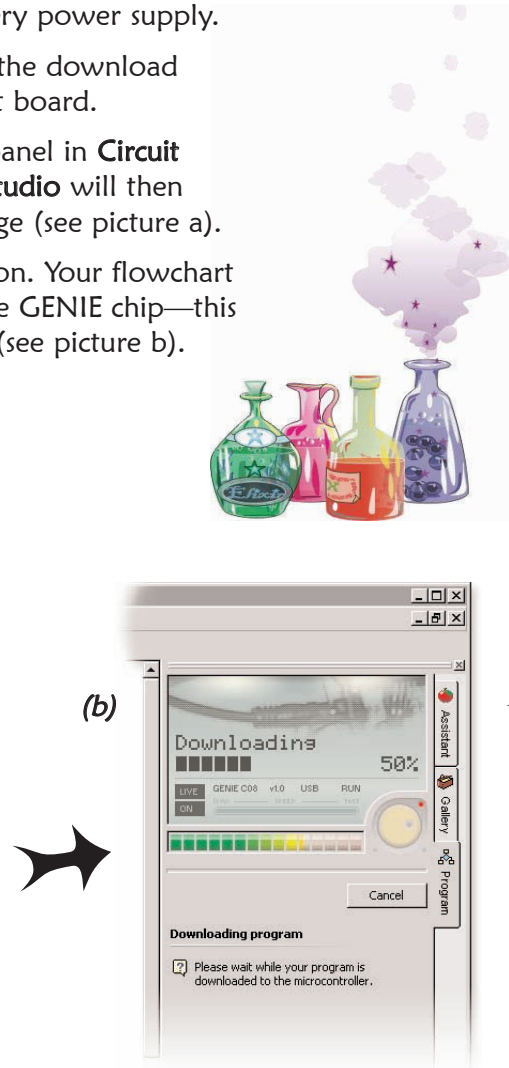
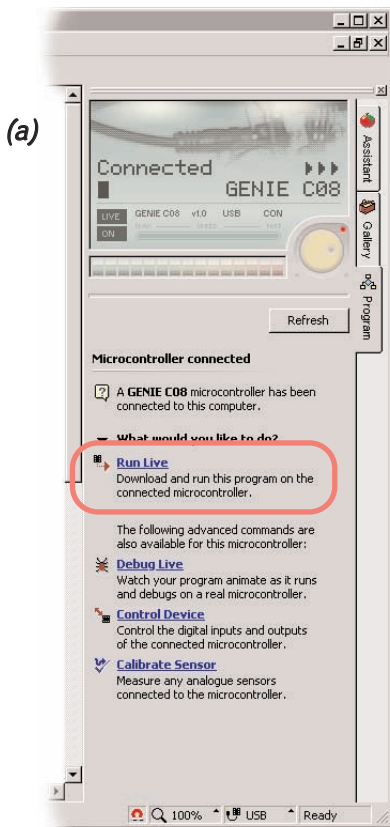
The output patterns are as shown on page 5.





Once you have written your flowchart program, you need to store it on the GENIE chip. Here's how you do it:

- 1 Wire-up the built GENIE circuit board and connect up a suitable battery power supply.
- 2 Plug the GENIE cable into the download socket on the GENIE circuit board.
- 3 Once done, the **Program** panel in **Circuit Wizard** or **GENIE Design Studio** will then show a 'Connected' message (see picture a).
- 4 Click on the **Run Live** option. Your flowchart will be transferred onto the GENIE chip—this is known as **downloading** (see picture b).



*The two red LEDs that are connected to output GO on the light kit will flash as the download takes place. It tells you everything is OK!*

As soon as the program has been downloaded you will see the above screen (c) and GENIE will start running your flowchart.

Your GENIE project is now ready to go! You can disconnect the cable and use your GENIE board away from the computer.

**Finished!**





## Troubleshooting GENIE 8

If you are unable to connect to a GENIE microcontroller or download a program, you should go through the following troubleshooting hints and tips.

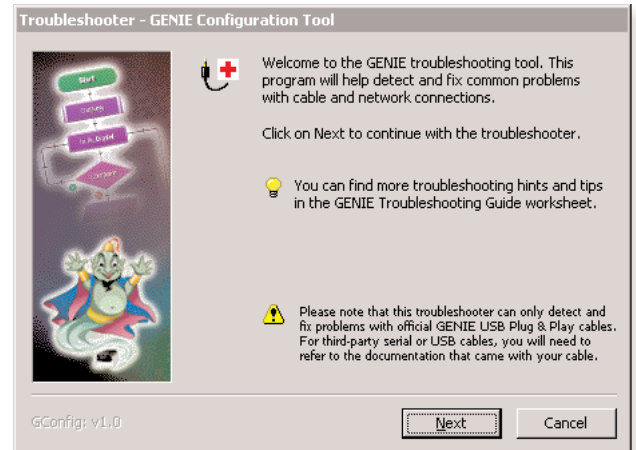
### A Run the GENIE troubleshooting tool

The GENIE troubleshooter will automatically check your cable and software to ensure that the computer can access the GENIE cable.

To run the GENIE troubleshooter, choose **Troubleshoot GENIE...** from the **Help** menu of GENIE Design Studio 1.1 or Circuit Wizard 2.

If you have an earlier version of GENIE Design Studio or Circuit Wizard, you can download it from [www.genieonline.com/cable](http://www.genieonline.com/cable).

Step through the on-screen instructions.



### B Step through the following checklist of common problems

#### Cable

- GENIE Design Studio and Circuit Wizard both check and report problems involving the cable that is connected. If given, follow through on the on-screen help and advice.
- Unplug the cable, wait a few seconds and then plug it back in. Windows can occasionally fail to detect that a cable has been inserted.

#### Power

- Check that the voltage of the battery is sufficient. For this board, the battery voltage should be in the range of 3 volts to 5 volts.
- Check the voltage level across the power connections (+V and 0V) on the board. This can identify if there is a problem with the battery clip or battery holder. Ensure that the wiring has not become loose and the batteries are properly seated in the holder.

#### Circuit

- Try plugging the cable into another GENIE board if you have one available. When powering up this circuit, the STATUS LED(s) should flash once (when properly connected it will flash repeatedly).
- Try with another GENIE microcontroller if possible.
- Visually inspect the board for bad solder joints or cases where soldering has incorrectly bridged pins together. Note that for the download socket, the two left-most pins should be connected together, as should the two right-most pins.

For more troubleshooting hints and tips, please read the separate **GENIE Troubleshooting Guide**.







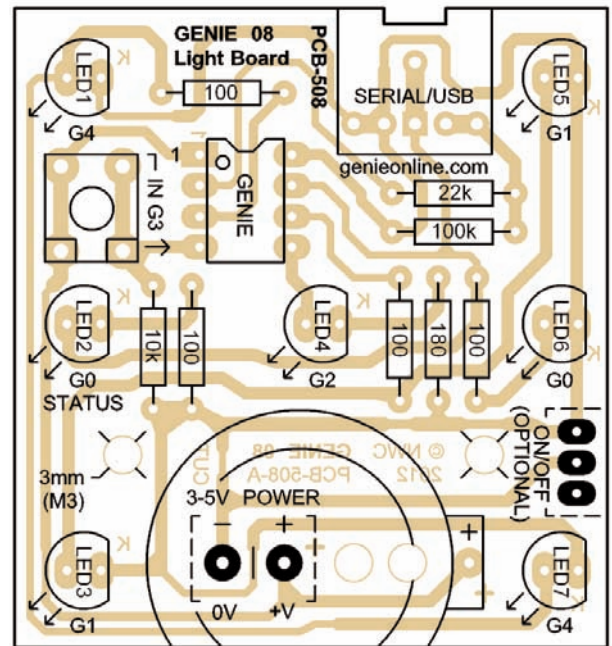
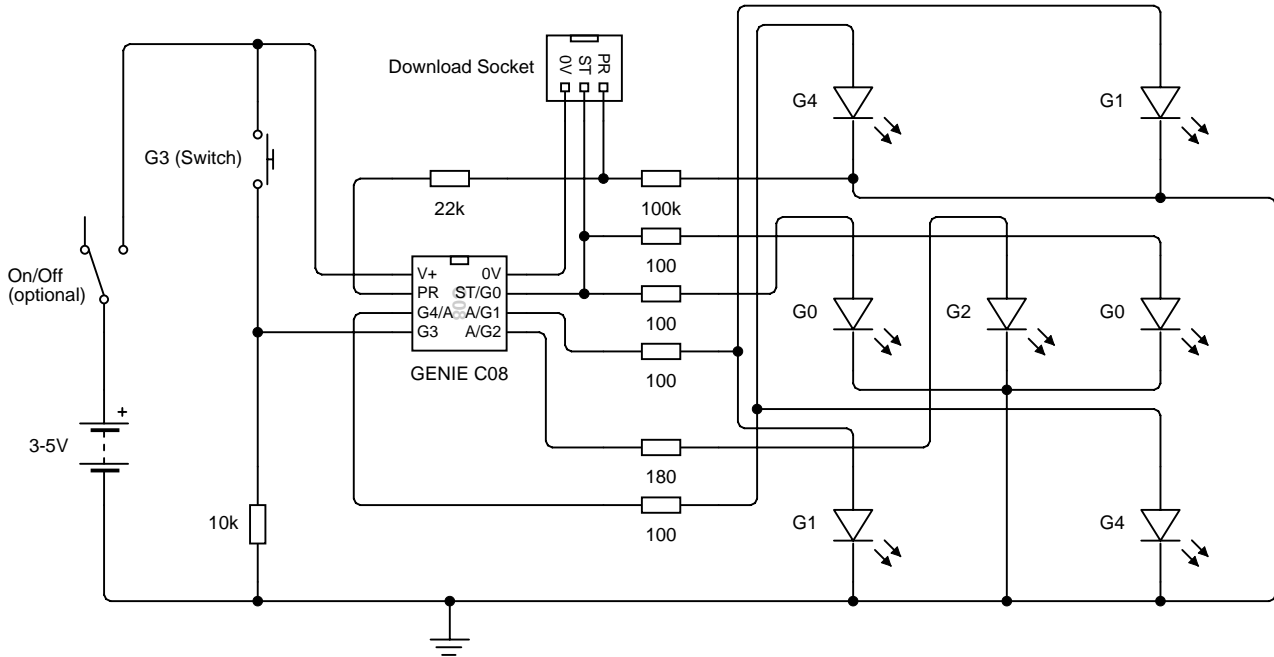
## Circuit information

# 9



The technical bit... it's only needed if you want to learn more!

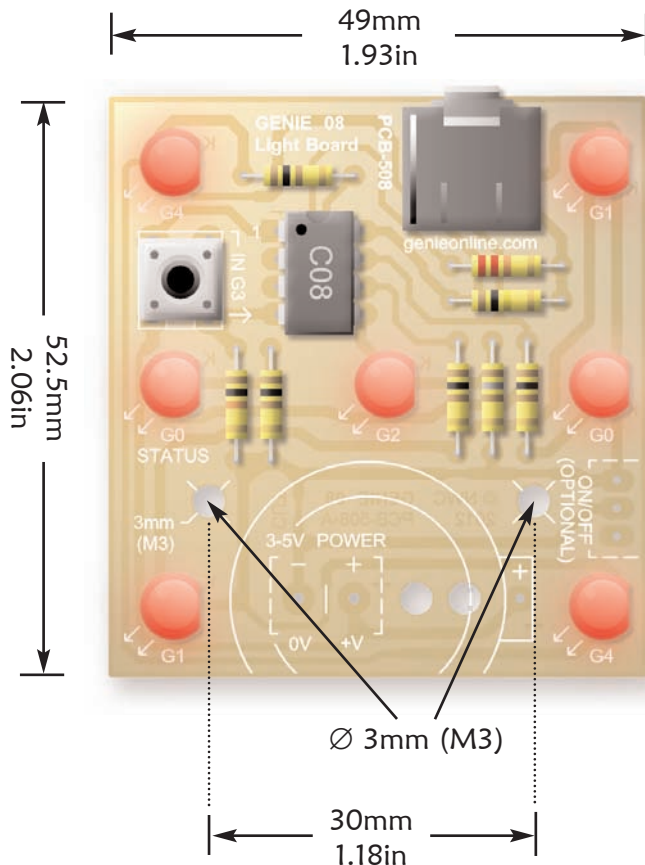
This is the **circuit diagram**. It shows how all of the components in the circuit are connected. You can compare it to the layout of the components on the actual circuit board (shown below it).





## Physical dimensions and mounting 10

The diagram below shows the physical dimensions of the printed circuit board (PCB). This information is important to know when you are embedding the circuit into another project or container.



### Height

The PCB's height including components, legs and soldering, is approximately 15mm (0.6in).

### Mounting

There are four large holes, two of which (indicated by the arrows) are designed for mounting the PCB. The holes have a diameter of 3mm, suitable for use with M3-sized screws.

The spacing between the two holes is 30mm (1.18in), which matches the spacing between the two mounting holes on a standard 3xAA battery pack. It is therefore possible to mount the battery pack to the back of the PCB.

The other two large holes are of the same size but are instead intended to act as strain-relief holes for an off-board battery clip. These holes will be covered if an on-board watch-type cell battery is used in place of a standard battery pack.

