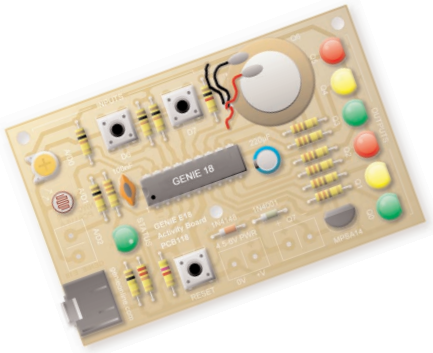
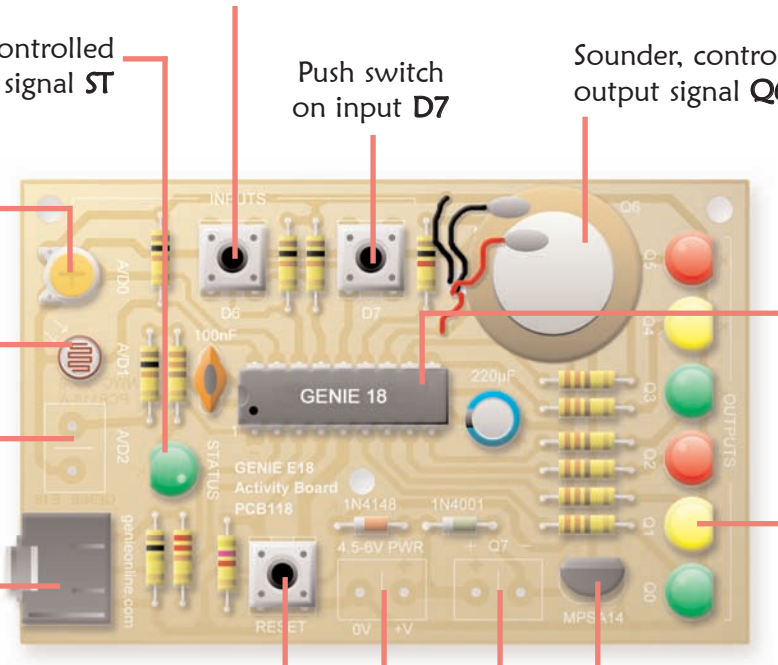
Introduction 1

Welcome to the GENIE microcontroller system!

The activity kit allows you to experiment with a wide variety of inputs and outputs... so why not try reading sensors, controlling lights or making sounds!





Push switch on input **D6**

Green status LED, controlled by output signal **ST**

Push switch on input **D7**

Sounder, controlled by output signal **Q6**

Dial on analogue input **A0**

18-pin GENIE microcontroller (the smart bit!)

Light sensor (LDR) on analogue input **A1**

Analogue sensor on input **A2**

Red, green and yellow LEDs, controlled by output signals **Q0** to **Q5**

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

Reset switch (starts any program running from the beginning again)

Transistor (allows output Q7 to control more powerful things)

Battery power must be between 4.5 volts and 6 volts...

...that's 3 or 4 AA-sized batteries!

Battery connects here (red wire to '+V', black wire to '0V')

Medium-power output, controlled by signal **Q7**

Making the activity kit 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.

Components List

This is what you will need:

Component	Quantity
18-pin GENIE microcontroller	1
GENIE 18 activity board (PCB118)	1
Download (3.5mm stereo) socket	1
18-pin DIL socket	1
Battery clip	1
3 or 4 x AA battery holder	1
MPSA14 transistor	1
1N4001 diode	1
1N4148 diode	1
Green LED	3
Yellow LED	2
Red LED	2
Piezo sounder	1
Miniature light sensor (LDR)	1
6 x 6mm switch	3
220uF electrolytic capacitor	1
100nF capacitor	1
10k ohm potentiometer	1
330 ohm resistor *(orange, orange, brown, gold)*	7
1k ohm resistor *(brown, black, red, gold)*	1
4.7k ohm resistor *(yellow, violet, red, gold)*	1
10k ohm resistor *(brown, black, orange, gold)*	4
22k ohm resistor *(red, red, orange, gold)*	1
100k ohm resistor *(brown, black, yellow, gold)*	1

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 18-pin 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 on the LEDs line up with the flat edges shown on the board.
- Diodes should be positioned so that the stripe on the diode matches the stripe on the board.
- The flat side of the transistor must match the flat side shown on the board.
- When fitting the electrolytic capacitor, you need to ensure that the positive side of the capacitor (the side without the stripe) is nearest to the '+' sign 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.

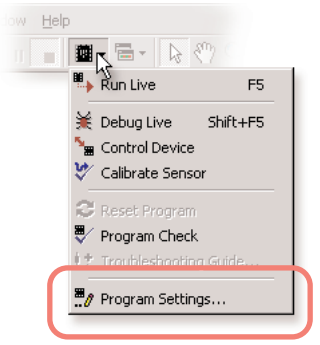
You should always remember to replace the soldering iron back into the stand after soldering and repeat cleaning the tip of the iron with the moist sponge before the start of each soldering operation.

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

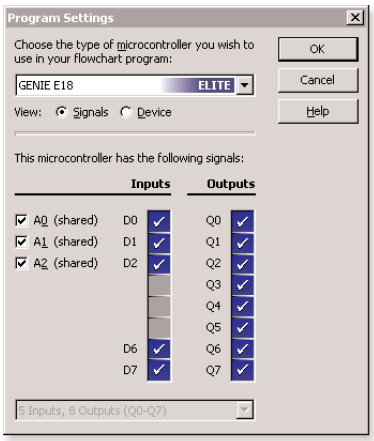
Telling the GENIE your wishes 3

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 chip. By changing the flowchart, you can vary how the GENIE behaves.

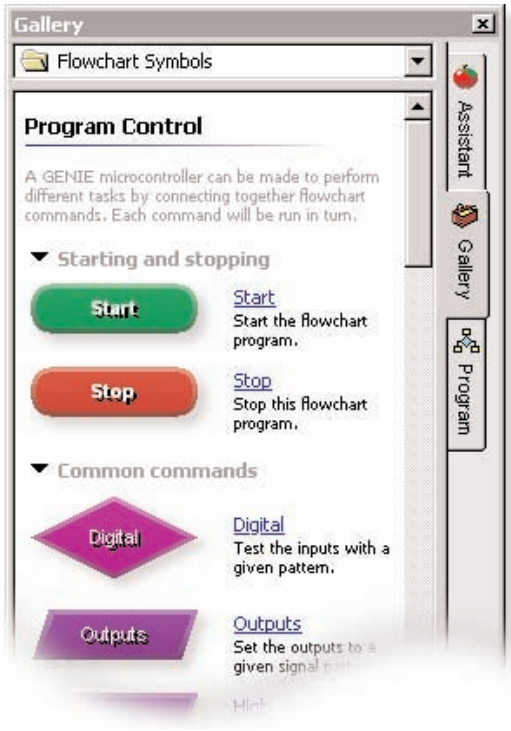


First, you need to tell the software which type of chip you are using. To do this, click on the **Microcontroller** button on the toolbar and choose **Program Settings**.



Select an 18-pin **GENIE** chip.

The inputs and output signals for this type of microcontroller are fixed, so click on **OK** when you are ready to continue.



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.

Available Signals

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

Input	Description
A/D0	Dial (potentiometer)
A/D1	Light sensor (LDR)
A/D2	Analogue or digital
D6 and D7	Push switch

Output	Description
Q0 to Q5	LEDs
Q6	Sounder
Q7	Medium-power

Telling the GENIE your wishes 4

Turning outputs on and off

You can use GENIE to turn outputs on and off.

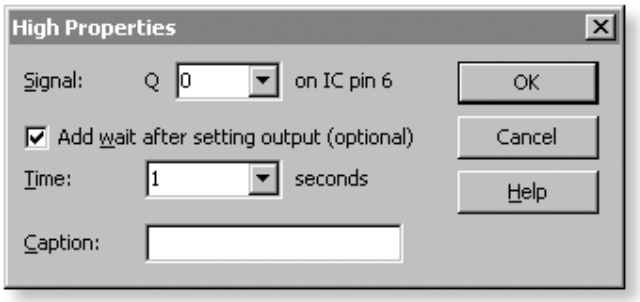
Use the **HIGH** command to turn a single output on.

Use the **LOW** command to turn a single output off.

Use the **OUTPUTS** command to control several outputs.

There are six LEDs on outputs **Q0** to **Q5** (in addition to the green LED on output **ST**) as well as a medium-power output on **Q7**.

Double-clicking on an output command allows you to control these signals, for example:

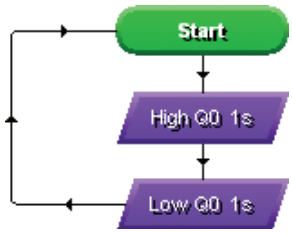


This will light the green LED connected to that output.

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

The flowchart on the right uses the HIGH and LOW commands to turn the green LED on output **Q0** on and off.

It loops back to make the flashing repeat.



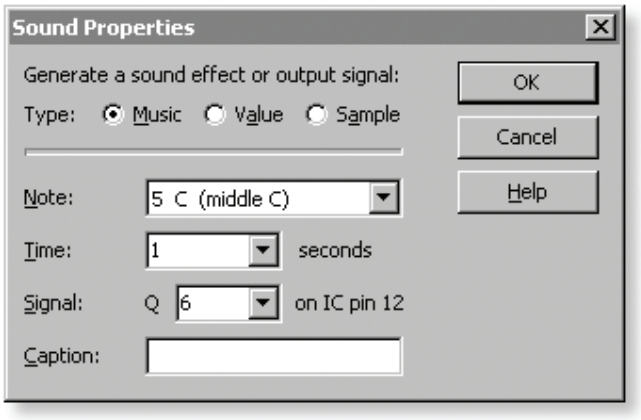
Making sounds or playing tunes

GENIE microcontrollers can make sounds and also play musical tunes.

Use the **SOUND** command to play a single note.

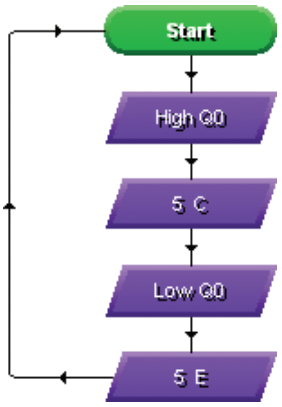
Use the **TUNE** command to play a whole musical tune.

The activity kit has a sounder connected to output **Q6**. To make a sound, you could use the SOUND command as follows:



This would play the note middle C for one second.

By playing two different notes (one after the other, as shown on the right), you can create an alarm. In this flowchart, a green LED (**Q0**) is also flashed to give a visible as well as audible alarm.



You can use the TUNE command to play a whole tune such as a mobile telephone ring tone. For better quality sound and music, you may wish to consider the GENIE 14 Audio Kit.

Responding to digital signals

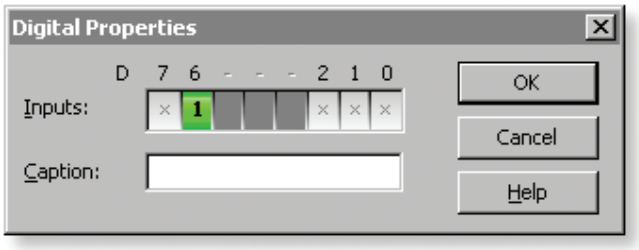
Some types of signal, such as push switches, can only be either on or off. These are known as **digital** signals.

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

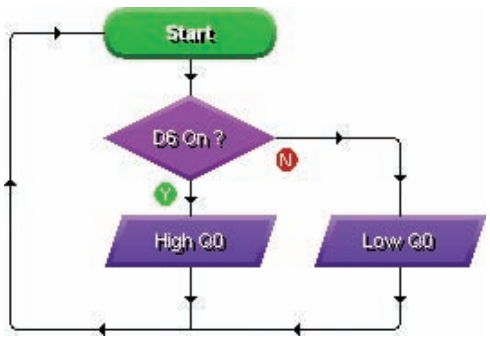
The DIGITAL command allows you to make a decision based on whether a digital signal is either on (high) or off (low).

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 push switch on digital input D6 is on (pressed). You can see below how to light the green LED on output Q0 whenever the switch is pressed:



Responding to analogue signals

Other types of signal, such as temperature or light, can be at a number of different levels. These are known as **analogue** signals.

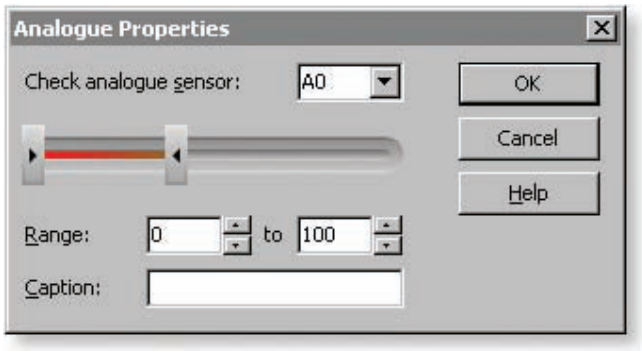
Use the **ANALOGUE** command to respond to analogue signals.

The ANALOGUE command allows you to check if a signal lies within a given range.

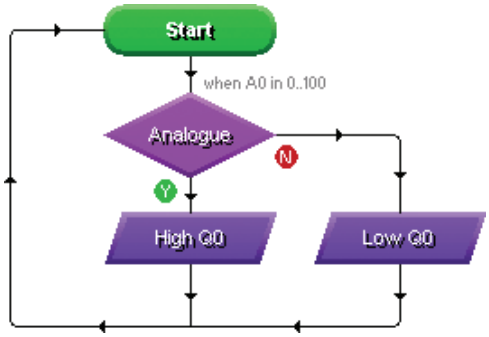
With GENIE, analogue levels can vary between **0** (the lowest level) and **255** (the highest).

Double-click on the command to select a sensor to check and a range. GENIE will follow the '**Y**' (yes) path when the signal is in range, otherwise it will follow the '**N**' (no) path.

For example, to test if the light sensor on analogue signal A0 is between 0 and 100, you should enter the following:



In a flowchart, this would look like:

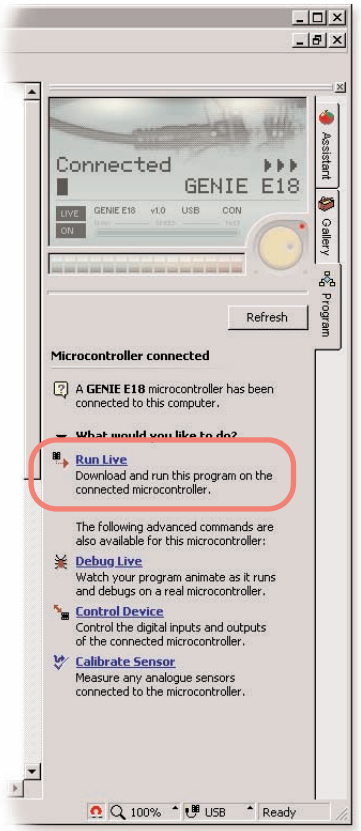


Bringing the GENIE to life 6

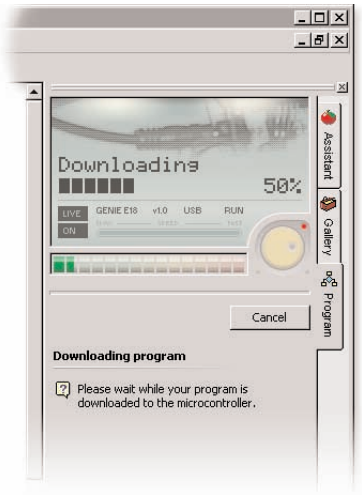
Once you have written your flowchart program, you need to store it on the GENIE chip. Here's how you do it:

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 the software 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).

(a)



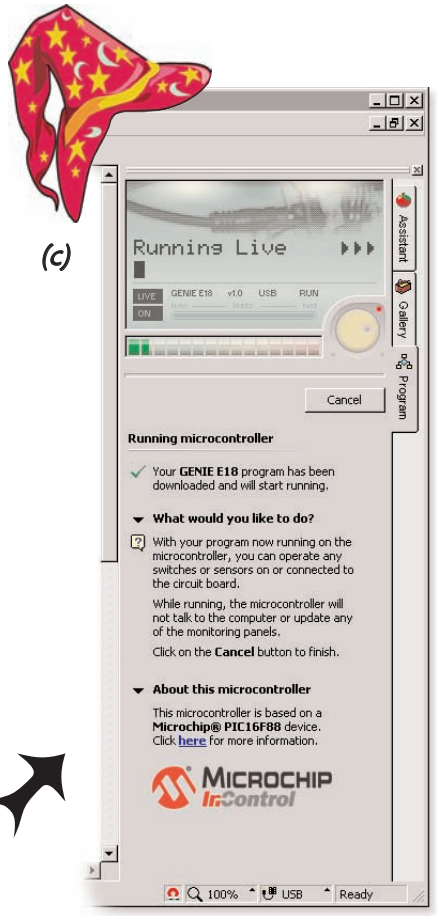
(b)



The green status LED on the activity kit will flash as the download takes place.

It tells you everything is OK!

(c)



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 7

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

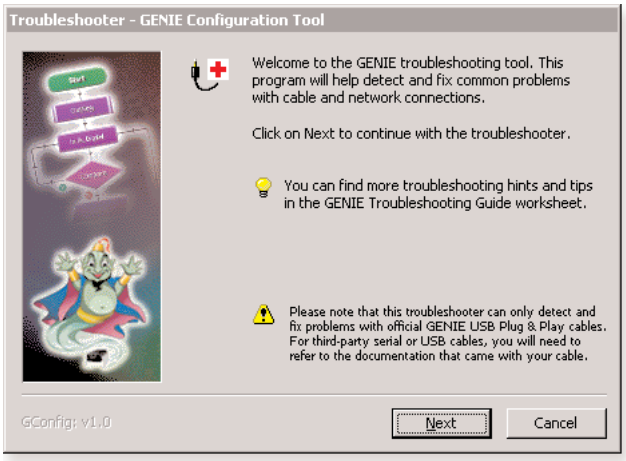
A Run the GENIE troubleshooting tool

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 the Circuit Wizard or GENIE software.

If that option is not shown in your version of the software, you can download it separately from **www.genieonline.com/cable**.

Step through the on-screen instructions.



B Step through the following checklist of common problems

Cable

- Circuit Wizard, GENIE Design Studio and the GENIE Programming Editor software all check and report problems involving the cable. If given, follow through on the on-screen 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 4.5 volts to 6 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 18-pin GENIE board or kit if you have one available. When powering up this circuit, the green STATUS LED 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**.

More information 8

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).