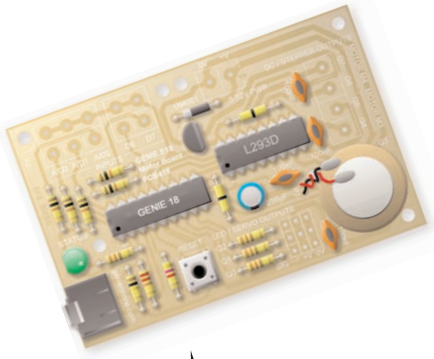
GENIE 18 Motor Kit (PCB418)

Introduction 1

Welcome to the GENIE microcontroller system!

This kit provides an ideal way to add motor control to your projects. Simply wire up DC, stepper or servo motors and away you go!



Driver chip (it allows the GENIE microcontroller to turn DC or stepper motors forwards and backwards)

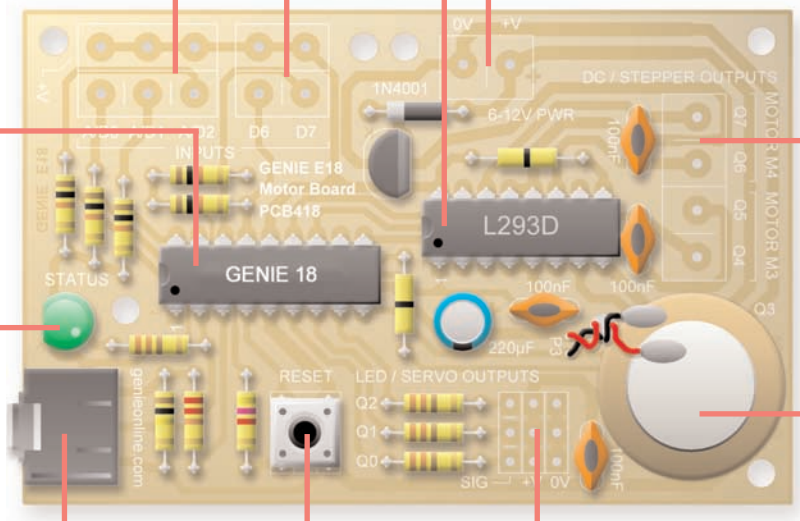
Battery power must be between 6 volts and 12 volts...

...that's 4, 6 or 8 AA-sized batteries!

Digital inputs **D6** and **D7**

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

Analogue inputs **A0**, **A1** and **A2** or digital inputs **D0**, **D1** and **D2**



18-pin GENIE microcontroller (the smart bit!)

Medium-power DC or stepper motor outputs, controlled by signals **Q4** to **Q7**

Outputs Q4 and Q5 combine to form motor output **M3**

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

Outputs Q6 and Q7 combine to form motor output **M4**

Sounder, controlled by output signal **Q3**

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

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

LED or servo motor outputs, controlled by signals **Q0**, **Q1** and **Q2**

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.

Components List

This is what you will need:

Component	Quantity
18-pin GENIE microcontroller	1
GENIE 18 motor board (PCB418)	1
L293D driver chip	1
Download (3.5mm stereo) socket	1
16-pin DIL socket	1
18-pin DIL socket	1
Battery clip	1
4, 6 or 8 x AA battery holder	1
78L05 voltage regulator	1
1N4001 diode	1
Green LED	1
Piezo sounder	1
6 x 6mm switch	1
220uF electrolytic capacitor	1
100nF capacitor	4
0 ohm resistor *(black, marked LK on the PCB)*	2
330 ohm resistor *(orange, orange, brown, gold)*	4
4.7k ohm resistor *(yellow, violet, red, gold)*	1
10k ohm resistor *(brown, black, orange, gold)*	5
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 and the driver chip 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 green LED should be fitted so that the flat edge of the LED lines up with the flat edge shown on the board.
- The diode should be positioned so that the stripe on the diode matches the stripe shown on the board.
- The flat side of the voltage regulator (the component that looks like a 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.

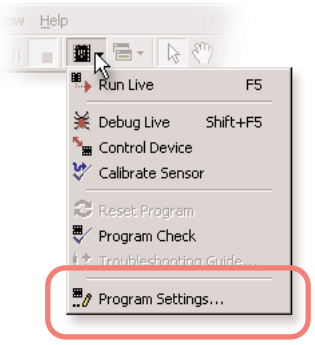
You should always remember to replace the soldering iron back into the stand after soldering and repeat cleaning the tip of the iron with the moist sponge before the start of each soldering operation.

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

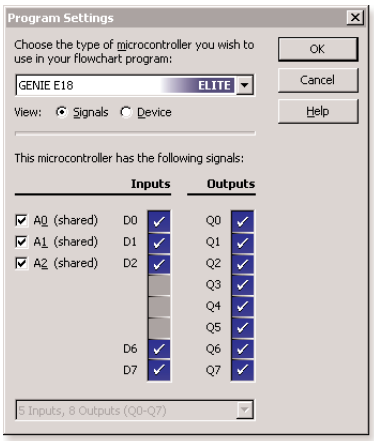
Telling the GENIE your wishes 3

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

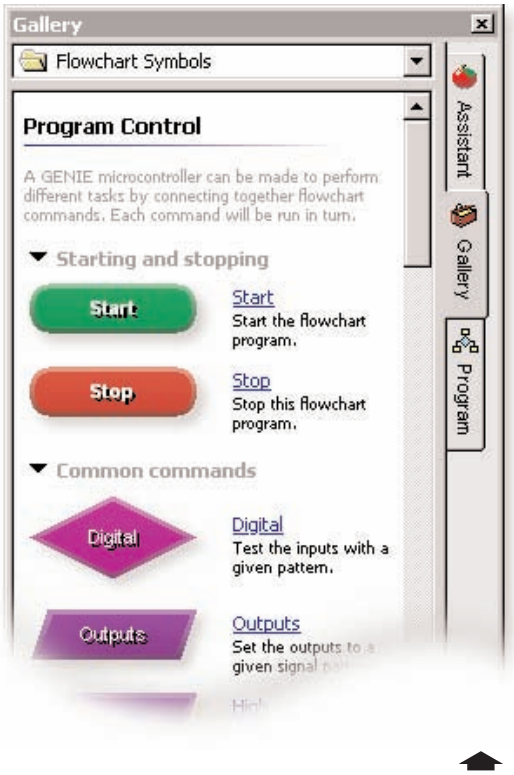


First of all, you need to tell GENIE which type of chip you are using. To do this, click on the **Microcontroller** button on the toolbar and choose **Program Settings**.



Select 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 to A/D2	Analogue or digital
D6 and D7	Digital

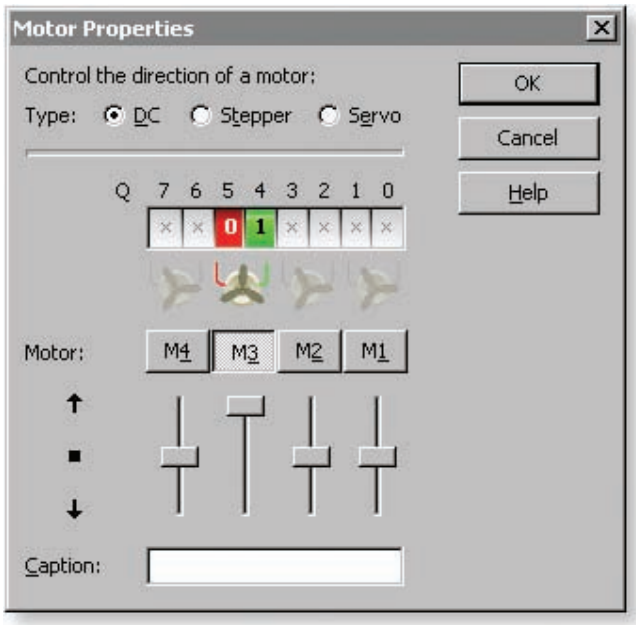
Output	Description
Q0 to Q2	LED/servo motor
Q3	Sounder
Q4 to Q7	DC/stepper motor

Controlling a DC motor

GENIE allows you to connect up and control a variety of different types of motor.

Use the **MOTOR** command to control a connected motor.

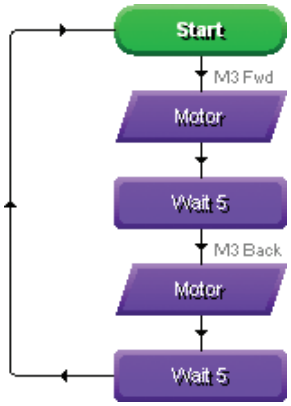
After double-clicking on a MOTOR command, you can select which type of motor you have:



Most low-power motors are called DC motors. With a DC motor, you can turn them forwards or backwards using the appropriate slider.

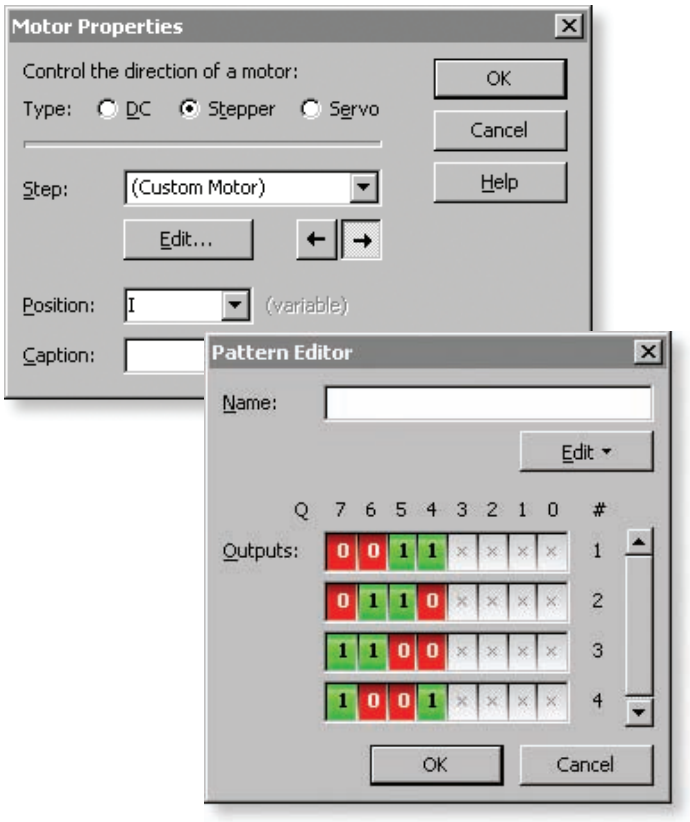
With a DC motor wired to motor output **M3** (which is outputs Q4 and Q5), the flowchart on the right turns this motor first forwards and then backwards.

You can connect two DC motors to the motor board: **M3** and **M4**.



Controlling a stepper motor

Choosing the **Stepper** option in the MOTOR window allows you to control a stepper motor:

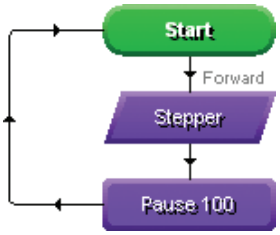


Stepper motors require you to send a changing pattern of outputs (with each change in pattern causing the motor to turn by a small amount).

Clicking on the **Edit** button allows you to decide which output patterns will be sent. These will often vary depending on which type of stepper motor you have connected to the motor board.

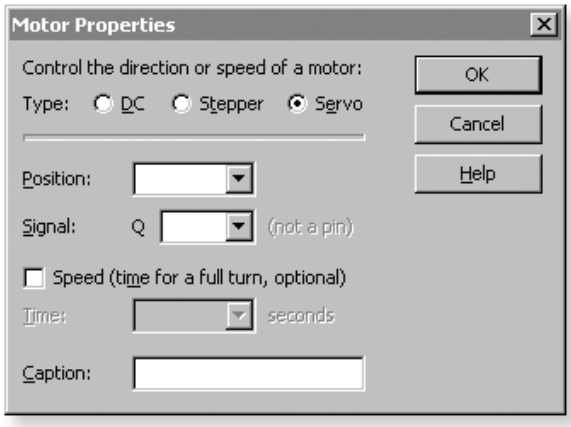
A variable is also required. It is used to hold the number of the last output pattern (it is updated by GENIE each time around).

On the right is a simple stepper motor flowchart.



Controlling a servo motor

Choosing the **Servo** option in the MOTOR window allows you to control a servo motor:



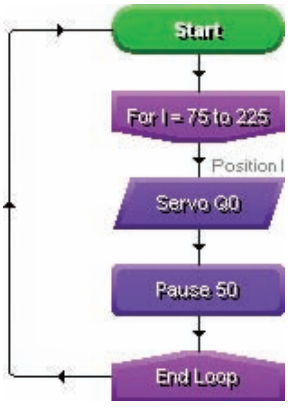
A servo motor is a special type of motor that allows its position to be set very precisely. It is controlled by sending a pulse (the length of which determines the servo motor's position).

The position can be between **75** and **225**. These values correspond to the furthermost clockwise or anti-clockwise motor positions. The middle point is represented by a position of **150**.

Once set, the MOTOR command will keep the servo motor in the chosen position, even if you run other commands.

The motor board allows you to connect servo motors to outputs **Q0**, **Q1** and **Q2**. You should wire each servo motor to the SIG, +V and 0V holes on the motor board.

The flowchart on the right moves a servo motor on output Q0 slowly from one position to the other. You can control the speed by changing the value in the PAUSE command.



It uses variable **I** to change the position from 75 to 225.

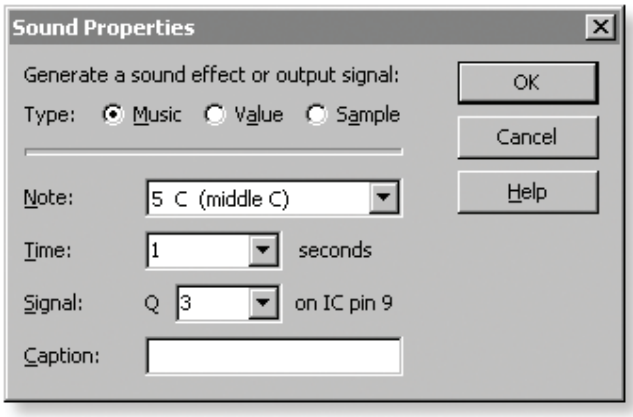
Making sounds or playing tunes

GENIE microcontrollers can make sounds and also play musical tunes.

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

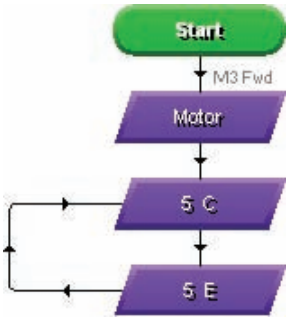
Use the **TUNE** command to play a whole musical tune.

The motor board has a sounder connected to output **Q3**. 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, an alarm sounds while motor M3 is turning.



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

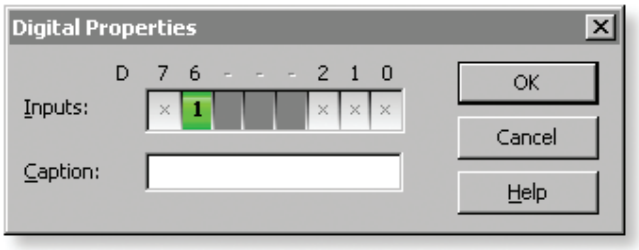
Some types of signal, such as push switches, can only be either on or off. These are known as **digital** signals.

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

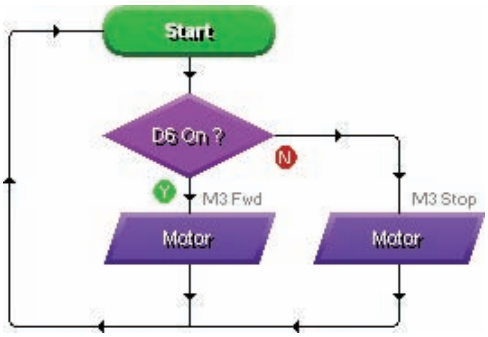
The DIGITAL command allows you to make a decision based on whether a digital signal is either on (high) or off (low).

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, for example, a push switch on digital input D6 is on (pressed). You can see below how to turn motor M3 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.

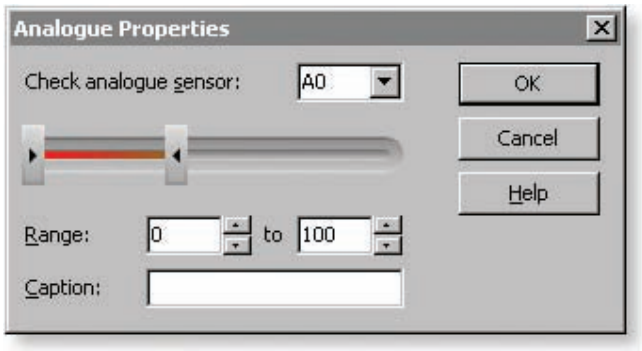
Use the **ANALOGUE** command to respond to analogue signals.

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

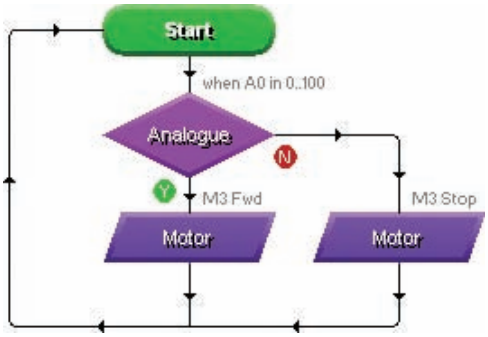
With GENIE, analogue levels can vary between **0** (the lowest level) and **255** (the highest).

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:

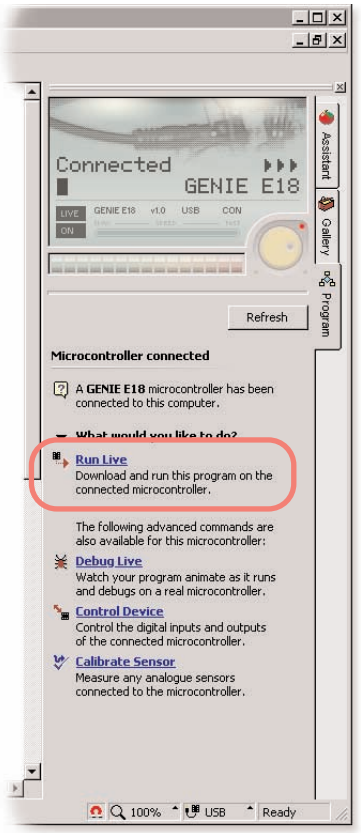


Bringing the GENIE to life 7

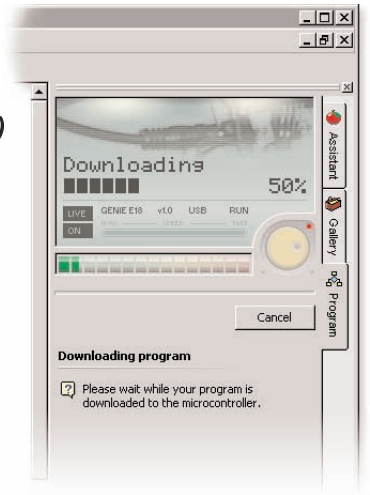
Once you have written your flowchart program, you need to store it on the GENIE chip. Here's how you do it:

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).

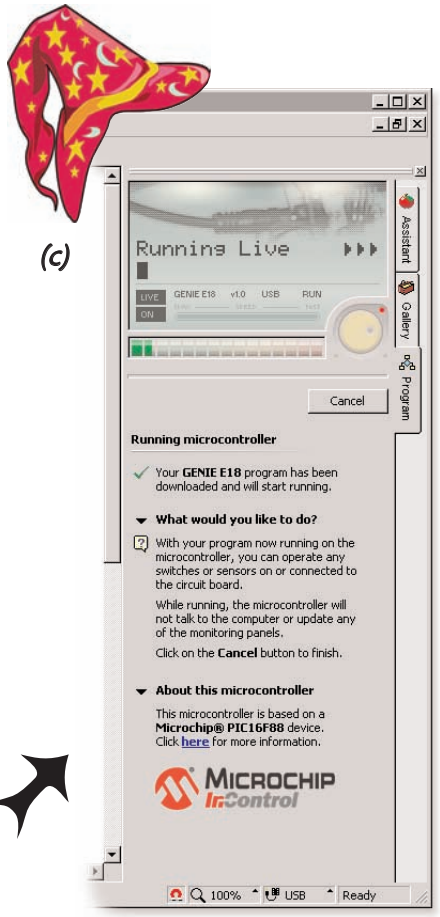
(a)



(b)



(c)



The green status LED on the motor 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.

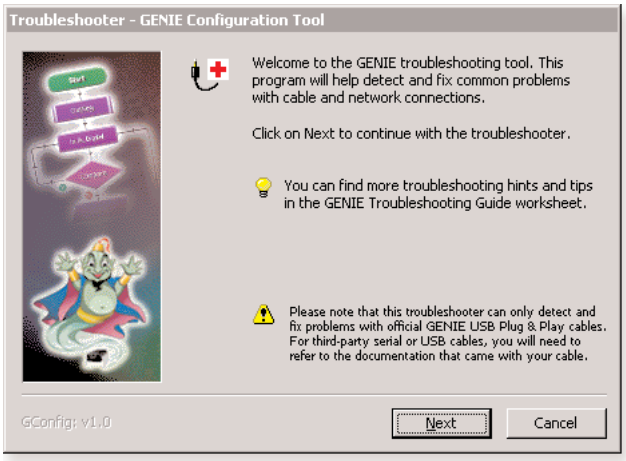
A Run the GENIE troubleshooting tool

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 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 6 volts to 12 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

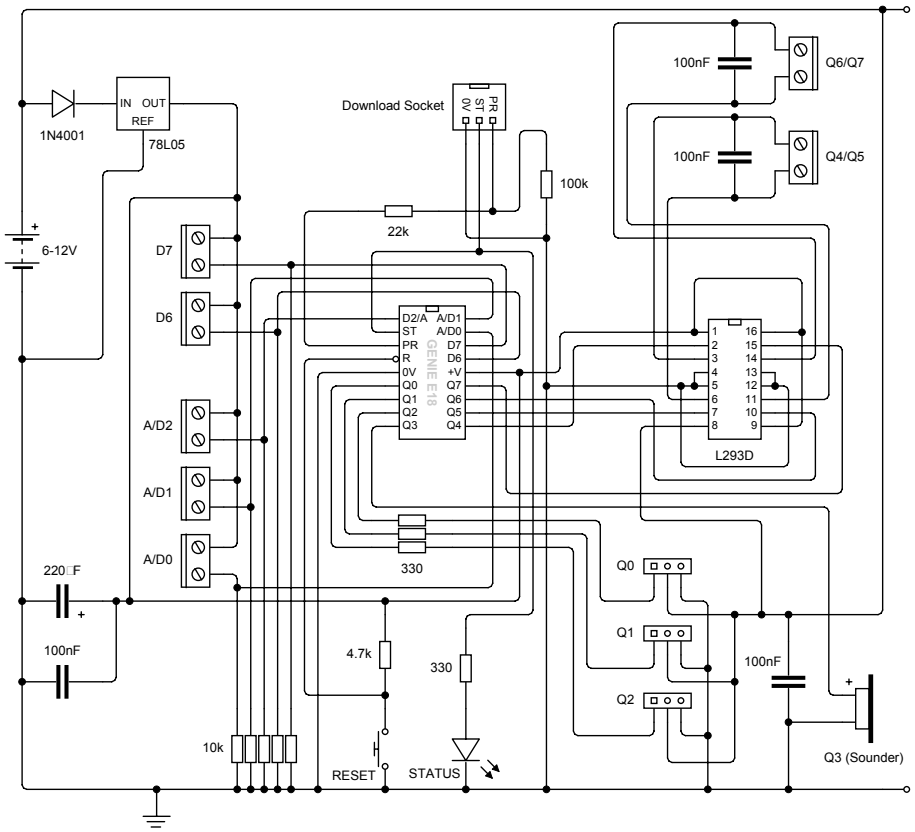
- Try plugging the cable into another GENIE board if you have one available. When powering up this circuit, the green STATUS LED should flash once (when properly connected it will flash repeatedly).
- Try with another GENIE microcontroller if possible.
- Visually inspect the board for bad solder joints 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.

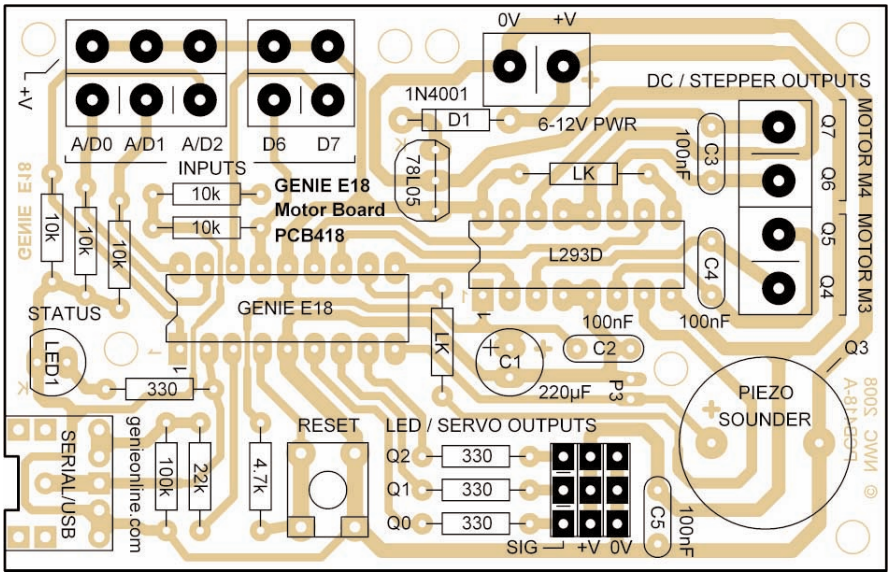
For more troubleshooting hints and tips, please read the separate **GENIE Troubleshooting Guide**.

More information 9

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

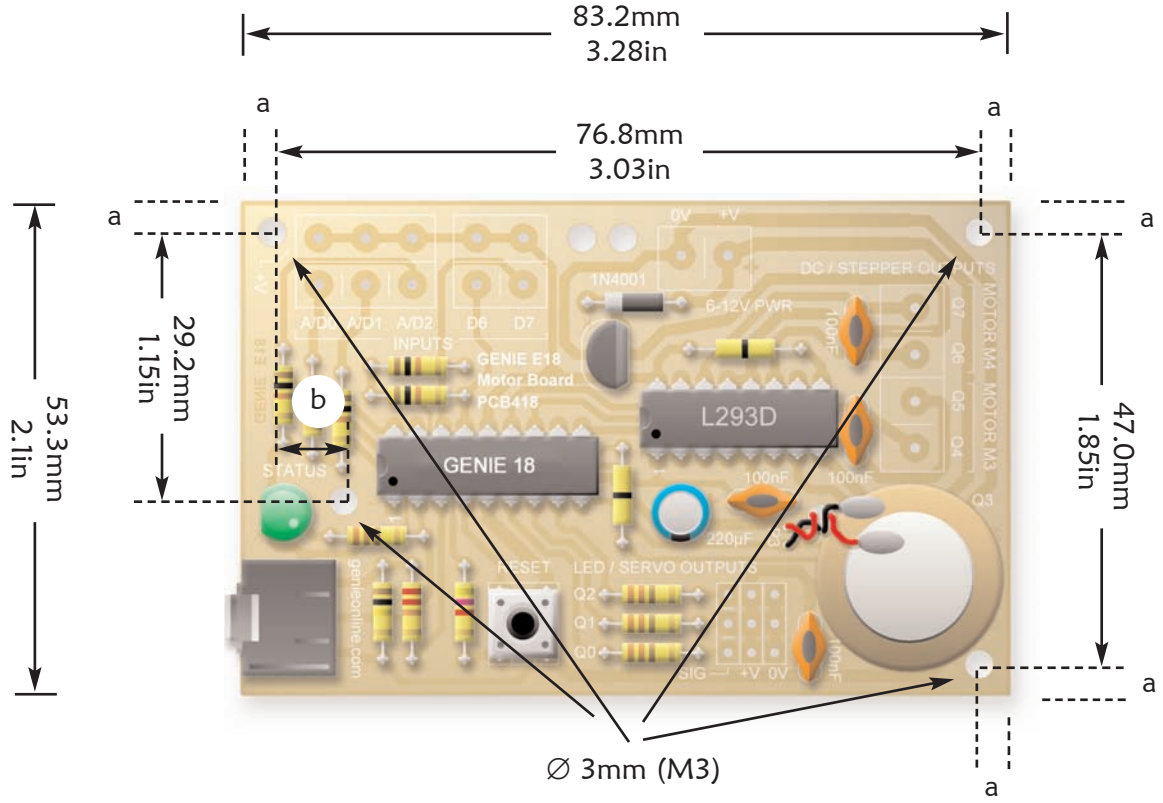
This is the **circuit diagram**. It shows how all of the components in the circuit are connected. You can compare it to the layout of the components on the actual circuit board (shown below it).





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

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

The other two large holes, located at the top-middle of the PCB, are of the same size but are instead intended to act as strain-relief holes for an off-board battery clip.

a = 3.2mm, 0.13in
b = 7.6mm, 0.3in