Science & Technology Equipment News ____

Number 26 Winter 2002

For Primary Schools and Teachers of S1/S2 courses

STS National Support Services in Science, Technology, Safety

Helpline: 0131 558 8180 Fax: 0131 558 8191

Email: sts@sserc.org.uk Web:www.sserc.org.uk

L SSERC 2002 ISSN 1369-9962

Don't talk to me about life1

"I've been ordered to take you down to the bridge. Here I am, brain the size of a planet and they ask me to take you down to the bridge. Call that job satisfaction? 'Cos I don't."

This Newsletter revisits control technology, this time at the request of a primary school teacher. We were asked to evaluate an inexpensive robot arm from CPC, a supplier of educational, electrical and electronic components. In the past we have not been keen on robot arms, as they tended to be expensive and of limited use. After trialling this particular device, however, our opinion may now be moving in their favour for some work at 5-14.

Footnote 1. The quotations are from Marvin the Paranoid Android in the *Hitchhiker's Guide to the Galaxy* by Douglas Adams. One of Marvin's websites is at: http://www.kodie.demon.co.uk/marvin.htm

Curricular contexts

Controlling devices, sensing and collecting data are all referred to in the National Guidelines for Environmental Studies 5-14. For example in the Guide for Teachers and Managers:

ICT: Controlling and Modelling - Main features of Strand Control Hardware - *Knowledge of terms and uses - Input and output sensor/ devices* (Levels A, B, C, D, E & F)

Technology Designing and Making - A way of Exploring Space. *Processes and how they are applied - Developing ideas and creating solutions* (Levels C & D).

And, in the guidelines for science:

Science: Energy & Forces - Properties & Uses of Energy Analyse the functions of everyday electronics systems in terms of input and output conditions.

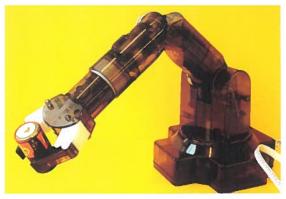


Figure 1 An assembled CPC robot arm kit

Why use a robot?

Whilst there are many devices that could be used, a robot arm will no doubt be enjoyed by children as part of their space war and computer game fantasies. This particular robot arm can be used with the keyboard supplied or programmed, with the addition of software and an interface, to work from a computer.

Children could view the arm as part of a life size robot, like *C3-P0* from *Star Wars*. Can they think of a process where robots are used? Examples include cold stores, deep sea diving bells, nuclear power stations, space stations etc. Is an automatic washing machine a robot? Can robots be useful in a social context or take on human characteristics as in the film AI? Perhaps they could, or already do, clear land mines, work in other hostile environments or stack shelves in the supermarket. Could the class design a robot to help people with disabilities?

The word robot was coined from the Czech *robota* meaning drudgery and was first used in Karel Capek's play *RUR* (*Rossum's Universal Robots*).

The Oxford Dictionary definitions offered for a robot are:

- "1. A machine with a human appearance or functioning like a human.
- A machine capable of carrying out a complex series of actions automatically.
- A person who works mechanically and efficiently but insensitively".

This last definition was used by Erich Fromm in *The Sane Society* (1955) when he suggested that society was approaching a crossroads whereat - "The danger of the past was that men became slaves. The danger of the future is that men may become robots."

Human interest in the mechanical copying of animal or human actions goes back many centuries. From the work of Hero's *Automatic opening temple doors* in 60 AD to the automata in 14th century clocks and thence to recent TV adverts for the Renault Picasso.

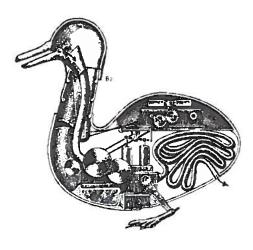


Figure 2 Vaucason's duc

Early in the 18th century Vaucason designed and built his famous duck. Even within today's technology this would be a marvellous accomplishment, for the period it must have seemed to possess magical qualities. Contemporary descriptions of the duck assign to it the ability of moving its body, flexing its wings so that all the feathers work in unison, quacking, drinking water, eating grain, and excreting the results - all in perfect mimicry of the living animal.

Lend a Hand

The robotics arm is delivered in kit form and at first sight the assembly of all the parts may look a tad complicated. Anyone who has assembled an IKEA or MFI bookcase, however, should find assembly of the arm reasonably straightforward. A helper would come in handy (groan!). The instructions are clear and easy to follow. You will end up with a few spare self-tapping screws but, don't worry, they really are spares. Depending on your experience, complete assembly could be done in about 2 hours but it is better take your time and make sure each part works properly as you go along. The beauty is that you can make up parts when you have a spare half-hour and leave them assembled until you have your next little bit of 'free' time.

Fiigure 1 on the front page shows the completed model holding a D cell to give some idea of scale. The body parts of the robot are made from smoked acrylic, the gear wheels are plastic and there are five motors each with a gearbox. The base of the robot holds the power source, four D type cells. The weight of these 'batteries' helps stabilise the arm. The keyboard (Figure 3, top right) is also made from smoked acrylic with five labelled keys; individual named keys operating different parts of the arm.

A perfect put-down

The most obvious use of the arm with the keyboard is to use it simply as a *pick and place* robot. Imagine processed parts being removed from an assembly line and placed on a test rig or placed in a box for packing. Now your challenge, should you wish to take it, is to move the D cell from a paper circle and place it in a box. Any box will do, but if you wish the robot to retrieve the battery the box should be big enough to accommodate the gripper and wrist. The battery could then be taken from the box and returned to the circle of paper.



Figure 3 Robotic arm connected to the keyboard.

This is where the children come in. What other simple tasks could we undertake with the arm? For example, since the gripper can be turned through 180 degrees, could the arm be used to fill or empty a cardboard or polystyrene drinks cup?

ICT applications

To use the robot arm with a computer, an interface board is needed and one is supplied with the MOVIT LAB software. The interface uses the same socket as the keyboard on the base of the robot. There are also two light sensors attached to the board. Figure 4 below shows the interface board and one sensor. The sensors act as switches and a sample program using sensors is given in the demonstration (demo) mode. The software to program the arm is written in a high-level computer language, which is easy to understand and use.

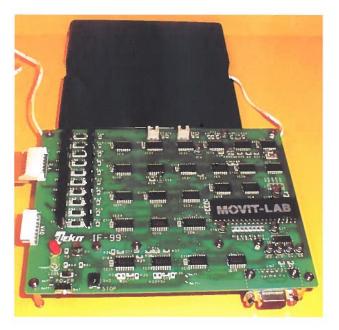


Figure 4 Interface and sensor

Wealth warning! The software reviewed here is only available for Windows '95 or '98.



Figure 5 Screen choice display or menu.



Figure 6 Screen display when in keyboard simulation mode.

Those familiar with Basic or LOGO should have no difficulty in writing programs. When the software is loaded, a screen prompts the user to choose a mode of operation (Figure 5).

Keyboard direct mode enables the various parts of the arm to be activated in a similar way to the keyboard. A demonstration program in the software gives an idea of the simple commands needed to grab and lift an object.

For those who like to use flowcharts, Figure 7 provides an example of a chart for this demonstration program. An added attraction of the *demo mode* is a thumbnail video clip showing the arm in operation.

Is it worth it?

The robot kit, leaving aside time for assembly, appears to be a good buy. Our only concerns are whether the device is robust enough to stand up to a lot of work with pupils, and the lack of Apple-Mac software. With those reservations in mind we think that the arm, either on it's own or with the software, is quite a good buy for 5 -14 work in science, technology and ICT. The software may seem expensive. But, with both arm and software all of the control outcomes shown in the 5-14 guidelines can be covered.

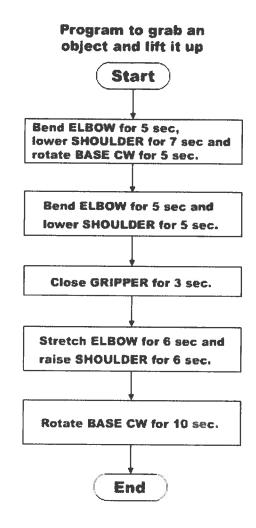


Figure 7 Flowchart display.

If the pupils are also considered to be responsible enough to carry out the assembly of the robot, this will certainly contribute to a few more ticked targets. As a bonus, for those working with *Basic Stamp, PICAXE* or *PIC Logicator*, this is a marvellous opportunity to add another model for work in S1/S2, Standard Grade or possibly in some Intermediate courses.

We trust that this Newsletter has included enough background material to indicate also the many possibilities for setting the science and technology of robotics in appropriate historical, commercial, social and ethical contexts.

Supply details

The robotics arm itself is available from CPC Components catalogue number HK00312 and costs £51.04. The interface and software for Windows is known as MOVIT-LAB, and is available from the same source at £129.97. Although details are also available on the CPC website this does not seem currently to have an online shopping facility.

CPC contact details:

CPC, Component House, Faraday Drive, Fullwood, Preston, PR2 9PP. T: 08701 202530 F: 08701 202531 E: sales@cpc.co.uk W: www.cpc.co.uk

Components & Materials

 Miniature motor, 1.5V to 3V, 2mm dia. shaft. Both motors above can be used for project work but they run at fairly high speeds, some gearing will be required. See worm/gear, item 811. 45p Miniature motor, 3V to 6V, 2mm dia. shaft. Both motors above can be used for project work but they run at fairly high speeds, some gearing will be required. See worm/gear, item 811. 45p Miniature motor, 1.5V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed for show						
Miniature motor, 3V to 6V, 2mm dia. shaft. Both motors above can be used for project work but they run at fairly high speeds, some gearing will be required. See worm/gear, item 811. Miniature motor, 1.5V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed 25p Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £1.00 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole As above but 5 mm long, pack of 4 More so ft 2 mm long, per pack of 4 More so ft 2 mm long, per pack of 4 More showing how such a motor is constructed 25p Pack of 100 wheels, 39 mm dia, assorted colours, 3 mm axle hole MES battenholders for above. Lens end lamps, 1.2 V MES, Ideal for use where a narrow, concentrated beam of light is needed. Bargain pack of 100 ED (light emitting diode) 3 mm, red, per 10 60p 60p 61b Follow, per 10 60p 61c Follow, per 10 60p 60p 61c Follow, per 10 61c Follow, per 10 60p 61c Follow, per 10 60p 61c Follow, pe	Item	Description F	Price	Item	2 CO 01. P CO 01.	Price
motors above can be used for project work but they run at fairly high speeds, some gearing will be required. See worm/year, item 811. 45p 621 Miniature motor, 1.5V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed for showing how such a motor is constructed and for showing how such a motor is constructed for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed and for showing how such a motor is constructed. 500	593	Miniature motor, 1.5V to 3V, 2mm dia. shaft	30p			
they run at fairly high speeds, some gearing will be required. See worm/gear, Item 811. 45p 25p 2621 Minitare motor, 1.5 V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed 2.5p 25p 262 Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 263 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole £5.25 264 Sal1 Worm and gear, 34 to 1 speed reduction 35p 265 Worms to fit 2 mm long, per pack of 4 40p 368 As above but 12 mm long, pack of 4 40p 369 Worms to fit 2 mm electric motor shaft, pack of 5 260 Reducers, 4 mm to 2 mm, as above, per 5 367 Reducers, 4 mm to 2 mm, as above, per 5 368 Reducers, 4 mm to 3 mm, as above, per 5 369 Reducers, 4 mm to 3 mm, as above, per 5 360 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm o.d., 22 mm i.d. 360 Pack of 100 wheels, 399 mm dia., assorted colours, as above, per 5 361 Reducers, 4 mm to 3 mm, as above, per 5 362 Reducers, 4 mm to 3 mm, as above, per 5 363 Reducers, 4 mm to 3 mm, as above, per 5 364 Reducers, 4 mm to 3 mm, as above, per 5 365 Reducers, 4 mm to 3 mm, as above, per 5 366 Reducers, 4 mm to 3 mm, as above, per 5 367 As above but black. 368 Reducers, 4 mm to 3 mm, as above, per 5 369 As above, but black. 360 Propeller kit with hub and blades for ten 3 or 2 bladed propellers 361 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 362 Corcodile eldis, red, miniature, insulated croc. dips at ends, 36 cm long. Pack of 10 for a decrease and pulleys, 70 minipul pracket, 50 pulleys, 50 feach of 10, 20, 30 and 40 mm diameters. 365 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 366 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 367 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 368 Reducers, 4 mm to 3 mm, sa bove, per 5 379 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters.	614					20p
be required. See worm/gear, item 811. 45p 621 Miniature motor, 1.5V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed 25p 798 Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 799 Pack of 24 cams, 6 of each of 4 shapes £1.00 800 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole £5.25 811 Worm and gear, 34 to 1 speed reduction 35p your middle shape and pulleys: 70 mm long, per pack of 4 40p 818 As above but 12 mm long, pack of 4 40p 820 Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers, 4 mm to 2mm, as above, per 5 25p 866 Reducers, 4 mm to 2mm, as above, per 5 25p 867 Reducers, 4 mm to 3 mm, as above, per 5 25p 868 Reducers, 4 mm to 3 mm, as above, per 5 25p 869 Reducers, 4 mm to 3 mm, as above, per 5 25p 860 Reducers, 4 mm to 3 mm, as above, per 5 25p 861 Reducers, 4 mm to 3 mm, as above, per 5 25p 862 Reducers, 4 mm to 3 mm, as above, per 5 25p 863 Reducers, 4 mm to 3 mm, as above, per 5 25p 864 Reducers, 4 mm to 3 mm, as above, per 5 25p 865 Reducers, 4 mm to 3 mm, as above, per 5 25p 866 Reducers, 4 mm to 3 mm, as above, per 5 25p 867 Reducers, 4 mm to 3 mm, as above, per 5 25p 868 Reducers, 4 mm to 3 mm, as above, per 5 25p 869 Reducers, 4 mm to 3 mm, as above, per 5 25p 860 Reducers, 4 mm to 3 mm, as above, per 5 25p 861 Reducers, 4 mm to 3 mm, as above, per 5 25p 862 Reducers, 4 mm to 3 mm, as above, per 5 25p 863 Reducers, 4 mm to 3 mm, as above, per 5 25p 864 Reducers, 4 mm to 3 mm, as above, per 5 25p 865 Reducers, 4 mm to 3 mm, as above, per 5 25p 866 Reducers, 4 mm to 3 mm, as above, per 5 25p 867 Reducers, 4 mm to 3 mm, as above, per 5 25p 868 Reducers, 4 mm to 3 mm, as above, per 5 25p 869 Reducers, 4 mm to 3 mm, as above, per 5 25p 860 Reducers, 4 mm to 3 mm, as above, per 5 25p 861 Reducers, 4 mm to 3 mm, as above, per 5 25p 862 Reducers, 4 mm to 3 mm, as abov				866		
pinion. The open body of this motor makes it ideal for showing how such a motor is constructed 25p Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 846 Sound module with 'melody' chip £1.00 838 Solar cell, 100 x 60 mm, 3.75 V per cell, max. £2.10 839 Pack of 100 wheels, 39 mm dia, assorted colours, 3 mm axle hole £5.25 831 Worm and gear, 34 to 1 speed reduction 35p Axles 3 mm dia, nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 40p As above but 12 mm long, pack of 4 40p 820 Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers, 4 mm to 2 mm, as above, per 5 867 Reducers, 4 mm to 2 mm, as above, per 5 868 Reducers, 4 mm to 2 mm, as above, per 5 868 Reducers, 4 mm to 3 mm, as above, per 5 869 Reducers, 4 mm to 3 mm, as above, per 5 860 Crocodile clips, red, miniature, lever operated 40p 822 Plastic toggle switch, low voltage 40p 835 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 835 2 x AX Cell ('battery') holder 20p 865 Coccilis divided for per load of the fits and the fits an						£3.50
for showing how such a motor is constructed 25p Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 Pack of 24 cams, 6 of each of 4 shapes £1.00 Pack of 100 wheels, 39 mm dia., assorted colours, a maxle hole £5.25 Worm and gear, 34 to 1 speed reduction 35p Worm and gear, 34 to 1 speed reduction 35p Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 40p As above but 95 mm long, pack of 4 40p Back of 50 mm, a sabove but 12 mm long, pack of 4 40p Back of 50 mm, a sabove but 12 mm long, pack of 4 40p Back of 50 mm, a sabove, per 5 25p Back Reducers, 4 mm to 2mm, as above, per 5 25p Sonic switch. SOLD OUT Pack of 20 min, yeard, year and 40 mm. 12 tooth gear fits motor shaft, pack of 5 plastic wheels, gears and wheels, to be fitted to motor shaft, pack of 5 Back Reducers, 4 mm to 3 mm, as above, per 5 25p Sonic switch. SOLD OUT Pack of 5 plastic toggle switch, low voltage 40p Back Crocodile clips, red, miniature, lever operated 40p Back Crocodile clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 Back Crocodile (backs,	621	Miniature motor, 1.5V to 3V, now with 8 tooth		508	LED (light emitting diode) 3 mm, red, per 10	50p
Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 Pack of 24 cams, 6 of each of 4 shapes £1.00 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole 11 Worm and gear, 34 to 1 speed reduction 12 Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 13 As above but 95 mm long, pack of 4 14 As above but 95 mm long, pack of 4 15 Reducers 3 mm to 2 mm enables gears, pulleys and wheels, to be fitted to motor shaft, pack of 5 16 Reducers, 4 mm to 2 mm, as above, per 5 17 Sonic switch. SOLD OUT 18 Microswitch miniature, lever operated 40p 18 As above, but black. 18 As above, but black. 18 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 18 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 2 x AC Cell ('battery') holder 18 Catter 18 mm green, per 10 3V buzzer (works with solar cells see Item 838) 3V buzzer (works with solar cell see Item 838) 55 Sound module with 'melody' chip £1.00 838 Solar cell, 100 x 60 mm, 3.75 V per cell, max. £2.10 839 Solar motor, body 25 dia.12 mm long with shaft 2 mm dia 6 mm long 50 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. £3.75 Motor mounts, plastic, push-fit with self adhesive base pad for SSEnc motors 593 & 614, 10pk £2.35 840 Solar motor, body 25 dia.12 mm long with shaft 2 mm dia 6 mm long £1.70 841 Avies 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wholes, gears and pulleys: 70 mm long, per ord of 4 40p 840 Solar motor, body 25 dia.12 mm long with shaft 2 mm dia 6 mm long £1.70 840 More mounts, plastic, motor spark 5 above but 95 mm long and 40 mm long \$10 Propeller sh tiw tiw self adhesive base pad for SSEnc motors 593 & 614, 10pk £2.35 794 Cotton reels (for making buggies, rubber powered tanks etc.) pack of 20°. 8				761	LED 3 mm, yellow, per 10	60p
dia.15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel £2.00 799 Pack of 24 cams, 6 of each of 4 shapes £1.00 800 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole £5.25 811 Worm and gear, 34 to 1 speed reduction 35p Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 40p Worms to fit 2 mm long, pack of 4 40p Worms to fit 2 mm long, pack of 4 40p Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers 3 mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, pack of 5 867 Reducers, 4 mm to 3 mm, as above, per 5 25p Sonic switch. SOLD OUT 723 Microswitch miniature, lever operated 822 Plastic toggle switch, low voltage 688 Crocodile clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 £1.35 835 2 x AA Cell ('battery') holder 90	700			762	LED 3 mm green, per 10	60p
shaft and 40 tooth gear push fits in cotton reel \$2.00 799 Pack of 24 cams, 6 of each of 4 shapes \$2.10 800 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole 811 Worm and gear, 34 to 1 speed reduction 812 Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, pack of 4 819 As above but 95 mm long, pack of 4 819 As above but 12 mm long, pack of 4 820 Worms to fit 2 mm elables gears, pulleys and wheels, to be fitted to motor shaft, pack of 5 821 Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 826 Reducers, 4 mm to 3 mm, as above, per 5 827 Reducers, 4 mm to 3 mm, as above, per 5 828 Reducers, 4 mm to 3 mm, as above, per 5 829 Microswitch miniature, lever operated 820 Plastic toggle switch, low voltage 821 Plastic toggle switch, low voltage 822 Plastic toggle switch, low voltage 823 Solar motor, body 25 dia.12 mm long with shaft 2 mm long of 21.70 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 841 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 842 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long 840 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long 840 Propeller kit with hub and blades for ten 3 or 2 bladed propellers 844 Cotton reels (for making buggles, rubber powered tanks etc.) pack of 20*. 854 Cetamic square magnet, 19 x 5 mm 15p 855 Ceramic square magnet, 19 x 5 mm 15p 866 Reducers, 4 mm to 3 mm, as above, per 5 876 Reducers, 4 mm to 3 mm, as above, per 5 877 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 878 Ceramic square magnet, 19 x 5 mm 15p 879 Ceramic square magnet, 19 x 5 mm 15p 870 Ceramic magnets, poles at ends, 10 x 6 x 22mm 12p 871 See CD Clocks, Newsletter 18. 871 See CD Clocks, Newsletter 18. 872 Ceramic magnets, poles at e	798	dia.15. 22. 32 and 40 mm. 12 tooth gear fits me	eui, otor	790	3V buzzer (works with solar cell see Item 838)	55p
800 Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole 811 Worm and gear, 34 to 1 speed reduction 812 Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 813 As above but 95 mm long, pack of 4 814 As above but 12 mm long, pack of 4 815 As above but 12 mm long, pack of 4 816 As above but 12 mm long, pack of 4 817 Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 819 As above but 95 mm long, pack of 4 810 As above but 12 mm long, pack of 4 810 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long 820 Worms to fit 2 mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 821 Reducers, 4 mm to 2mm, as above, per 5 825 Reducers, 4 mm to 2mm, as above, per 5 826 Reducers, 4 mm to 3 mm, as above, per 5 827 Roicrowitch miniature, lever operated 828 Plastic toggle switch, low voltage 829 Plastic toggle switch, low voltage 820 Plastic toggle switch, low voltage 821 Popeller xit with hub and blades for ten 3 or 2 bladed propellers 825 Plastic toggle switch, low voltage 826 Crocodile clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 827 Eramic square magnet, 19 x 19 x 5 mm 828 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 828 Quartz clock movement , dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 829 Solar motor, body 25 dia. 12 mm long with shaft 2 mm dia 6 mm long on propeller (801), and 3 V buzzer - with notes. 837 Motor mounts, plastic, push fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 836 Motor mounts, plastic, push rit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 837 Propeller xit with hub and blades for ten 3 or 2 bladed propellers 839 Cotton reels (for making buggles, rubber powered tanks etc.) pack of 20				846	Sound module with 'melody' chip	£1,00
shaft 2 mm dia 6 mm long \$11 Worm and gear, 34 to 1 speed reduction \$17 Axies 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 \$18 As above but 95 mm long, pack of 4 \$19 As above but 12 mm long, pack of 4 \$20 Worms to fit 2 mm electric motor shaft, pack of 5 \$21 Reducers 3 mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 \$25 Reducers, 4 mm to 2 mm, as above, per 5 \$25 Reducers, 4 mm to 3 mm, as above, per 5 \$25 Posic switch. SOLD OUT \$25 Posic switch. SOLD OUT \$25 Posic switch social clips, red, miniature, lever operated \$25 Posic switch social clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 \$25 x AA Cell ('battery') holder \$25 make 2 mm dia 6 mm long \$25 posic act on of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. \$23.75 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 \$25 motor mounts, plastic, push-fit with nub and blades for ten 3 or 2 bladed propellers \$25 motor mounts, plastic, push-fit with nub and blades for ten 3 or 2 bladed propellers \$25 motor mounts, plastic, push-fit with nub and blades for ten 3 or 2 bladed propellers \$25 motor mounts, plastic, push-fit with nub and blades for ten 3 or 2 bladed propellers \$25 motor mounts, plastic, push-fit with nub and bl	799	Pack of 24 cams, 6 of each of 4 shapes	£1.00	838	Solar cell, 100 x 60 mm, 3.75 V per cell, max.	£2.10
811 Worm and gear, 34 to 1 speed reduction 817 Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 818 As above but 95 mm long, pack of 4 819 As above but 12 mm long, pack of 4 820 Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 826 Reducers, 4 mm to 2 mm, as above, per 5 827 Sonic switch. SOLD OUT 828 Plastic toggle switch, low voltage 829 Plastic toggle switch, low voltage 830 Crocodille clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 831 Experimental colours, insulated croc. clips at ends, 36 cm long. Pack of 10 832 Ax A Cell ('battery') holder 834 Cell ('battery') holder 835 Can box 2 x A Cell ('battery') holder 836 Reducers 3 mm to 3 mm, as above, per 5 847 Reducers, 4 mm to 3 mm, as above, per 5 848 Crocodille clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 849 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes. 840 Solar pack : one of each solar cell, solar mith of buzzer - with notes. 840 Motor mounts, plastic, push-fit with self adhesive base pad for SERC motors 593 & 614, 10pk 82.35 840 Propeller (801), and 3 V buzzer - with notes. 840 Propeller (801), and 3 V buzzer - with notes. 840 Propeller (801), and 3 V buzzer - with notes. 840 Propeller (801), and 3 V buzzer - with notes. 846 Motor mounts, plastic, push-fit with hub and blades for ten 3 or 2 bladed propellers 840 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long 840 Propeller, 3 blade,	800			839	• •	
Axies 3 mm dia, nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 As above but 95 mm long, pack of 4 As above but 12 mm long, pack of 4 Worms to fit 2 mm electric motor shaft, pack of 5 Reducers 3 mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 Reducers, 4 mm to 2mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Microswitch miniature, lever operated As above, but black. Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long Propeller (801), and 3 V buzzer - with notes. And the service of the service base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long Propeller, 801), and 3 V buzzer - with notes. \$350 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk £2.35 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long The propeller (801), and 3 V buzzer - with notes. Stantally all and pade for fits 2 mm shaft. Blade 62 mm long The propeller (801), and 3 V buzzer - with notes. Stantally all and pade for fits 2 mm shaft. Blade 62 mm long The propeller (801), and 3 V buzzer - with notes. Stantally all and pade for fits 2 mm shaft. Blade 62 mm long The propeller (801), and 3 V buzzer					· · · · · · · · · · · · · · · · · · ·	£1.70
push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 818 As above but 95 mm long, pack of 4 819 As above but 12 mm long, pack of 4 820 Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 826 Reducers, 4 mm to 2mm, as above, per 5 827 Reducers, 4 mm to 2 mm, as above, per 5 828 Reducers, 4 mm to 3 mm, as above, per 5 829 Plastic toggle switch, low voltage 820 Plastic toggle switch, low voltage 821 Reducers, 4 mm to 3 mm, as above, per 5 822 Plastic toggle switch, low voltage 823 Crocodile clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 824 Sabove, but black. 825 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 826 Reducers, 4 mm to 3 mm, as above, per 5 827 Plastic toggle switch, low voltage 828 Crocodile clips, red, miniature, insulated croc. clips at ends, 36 cm long. Pack of 10 829 Plastic toggle switch, low voltage 830 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk 820 Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk 820 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long 821 Cotton reels (for making buggies, rubber powered tanks etc.) pack of 20*. 825 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 826 Reducers, 4 mm to 2 mm, as above, per 5 827 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 828 Ring magnet, 40 mm o.d., 22 mm i.d. 829 Sec Ceramic magnets, poles at ends, 10 x 6 x 22mm 820 Quartz clock movement , dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. 820 Sec CD Clocks, Newsletter 18. 821 Chariek it it. Tompleter and parts. 822 Plastic toggle switch, low od cut to length etc. 823 Onager kit. Wood cut to length etc.	0	• ,	35p	840		£3.75
base pad for SSERC motors 593 & 614, 10pk 10	817	Axles 3 mm dia., nickel plated, round ends,		836	• •	
819 As above but 12 mm long, pack of 4 820 Worms to fit 2 mm electric motor shaft, pack of 5 821 Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 867 Reducers, 4 mm to 2mm, as above, per 5 868 Reducers, 4 mm to 3 mm, as above, per 5 710 Sonic switch. SOLD OUT 723 Microswitch miniature, lever operated 822 Plastic toggle switch, low voltage 823 Crocodile clips, red, miniature, insulated 759 As above, but black. 750 As above, but black. 750 As above, but black. 751 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 825 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 826 Propeller kit with hub and blades for ten 3 or 2 bladed propellers 827 Cotton reels (for making buggies, rubber powered tanks etc.) pack of 20*. 828 Reducers, 4 mm to 3 mm, as above, per 5 829 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. 820 Ring magnet, 40 mm o.d., 22 mm i.d. 821 Seramic square magnet, 19 x 19 x 5 mm 822 Ceramic magnets, poles at ends, 10 x 6 x 22mm 823 Ceramic magnets, poles at ends, 10 x 6 x 22mm 824 Quartz clock movement , dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. 825 See CD Clocks, Newsletter 18. 826 Chariet kit. Tomplates and natte to 200 and 40 mm diameters. 827 Ring magnet, 40 mm o.d., 22 mm i.d. 828 Sec am long 829 Popeller kit with hub and blades for ten 3 or 2 bladed propellers 820 Cotton reels (for making buggies, rubber powered tanks etc.) pack of 20*. 825 Pack of 20 pulleys, 5 of each of 10, 20, 30 826 Ceramic square magnet, 19 x 19 x 5 mm 827 Ceramic magnets, poles at ends, 10 x 6 x 22mm 828 Quartz clock movement , dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial diameter to 200mm. Requires an AA battery. 828 Colton reels (for making buggies, rubber powered tanks etc.) pack of 20*.			40p	-		
## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 3 or 2 bladed propellers ## \$3.50 ## Propeller kit with hub and blades for ten 4	818	As above but 95 mm long, pack of 4	40p	801		
2 bladed propellers 20 bladed propelles 20 blade popel blade acch of 10, 20, 30 and 40 mm diameters. 815 825 827 825 827 828 829 829 829 829 829 820 820 821 821 821 821 822 821 823 824 824 825 825 825 825 826 826 826 827 828 828 828 828 82	819	As above but 12 mm long, pack of 4	40p			35p
Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 Reducers, 4 mm to 2mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Sonic switch. SOLD OUT 723 Microswitch miniature, lever operated Reducers witch, low voltage Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, 4 mm to 2mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Ceramic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm Reducers, 4 mm to 2mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm Reducers, 4 mm to 2mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm Reducers, 4 mm to 2mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm Reducers, 4 mm to 2mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm 15p Bimetallic strip, 10 cm length Reducers, 4 mm to 2mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm 15p Reducers, 4 mm to 2 mm, as above, per 5 Pack of 20 pulleys, 5 of each of 10, 20, 30 Ring magnet, 40 mm o.d., 22 mm i.d. Secamic square magnet, 19 x 19 x 5 mm Ceramic requires and 40 mm d	820	•		792	•	£3.50
and wheels, to be fitted to motor shaft, per 5 and wheels, to be fitted to motor shaft, per 5 Reducers, 4 mm to 2mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Sonic switch. SOLD OUT Microswitch miniature, lever operated Plastic toggle switch, low voltage Reducers, 4 mm to 3 mm, as above, per 5 Plastic toggle switch, low voltage Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, 4 mm to 3 mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Ring magnet, 40 mm o.d., 20 mm i.d. Ring magnet, 40 mm o.d., 20 mm i.d. Ring magnet, 40 mm o.d., 20 mm i.d. Ring magnet, 40 mm o.d		,	£1.00	794		
Reducers, 4 mm to 2mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 2 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Reducers, 4 mm to 3 mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Standard omm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard omm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, 4 mm to 3 mm, as above, per 5 Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, 4 mm to 3 mm, as above, but black. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, 4 mm to 3 mm, as above, but black. Standard om m diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Ring magnet, 40 mm o.d., 22 mm i.d. Ring magnet, 40 mm o.d., 22 mm i.d. Reducers, and 40 mm diameters. Ring magnet, 40 mm o.d., 22 mm i.d. Reducer	821		25p	/54		75p
Reducers, 4 mm to 3 mm, as above, per 5 Sonic switch. SOLD OUT Microswitch miniature, lever operated Plastic toggle switch, low voltage Crocodile clips, red, miniature, insulated As above, but black. Crocodile leads, assorted colours, insulated croc. clips at ends,36 cm long. Pack of 10 Sassonic switch. SOLD OUT Ring magnet, 40 mm o.d., 22 mm i.d. Ceramic square magnet, 19 x 19 x 5 mm Ceramic magnets, poles at ends, 10 x 6 x 22mm Bimetallic strip, 10 cm length Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. Sassonic switch. SOLD OUT String magnet, 40 mm o.d., 22 mm i.d. String magnet, 40 mm o.d., 22	867	<u> </u>	•	796	Pack of 20 pulleys, 5 of each of 10, 20, 30	
710 Sonic switch. SOLD OUT 723 Microswitch miniature, lever operated 826 Plastic toggle switch, low voltage 827 Plastic toggle switch, low voltage 828 Crocodile clips, red, miniature, insulated 829 As above, but black. 820 Plastic toggle switch, low voltage 821 Ceramic square magnet, 19 x 19 x 5 mm 822 Ceramic magnets, poles at ends, 10 x 6 x 22mm 823 Ceramic magnets, poles at ends, 10 x 6 x 22mm 824 Democration of the properties of the pro		•	•		and 40 mm diameters.	
Microswitch miniature, lever operated Plastic toggle switch, low voltage Crocodile clips, red, miniature, insulated As above, but black. Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. Pack of 10 2 x AA Cell ('battery') holder Microswitch miniature, lever operated 40p 40p 823		• • • • • • • • • • • • • • • • • • • •				
Plastic toggle switch, low voltage Crocodile clips, red, miniature, insulated As above, but black. Crocodile leads, assorted colours, insulated croc. clips at ends,36 cm long. Pack of 10 2 x AA Cell ('battery') holder Plastic toggle switch, low voltage 40p 5p 881 Bimetallic strip, 10 cm length Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 2 x C Cell ('battery') holder 882 Ceramic magnets, poles at ends, 10 x 6 x 22mm 12p 883 Bimetallic strip, 10 cm length 983 Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 61 Dimetallic strip, 10 cm length 983 Quartz clock movement of the complete of the com			40p			-
688 Crocodile clips, red, miniature, insulated 759 As above, but black. 788 Crocodile leads, assorted colours, insulated croc. clips at ends,36 cm long. Pack of 10 839 2 x AA Cell ('battery') holder 840 Simetallic strip, 10 cm length 850 Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 850 Simetallic strip, 10 cm length 851 Simetallic strip, 10 cm length 952 Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 953 2 x AA Cell ('battery') holder 954 300 Chariet kit. Tomplates and parts			•			
As above, but black. 759 As above, but black. 769 Crocodile leads, assorted colours, insulated croc. clips at ends,36 cm long. Pack of 10 810 See CD Clocks, Newsletter 18. 811.75 See CD Clocks, Newsletter 18.			5p		The state of the s	•
788 Crocodile leads, assorted colours, insulated croc. clips at ends,36 cm long. Pack of 10 835 2 x AA Cell ('battery') holder 845 2 x C Cell ('battery') holder 20p 41.35 41.35 41.35 41.35 41.35 42.00 43.35 44.35 45.36 45.36 46.36 46.36 47.37 48.36 48.47 48.47 48.47 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 48.48 4	759	• • • •	-	882		
croc. clips at ends,36 cm long. Pack of 10 835 2 x AA Cell ('battery') holder 845 2 x C Cell ('battery') holder 20p diameter to 200mm. Requires an AA battery. See CD Clocks, Newsletter 18. 41.75 884 Onager kit. Wood cut to length etc. 62.00		Crocodile leads, assorted colours, insulated	-		up to 10mm. Includes plastic hands suitable for	r dial
835 2 x AA Cell ('battery') holder 845 2 x C Cell ('battery') holder 20p 884 Onager kit. Wood cut to length etc. £2.00		croc. clips at ends,36 cm long. Pack of 10	£1.35			£1 7E
845 2 x C Cell ('battery') holder 20p	835	2 x AA Cell ('battery') holder	•	004	•	
Table Relient connector DD2 has connected process 553 Undflot Kit, lettiplates distributes the E2.00	845	` ''	20p		• "	
729 Battery Connector, FF3 type, snap-on press	729	Battery connector, PP3 type, snap-on press-	Se.			£2.00
stud, suitable for Items 835 and 845 5p *Item 794 Not 200 as previously stated in error	0	stud, suitable for Items 835 and 845	эþ	+1ten	1 / 200 as previously stated in entit	

An interactive, fully illustrated, version of this list is posted on the SSERC site at:

http://www.sserc.org.uk/Members/Primary/Surplus/body.htm

This newsletter and a number of previous issues are posted in web page format on the Improving Science Education 5-14 site at: www.ise5-14.org.uk

Prices do not include VAT which will be charged at the ruling standard rate. Cash with order only when total value is less than £5 and please add £1 for carriage solely to these small orders (except where an inclusive price is indicated eg kits, etc). For orders totalling more than £5 please do not send payment etc but await delivery and then pay on our advice note or invoice.

SSERC, St Mary's Building, 23 Holyrood Road, Edinburgh, EH8 8AE Tel. 0131 558 8180 Fax 0131 558 8191

Email: sts@sserc.org.uk Web: www.sserc.org.uk