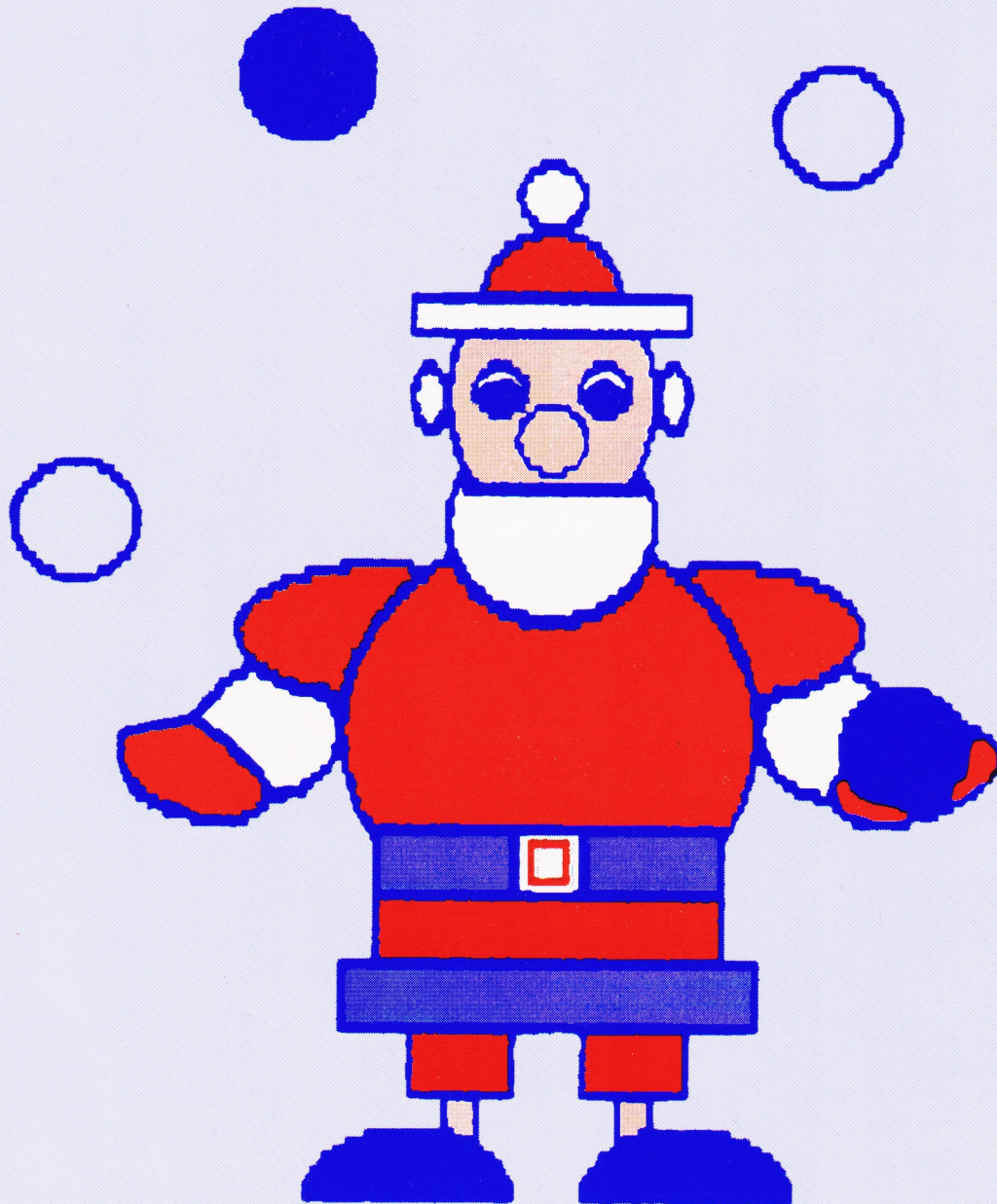


MICROSCOPE

Software Special



Switch-on
(an introduction to Control)

NEWMAN COLLEGE with MAPE

ACKNOWLEDGEMENTS

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Additional copies of this book are available at £3 each (including p&p) from:

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Switch-On is available at £15 plus VAT, for Acorn machines only.

MAPE (MICROS AND PRIMARY EDUCATION)

MAPE is open to individuals and institutions. The current subscription of £15.00 p.a. (UK), £20.00 p.a. (overseas), includes direct mailing of **MICRO-SCOPE**.

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Application forms from: Val Siviter
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ISBN: 0 948048 08 5

Published by: Castlefield (Publishers) Ltd.
Castlefield House
12 Headlands
Kettering
Northants NN15 7HP

MAPE reference: Income and Corporation Tax relief on membership fee - T1644/23/1968/MT.
Charity Commission reference: OSP-292898-R Reg. No. 292898

Vat Number: 544 8661 18

Produced by The Castlefield Press, Kettering, Northants.

SWITCH-ON

USER DOCUMENTATION

INTRODUCTION

Using a computer for 'control' purposes can prove a daunting task as it often requires:

- a) an interface box
- b) appropriate software
- c) a model or artefact to control
- d) appropriate connecting wires

This requires an investment in time and resources plus a teacher who is sufficiently confident to discover through experimentation.

This program is aimed to help teachers, and their pupils, to gain the necessary confidence before moving on to the investment of specialist hardware and software. It is intended to allow users to control models (represented on the screen pictorially) without the need for an actual model, interface box and connecting leads. It does require mastery of a very simple, Logo-like control language. The program is restricted to switching 'outputs' - things that can be switched on or off (e.g. lights, buzzers, motors). Hopefully, if pupils are successful with this program, it will serve as an incentive for them to progress to work involving the 'real' environment; namely controlling a physical model they have built such as a lighthouse

CURRICULUM & TEACHING IDEAS

WHAT IS IT?

Switch-On is a simple introduction to control by computers without wires and interface boxes! Children learn to write simple routines to control a number of devices - lamps, motors and sounds - and to produce animation. Switch-On is not intended to replace the 'real thing' but is a great way to start.

WHAT'S GOOD ABOUT IT?

You can turn lights on and off without worrying about interface boxes, broken wires, flat batteries and blown bulbs; it all happens on the screen. A lesson can start almost straight away without having to distribute things, connect them and then collect them all back at the end of the lesson.

The response is safe. A turtle programmed to go 300 steps instead of 30 will disappear into the distance; similarly a buzzer will sound for ever. Switch-On routines won't damage anything. Children can safely learn that it's all right to make mistakes. It's all part of the learning experience.

Some children might like to explore the programming features such as repeats, using variables and procedures, all of which can be transferred to other activities, especially Logo and language development. By explaining to someone else what they're expecting their program to do, they have to articulate their thoughts and planning.

WHAT DO THEY NEED TO KNOW/UNDERSTAND/BE TAUGHT?

- The linear nature of a set of instructions. Doing things in the right order is often important. Where does order matter? Shopping, cleaning the hamster cage. Traffic lights may be familiar but they are a useful teaching aid in simple control procedures.
- Lights etc. do not switch themselves on or off without being instructed to.
- The nature of animation. How we perceive movement. Lights across a screen. A flick book.

- 'Repeating' a set of commands in order to carry out an operation several times using a minimum of commands.
- Procedures are a set of commands that can be called into use when a particular operation is needed (a difficult concept, even for adults). Useful analogies could be drawing a train with a series of carriages, a house with lots of windows

WHAT ARE THE LIMITATIONS?

Backgrounds of the appropriate size can be created in a painting program and saved in the background folder inside the !Switch-On application. This could lead to follow-up work stimulated by the icons available.

Icons can be changed but not easily (it is best to work with what's there). The sounds can't be edited.

There is no input to respond to. There is no monitoring function. There are no sensors.

WHAT SHALL I DO WITH IT?

To start with let the children play with the program for 5/10 minutes to find out what it does, then pool ideas.

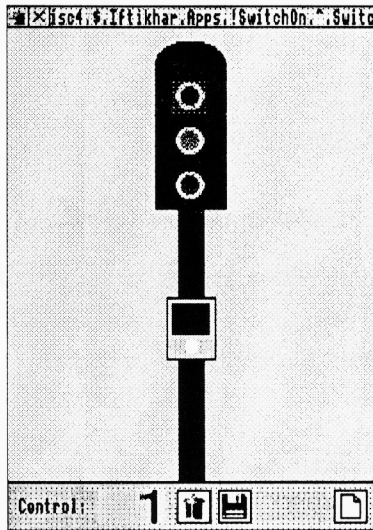
- Load one of the backgrounds, put some icons on it and write a routine to make them work.
- Did it work as expected?
- Where did it go wrong? What has to be done to put it right?
- Are there any other changes that can be made?
- Show everyone else. Tell them what it's going to do.

STARTING THE PROGRAM

Using the Switch-On Program Disc supplied:

- Open a '**directory viewer**' by clicking on the :0 disc icon on the icon bar. This will bring up a window showing the files contained on the disc.
- If you will be printing from within Switch-On you must load a suitable printer driver first. The choice of driver will depend on which printer you have connected.
- Double-click using the left-hand mouse button on the !Switch-On icon in the directory viewer.
- After a while the Switch-On icon will appear on the icon bar together with a header window which will remain for a further 5 seconds.
- To invoke Switch-On, click the left-hand mouse button over the Switch-On icon on the icon bar. The drawing board, program window and toolbox windows will appear.

THE DRAWING BOARD



Imagine the drawing board to be a table-top for arranging any sequence of icons, each of which can be switched on or off. These can be moved about until a satisfactory arrangement is accomplished before writing a **control program**. In addition, the colour of the drawing board can be changed or an optional background picture can be used as a source of inspiration!

Select an icon by clicking on it with the left-hand mouse button (denoted by the icon becoming highlighted in red). This reveals the corresponding **icon number** in the **control pane** situated at the bottom of the drawing board. Each icon number is unique and should be used as its reference when it comes to writing a control program.

The control pane not only reveals icon numbers but contains a further three options, **clear all** (represented by a waste bin), **save file** (floppy disk) and **file new** (blank sheet of paper).

There is also a menu associated with the drawing board. This is accessed by clicking over the drawing board area with the middle mouse button. It is explained in detail later.

THE TOOLBOX

The toolbox contains all the different icons that can be dragged onto, and arranged on, the **drawing board**.

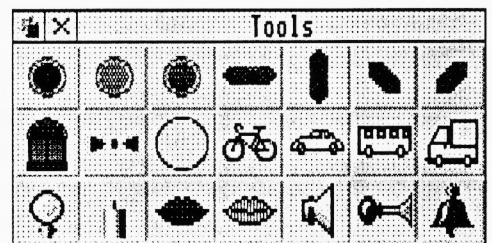
TYPES OF ICON

There are three different types of icon that you can have on the drawing board. These are as follows:

Normal These are representations of ordinary controls that you would use for a modelling project i.e. lights, LED's, buzzers.

Animation These are specialised icons for animation. In the tool box, and when placed on the drawing board, they appear as an outline. When a program is executed they disappear and only become visible when they are switched back on via a **Switch on** instruction or when the program ends, whereby all animation icons resume their outline state.

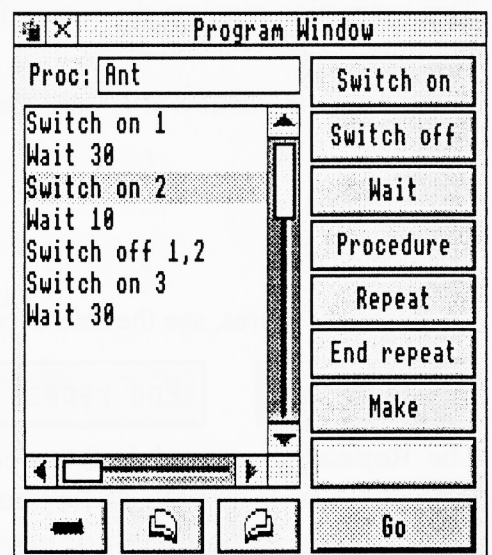
Sound There are five icons, which when activated via a **Switch on** instruction, play a sampled sound.



THE PROGRAM WINDOW

When a layout of icons has been accomplished, the **Program Window** facilitates the writing of a control program.

The program consists of a sequence of single-line instructions.



GETTING STARTED

THE PROGRAMMING LANGUAGE

Here is a list of the different programming commands. If you are uncertain about writing a short program, just use the first 4 instructions below together with the **Repeat** instruction.

Switch on

This command is followed by a list of icon numbers (separated by commas) which are to be activated (switched on) on the drawing board.

```
Switch on 1
Switch on 2, 5
Switch on A
Switch on A, B, C
```

Switch off

This command is followed by a list of control numbers which are to be de-activated (switched off) on the drawing board.

```
Switch off 1
Switch off 2, 5
Switch off A
Switch off A, B, C
```

Wait

The **Wait** command is followed by a number, or a variable, specifying the duration, in tenths of a second, by which the program is to be paused.

```
Wait 10
Wait A
```

Go

Clicking on **Go** will begin execution of the program. To abort a program simply press the Escape key.

Procedure

This instruction requires the name of a procedure which will be executed within the program during run-time.

In the program window it is only the name of the procedure that is displayed enclosed in square ([]) brackets.

```
Switchon 1
[Bat]
Switchoff 1
```

To clear procedures, see the reference to the Procedure menu further on.

Repeat

End repeat

The **Repeat** command is followed by a number, or variable, specifying the number of times instructions enclosed within a **Repeat....End repeat** structure are to be performed. The program also allows for **Repeat....End repeat** structures to be nested inside one another.


```
Repeat 4
...
End repeat
```

```
Repeat A
...
End repeat
```

```
Repeat B
...
Repeat 3
...
End repeat
...
End repeat
```

The **End repeat** instruction marks the end of a **Repeat** structure.

Make

The **Make** instruction allows an assignment to a variable.

```
Make A=1
Make A=B+C
Make A=B+1
```

(Spaces are not permissible.)

PROGRAM VARIABLES

The program can utilise 3 special integer variables - **A**, **B** and **C**. These variables can have any positive value ranging from 0 to 4095 inclusive. If an operation should cause a variable to become negative, or if the allowed range is exceeded, an error is generated.

The **Make** instruction can assign values to these variables and also perform simple mathematical operations on them. Other programming commands such as **Switch on**, **Switch off**, **Wait**, **Repeat**, can also make reference to these variables.

PROCEDURES

There are 26 pre-defined procedure names that can be used in a program. Each begins with a different letter of the alphabet and, for simplicity, is named after an animal (e.g. Ant, Bat).

Any of the procedures can be accessed by 'flipping through' them as with a book. Two icons exist which when clicked on will turn forwards or backwards through the procedures. These are:



To turn back to the previous procedure.



To turn to the next procedure.

Listed below are a couple of example programs to demonstrate the use of the programming language. Both of these examples are supplied with the Program Disc.

Traffic lights simulation:

```
{Ant}
Repeat 4
  Switch on 1
  Wait 30
  Switch on 2
  Wait 10
  Switch off 1,2
  Switch on 3
  Wait 30
  Switch off 3
  Switch on 2
  Wait 10
  Switch off 2
End repeat
```

1=Red; 2=Amber; 3=Green

Listing for 'juggler':

```
{Ant}
Repeat 4
  Switch on 1,3
  Wait 5
  Switch off 1,3
  Switch on 2,4
  Wait 5
  Switch off 2,4
End repeat
```


MENUS

THE PROGRAM MENU

Click on the icon bar over the Switch-On icon, using the middle mouse button, to bring up the program menu with the following options:

Switch-on	
Info	↕
Quit	

- Info** Leads to a standard RISC-OS program information window containing the program name, purpose, author and version details.
- Quit** Choose this whenever you wish to exit from the Switch-On program.

THE SWITCH-ON MENU

Click over the Drawing Board window with the middle mouse button to bring up a menu with the following choices:

Switch-on	
Info	↕
File	↕
Demos ...	
Select	↕

✓ Program	
✓ Tools	

Background	↕

- File** Leads to a further sub-menu with the following options:
- Save** Provides a standard RISC-OS save dialogue box. To save you can:
- Supply a file name of up to ten letters and press **Return** or click on **ok**. This is provided as a convenience feature because the file is automatically saved in the 'Switch-On' directory.
 - Type in a file name of up to ten letters. Then click on the icon in the save dialogue box with the left-hand mouse button (select) and drag it to a directory viewer.
 - Type in a full path name and then press **Return** or click on **ok**.
- New** After confirmation, all control icons on the drawing board and instructions in the program window are cleared so that a new file can be commenced.
- Demos...** Choosing this option brings up a directory viewer containing example control programs.
- Select** Leads to a further sub-menu allowing various operations to be carried out on the selected icons (the icons must be selected prior to choosing this option):
- Select all** Expands the selection so that all the icons are highlighted.
- Clear** Clears (de-selects) all the selected icons.
- Delete** Deletes the selected icons. The icon numbers of the deleted icons become available for re-use.
- Amend** Allows you to select a number of icons on the drawing board and replace them all by the one selected from the list that appears as a result of this option.
- Program** Choosing this option toggles the program window on or off.
- Tools** Toggles the icon toolbox on or off.
- Background** Invokes a further sub-menu with the following choices:
- Colour** Leads to a further 'Colours' menu listing the various colours that can be selected for the drawing board.

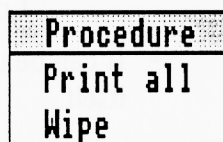
Picture

Leads to a further menu listing the various backdrop pictures that can be selected for the drawing board. The pictures that are supplied on the program disc are as follows:

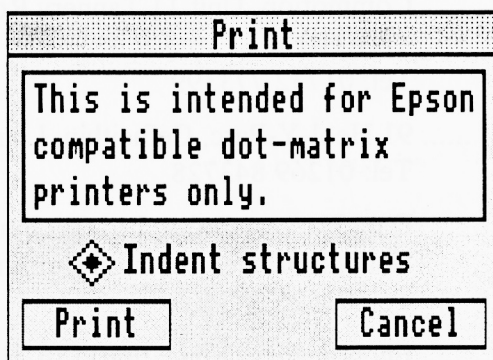
Blank	Bus	Clown	Face	Juggler
Lights	Plane	Road	SkyAtNight	XmasTree

THE PROCEDURE MENU

Clicking over the program window with the middle mouse button (menu) leads to a procedure menu with the following options:



Print program Choosing this option leads to a 'print' dialogue box.



This option provides a draft copy of all the procedures and is only intended for Epson compatible dot-matrix printers, although it is quite likely it will work with other printers if the appropriate printer driver has been loaded prior to starting Switch-On.

An 'indent structures' choice is provided which will determine whether instructions enclosed within a **Repeat....End repeat** will be indented for legibility.

Choose 'cancel' if you decide not to go ahead with printing. Otherwise, click on 'print' to commence (please ensure that the printer has been switched on and is on-line).

Wipe PROC

Whenever you wish to abandon the current procedure and start it afresh, choose this option. It is also useful for clearing any redundant procedures which are no longer required.

A confirmation prompt is always provided first.

Save program text

Leads to a standard RISC-OS save dialogue box to allow the text of the program to be saved. The text could then be taken into a word processor for 'smartening up'.

CREATING CUSTOM BACKDROPS

All backdrops supplied with the Program Disc have been created as sprites using !Paint. Observe the following points when creating your own custom designs.

- Use the "Blank" sprite as a template when designing your own backdrops.
- There must only be one sprite drawing per sprite file.
- All sprites should be created for mode 12.
- The maximum visible sprite size is 342 x 203 pixels.
- Completed sprites must be saved in the "Backdrops" directory on the Program Disc so that the program knows where to look for them.

FURTHER IDEAS AND INFORMATION

- Switch-On can form part of a sequence of teaching about control, complementing any of the following:

Roamer	Valiant
Pip/Pixie.....	Swallow
Logo	Longmans

- It can be used as a program in its own right, just for the fun and experience. It can be an end in itself.

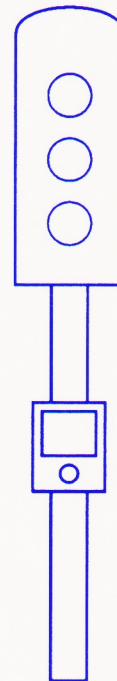
If you want to pursue control further then some firms providing the necessary hardware/sensors are:

Commotion.....	Commotion, Unit 11 Tannery Road, Tonbridge, Kent TN9 1RF Tel: 01732 773399
Deltronics.....	91 Heol-Y-Parc, Cefneithin, Llanelli, Dyfed SA14 7DL Tel: 01269 843728
Data Harvest.....	Data Harvest Group Ltd, Woburn Lodge, Waterloo Road, Linslade, Leighton Buzzard, Beds. LU7 7NR Tel: 01525 373666
Smart Box	Economatics (Education) Ltd, Epic House, Darnall Road, Attercliffe, Sheffield S9 5AA Tel: 0114 2813344
Pip.....	Swallow Systems, 134 Cock Lane, High Wycombe, Bucks HP13 7EA
Roamer.....	Valiant Technology, Valiant House, 3 Grange Mills, Weir Road, London SW12 0NE Tel: 0181 673 2233
Logo.....	Longman Logotron, 124 Cambridge Science Park, Milton Road, Cambridge CB4 4ZS Tel: 01223 425558

MICROSCOPE

Traffic Lights

Repeat 4
Switch on 1
Wait 30
Switch on 2
Wait 10
Switch off 1,2
Switch on 3
Wait 30
Switch off 3
Switch on 2
Wait 10
Switch off 2
End repeat



Published by Castlefield (Publishers) Ltd, Castlefield House,
12 Headlands, Kettering, Northants NN15 7HP
