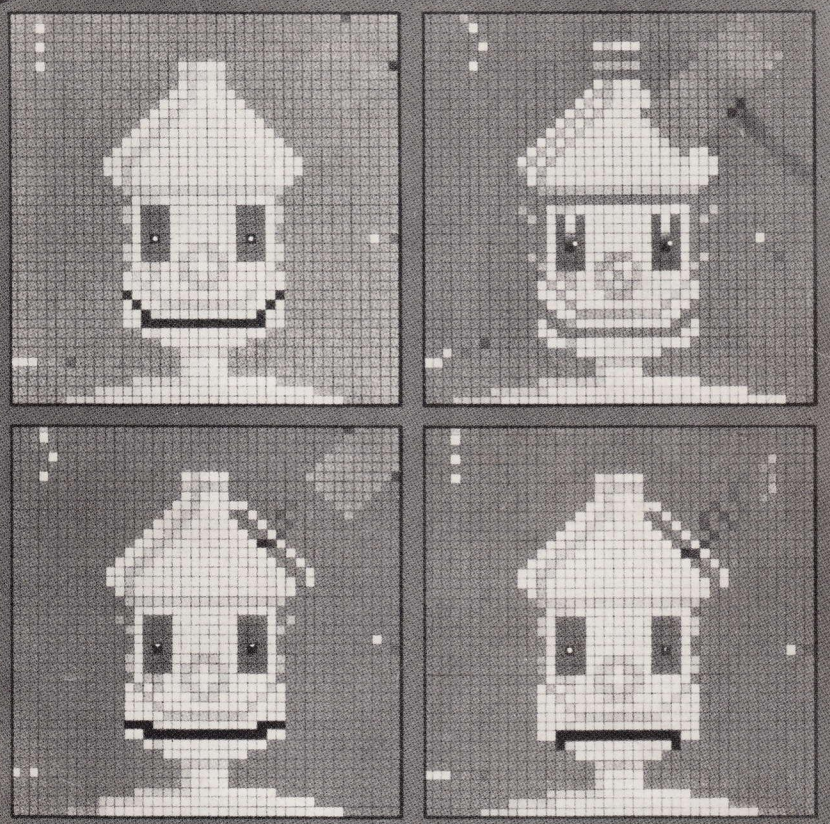
The ANIMATOR



AMSTRAD CPC 464/664/6128

PLEASE NOTE:

THE ANIMATOR–CASSETTE VERSION

This comprises of the main Animator program, 'SHELL' which is used when creating run-time demo's & the demonstration file "ALPHA".

THE ANIMATOR–DISK VERSION

This contains all the above plus three run-time demonstrations which can be used with the short basic program on page 32 of the manual.

IMPORTANT

Due to the amount of memory used by these demonstrations they may only work on an Amstrad 6128.

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INTRODUCTION

With the Animator anyone can create animation in a matter of minutes. But it may take a little longer to explore all its facilities. You can, in fact, treat it as two programs in one, a drawing program coupled to an animation program. There is an extensive range of controls which handle animation; and there are also over 20 different drawing commands.

The best way to start is to work through Section 1, which introduces some of the program's facilities by way of a simple example. At the back of the manual there is a Quick Reference Guide which gives a brief explanation of all the program's features – controls, menu options, and error messages. These are covered in greater detail in the intervening sections.

If you would rather see the program in action first, turn to the entry on Saving and Loading in Section 2. You can then load and run one of the demonstration files.

DEFINITION OF TERMS

Animation Sequence – The Animator works in the same way as a cartoon. In fact, using the word in its widest sense, you could call the program a cartoon maker. It displays a sequence of pictures at a fast enough speed to create an impression of smooth, continuous movement: in a word, animation. Each picture is known as a frame, and a sequence of related frames is an animation sequence. Note that throughout this manual the words, animation and sequence, are used interchangeably; so the manual sometimes refers to "an animation", or an "animation sequence", and at other times to "a sequence".

Compacting – The Amstrad computer uses 16K of memory to store what is on the screen. If The Animator stored pictures in the same way there would barely be enough room for one frame. Instead it compacts the screen data so that it can fit in many more than one frame.

When you run an animation sequence the program first compacts all the frames in the sequence, and stores them in memory. Then it displays the sequence by decompacting the frames at rates of up to and over 25 frames per second.

The compaction routine used is a complex one which employs several different techniques to save as much memory as possible. Among other things, it notes any repetition of particular byte in memory, and keeps a count of it. For example, in Mode 1 a line of spaces or blank pixels is stored in the Amstrad's screen memory as 80 zeros. The Animator counts them up and stores them in just one byte.

Inbetweening – The beauty of this program is that it doest most of the work for you. If you were making a cartoon by hand – filming each frame separately – the job might take months. Bear in mind that it takes 25 frames to produce one second of cartoon animation.

With The Animator you only need to draw (or copy) two frames to produce a second of animation. The program itself generates the frames in between the two you have drawn. The process by which it does this is called inbetweening.

Pixel – A single dot on the screen.

X axis and Y axis – The X and Y axes are the two scales used to measure a pixel's position on the screen. You can think of the X axis as a horizontal line running across the middle of the screen, and the Y axis as a vertical line up the screen. Thus enlarging a shape in the X axis makes it wider, while enlarging it in the Y axis extends its height.

Section 1 – GETTING STARTED

Starting a new animation sequence

Load The Animator by typing RUN "ANIMATOR". Then press the RETURN key. Once the program has loaded you will be faced with the Main Menu screen. To create your first animation sequence select option 1 (ANIMATE), by pressing the number 1 on the keyboard.

At the bottom of the screen you will see the words

Which Animation:

followed by an input cursor – a coloured square. Give your animation a name by typing in any string of letters and numbers up to eight characters. If you make a mistake, use the DEL key to correct it. When you have finished press the RETURN key. (Whenever the cursor appears, you need to press RETURN after typing something in).

The program will then ask you which Mode you want. Enter 0 (and press RETURN). There is a choice of three screen modes but we will stick to Mode 0 for the purposes of this example.

You will now be in the Editing Screen. At the bottom of the screen there is a panel which gives various bits of information about the current frame, and the amount of memory used. Notice that on the right the panel shows that this is Frame 1.

In the middle of the screen are four short lines which form the Editing Screen cursor. When you are drawing a line on the screen, the drawing cursor shows the position of your "pen". Move the cursor using a joystick or the cursor keys (the right/left/up/down arrows).

You are now in a position to draw your first frame. The Animator offers a large number of different facilities for creating pictures; to keep things simple, this example uses just one of them, the line drawing facility.

Drawing lines

There are two line drawing modes. The letters DM on the panel indicate which mode you have selected. In the first mode (DMØ), which draws separate lines, you need to fix the start and end points of a line. Move the cursor to the start point and press the fire button or the COPY key. Do the same to fix the end point.

Notice that after you have fixed the start point of a line, the cursor is connected to it by a line which flickers as it moves. Known as a "rubber band", this shows where the line will be when you fix the end point. You can turn the rubber band on and off by pressing B, but not while the LINE DRAW message is present on the panel.

The second drawing mode (DM1) draws continuous lines. So after you have drawn the first line you only need to press Fire/COPY once, at the end of each new line.

To switch between the two drawing modes press M. To leave DM1 either press the ESCAPE key, or – when you have completed a line and without moving the cursor – press Fire/COPY.

For fine detail the SHIFT key plus the cursor keys or joystick moves the drawing cursor a pixel at a time. The Space bar plus the cursor keys or joystick speeds it up.

Creating two key frames

Each frame can contain up to 500 lines. For this example, we will settle for just six lines. Draw them anywhere on the screen, either joined or separate. The Tot Lines counter in the panel shows how many lines have already been drawn; while the Line counter gives the number of the line that you are in the process of drawing. Note that lines are numbered from 0 upwards, so the first is Line 0.

If you are not satisfied with a line, you can delete it by pressing the DEL key; R restores the last deletion.

You can clear the entire screen by pressing L. To prevent you wiping out a screen by accident, the program first asks if you are sure – SURE (Y/N)? Press Y to confirm that you do indeed want to clear the screen.

When you have finished your first frame, press ESCAPE to enter the Animation Menu. Explanations of the various options in this menu are given elsewhere in the manual. At this stage it is only necessary to point out that the CURRENT FRAME indicator, in the middle of the screen, shows which frame you are working on. Below it, KEY'S – short for Key Frames – shows the key frames that have already been defined.

Now select the USE FRAME option by pressing 7. This option allows you to define a new key frame (or return to an existing key frame. At the bottom of

the screen you will see the word FRAME followed by an input cursor. Enter 24, as the number of the second key frame. (If you make a typing error, use the DEL key to correct it. And you can abort the input sequence by pressing RETURN without entering a number).

Option D (EDIT FRAME) takes you back to the Editing Screen. Notice that the panel indicates that this is Frame 24. Now draw another picture using exactly six lines.

If at any point you want to look back at Frame 1, press V to view. Another way of doing this is to return to the Animation Menu (by pressing Escape), then change the CURRENT FRAME number using option 7, and press D (EDIT FRAME). Repeat the process to return to Frame 24. Switching between different screens and menus does not destroy any existing frames.

Animating the sequence

Once you have drawn two key frames, you can animate them. To do this, select option 6 (RUN) from the Animation Menu.

Provided both frames have the same number of lines, the program will first generate and compact the frames from 1 to 24, and then display them at the maximum speed. You will probably find this is too fast. Pressing the right cursor or pushing the joystick to the right slows down the rate at which the frames are displayed; while the left cursor/joystick speeds it up. To stop animation and return to the Animation Menu press ESCAPE.

If a LINE MISSING or a LINE EXTRA error message appears press D to enter the Current Frame, and add or delete a line (press the DEL key).

Adding another key frame

Select Option 7 again and enter the number of your third key frame. It can be Frame 12, or 48 or 100 – any frame you like provided there is enough memory for it. The amount of space a sequence takes up depends on how long the lines are in each frame. 464 and 664 owners may find that the program stops compacting the sequence and issues an Out of Memory error message. If this happens start again and draw shorter lines, or select a lower number for your third key frame. The problem is covered in greater detail in the Quick Reference Guide at the back.

When you enter the Editing Screen, you will notice that frame has already been drawn. The reason for this is that after the second key frame, the

program makes every new frame a semi-key frame. Semi-key frames are explained in the next section. At this stage, it is best to convert the semi-key frame to a key frame by pressing K, followed by Y to confirm. Then press L to clear the screen.

Starting again

The Animator offers a large number of facilities for improving or modifying an animation sequence: you can add or delete key frames, copy them, edit lines, transform pictures, and so on. All these facilities are explained in detail in following sections.

But if you simply want to repeat this introductory exercise, select option 9 (RETURN) in the Animation menu. This returns you to the Main Menu. Now press 1 and enter another name to start a new animation.

Section 2 – MAIN FEATURES

Menus and Options

The Animator has three different screens – the Main Menu, the Animation Menu, and the Editing Screen. The Main Menu comes up when the program has first been loaded. It gives a list of six options (five on tape systems) and, at the bottom, shows the names of the animation sequences currently present in memory, if there are any.

To select an option press the number next to it. Some options then require you to enter a number or a file name. If an input prompt appears – a coloured square – you need to press the RETURN key after typing something in. To cancel the option press RETURN without typing anything in.

Before you can pass on to one of the two other screens you need to enter the name of the sequence you are going to animate. Do this using option 1 (ANIMATE). Entering the name of an existing animation sequence takes you on to the Animation Menu. If you start a new animation you pass directly into the Editing Screen.

From the Animation Menu, option D (EDIT) takes the user into the Editing Screen; while pressing Escape from the Editing Screen switches back to the Animation Menu. If you want to start again you can return to the Main Menu using option 9 (RETURN). Brief explanations of all the options in both menus are given in the Quick Reference Guide at the back. They are also covered in more detail throughout this section.

Animation Sequences

An animation sequence is made up of a number of key frames. When a sequence is run, The Animator generates the frames in between the key frames and then animates the sequence. Although you can save and load a sequence with just one frame, it needs at least two frames before it can be run. And each frame must have exactly the same number of lines in it.

The Animator can hold up to 24 different animation sequences – if there is enough memory for them. Option 2 in the Main Memory deletes a sequence from memory. After you have given a sequence a name, you can change the name by selecting option 1 in the Animation Menu.

Saving and Loading

The procedure for loading and running an animation from tape or disc is as follows:

1. If a disc drive is connected to the computer, press 6 in the Main Menu to select tape or disc loading.

2. Select option 4 (LOAD) and enter the name of the animation sequence, followed by RETURN.

3. When the file has loaded, select option 1 (ANIMATE) and type in the name again.

4. Press 6 in the Animation Menu to run the sequence.

There are three ways of saving a seqeuence. Option 4 (SAVE DATA) in the Animation Menu saves all the data needed to create the current sequence. This consists of the data for each line in each key frame, colour data, and the data for any other parameters such as pauses and rotations. It does not save the frames themselves; so after a file has been loaded in, the program has to recreate each frame and recompact it.

Option 5 (SAVE DEMO) saves an entire sequence – referred to here as a demo – as a series of compacted frames. A demo can be run immediately. However, it cannot be loaded back into The Animator. Demos are intended to be loaded into the run-time module.

Option 3 (SAVE ALL) in the Main Menu saves animations in the same way as the SAVE DATA option, except that it saves all the animations in memory, under one name.

Defining Key Frames

When a new sequence is created the program automatically starts off in the Editing Screen with Frame 1. When you have drawn the first frame, you can define up to 27 other key frames using option 7 (USE FRAME) in the Animation Menu, by simply typing a frame number. (Option 8, which is explained further on, can also be used to define a new frame by copying existing frames).

A key frame can have any number between 1 and 999. Generally speaking it is a good idea to have a gap of at least 15 frames between key frames. Less than this and the animation may look a little jerky. But it all depends on how much your pictures change from key frame to key frame.

Say, for example, Frame 1 shows a letter on the far left of the screen, and you want it to move to the far right. If the number of the second key frame – with the letter on the far right – is at least 18, the letter will move across the screen fairly smoothly. To make the animation even smoother, you can simply increase the frame number – using option 8 (FRAME MOVE). If, on the other hand, you only want the letter to move a short distance, then the gap between the two key frames can be smaller.

After the first two frames have been defined Option 7 (USE FRAME) makes every new frame a semi-key frame. In most cases you will probably want to convert a semi-key frame to a key frame, then clear the screen and start again. Do this by pressing K and typing Y in answer to the question "Sure?". Press L to clear the screen.

Drawing a frame

Once you have defined a frame, press D in the Animation Menu to enter the Editing Screen, and start drawing. The drawing commands are listed in the Quick Reference Guide and are covered in more detail in the next section.

It is important to remember that each frame must have the same number of lines. While you are creating a frame the program does not tell you if you have overstepped the mark or have drawn too few lines. It is therefore a good idea to make a note of the number of lines in your first frame. But if you forget to do this, you can always go back and look at the first frame: press Escape to return to the Animation Menu then change the current frame to 1 using option 7.

Semi-key frames

Semi-key frames are generated by the program. After you have defined the first two key frames the program makes every new frame a semi-key frame. This it does by inbetweening the two key frames on either side of the new frame. If there is no key frame with a higher number, the semi-key frame is a copy of the last frame.

Take, for example, an animation with two key frames, 1 and 24. if you define Frame 12, all the lines in it will be placed half way between the corresponding lines in the frames on either side. In other words, Frame 12 is the same as it would be if the program had generated it during the compaction stage. The difference is that you can now modify it.

Lines cannot be deleted from a semi-key frame unless they have been added by the user. But they can be moved about the screen and transformed. And the program only stores the data for those lines that have been altered. So one of the advantages of a semi-key frame is that it can be used to save memory. Since only the line data is involved, the savings are not great: when it is compacted a semi-key frame takes up as much memory as a key frame.

A much greater advantage of semi-key frames is that they allow you to introduce variations in an animation without having to redraw an entire frame. Say, for example, you wanted to show the wheels of a car rotating as it moves along, You could use a semi-key frame to alter the angle of the wheels while leaving the rest of the car unchanged.

To convert a semi-key to a key frame, press K. You will then be able to delete lines or clear the screen.

Note that if the key frames contain a large number of lines, there may be a short delay while the program generates a semi-key frame.

Copying Frames

To copy a frame select Option 8 (MOVE FRAME) and press C. First enter the number of the frame that you want to copy. Then give the number of the frame that will take the copy – the destination frame. If the destination frame has already been defined, it will be overwritten by the copy. As a safeguard, the program asks for confirmation – SURE (Y/N)? – before proceeding.

The frame copy facility is one of The Animator's most useful features. It means that you do not actually have to draw anything yourself. Instead you can copy an existing frame – from the demonstration files for example – and then alter it by setting the Rotation values or using the Transform command. (This command also has its own Copy option which is explained in Section 3).

Editing a sequence

Edit a sequence using the Delete and Move facilities provided by option 8 (MOVE FRAME). You can move any key or semi-key frame, except Frame 1, to any other frame number. If the new frame number has already been defined, the program first asks for confirmation. This is to safeguard against the possibility of accidentally overwriting another frame. Any frame can also be deleted except Frame 1.

Modes

The Animator has three graphics modes – Modes 0, 1, and 2. As on the Amstrad itself, selecting a particular mode determines what the screen resolution is, and how many colours are available. Mode 0 offers a resolution of 320 horizonal pixels by 136 vertical pixels with a choice of two colours. Mode 1 is the high-res mode with 640 by 136 pixels, again in two colours. Mode 2 has the same resolution as Mode 0, but with four colours.

You will notice that there are several differences between the modes on The Animator and those on the Amstrad. Mode 1 corresponds to the Amstrad's Mode 2, while Mode 2 is the same as the Amstrad's Mode 1. But there is no Amstrad equivalent to Mode 0. And it is not possible to use the Amstrad's Mode 0 on the Animator (to some extent it is possible with the run-time module).

Although you can run animations in any of these modes, it is generally preferable to use Mode 0. In Modes 1 and 2 there is sometimes a certain amount of flickering on the screen when a sequence is animated. The problem only occurs if a picture occupies much more than a quarter of the total screen area. It is particularly noticeable with large areas of colour and vertical lines. By contrast, Mode 0 is always flicker-free no matter how much of the screen is filled up.

One way round the flicker problem is to save animation sequences as demos with option 5 in the Animation Menu. They can then be animated without any flicker at all, by using the two-screen option in the run-time module.

To give a more technical explanation, although the program can write frames at a rate of 25 frames per second, this is still not fast enough to avoid interference from the monitor's raster beam. In fact, the display routine for Modes 1 and 2 has been written in such a way that it reduces the interference to a minimum – at the cost of slowing down the display rate: animations run twice as fast in Mode 0.

Mode 0 uses a different technique for displaying animations. First it writes a picture on the screen in the same colour as the background, then it changes the colour – to that of the foreground – instantly.

Note that option 2 in the Animation Menu allows you to change the mode – even after a sequence has been created. This means that you can build up a sequence in the multi-colour mode, Mode 2, and if there is too much flicker, try it out in Mode 0. When you are satisfied with it, switch back to Mode 2, and save it as a demo. Then run the demo without any flicker, from the run-time module.

Running an animation sequence

Select option 6 (RUN) to run a sequence. The program will first generate and compact all the frames, and then display the sequence at the maximum speed. The animation will continue to run until you press Escape. Press the SHIFT key to switch the panel off and on.

Option 3 (REVERSE) in the Animation Menu determines whether a sequence plays backwards or not. If you turn REVERSE off an animation runs from the first frame to the last, then starts again.

Pressing the space bar/fire button freezes the action, then pressing the cursor keys or joystick to the left or the right takes you through the sequence frame by frame.

You will probably find that SPEED 0 is too fast. In Mode 0 the display rate goes up to 50 frames per second. Holding down the right cursor or pushing the joystick to the right decreases the speed, while the left cursor/joystick increases it.

With option C (PAUSE) you can make the program pause at a particular frame while it is running a sequence. To do this select the frame where you want to insert a pause using option 7 – that is, make it the Current Frame.

Now press C and enter the value of the pause in fiftieths of a second. For example, to make the program pause for two seconds type in a value of 100. There can be as many pauses as there are frames. If you like you can insert one at every frame.

Note that a sequence has to be compacted every time it is run – even if the only change you make is to turn the REVERSE off or put in a pause. If you want to run the same sequence over and over again, perhaps changing the colours or the mode each time, it is easier to save it as demo and use the run-time module.

Memory

On the Amstrads 464/664 there is 17K of memory available for storing frames; and 81K on the 6128. Just how many frames you can fit in depends on how much of the screen is occupied by lines and filled areas. A sequence with a large amount of detail will probably not extend to more than a hundred frames on the 6128, and much less than that on the 464/664. On the other hand, if you settle for an animation with only two lines, it could stretch to over 500 or 600 frames – again, less on the 464/664.

Unfortunately there is no way to tell exactly how much memory a sequence will take up until it has been animated. When you return to the Animation Menu after running an animation, the memory counter shows what percentage of memory is used up by the compacted frames. Note that the counter only gives a rough estimate. Even if it indicates that 99% of memory is full, you may well find that you can squeeze in several more frames.

At other times, the memory counter shows how much space is occupied by the line data for the key and semi-key frames – rather than the frames themselves. The other memory counter in the Editing Screen only indicates the amount of memory consumed by the line data.

There are several steps that can be taken when an Out of Memory error message occurs. You can either move the last frame down – using option 8 – or delete it altogether. Another solution is to reduce the size of some of the lines in one or more key frames, using the Transform command.

You may also find that deleting any other animations in memory – using option 2 in the Main Menu – makes a difference. (Be careful not to delete the animation you are working on). The program uses six bytes to store the colour and co-ordinate data for each line in each key frame. So the line data for an animation sequence can take up an appreciable amount of memory space.

Rotation

Options A and B in the Animation Menu allow you to rotate an entire frame around the two screen axes, X and Y, either separately or in combination. To understand what this means, imagine that these are lines running through the middle of the screen. Rotating a frame makes it look as if the two dimensional screen is being swung round one of these central axes, in three dimensions.

The best way of illustrating this is with an example. Draw a box along the centre of the screen in Frame 1. (Do not make the lines too long. Otherwise you risk an Out of Range error message – for further explanation see the Quick Reference Guide).

To distinguish the right-hand side from left draw a few lines across the right-hand side. Exit to the Animation Menu and copy Frame 1 to Frame 24 using option 8. If you were to animate the sequence now there would be no movement, since both frames are the same. Instead, select Option B and give Frame 24 a rotation of 180 degrees.

When you run the program, you will notice that the box appears to swing round in front of and behind the screen. In order to increase the 3D effect The Animator creates a perspective view by making the lines on one side of the box shorter than those on the other side.

Note that the program only rotates a frame during animation. When you edit a single key or semi-key frame, you will notice that it shows no change despite the fact that it has been rotated.

To rotate a shape around 360 degrees you need to define four key frames. Rotate the second and third frames by 120 and 240 degrees respectively; and give a zero rotation to the first and last frames.

Section 3 – DRAWING

As a drawing program, The Animator provides an extensive set of commands for creating single-frame pictures. It may not offer as many options as some stand-alone drawing programs but it does include several extremely powerful facilities not found anywhere else – the Transform and Curve Draw commands, in particular.

In this section some of the more complex commands are explained. Other facilities such as Box Draw, Clear Screen and View are listed in the Quick Reference Guide. The Line Draw command is covered in the section on Getting Started.

Cancelling a command

Two keys are used to cancel or interrupt a command – Return and Escape. Whenever the program expects you to select an option by pressing a key, you can cancel the function by pressing the RETURN key. Otherwise use the Escape key.

For example, if you change your mind about filling in a shape, instead of selecting a fill pattern, press RETURN. To abort a transformation press Escape.

Colour change

To change the colours in the Drawing Screen press I, and then enter an Ink number: 0 for the background colour, 1 for the colour in which lines are drawn. Now select a new colour from the Amstrad's Master Colour Chart. E.g. for red lines on a white background take the following steps: Press I; enter 1; enter 6; Press I; enter 0; enter 26. Remember to press RETURN after entering each number.

In Mode 2 there can be four colours on screen, three foreground and one background colour. Inks 2 and 3 are changed in the same way as Ink 1. keys 1, 2 and 3 select the current "ink" – simply press 2 or 3 and the next line will be drawn in a different colour.

Note that The Animator does not allow you to make the background colour the same as the foreground colours, and vice-versa.

Polygon Draw

To draw a polygon with any number of sides from 3 to 24, first decide where the centre of the polygon will be, and move the cursor to that point. Press P and enter the number of sides. Define the radius by moving the cursor straight up, then set the angle of the first point or vertex by pressing the joystick/cursor keys left or right. As you do so, the cursor will move around the circumference of the polygon. Fix the polygon by pressing Fire/Copy.

This facility produces regular closed figures with the number of sides specified. Entering 3 for the number of sides produces an equilateral triangle, 4 produces a square, 5 a pentagon, and so on. Figures with over 15 sides look more or less circular.

Fill

With this command any closed shape (a shape with a continuous outline) can be filled with colour. If the outline is not continuous the colour will "leak" out and fill the rest of the screen. Press Escape to interrupt this process.

To fill a shape move the cursor inside it and press F. Select one of the four fill patterns by pressing the appropriate number. A fill will not occur if the cursor is on top of a line or pixel.

In Mode 2 any two of the four colours on screen can be mixed. The second and third fill patterns are particularly useful here since they allow you to create new colour effects.

By mixing colours it is possible to have many more than four colours, or shades of colour, on the screen at the same time. For example, mixing Bright Red and Bright Yellow gives an orange effect; while to create a lighter shade of red you can mix Bright Red with a black or white background (Ink O)

When fill patterns 2, 3 or 4 are selected in Mode 2, you need to enter a number for the second ink colour. This should not be the same number as the current ink.

Note that the program records a fill by storing the position of the fill origin; this is the position of the cursor when you press F. If you enclose the fill origin in the Transform Box you can move it in the same way as you can move a group of lines. Moving the origin without having also enclosed the shape will, of course, cause a leak.

For an explanation of how to animate filled shapes see the section on Fill Inbetweening.

Curve Draw

This could equally well be called a freehand drawing facility. It allows you to draw any shape you like, pixel by pixel up to a limit of 250 pixels, and then to smooth out the shape.

Start by pressing U. A single pixel will appear on the screen where the cursor was. Move the joystick/cursor keys in any direction to draw a shape a pixel at a time.

While you are drawing, each pixel is treated as one line or segment. When you have finished you can press the > key (above the full stop) to reduce the number of segments in the shape.

Notice that as you reduce the number of segments, the step number increases. Say, for example you draw a curve – or a squiggly line – with a hundred pixels. Initially it has 100 segments and a step size of one. In other words each pixel is joined to an adjacent pixel. When the step size is increased to two, the program joins up every second pixel. As a result the number of segments is cut in half. If you continue to increase the step size until it reaches 50, you will end up with just two segments.

The < key (above the comma) increases the number of segments after they have been reduced; the DEL key deletes the last pixels drawn, and the space bar deletes the whole curve except for the first point. Press Fire/Copy to fix a shape. A quick way of restoring a curve to its original shape is to add or delete a pixel.

It is often important to ensure that a curve has an exact number of segments. But when you are smoothing out a curve you may find it difficult to arrive at the number you want. One solution is to make the total number of pixels a multiple of your target number. (For example, the multiples of 27 are two times 27, three times 27, and so on). A much simpler technique is to add or delete a pixel and try again.

Block Transform

Of all the drawing facilities this is probably the most powerful. It allows you to create impressive animation sequences even if you have no gift for drawing. Block Transform makes it possible to pick out a line or any block of lines, move them around, enlarge or contract them, stretch, rotate or flip them over – and make a copy of them to another part of the screen. Any part of a picture can also be deleted. This means that you can start out with a ready-made picture and then build up a new animation sequence – without drawing any lines yourself.

The best way to illustrate this command is through an example. Draw a capital E using just four lines. Then press T to transform it. From the three options, Copy/Delete/Move, select Move by pressing M. Using the joystick/

cursor keys open up the transform box so that it is large enough to enclose the four lines you have drawn. You can move the box using the keys A (up), Z (down), N (left), M (right), or use the joystick. When the box is positioned around the letter E, press Fire/Copy.

You can now use any of the Transform options to change the shape of the letter. Consult the Quick Reference Guide for a full list of the options.

B, for example, makes the shape bigger, S contracts it; N rotates it anti-clockwise by 90 degrees, Y flips it over in the Y axis. Move the shape to a different part of the screen using the joystick cursor keys. As long as the shape is highlighted in yellow, pressing Escape will restore it as it was initially. To fix a block of lines after they have been transformed use Fire/Copy.

All these effects also work with the Copy option, except that they duplicate the lines. And you can also copy part or all of a picture to another frame.

There are two points to note about the Transform command. First, it will only pick out lines that are completely enclosed by the box. Second, transforming the box with a large number of lines can take some time. If it is just a matter of moving the block around the screen, hold the space bar down to speed up the process.

Transform applications

It is worth indicating some of the many uses of the Transform facility. For a start, it allows you to take one image and break it up or distort it in a variety of different ways. Take, for example, a picture of a face. You could enlarge the nose, stretch the mouth in the X axis, rotate the eyebrows, or even detach particular features so that they appear to fly together from different parts of the screen.

Transform also makes creating symmetrical patterns extremely easy. You simply select Copy and reflect a shape in the X axis, then reflect the result in the Y axis.

When it comes to animating filled shapes, Transform is particularly useful. Altering an existing shape, rather than redrawing it, ensures that the fill origin stays the same relative to the outline of the shape. This in turn reduces the chances that the ink will leak during the compaction stage.

Section 4 – EDITING FRAMES

Editing key frames

This section explains how to take a frame you have already drawn or copied and modify it. The easiest way of doing this is to use the Transform facilities. However, if you want to redraw a small detail in a picture, involving just one or two lines, use Keys Q and W.

These keys alter the current line number as shown by the line counter in the Editing Screen panel. (Normally the line counter in the panel indicates the number of the next line to be drawn). Q decreases the line number, W increases it. Once a particular line has been selected, CLR (not DEL) deletes it. If you change your mind, press R to restore it.

Notice that the line number on the panel does not change after a line has been removed. This allows you to replace it with another line, leaving the line order the same as it was before.

The Current Select option works in the same way as Q and W, but also highlights the line selected. To use it, press C and then select a line by holding down the right/left cursor keys or with the joystick. If you want to jump to a particular line press Fire/Copy and enter its number. CLR deletes the line, but Current Select must first be cancelled by pressing the Return Key.

The less than and greater than signs, < and > (above the comma and full stop), are useful when you have finished editing a group of lines. > makes the current line one greater than the highest numbered line that has already been drawn. That is, it restores the Line indicator to its normal state.

< jumps to the first line number that has not been drawn. In other words, < is equivalent to > unless the numbering of the lines is not continuous.

Note that the Transform command's Delete option is also a useful editing facility, particularly for deleting a large block of lines.

An editing example

The following example will clarify the way the editing commands work. It shows how to delete and redraw a group of four lines.

First draw a frame with 12 lines. Now press Q to change the current line number to 5. Delete line 5 by pressing CLR and then use W to change the line number to 6. Delete line 6 and repeat the process until you have removed lines 5 to 8.

The Line indicator in the panel should now show that the current line is number 8. Use Q again to change it back to 5, and redraw the four lines. When you have drawn the line 8 the Line indicator will change to 12, the number of the next line to be added to the frame. (Remember that lines are numbered from 0 upwards, so line 12 would be the thirteenth line.

Editing semi-key frames

Lines cannot be deleted from a semi-key frame unless you have added them yourself. The lines generated by computer – the initial set – are there to stay, although they can be transformed.

In a semi-key frame the keys Q, W and C do not have the same function as they do in key frames. Like many of The Animator's facilities, this is best explained through an example. Select a number belonging to one of the initial set of lines. If you press CLR it will have no effect. But if you draw a new line it will automatically replace the current line.

Try this out by selecting Line 0 in a semi-key frame. Then carry on drawing lines until all the original lines have been replaced. Now press DEL. You will notice that it restores the last line. If you carry on pressing DEL, it will restore all the lines to their initial position.

When it comes to editing lines which have been added to a semi-key frame, the keys Q, W, C, CLR and DEL have the same effect as they do in a key frame.

Closing the gap

There is an important point to bear in mind when editing a line or a group of lines. You need to make sure that the number of the line which you are

redrawing is the same as the number of the line which has been deleted. It may happen that you alter the current line number (using Q and W) so that it points to a line which already exists. If you now draw another line the program will assign it the next number after the Tot Lines figure.

To make this point clearer, draw a frame with 20 lines. Then use Current Select to delete Line 10. Change the current line – as shown by the Line indicator in the panel – to 11 by pressing W, and draw a new line. You will notice that the current line is now 21. however the Tot Lines figure is still 20.

If you try and animate a sequence which contains this frame, the program will issue a Line Missing error message. The solution to this problem is to use the Close Up facility by pressing S. This command closes up any gaps in the line numbers. In the example above, it would move all the line numbers above 11 down one place.

Section 5 – FILL ANIMATION

Fill inbetweening

When The Animator generates the frames in between, it does not automatically fill the shapes which have been filled in the key frames. You need to indicate which shapes are to be filled, at the start of the compaction stage. For each shape you must define the start fill and the end fill.

A simple example will illustrate this. In Mode 0 create Frame 1 with two shapes, a square and triangle, making each fairly small. Fill them in, then copy Frame 1 to Frame 20. Now use the Transform command to move the shapes to different positions on the screen. Return to the Animation Menu and press 6 to start compacting.

You will notice that a yellow cross appears over the centre of one of the two shapes. If there is more than one filled area on the screen, this can be switched from one shape to another by pushing the joystick up or down, or pressing the up/down cursor keys. Position the cross over the square – if it is not there already – and press Fire/Copy again to define the first end fill.

If you press Escape now, the program will start compacting but in each frame will only fill in the square. To fill the triangle, you need to define a second fill. Repeat the process in Frame 1 and Frame 20, but this time move the cross so that it is over the triangle. Press Escape when you have finished.

If your two frames contained six filled shapes you would have to press Fire/Copy 12 times, and the program would have to switch between Frame 1 and Frame 20 six times in succession.

If you copy Frame 20 to Frame 40, moving the square and the triangle to new positions, you will have to define another set of fills from Frame 20 to Frame 40. First define the two fills in Frame 1 and Frame 20. Then switch to Frame 20 by pushing the joystick right or pressing the right cursor key. Select another pair of start and end fills for each of the two shapes.

Note that if the square and the triangle had stayed in more or less the same position from Frame 20 to Frame 40, you would not need to define two sets of fills. Instead you could skip over Frame 20 and just define the start fills in Frame 1 and the end fills in Frame 40.

The program works by inbetweening the fill origins. When a shape is filled in a key (or semi-key) frame, The Animator stores the position of the cursor at the point where you press F. Think of the fill origin as a single pixel or a line one pixel long. At the compaction stage the program inbetweens the origin in the same way it would inbetween a line.

For this reason it is necessary to define enough fills to make sure that the fill routine stays inside its shape. Otherwise you may find that the ink leaks during compaction. The problem only arises with sequences of more than two key frames.

Summary

To animate a single filled shape in a sequence with only two frames:

1. Press 6 (RUN) in the Animation Menu.
2. Press Fire/Copy to define the start fill.
3. In the second key frame press Fire/Copy to define the end fill.
4. When the program has drawn the first key frame again, press Escape.

If there is more than one filled shape:

4. When the program has drawn the first key frame again, move the cross over the second shape using up and down cursor keys or joystick.
5. Press Fire/Copy to define the start fill for the second shape.
6. In the second key frame, move the cross over the second shape and press Fire/Copy.
7. Repeat steps 4 to 6 for any further shapes.
8. Press Escape to start compacting (after the program has drawn the first key frame again).

If there are more than two key frames:

8. for each shape define another fill between the second and third key frames. First select the second key frame (to define the new start fill) by pressing the right cursor key or joystick.
9. If there are four or more key frames, repeat the process. E.g. define another set of fills between the third and fourth key frames, between the fourth and fifth, and so on.

Note that if a shape stays in roughly the same position on the screen in the intervening key frames, it is only necessary to define fills between the first and last key frames.

To skip fill inbetweening press Escape after the first frame has been drawn. For other options such as cancelling a fill, starting again, see the Quick Reference Guide.

Leaks

Fills sometimes leak when a sequence is compacted. This is particularly likely to occur if a shape is rotated by more than 90 degrees. The best way to avoid it is to copy a filled shape from one frame to another. This ensures that the fill origin is in exactly the same position (relative to the shape) in both frames.

You might think that there should not be any problem as long as the fill origin always stays inside a shape. However, when a shape is rotated around the X or Y axis, its outline and fill origin are reduced to a single line. As a result, the fill origin can end up outside the shape. This is because the program only performs its arithmetic operations on the screen co-ordinates to a certain degree of accuracy: rounding up errors can sometimes occur. It means that leaks are not always avoidable. The only solution is to start again.

Note that if an animation is drawn in Mode 0 or 2 and then changed to Mode 1, any fills are bound to leak.

Section 6 – ANIMATION TECHNIQUES

First principles

The Animator offers immense scope for experimenting with different animation techniques. You will soon find out that there is more to animation than simply drawing pictures. What looks good as a single frame picture will not necessarily work well when it is animated.

To produce the most impressive sequences you may need to spend some time exploring the different techniques. Most of these you will have to discover yourself simply by playing around with the program. There are also several basic principles which are discussed further on in this section.

Looking at the demonstration files will give you some idea how to achieve particular effects. Once you have run one of the demos, you can try modifying it. There are numerous ways in which a sequence can be altered. For example, you could delete one of the key frames, or change the rotation values, or change the colours. Better still, use the Transform command to alter a particular figure within a frame. Enclose any group of lines and stretch, reflect, enlarge, contract, rotate them or just move the shape to a different part of the screen.

Line order

Remember that every shape you draw on The Animator is made up of straight lights – even curves and circles. For a graphic demonstration of this, use the Polygon Draw facility to produce a 24-sided polygon (a circle) in Frame 1. Now create a second frame with 24 separate lines – and run the sequence.

Every line changes into a corresponding line in the next key frame. This means that for some effects you have to bear in mind the order in which you draw lines. Say, for example, you want to show the letter H – in ouline – changing into the letter N. If line 1 is on the left in the first key frame, and on the right in the second, the letter will appear twisted during animation. It may be more effective if the line order is roughly the same.

Take the more complicated problem of animating a face. After drawing your face in the first frame, how do you make the nose bulge in the second? If the second nose is not made up from the same lines, it may turn into an ear. In this case, the best technique would be to copy the first key frame into

the second. Then you can use the Current Select command to delete the nose – leaving the rest of the face intact – and redraw it using the same line numbers. Current Select is also usful for discovering what the line order of a shape is.

Of course it often turns out that changing the line order produces some equally impressive effects. As an example, try out this technique: with 12 lines joined together draw the outline of the capital letter E. Copy the letter to a second key frame. Now delete line 0 and press S to close up the line numbers. This has the effect of moving every line in the second frame down, by one number. When you replace the missing line and animate the sequence, the letter E starts and ends in the same position but distorts itself along the way.

Superimposing lines

Anything that can be drawn with The Animator can be animated. The only restriction is that each frame must have the same lines. In fact, this is not as restricting as you might think.

If you want to change one shape such as a triangle into another one which has more lines – such as a square – there are several ways to do it. You can either superimpose an extra line on one side of the figure or you can simply draw two short lines together so that they look like one line. It is also possible to store one or more lines on top of each other as a single pixel, using the Curve Draw command. These techniques make it easy to create animations where one shape changes into a more complicated shape or splits up into several versions of itself.

Notice that all the letters in the demo file, ALPHA, have the same number of lines. This means that any letter can be smoothly transformed into another. Here again, though, adopting the opposite technique – in which letters break up and fly about the screen before forming another letter – can be equally effective.

Section 7 – RUN-TIME MODULE

The idea behind the run-time module is to allow you to run animation sequences without having to load The Animator. It means you can create free-standing demos or incorporate animation in your own programs – as title sequences, for example.

One of the great advantages of the module is that it runs ready made animations. Demos can be animated as soon as they have been loaded. There is no need to re-compact a sequence every time it runs. Instead you can experiment with different colours and different speeds, then animate a sequence immediately.

Another bonus is that it makes it possible to display high-res and multi-colour animations – those created in The Animator's Mode 1 and Mode 2 – without any flicker. Normally in these modes there is a small amount of flicker if the picture occupies a large part of the screen. The run-time module uses a different method of displaying a demo sequence. It is referred to here as the two-screen method. If you want to understand how it works, an explanation is given further on in this section. At this point, it is only necessary to say that the two-screen method takes up an extra 16K of memory.

You can animate your demos simply by following the instructions below, or by typing in the program at the end of this section. But to make the best use of the run-time routine, it is a good idea to have some idea of how it organises the Amstrad's memory space. Basic programs start at the memory location 368 and extend upwards (the lower limit for demo files is 512). The run-time module occupies the space from 37936 upwards, and takes a further 2K RAM as a buffer; the demo files are stored in the memory space in between.

Loading the run-time module

The module is a separated program, stored on tape or disc under the name SHELL. Before loading it you need to reserve memory both for the program itself and the demos it is going to run. So start by entering:

```
MEMORY 4999
LOAD "SHELL"
```

Now initialise the program with

```
CALL 37936,5000
```

If you want your demos to be run using the two-screen method, enter

```
CALL 37936,5000,1
```

The first number, 37936, gives the start address of the run-time routine, while the second number tells the routine where to load the first animation sequence. In this case, 32936 bytes are free for storing animations – from locations 5000 to 37396. If the demo file – or files – takes up less space, you can make the second address higher in order to leave more space for Basic programs.

For example:

```
MEMORY 9999
LOAD "SHELL"
CALL 37936,10000
```

By lowering the top of memory to location 511 it is possible to leave around 35000 bytes free for storing animations; but you cannot do this immediately, since the Amstrad's Disc Operating System uses 2K Ram as a buffer when it loads in SHELL. In other words, the second command could be CALL 37936,512 – followed by MEMORY 511 to protect any Basic program – but the first must be MEMORY 4999, or higher. Note that lowering the top of memory (HIMEM) to 511 only leaves 143 bytes for Basic programs.

On the 6128, the run-time module uses the extra 64K, making a maximum total of around 100K available.

Loading and running a demo

When the run-time program has been loaded and initialised, load an animation sequence using the command:

```
¦GET, N
```

where N is the number of the demonstration file saved using option 5 from the Animation Menu. For example, to load DEMO #3, enter

```
¦GET,3
```

Now enter

```
¦SETCOL
```

to set the appropriate mode and colours. Follow this command with

```
¦ANIMATE
```

to run a sequence. Pressing any key stops the animation.

Using the commands

All the run-time commands are presented as RSX extensions to Basic. Each must be preceded by the bar character above the @ sign. They can be inserted in a Basic program or entered directly from the keyboard – in either capital or lower case letters. Each command can be followed by one or more numbers (parameters) separated by commands, which specify how an action is to be performed. For example, ¦ANIMATE,2 runs the current animation sequence two times then it stops.

¦GET must be followed by a demo number. Otherwise all parameters are optional. When a command is typed in without any parameters it operates on the last file that has been loaded in, and takes any other parameters to be zero. For example, ¦SETCOL is the same as ¦SETCOL,0.

The exception to this is the ¦CLEAN command. If you do not give its parameters, it uses the last ones, which may be non-zero).

The run-time commands

¦ANIMATE,T,speed (0– 99), demo number

runs an animation T times at the speed specified. A positive non-zero value for T means that the animation can only be interrupted by pressing ESCAPE: if a negative value is given any key stops the sequence. When T is zero the animation goes on running until a key is pressed. E.g.

```
¦ANIMATE,0,0,3
```

repeats demo number 3 until stopped.

```
¦ANIMATE,2,5,1
```

runs the DEMO#01 two times at SPEED 5.

```
¦ANIMATE,–1,0,2
```

runs DEMO#02 once at maximum speed, and any key stops it. Note that ¦ANIMATE on its own (without any following parameters) operates on the last file that has been loaded in.

¦CLEAN,display method (0/1),load address

clears all demos from memory. A value of zero for the first parameter selects the normal way of running an animation – ie., the same routine as used by The Animator; a value of 1 selects the two-screen method.

The second parameter can be used to specify a new load address. E.g.

```
¦CLEAN,0,12000
```

will cause any new demo files to be loaded in from location 12000 upwards.

¦GET,Demo number (1 to 999)

loads in a demo file at the next free memory location. Up to 9 demos can coexist in the memory at the same time, but in practice it is unlikely that there will be room for more than three or four. Use CAT to find out how much room each demo file takes up.

The following program loads in and runs the first three demo files:

```
10 for N = 1 to 3
20 | GET,N
30 NEXT
40 FOR N=1 TO 3
50 ¦ SETCOL,0,N
60 ¦ ANIMATE,1,0,N
70 NEXT
```

¦ SETCOL, colour/mode/both (1/– 1/0), demo number
makes the colours and mode the same as those used when a demo was created. Entering ¦ SETCOL without any numbers following it, means that an animation will look exactly the same as it did in The Animator. And it operates on the last demo file that has been loaded.

¦ SETCOL, 1
just sets the colours, and allows you to run a sequence in a different mode. If the sequence was created in The Animator's Modes 1 or 2 you can even run it in Amstrad Mode 0 – be prepared for interesting but unpredictable colour effects.

¦ SETCOL,–1
sets the original mode but not the colours. The screen colours can then be changed using the INK command.

The third parameter assigns the mode and colours from any of the current demos. Thus

```
¦ SETCOL,0,3
```

assigns the colours and mode from demo file 3 for the next animation – which may or may not be DEMO#03.

If the SETCOL command is not given, an animation sequence is run in the current mode using the current colours. Note that Animator Mode 0 animations can only be run in Amstrad Mode 1.

¦ SHOW, frame number, demo number
displays a specified frame from any of the animations in memory. E.g.

```
¦ SHOW,12
```

displays the twelfth frame in the last sequence that was loaded in.

```
¦ SHOW,5,2
```

shows the second frame from demo number 2.

If you want to print out a frame, this is the command to use – in combination with a screen dump routine.

Two-screen animation

Use this method of displaying animation for those sequences that show a slight screen flicker when run on The Animator itself. It works by setting aside 16K RAM – from 16384 to 32767 – to act as an alternative screen memory. While one screen is being displayed, the program writes a frame into the other screen area. Then it switches the first screen out, and the second screen in. This means that an entire frame can be displayed instantly, no matter how much detail it contains.

The drawback to this method is that you have to give up 16K Ram that could otherwise be used for storing animations. On the 6128, this still leaves over 84K for frame storage, but on the 464 and 664 the maximum memory is reduced to about 20K. (When two-screen animation is selected the program only uses 680 bytes as a buffer instead of the normal 2K).

It is not necessary to reset the start of the frame storage area, as the routine takes care of this itself: if the first block of memory, from 512 to 16384, is full up it loads animations into the space above the second screen, from 32767 to 37936.

Both the CALL and CLEAN commands can be used to select the two-screen options. The data address here must be below 16384. For example

```
CALL 37936,512,1 or ' CLEAN,1,512
```

but NOT

```
CALL 37936,18000,1
```

Note that there is no need to use this option for demos which have been saved from Mode 0 on The Animator.

Windows

By using the Amstrad's WINDOW command you can set up a separate text area at the bottom part of the screen. This allows you to print titles or captions for demos in a different colour. For example:

```
10 ¦ SETCOL
20 PAPER 2
30 WINDOW 1,40,18,25
40 CLS
50 PRINT "Demo 3"
60 ¦ ANIMATE,1,0,3
```

Machine code programmers can use interrupts to create a scrolling text display or even to accompany animation with music.

A run-time loader program

This program simply loads in the run-time module, then loads and animates a specified demo. Press the ESCAPE key to stop the animation.

```
10 MEMORY 4999
20 LOAD "SHELL"
30 CALL 37937,5000,1
40 PRINT "Type in the number of the demo you wish to run"
50 PRINT "Then press RETURN"
60 INPUT N
70 ¦ GET,N
80 ¦ SETCOL
90 ¦ ANIMATE
```


QUICK REFERENCE GUIDE

Drawing Controls

ESCAPE	Cancels any command that does not require further input.
RETURN	Cancels a command when it expects further input, e.g. Fill, Current Select.
Cursor keys/ Joystick	Move cursor. Hold down SHIFT to move the cursor a pixel at a time in any direction. Hold down the Space Bar to speed up the cursor.
Fire/Copy	Line draw. Press Fire/Copy to start and finish a line. To exit from Drawing Mode 1 press Escape or Fire/Copy twice.
K	Convert a semi-key frame to a key frame.
I	Change colour.
1/2/3	Select current ink (Mode 2 only).
L	Clears the screen in key frames. In semi-key frames resets any lines that have been altered.
F	Fill a shape. First move the cursor inside the shape to be filled. Then press F and select a fill pattern.
X	Clear all fills.
B	Toggle rubberband on/off.
M	Toggle drawing modes. Mode 1 (DM1) joins each line up to the previous one, Mode 0 (DM0) draws separate lines.
V	View another key frame. If the current frame is a semi-key frame V also offers a Highlight option to show the lines which have been altered.

P — Polygon draw (up to 24 sides). Enter the number of sides, move the cursor to fix the radius and angle of the polygon, then press Fire/Copy.

O — Box draw. Set the size of the box using joystick/cursor keys. Move the box using keys A (up), Z (down), N (left), M (right). press Fire/Copy to fix.

U — Curve draw/free-hand draw up to 250 pixels. Use < and > keys to smooth out the curve by reducing the number of segments. Press Space Bar to start again, DEL to delete last point, FIRE/COPY to fix the curve.

T — Transform a line or a block of lines. Select Copy/Delete/Move then move the Transform box into position with keys A (up), Z (down), N (left), M (right). Enclose lines in the Transform box using joystick/cursor keys (hold down SHIFT for pixel accuracy. Press Fire/COPY to start transformation.

Use: joystick/cursor keys to move lines.
B to enlarge
S to make smaller
R to rotate right
L to rotate left
1 to enlarge in x axis
2 to contract x axis
3 to enlarge y axis
4 to contract y axis
N to rotate 90 degrees anti-clockwise
M to rotate 90 degrees clockwise
X to reflect in x axis
Y to reflect in y axis

Press Fire/Copy to complete transformation. Escape abandons a transformation and restores the original shape.

Line Editing Controls

DEL — Deletes the last line/lines or undoes the last action, e.g. removes a circle drawn with the Polygon Draw facility.

R — Restores the last line.

C — Current select. Use left and right cursor keys/joystick to select and highlight line. To jump to a particular line, press Fire/Copy and enter its number. Press RETURN to finish line selection. CLR now deletes the line. Cancel Current Select by pressing RETURN.

Q and W — Increase and decrease the line number without highlighting the line. CLR deletes the line with the current line number.

> — Gives the current line the next number after the highest numbered line that has already been drawn.

< — Gives the current line the number of the first line that has not been drawn. Equivalent to >, unless the line numbers are not continuous.

S — Close the gap between line numbers so that all the lines in a frame have consecutive numbers. If you get a Line Missing error message despite the fact the Tot Lines figure in each frame is the same, use S. This command only works with key frames.

Animation Controls

Fill inbetween	Left and right cursor keys/joystick select the frame, up and down cursor keys/joystick select a shape. Press Escape to finish and start compacting. Space Bar restarts, Del deletes last fill selection. Escape aborts compaction stage.
Space Bar	Freeze animation. Left and right cursor keys/joystick step through a sequence frame by frame.
Left/right cursor keys or joystick	Decrease and increase the animation speed.

Menu Options

Select an option by pressing the appropriate number or letter on the keyboard. When the input cursor (a coloured square) appears press RETURN after typing in. Use the DEL key to correct typing mistakes. Pressing RETURN without typing anything (or after deleting an input) cancels the option and restores any previous input.

Main Menu

1 ANIMATE	Selects an animation already in memory or starts a new one. Enter the name of the animation and then the mode (0/1/2).
2 DELETE	Deletes an animation from the program's memory store. Enter the animation and then press Y if you want to go ahead with the deletion.
3 SAVE ALL	Saves all the animation data currently in memory under one name.
4 LOAD	Loads animation data from tape or disc. To run an animation that has just been loaded select option 1 and enter its name.
5 CATALOGUE/ WRITE SPEED	Reads the disc catalogue if option 6 is set to DISC. Otherwise toggles between Write Speed 0 and 1 for saving to tape. Always set to WRITE SPEED if a disc drive is not connected.

6 TAPE/DISC	Toggles between disc and tape filing systems. This option is not present if a disc drive is not connected.

Animation Menu

1 NAME	Change the name of the current animation.
2 MODE	Change the current graphics mode.
3 REVERSE	Toggles reverse animation on and off. When reverse is on a sequence is played through from the first to last frame then back again.
4 SAVE DATA	Saves the line data for each key and semi-key frame in an animation sequence. Also records the Mode, Reverse, and colour details, as well as saving the pause and rotation data for each frame.
5 SAVE DEMO	Saves all the compacted frames that make up a sequence. Each demo is saved as DEMO#N, where N is the demo number entered by the user, e.g. DEMO#07. A demo can only be run using the run-time module: it is not possible to load a demo back into The Animator.
6 RUN	First compacts and then runs the current animation. pressing the Escape key interrupts the compaction process.
7 USE FRAME	Either selects an existing frame or defines a new one.
8 MOVE FRAME	Allows you to copy, delete or move key and semi-key frames. Press C, D or M according to your choice. Frame 1 cannot be moved or deleted.
9 RETURN	Returns you to the Main Menu.
A X-ROTATION	Rotates the entire frame about the X-axis by a given number of degrees (from 0 to 359). E.g. a value of 180 turns the frame upside down. If you are entering a number less than 100 (a one or two digit number) it is not necessary to put zeros in front of it.

B Y-ROTATION	Rotates the entire frame about the Y-axis by a given number of degrees. E.g. a value of 180 flips a shape over so that the right side is on the left and the left is on the right.
C PAUSE	Causes the program to pause at the current frame during animation. PAUSE expects you to enter a number from 0 to 9999 where one pause unit is worth a fiftieth of a second. E.g. if the current frame number is 24 and you have entered a pause value of 50, the program will stop for one second when it reaches the twenty-fourth frame.
D EDIT	Takes you into the Editing Screen for the current frame.

Error Messages

Out of Memory at Frame nnn

There is not enough room in memory for the current animation sequence. There are several solutions: move the last key frame down to nnn–1; delete the last key frame; reduce the size of some of the lines in certain key frames (especially vertical lines); delete any other animations in memory.

Line nnn out of range in Frame nnn

The program is unable to rotate the frame because Line nnn is too close to the edge. Move the line nearer the centre or make it smaller.

Fill out of range in Frame nnn

This error occurs for the same reason as the one above. Move the shape nearer the centre or make it smaller.

Line nnn missing in Frame nnn

If the Tot Lines number is the same in Frame nnn and the previous key frame, enter Frame nnn and press S followed by Y. Otherwise add a line to Frame nnn, or delete a line from the previous frame.

Line nnn extra in Frame nnn

If the Tot Lines number is the same in Frame nnn and the previous frame, enter the previous frame and press S followed by Y. Otherwise delete a line from Frame nnn, or add a line to the previous frame.

Illegal line nnn in Frame nnn

Semi-key frame nnn has a line in it that has since been deleted from the key frames on either side.

Only one frame present

There must be at least two key frames before a sequence can be animated. Draw another frame.