

GRAPHICS LIGHT PEN

The DK'tronics graphics lightpen is compatible with the GT64 * CTM640 * MPI and DDI 1 interfaces.

It is supplied with a sophisticated graphics package in both cassette and ROM versions.

Features include:-

- colour palette
- 'nudge' control for 1 pixel accuracy
- brush choice
- text handling
- user defined sprites
- magnify
- shrink
- circles
- rectangles
- lines
- curves
- colour fill
- tape and disc facilities
- picture storage and retrieval
- pen calibration utility
- printer dump

GRAPHICS LIGHTPEN MANUALWARNING

This unit must be used in accordance with these instructions. Never plug in or remove the interface without first disconnecting the power from the computer. Failure to follow these instructions may result in damage to the interface or the computer.

1.1 INSTALLATION

To set up your Graphics Lightpen, TURN OFF THE POWER TO YOUR AMSTRAD, then plug the interface into the disc port on the CPC 464 or the expansion port on the CPC 664/6128. If you have a disc drive (464) then fit the disc drive interface onto the back of your lightpen via the through connector. Attach the lightpen itself to the jack socket on the left side of the interface.

The DK'Tronics Graphics Lightpen is compatible with the Amstrad disc drive (DDI-1) and the DK'Tronics speech unit, and any combination of the three can be used.

Now turn on your computer. The computer should initialise normally. If it does not, switch off the power to the computer by the switch on the monitor and check that all the connections have been made correctly. Now switch on again. Due to the construction of the monochrome monitor, you may have to wait a short while before switching on while the monitor resets power to the computer, this is quite normal.

1.2.1 SOFTWARE LOADING DETAILS (cassette)

Your Graphics Lightpen can be used directly from BASIC or machine-code programs of your own, but the graphics package supplied illustrates what can be achieved with the lightpen and serves as a useful demonstration of its powers. It is also a powerful program in its own right as shown by the artwork on the packaging, which was drawn using the Graphics Lightpen.

To load, simply place the cassette in the tape drive, press <PLAY>, and type 'RUN ""' and press <ENTER>. The program will now load into the computer.

If you have an Amstrad disc drive attached to your computer then you need to type 'ITAPE' and press <ENTER>. Now type 'RUN ""' and press <ENTER>. The procedure for loading on the Amstrad 664 is similar except you need to attach an external cassette unit before using the above instructions. Full instructions on loading tapes may be found in your Amstrad manual.

The tape is recorded on both sides using SPEED WRITE 0 and is NOT protected, so that users with disc drives may copy the software to disc. After four and a half minutes the Graphics Package should have loaded.

1.2.2 SOFTWARE LOADING DETAILS (ROM)

All that is required to run the ROM software is to type in "llightpen" then press <ENTER>.

1.3 RUNNING THE PACKAGE - BASICS

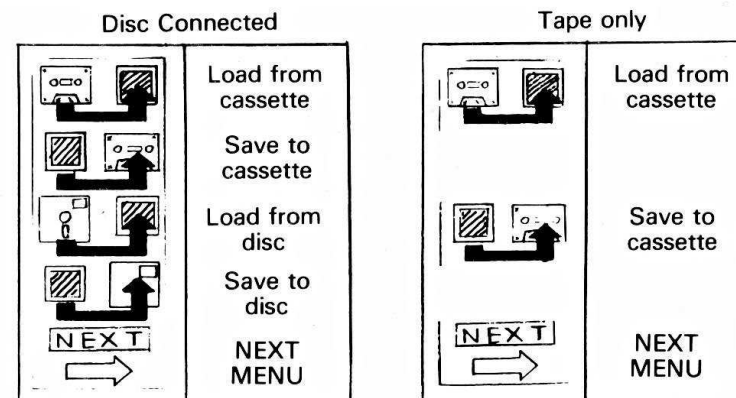
Once the program is run, the screen will clear to a white background with a blue border and a menu will appear. A menu is a list of tasks which the computer can carry out. Instead of you having to tell the computer what to do by using symbols and words (like in BASIC), it enables you to select from a certain number of functions. Compare this to the menu you might find in a restaurant. The menu saves you having to ask for meals which are not available, and reminds you of the kinds of dishes that you can have. Similarly when you want the computer to draw a circle or edit some screen, you simply select an item from the menu. To make the things easier to remember, all the choices are in the form of pictures. These express what the function is without using lots of text!

This is the first of several menus which hold up to five choices represented as pictures or 'ikons'. Pointing the lightpen to each ikon will make a set of white brackets appear around the ikon. This indicates which choice you require. When the brackets are around the ikon you require, press either <ENTER> key to make your choice. Remember to leave the lightpen pointing at the ikon while you press <ENTER>.

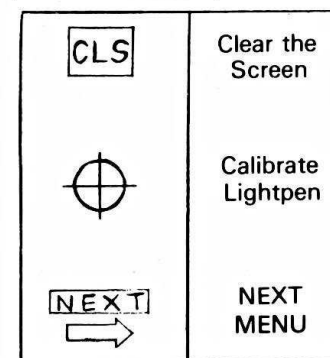
If you wish, the selection can also be made by pressing the number keys '1' through to '5' and then <ENTER>. This is useful for making choices before the pen has been calibrated. You can change your mind once you have pressed a number key, but you cannot use the lightpen to select an ikon again until the next menu appears. Once <ENTER> has been pressed your choice is made, however pressing <ESC> will get you back to where you were.

Practice pointing the lightpen at the ikons to make choices and see where you get to! Remember <ESC> will always get you back to the last menu.

When you are familiar with choosing ikons, press <ESC> until the very first menu appears on the screen. This is the LOADING and SAVING menu and allows you to load and save pictures you have drawn to tape or disc. The menu will look different depending on whether you have a disc drive attached:-



Point to the last ikon 'NEXT' or press '5'. Then press <ENTER>. A new menu will appear with just three ikons:-

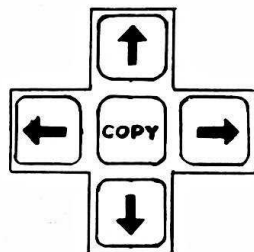


The first ikon will clear the screen's contents and should be carefully used! The second allows you to enter the lightpen calibration routine. Point the lightpen at the calibrate ikon and press <ENTER> to confirm your choice.

A target like the ikon itself will appear on the screen. Now hold the lightpen up against the screen in the centre. If all is well the target will hover directly under the top of the pen. Increase or decrease the brightness and/or contrast on your monitor or TV until the target follows the pen to all corners of the screen. For best response hold the pen perpendicular to the screen, touching the glass and keep your arm well supported to prevent your hand shaking.

Once you have got the target to follow the pen, reduce the brightness until you get best results with minimum brightness. The target may 'jitter' to a greater or lesser degree but this does not matter as you will see when using the 'nudge' feature.

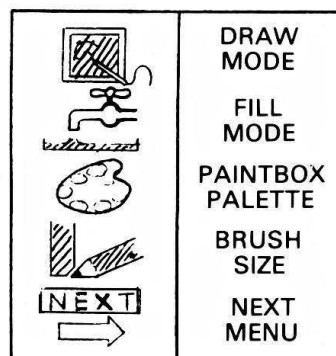
The target may seem to be a short distance away from the tip of the lightpen. If so, you can adjust the centre of the pen by using the Amstrad's cursor keys:-



Hold the pen very steady and press the respective directions to move the cross under the tip of the pen. Press <ENTER> to record this new setting or <ESC> to leave the setting unchanged. You can recalibrate at any time during using the program.

Your lightpen is now fully functional and calibrated. Do not worry if it does not seem accurate enough for fine line drawing - using the DK'Tronics 'nudge' feature the pen can draw as accurately as you wish:-

The last menu will reappear. Select the 'NEXT' ikon and press <ENTER> to confirm your choice. A new menu will appear:-



You are now in the third menu. Pressing <ESC> will make the previous menu appear. Press <ESC> again and the first menu will appear. Pressing <ESC> again will not take you to any further menus. Select 'NEXT' to get into the second menu, then 'NEXT' again to get back to the third menu.

***** REMEMBER *****

Pressing <ESC> whilst a menu is on the screen will take you BACK one menu.

Pressing <ESC> whilst you are performing some action on the screen (eg Calibrating, Drawing) will simply make the current menu reappear.

In all cases, selecting 'NEXT' selects and displays the next menu.

There are five main menus and several sub-menus. You now know enough to flick through the five menus and back again but do not select any function as yet.

Go back to the third menu and select the third ikon, a paint palette. A paint box will be displayed (different tones on the monochrome monitor). Use the lightpen or number keys ('1' to '0') to select a colour/tone from the box. The paint box is surrounded by a yellow boarder, you can use this to select the darker colours by pointing the pen to the border next to the required colour.

***** REMEMBER *****

The lightpen needs light to work - it will not pick up on dark colours or tones.

Select a bright colour/tone and press <ENTER> to confirm your choice. If you press <ESC> then the colour will remain the same and you will return to the last menu.

Now select the fourth ikon, the pencil ikon. A menu of pencil sizes will appear and you can select any size you want! The bottom ikon is a spray can! this produces a splatter effect like an airbrush. Press <ENTER> to select your pencil.

When you return to the third menu, point the lightpen to the first ikon and press <ENTER> to confirm your choice. You are now in draw mode!

There should now be a clear screen with a single small cross under the lightpen. This cross represents where the computer 'sees' the lightpen. Pressing <ENTER> will draw a blob using the pencil and colour/tone you selected. Move the pen around the screen and press <ENTER> again. More blobs will appear! If you keep the Large <ENTER> key pressed down, then repeated blobs will appear and in this way you can shade in areas of screen.

Now press the space bar. A continuous line will be drawn from the last point to the tip of the lightpen. If you are using a thin pencil then you can keep the space bar pressed and draw sequence of lines quite quickly. If you are using a thick pencil then you may have to move the lightpen more slowly.

When you are fed up, try pressing <ESC> and changing the colours and pencil sizes as outlined beforehand. Also try clearing the screen by pressing <ESC> twice and going back to the second menu.

When you have finished making patterns on the screen using the drawing mode, clear the screen then enter draw mode again. Now move the pen to the top right hand corner of the screen without pressing any key. Now press one of the cursor keys and notice what happens.

The cross has now halted in one position and can only be moved by using the four cursor keys. This is the 'nudge' feature which means you can move the cross to a single pixel. Pressing <ENTER> or the SPACEBAR will still have the same effect as before. If you press <COPY> then the cross will once more move with the lightpen. Try to draw some shapes by moving the cross, pressing <ENTER> then moving the cross to another point, use the 'nudge' feature to move the cross to an exact position for say a square or a triangle. Now press the SPACEBAR to draw a line to that point. Finally, use the 'nudge' to link the final edge of your shape to the starting point.

1.4 FILLING IN SHAPES

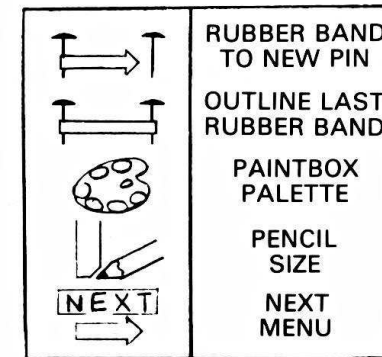
When you have your shape on the screen you may wish to fill in the centre with a colour/tone. Press <ESC> to re-enter the third menu. Then select the second icon, the tap! After you press <ENTER>, the menu will disappear and the cross will reappear. Move the cross so that it is inside the shape and press <ENTER>. If you want to fill in small shapes where it is difficult to move the tip of the light pen into the centre of the shape, then move the cross close to the shape, then use the 'nudge' feature to move the cross into the exact area to be filled. Then press <ENTER> as before.

Watch out for shapes which have 'a leak'! Any shape which is not fully enclosed will let the ink spill out until it fills the whole screen. You can still press <ESC> to stop a fill whilst it is in action. It is worth remembering that whatever colour exists at the point where you start filling is taken as background colour. Hence you can remove objects by filling in a shape with white colour.

The best way to learn how to use fill is to experiment with lots of different shapes drawn in draw mode, then fill them in. Remember to change the paint colour and pencil size. You may even like to try and fill the outline of a shape. If you use a thick line, then you can change the colour of the outline in one fill command.

1.5 DRAWING CURVES AND COMPLEX SHAPES

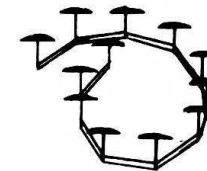
Select the fourth menu:-



For drawing complex shapes or curves, the software makes use of 'rubber bands' stretched between 'drawing pins'. For instance, a curve can be considered as a series of short lines:-



Or even:-



The Graphics package allows you to define a shape on the screen using one rubber band and up to twenty drawing pins. This feature is most useful because just as real drawing pins can be removed, so can the imaginary computer drawing pins.

Once you are happy with the shape you have drawn, the computer removes the rubber band and pins then outlines the shape in the current pencil and colour/tone.

Go back to the second menu and clear the screen. Then return to this menu and select the first ikon. Press <ENTER> to confirm your choice. A cross like the one used in draw and fill mode will appear in the bottom left of the screen. The first effect that you may notice is that the cross does not follow the lightpen. This is because the cross is initially locked in position and will only move to the lightpen when <COPY> is pressed. Try keeping <COPY> pressed and waving the lightpen on the screen. The cross represents where the first drawing pin (or the start of a shape) will go. Let the <COPY> key go and the cross will lock into position. It can now be finely adjusted by using the cursor keys.

When you have the cross just where you want it, press <ENTER>. The cross now becomes a pin, and one end of the rubber band is fixed to the screen. If you now press <COPY> again while moving the lightpen on the screen, you will see a line from the first pin to the cross at the tip of the lightpen. The line will not affect anything already on the screen. Press <ENTER> after the line is correct. This will insert the second pin into place and the rubber band is held between the two pins. If you press <COPY> again a second line will come from the last drawing pin. As you continue putting pins down, the shape grows. Up to twenty pins can form the rubber band into many complex shapes.

For very small shapes you may not even want to use the lightpen for positioning of the small cross.

If you make a mistake in the shape you have drawn, press to remove the drawing pins in the reverse order to which you placed them.

Once your shape is finished, press <ESC> to enter the fourth menu. You may now wish to select a colour and a pencil to use, then select ikon number two, outline rubber band. On pressing <ENTER> the menu will briefly disappear, the computer will remove the rubber band, and then outline the path of the rubber band with the pencil and colour you have just chosen.

The rubber band, although invisible, is still active, and can be reused. Try choosing a different pencil, then select the second ikon and outline the rubber band in a different pencil. You can repeat this as many times as you like, until you use the rubber band mode again by choosing ikon number one.

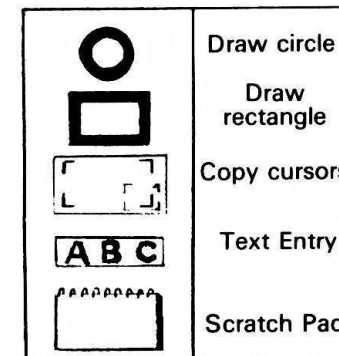
Try using the rubber band to draw some shapes on the screen and see if you can fill them in different colours.

If you run out of rubber bands, then return to the menu and outline that section of the shape, then continue the rest of the line by entering ikon one again.

NOTE: If you define a rubber band and do not use it, when you select the rubber band ikon again, the last rubber band will still be in use and you may have to press to remove it.

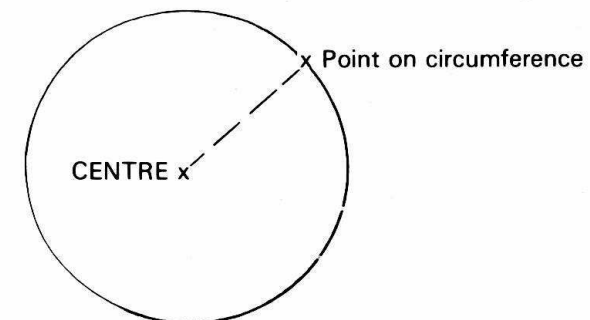
1.6 CIRCLES AND RECTANGLES

Select the fifth menu:-

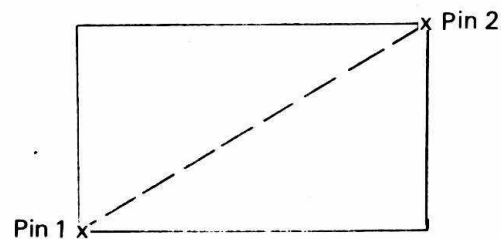


Circles and rectangles can quickly be drawn by using the rubber band to specify details about these shapes as follows:-

CIRCLE:-



RECTANGLE (or SQUARE):-



1.6.1 CIRCLE DRAWING

Enter rubber band mode (ikon 1, menu 4). Move the cross to where you want the centre of the circle to be. (By pressing <COPY> or using the nudge keys). Then fix that centre point by pressing <ENTER>. Now stretch out a rubber band to become the desired radius. (That is, the cross is a point on the circumference of the circle). Now fix a second pin using <ENTER>, then press <ESC>.

Once the radius is defined, select the 'NEXT' ikon to enter the fifth menu. Now select the circle ikon on the top of the menu. The computer will now draw a circle around the defined radius in the current pencil and colour.

Note that the computer will refuse to draw a circle if it goes off the screen. If the computer does refuse to draw a circle, try shortening the radius, or moving the centre.

1.6.2 RECTANGLE DRAWING

The procedure is almost the same as for the circle above, except that the two points defined are the ends of one of the diagonal lines through the rectangle. When you enter the fifth menu, select the second ikon (the rectangle) and press <ENTER>. The computer will now draw a rectangle around the diagonal you have just defined, in the current pencil and colour. It does not matter which direction your diagonal goes, as long as it is not a horizontal or vertical line.

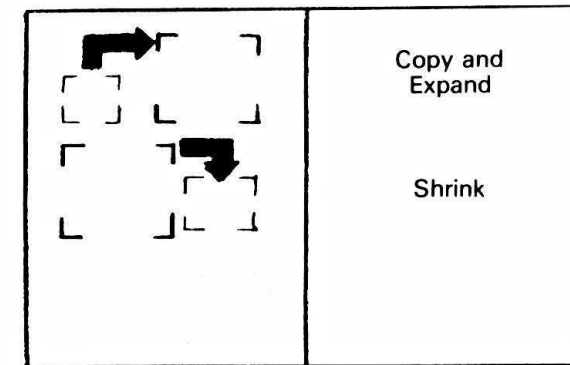
MENU REPETITION:-

You may have noticed that the pencil and palette ikons appear on more than one menu. This is just to make selecting of colour and pencil easier.

1.7 COPYING, EXPANDING AND SHRINKING

Often when you have drawn one complicated shape on the screen, you want to make bigger copies of it. Copies can be easily made, or even copies which are bigger or smaller than the original.

To demonstrate this facility, first clear the screen, then draw a circle in the centre of the screen (see section 1.6.1). Now enter menu five and select the third ikon. Press <ENTER> to confirm your choice. A sub-menu will appear containing only two ikons:-



The first ikon represents the copy with possible magnify. The second ikon is the copy with possible shrink.

Select the first ikon, and press <ENTER>. The menu will disappear and your circle will be on the screen. Somewhere on the screen will be a set of green (lighter on monochrome) flashing corner brackets.

Press <COPY> and move the lightpen on the screen. The brackets can be positioned in the same way as the rubber band cross. Use the cursor keys to fix the final position of the brackets.

The brackets surround the block which you want to copy. Try to get your circle into the centre of the brackets. If the circle is too big (which it probably will be!), then try the following:-

1. Press down the shift key with one finger, then press the cursor keys.
2. Press down the <CTRL> key with one finger, then press the cursor keys.

You should have noticed that the size of the brackets actually changed, and in this way try to get the circle to fit into the brackets.

Even after you have changed the size of the brackets, you may move them by pressing the cursor keys unshifted, or moving the lightpen while pressing <COPY>. Notice how the brackets will not go off the edge of the screen.

Now that you have the area of screen you want to copy defined, you need to tell the computer where to copy it to. Press . There are now two sets of brackets on the screen (although when you first press they are on top of each other). Keep <COPY> pressed and move the lightpen on the screen. Notice now that the second cursor is blue (or dark on monochrome) and flashing and that the first set of brackets is no longer flashing. Hence it is easy to tell which bracket is under lightpen control by which set is flashing. Pressing again will swap back and forth between the two cursors. Now when you alter the size of brackets, you will effect the size of both cursors.

Move the second set of brackets to a different position, using the 'nudge' feature for final setting. Now press <ENTER>. The computer will copy the area of screen in the first set of brackets into the second set of brackets.

When the copy is complete (the speed of copy depends on how large the brackets are), the original green/light set of brackets will reappear and you can do another copy. Press <ESC> to exit when you have finished. The green/light brackets stay in the same place at the same size, so for multiple copies, simply press and move the blue/dark 'TD' cursor to a new position and press <ENTER>.

Press <ESC> to return to the fifth menu as normal when you have finished with copying.

1.7.1 HOW TO ENLARGE AN OBJECT

Clear the screen and draw a very small rectangle in the bottom left of the screen (about six pixels high by eight wide) (see section 1.6.2). When you are in menu five, select the third ikon (the one with two copy cursor brackets). Now select the top ikon in the next menu, (the one showing a small green/light copy cursor and an arrow pointing to a larger blue/dark copy cursor). As before, move the green/light set of brackets so that they just surround the rectangle you have drawn, (Do not make the cursor too big yet).

Now split the brackets up by pressing and move the blue/dark set of brackets to the centre of the screen. If you were to press <ENTER> now, you would make a copy of your rectangle. However, before pressing <ENTER>, press the '2' key. This stands for double size. The blue/dark set of brackets now doubles in size. Press <ENTER> now and see what happens. The computer should have copied the rectangle into the blue/dark brackets at double its original size.

Try repeating the above instructions, but press '3' instead of '2'. '3' stands for treble size. Try once more using '4' for quadruple size.

The keys '1' to '4' set the magnification factor where '1' is the same size as original.

When you are defining the positions of the two cursors try setting magnification '4', then increasing the physical size of the cursors by pressing SHIFT and the cursor keys. As you increase the size of the green/light 'FROM' cursor, the size of the blue/dark 'TO' cursor grows accordingly. When the blue/dark cursor gets too big it will revert to a lower magnification, eventually the two cursors will be the same size. Because of this you may need to do some copies in two or more stages. However if you then shrink the physical size of the green/light set of brackets, then the blue/dark set will attain the maximum magnification up to that which you have set.

1.7.2 HOW TO REDUCE AN OBJECT

The method used to shrink an object is similar to expanding an object but you need to use the second ikon on the copying sub-menu.

NOTE: In this mode the area of screen is copied from the blue/dark set of brackets to the green/light set. Do not mix up the two or else you may lose your picture by copying a blank space onto your picture!!!!

Draw a large rectangle in the centre of the screen using the thickest pencil (the fourth ikon on the pencil menu) (see section 1.6.2). Now enter the copying sub-menu and select the second ikon, (a large blue/dark cursor with an arrow pointing to a smaller green/light set). The menu will disappear as normal. The green/light cursor is still the smaller of the two cursors. Press a number '1' to '4' for reduction factor. '4' is four times smaller while '1' is the same size. Now press to allow you to move the blue/dark cursor around your rectangle, use the <SHIFT> key and the cursor keys to enlarge the size of the brackets.

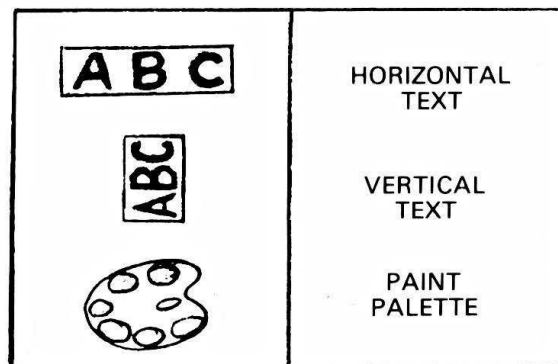
Use the <CTRL> key and cursor keys to reduce the size of the brackets. Now press again and move the green/light set of brackets to where you want the area of screen to go. Press <ENTER> and the rectangle will be shrunk into the green/light copy cursor.

It does not matter if the two sets of brackets overlap, however you may lose the original shape if the 'TD' cursor covers it.

The best way to get to know the copying system is by trial and error. You may wipe out a few drawings on the way but this is better than losing a screen you may have spent hours designing. Remember if you are unsure, press <ESC> and start again rather than forgetting whether you are in expand or shrink mode! Once you can use the copy cursors skilfully you will be surprised just how useful and 'simple' they become.

1.8 ENTERING TEXT

If you want to label any of your drawings then use the text feature. When you are in the fifth menu, select the ABC ikon, and press <ENTER> to confirm your choice. A sub-menu containing three ikons appears:-



Select a suitable colour/tone using the third ikon, then select the first ikon for horizontal text. After you press <ENTER> the menu will disappear and a single block cursor (like the AMSTRAD'S BASIC one) will appear this represents where text will appear. Move the cursor by holding <COPY> down, and moving the lightpen around the screen. You can finely place the text by using the cursor keys to nudge the cursor one pixel at a time. Now type what you want to write using the keyboard. All the standard characters are available as normal. The text will appear on the screen but if you want to adjust its position, simply use the same method as outlined above. In this way text can be finely positioned and the amount of required space can be gauged. Once you are happy with the text, press <ENTER> and the computer will ink in the text permanently. If you make a mistake, press to remove the letters one by one. Pressing <ESC> will abort and any text not inked in will be lost.

The same applies for vertical text. Try selecting the second ikon on the sub-menu.

Interesting effects can be obtained by writing text twice, offsetting the second piece by one pixel vertically and horizontally using the cursor keys to nudge the text cursor. Try writing in two different colours to give the text a feeling of depth.

To remove text that has been permanently inked in, re-write the same text in the background colour.

You may wish to use characters from the Amstrad character set which are not available from the keyboard. For example characters 160 and 161 are useful for french text. To enter these characters you need to look up the character's code in your Amstrad manual. When you require a special character, while entering normal text press <TAB> and then enter the character's code using THREE numerical digits. For example the character number 160 is entered as:-

<TAB>160

You do not need to press <ENTER> for the character to appear. Pressing will delete the character as normal. NOTE: even if the code of the character is one of two digits, you still need to type out THREE digits, using preceding zeros if necessary. For example the character number 4 is entered as:-

<TAB>004

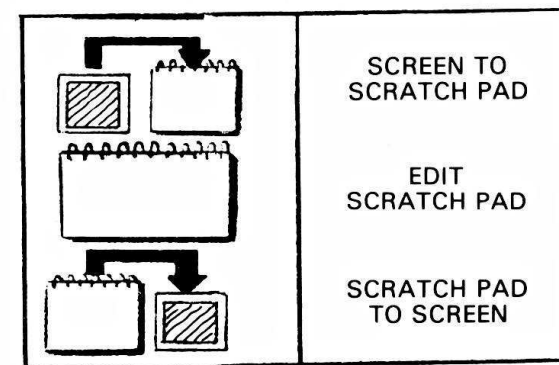
If you make a mistake in entering the digits, then press space and start again by pressing <TAB>.

1.9 FINE DETAIL AND ALTERATIONS

When you are trying to draw very fine detail on the screen, where every pixel may be in a different colour, it would be nice if a section of screen could be magnified to a suitable size.

For this reason a 'scratch pad' has been used to allow very fine detail to be applied to the whole screen.

Draw a small circle on the screen (one with a radius of about 6 pixels). (See section 1.6.1) Now select the last ikon in the fifth menu (the one that looks like a pad). Another sub-menu will appear as follows:-



Use the top ikon and press <ENTER>. (This represents a screen to pad). The menu will disappear and a red or dark bracket cursor will appear similar to the copy cursor mode (see section 1.7). These brackets can be moved using the <COPY> key and the lightpen, or by using the cursor keys to nudge the brackets to a single pixel. Notice that this set of brackets is a single size only. Move the brackets so that they surround the circle. (If your circle is too big, then you may need to re-draw it). When you have the circle in the centre, press <ENTER>. the section of screen is now 'blown' up to a size where fine detail can easily be done.

At the very bottom of the screen is a band containing the ink colour. Press the keys '1' through to '0' on your keyboard to select a colour within the scratch-pad ONLY. If you press the key labelled <CLR> then a special transparent colour will be used (shown as vertical bars). This colour will not be copied from the pad and hence will let the original colours on the screen show through. Now point the lightpen at the screen by pressing <ENTER>, you will be able to plot pixels in the current colour. Use white to blank out any mistakes.

Perhaps easier to use than the lightpen in this mode are the cursor keys. Use these to move the flashing cursor around. Once they are pressed they lock out the lightpen until <COPY> is pressed.

Using the lightpen or the cursor keys, alter the circle. Now press <ESC> and the sub-menu will reappear. Now select the third ikon (this represents pad to the screen) and press <ENTER> to confirm your choice. The red brackets reappear and pressing <ENTER> copies the contents of the scratch-pad to the area of screen inside the brackets. If you don't move the brackets, then your circle will be 'updated'. If you move the brackets by holding down <COPY> and using the lightpen or by nudging the brackets, then multiple copies of the circle can be created.

Now press <ESC> and select the second ikon on the sub-menu. This returns you to the scratch-pad. You could now re-edit the circle, or even start again.

If you want to create your own high-resolution object then clear the whole pad to a background colour: Select any colour using the '1' to '0' keys (a good idea would be to use white, key '1'), then press <CTRL> and <TAB> together. The screen will blank to the selected colour. Now select another colour and use the lightpen or cursor keys to draw a graphic object. Once you have finished press <ESC> and select the third ikon to place the contents of the scratch-pad onto the screen. Press <ENTER> and move the brackets around. Press <ENTER> again to place the object anywhere on the screen.

You may already have a complicated background onto which you want to place an object without the background being removed around the object. If this is the case then simply design your high-resolution object on a transparent background (selected by pressing <CLR>). If you have picked up an object from the screen with a set background then whilst in edit mode change this background to transparent <CLR> or select the same colour as the background and press <SHIFT> and '*'. This is to save you the trouble of manually changing all the background to clear.

The use of the scratch-pad, although seemingly complicated helps to make alterations to parts of the screen very quickly and accurately. Practice using the pick-up, edit and put-down sequence to edit your pictures. Also be careful not to forget you are in put-down mode when you try to pick something up, the result is the writing over of what you originally wanted to edit (and much displeasure to say the least!).

1.10 USING TAPE AND DISC DRIVES

The graphics package supports both tape and Amstrad disc drives. If you have no disc drive connected then the software acknowledges the fact and does not allow you to try and use discs.

There are two sections about tape and disc which will be of interest, and those are (1) saving the Graphics Package itself (including putting the software onto disc from the tape) and (2) saving pictures you create.

The first one is considered next.

1.11 BACKING-UP YOUR GRAPHICS PACKAGE (cassette version)

The software is NOT protected because users with disc drives may want to transfer the software to their discs. Secondly the software is saved using SPEED WRITE 0; users may wish to resave a copy in SPEED WRITE 1. Finally keeping a back-up is always recommended, and saves the trouble of ordering a second copy when you leave the tape on a magnet!

1.11.1 TO LOAD WITHOUT RUNNING:- (cassette version)

In all cases, the Graphics Package needs to be loaded into the computer as outlined below.

1. If your disc is attached then type 'ITape' and press <ENTER>.
2. Type 'LOAD "LPEN"' and press <ENTER>.
3. Put the tape in the tape drive and rewind the tape. Press <PLAY> then press any key. Do not release the <PLAY> key unless a TAPE ERROR occurs, in which case refer to the Amstrad manual for loading hints.

4. When the computer has finished type '35 STOP' and press <ENTER>.
5. Now type 'RUN' and press <ENTER>.
6. The tape will start to run again and about four minutes should pass.
7. Finally type '35' and press <ENTER>.

The complete program is now in the computer.

1.11.2 TO SAVE TO TAPE;-(cassette version)

1. Select the speed of tape you want to use:-
 - Type 'SPEED WRITE 0' for slow, safe SAVE.
 - Type 'SPEED WRITE 1' for fast SAVE.
2. Place a blank cassette into the drive. It needs to have at least five minutes of tape on it (or left on it).
3. Type:-
 - SAVE "LPEN"; SAVE "GRAPH", B, 6000, 7600; SAVE,
 - "PROG", B, 32768, 9750 and press <ENTER>.
4. Press <PLAY> and <RECORD> then any key. You will need to press any key twice again for each section.

1.11.3 TO SAVE TO DISC;-(cassette version)

1. Type 'DISC' and press <ENTER>.
2. Put a disc in your drive which has at least 19K free on it. Make sure the write protect tab is off.
3. Type:-
 - SAVE "LPEN"; SAVE "GRAPH", B, 6000, 7600; SAVE
 - "PROG", B, 32768, 9750 and press <ENTER>.

NOTE: You may wish to use SPEED WRITE 1 when saving pictures (see section 1.12). If so, before saving a copy of the program onto tape or disc, add this line:-

```
35 SPEED WRITE 1
```

Now save the program as outlined above.

1.12 LOADING AND SAVING

Once you have completed a picture, it can be stored on tape or disc for later use (see section 1.14). The very first menu contains the ikons which control saving and loading. Press <ESC> as many times as needed to return to the first menu. Whether you have a disc drive or not, the first two ikons represent tape to computer (Load), and computer to tape (Save). If you have a disc drive attached then you have the option of using tape or disc and there are two more ikons representing disc to computer (Load), and the computer to disc (Save).

To save your picture select the second ikon (tape) or the fourth ikon (disc only). The computer will ask you for a name, to be typed from the keyboard. Only letters and numbers are allowed. If you use disc then a directory containing any other pictures and amount of free memory will be displayed. (If you wanted directory only, press <ESC> to abort at this stage.) Once you type in the name, the computer will save the whole picture. For tape this will take some time, and the computer will inform you how many blocks it has saved. On disc, the computer will return to the main menu after a short time, unless an error occurs. If a disc error does occur then a message will be displayed, you may either correct it for non-fatal errors eg, read errors etc, or press any key and the first menu will reappear then you may need to change the disc and re-save to picture.

It is wise to save complicated pictures frequently (especially if you have a disc) in case you make a mistake. (Like filling the screen in white!) It takes only two minutes to save a screen using SPEED WRITE 1 (see section 1.11) or three and one half minutes using SPEED WRITE 0.

On the disc drive, pictures may be saved with the same name and the computer will rename the old version using the BAK extension. Consult your manual if you are unfamiliar with the AMSTRAD Disc Operating system.

To Load the picture from tape select ikon one, or ikon three if you are using disc. If you are using tape then the computer will load the first binary file on the cassette onto the screen. This need not have been one saved by this package. If all goes well, eight blocks will load into the computer. The computer will report on its progress as normal. Any errors will be reported and the action you need to take depends upon the error eg, if the disc read error occurs then the message "try Retry or Cancel" is displayed.

Note that the files which are output are standard binary files and can be used in your own BASIC or machine code programs. (See section 1.11 and 1.12.)

1.13 USING PRINTERS

To obtain a hard copy of your pictures (or any others you may have created without this package), it is necessary to load the second program on the tape supplied with your Graphics Lightpen. This program does not support any specific printer but it converts the colour data on the screen into a form which printers accept their data. This data can then be very quickly output from a BASIC program designed to suit YOUR printer. Two example BASIC programs are included for EPSON and AMSTREAD printers. From these and your own printer manual it is hoped that any printer, which can be controlled normally from your computer, can be used to produce a screen copy.

Also those users with expansion parallel printer ports, many of which use eight bits instead of seven, can very easily use these ports instead of the Amstrad one. This is possible because all the printer handling is actually done from BASIC.

1.13.1 EPSON PRINTER EXAMPLE:-

Before you can make any copies you need to have saved your picture on tape or disc. Now reset the computer and follow these instructions:-

1. Connect up your printer and make sure that it is working correctly, also connect the disc drive if you are going to be using discs.
2. Switch on and type 'MEMORY 9999' and press <ENTER>.
3. Load the second program on the software cassette. It is found at the end of either side. Fast forward the cassette until you are nearly at the end of the cassette and type 'LOAD "DUMPMC"' and press <ENTER>. If the program fails to load then rewind the tape and try again.
4. Type in the following program making sure you copy it exactly:-

```
10 MEMORY 9999:MODE 0
20 S=5:POKE 40003,S:POKE 40004,0
30 INPUT "NAME OF SCREEN";Y$:LOAD Y$
40 CALL 40000:REM REMEMBER TO LOAD DUMPMC FIRST! (STAGE 3)
50 WIDTH 255:PRINT #8, CHR$(27);"A";CHR$(4);
60 D=25; IF S>2 THEN D=50
70 L=S*2+2;IF S>2 THEN L=L-6
80 C=10000;FOR J=1 TO D:LA=C;FOR I=1 TO L
90 PRINT #8,CHR$(27);"K";CHR$(80);CHR$(0);;FOR K=1 TO 80
100 PRINT #8,CHR$(PEEK(C)/16);;C=C+1:NEXT K,I
110 PRINT #8:C=LA
120 FOR I=1 TO L:PRINT #8,CHR$(27);"K";CHR$(80);CHR$(0);
130 FOR K=1 TO 80:PRINT #8,CHR$(PEEK(C) AND 15);
140 C=C+1; NEXT K,I:PRINT #8:NEXT J
150 END
```

5. Type 'RUN' and press <ENTER>.
6. In reply to the prompt 'NAME OF SCREEN' type the name under which you saved the screen, or just press <ENTER> if you are using tape.
7. The screen will load and after a pause the printer will print out your screen using a shading effect to show the different colours.
8. (You may wish to SAVE the above program yourself to save retyping it every time you need to use it).

1.13.2 AMSTRAD PRINTER EXAMPLE:-

The procedure is almost the same as for the EPSON printer except that the program for step 4 is as follows:-

```
10 MEMORY 9999:MODE 0
20 S=5:POKE 40003,S:POKE 40004,1
30 INPUT"NAME OF SCREEN";Y$:LOAD Y$
40 CALL 40000
50 WIDTH 255
60 DIM D(8,5);FOR I=1 TO 8;FOR J=1 TO 5: READ D(I,J); NEXT J,I
70 DATA 127,1,0,1,1,128,128,63,2,0,192,64,31,4,0
80 DATA 224,32,15,8,0,240,16,7,16,0,248,8,3,32,0
90 DATA 252,4,1,64,0,254,2,0,1,0
100 C=10000;S=1;L=1
110 FOR I=1 TO 6:PRINT #8,CHR$(27);"K";CHR$(0);CHR$(S);
120 FOR J=1 TO 80:PRINT #8,CHR$(PEEK(C) AND D(S,1))/D(S,2)+(PEEK(C+480) AND D(S,3))*d(S,4);;C=C+1:NEXT J,I
130 PRINT #8:C=C480*D(S,5);S=S+1;IF S=9 THEN S=1
140 L=L+1;IF L=58 THEN STOP
150 GOTO 110
```

1.13.3 ADVANCED INSTRUCTIONS FOR PRINTOUTS

While the BASIC program in the two above examples looks complicated, most of the hard work of converting the screen into data has already been done by the machine-code program you first loaded. The BASIC program simply outputs the data to the printer after sending the respective printer's control codes. If you have one of the above printers then you need not worry about the next section, however you may have a different printer or simply be interested so let's go through the EPSON printer program step by step to see what is happening:-

After setting MODE 0, the program sets two variables in the machine-code program. The variable S sets the size of printout. Location 40003 is then altered to that value to inform the machine code of the size you want.

On the EPSON there are a possible 480 (in single density mode) pixels across the paper. This means that is the capable of displaying the largest size of output possible from the machine code program. On other printers however there may be less pixels across and hence a smaller size may need to be used. Try different values of S (0 to 5) on your EPSON printer to illustrate the effect.

The screen has dimensions of 160 pixels across the screen and 200 pixels down the screen. The machine code software can convert these to six different sizes on the printer. The possible dimensions are:-

S = 0 160 pixels across and 200 pixels down
 S = 1 320 pixels across and 200 pixels down
 S = 2 480 pixels across and 200 pixels down
 S = 3 160 pixels across and 400 pixels down
 S = 4 320 pixels across and 400 pixels down
 S = 5 480 pixels across and 400 pixels down

For your printer you will need to look up in your printer manual how many pixels your printer is capable of printing in one row. Then select a value of S that is smaller or equal to that maximum value.

As any printer prints, the head will print a number of dots in a VERTICAL column, so this is how the data from the screen is converted. Starting from location 10000 in memory, data is created where each byte represents one vertical column. The printer then has to be informed that the data is on its way, and the BASIC program needs to simply send the data from memory to the printer.

The location 40004 needs to contain either a 0 or a 1, '0' specifies that the most significant bit of the data is the bottom dot while '1' means that the most significant bit of the data is the top bit. If you are unsure, use 0 and it will be clear whether you need to use a 1 because the printout will be upside down!

Line 30 loads the screen from tape or disc. Note that the MODE 0 command makes sure that the screen has not scrolled. That, is the screen always starts at 49152 in memory.

Line 40 calls the machine code routine and fills the memory of the Amstrad from 10000 onwards, the actual amount of data depends on the size value S. For S=5, 24K of memory is needed.

Line 50 commands the EPSON to move just 4 pixels between every line. You may need to consult your printer manual to find out how to set the distance between rows. In some cases it may not be possible to set a 4 pixel line setting. In this case you may have to set a 7 pixel line setting and output 7 pixels of data at a time, meaning that the bottom row of pixels in each line will be lost.

It is necessary to note that the Amstrad's CENTRONICS parallel port uses only 7 bits. While this is industry standard, the EPSON and many other printers use 8 bits.

With only 7 bits you may realise that is impossible to send 8 pixels of data in one instruction to the printer. Hence on the EPSON (and more than likely on your printer) it is necessary to send the top four bits and then the bottom four bits seperately.

In line 60 a variable D is calculated, D stands for depth and is either 25 lines or 50 lines depending on which size (S) of printout was selected in line 20. On the next line L is calculated, L is the number of blocks of 80 bytes of data. Hence if you use the largest size of printout (480 pixels) then value of L is 6. The data is output as blocks of 80 bytes and not as a block of 480 bytes for one reason. When the amount of data to be printed is sent to the EPSON, then EPSON requires a low and high byte value.

If 480 were converted to low and high byte values you would get 224 low and 1 high, ie (1*256 + 224 = 480).

Due to the 7 bit CENTRONICS port, it is impossible to send the value 224. Hence it is safer to send blocks of 80.

After all these variables have been created, the program sets C to 10000 to count through the memory from 10000 onwards.

There is a loop (J) going through each row up to 25 (or 50 if double height is used). Then there is a second loop (I) going through each block of 80 bytes.

Finally the printer is told that it is to print out 80 bytes of high-resolution data 'CHR\$(27);"K";CHR\$(80);CHR\$(0)'. You will need to supply this from your own printer manual.

NOTE: Some printers use bit 7 being a 1 to designate high-resolution data. If this is the case with your printer, then your printer will not produce high-resolution with the AMSTRAD at all.

80 bytes are now read from memory and sent out to the printer. Note how the top 4 bits are selected by dividing by 16. Finally a carriage return and linefeed is sent.

Line 120 onwards repeats the same data but this time the bottom 4 bits are sent by masking out the high 4 bits. (Do not worry if you are unfamiliar with '/16 and 'AND 15', just believe they separate the top and bottom 4 bits!)

So that's all there is to it!!! If you are confused, try reading your printer manual thoroughly, especially the sections on high-resolution printing. Try using some of the examples in the manual and change the EPSON program to contain sections relevant to your printer. Also instead of keep loading a screen from tape or disc, delete line 30 and replace it with this line:-

```
30 FOR I=1 TO 10; FOR J=1 TO 15;PEN J;PRINT CHR$(64+J);;
  NEXT J;PRINT;NEXT I
```

This will print some different coloured letters on the screen as a test screen.

The authors sincerely hope that presenting the printer routines in this form will allow greater flexibility to use any printer which supports high-resolution graphics.

We hope that it can be appreciated that there are hundreds of different printers which can be used with your Amstrad and a single printer routine could never support all of them. The above information should make it possible to support your printer, with as little effort on your part as possible.

1.14 USING SCREENS IN YOUR OWN PROGRAMS

The screens which are saved from the Graphics Package as standard binary files.

These can be loaded into your programs simply by using a line such as:-

```
40 MODE 0
50 LOAD "NAME"
```

Where the 'NAME' is what you called the screen when you saved it.

The colours used in the Graphics Package are not the same as the colours assigned when the computer is first switched on. Hence you need to re-define the INKS before you see the pictures in the correct colours:-

```
10 BORDER 0;RESTORE 20;FOR I=0 TO 15:READ A;INK I,A;NEXT I
20 DATA 26,18,9,17,8,11,13,22,0,24,6,2,14,19,2,3
```

If you like you can load the screen into other areas of memory by adding a load address on the end of the above statement:-

```
30 MEMORY 19999
40 LOAD "NAME",20000
```

This will load in a screen at 20000 in memory. If you are doing this, remember that your BASIC program has less memory than normal.

You could even write a short machine code program to move the picture to the screen when you need it like the one below:-

```
60 MEMORY 19900;RESTORE 70;FOR I=19950 TO 19961:READ A;POKE I,A;NEXT I
70 DATA 33,32,78,1,0,64,17,0,192,237,176,201
90 CALL 19950
```

This will move the screen which has been loaded at 20000 onto the screen. You may even like to blank all the inks before you make the transfer to make the picture appear immediately.

```
80 FOR I=0 TO 15:INK I,0;NEXT
```

Then switch INKs back on again:-

```
100 RESTORE 20;FOR I=0 TO 15:READ A;INK I,A;NEXT I
```

If you own a disc drive then you could write a program similar to the one below which presents a number of pictures on screen almost like a slide show.

```
10 MEMORY 16300;POKE 16350,62;POKE 16351,192;POKE 16352,195;
   POKE 16353,&08;POKE 16354,&BC;CALL 16350
20 MODE 1;INK 0,0;INK 1,22;INK 2,2;INK 3,6;PEN 1;PAPER 0;BORDER 0
30 PRINT"          DISPLAY PROGRAM"
40 PRINT"          -----"
50 PRINT"
60 S=5;REM NUMBER OF SCREENS TO BE DISPLAYED
70 DIM N$(S)
80 N$(1)="HOUSE";REM NAMES OF SCREENS ON DISC
90 N$(2)="SHIP"
100 N$(3)="SPEECH"
110 N$(4)="CHART"
120 N$(5)="CAR"
130 PEN 2
140 PRINT;PRINT;PRINT;PRINT "DELAY BETWEEN SCREENS (10 - 6000
   SECS)";PRINT;PEN 3;INPUT "
150 IF D<>INT(D) OR D<10 OR D>6000 THEN 140
160 D=D-5
170 MODE 0;RESTORE 170;FOR I=0 TO 15:READ A;INK I,A;NEXT I;
   DATA 26,18,9,17,8,11,13,22,0,24,6,2,14,19,2,3
180 NS=0;FT=1
190 LOCATE 1,13;PRINT " SCREENS FOLLOW!"
200 FOR I=1 TO S
210 SL=16384;IF NS=1 THEN SL=49152
220 T=TIME;LOAD N$(I),SL;IF FT=1 THEN FT=0;GOTO 240
230 WHILE(TIME-T)/300<D;WEND
240 POKE 16351,192;IF NS=0 THEN POKE 16351,64
250 CALL 16350;REM SWAP SCREEN BEING DISPLAYED
260 NS=NS+1;IF NS=2 THEN NS=0
270 NEXT I;GOTO 200
```


1.15 USING THE GRAPHICS LIGHTPEN IN YOUR OWN PROGRAM

Your program could be as complicated as this Graphics Package or as simple as a telephone directly program, but both are improved by using a lightpen to save using the keyboard for choices.

Listed below are two programs, one in BASIC and one in machine code to allow you to read the position of the lightpen on the screen.

IN BASIC:-

```
10000 OUT &1C00,17:L=INP(&1F00):OUT &1C00,16:H=INP(&1F00)
10010 L=H*256+L-12292:Y=L/40:X=L-Y*40
10020 RETURN
```

A GOSUB 10000, would return X and Y coordinates of the position of the lightpen. X ranges from 0 to 39 and Y ranges from 0 to 24. This scale is irrespective of which mode you use, although when in MODE 1, each graduation represents one character square.

(The value 12292 may have to be altered by one or two to suit your monitor or television.)

IN MACHINE CODE:-

```
COORDINATES: LD BC,1C00H ; set register pair to 1C00
              LD A,17
              OUT (C),A
              LD BC,1F00H
              IN L,(C) ; read low order position
              LD BC,1C00H
              LD A,16
              OUT (C),A
              LD BC,1F00H
              IN H,(C) ; read high order position
              LD DE,12292
              AND A
              SBC HL,DE ; remove constant offset
              LD BC,0
              LD DE,40 ; divide by 40
LOOP:        AND A
              SBC HL,DE
              JR C,FINISH
              INC C ; C is Y position
              JR LOOP
FINISH:      ADD HL,DE
              LD B,L ; B is remainder =X
              RET
```

This routine returns the X and Y coordinates in the BC register pair, where B=X and C=Y.

The two routines above could simply be included in a program which uses menus or need to select choices from anywhere on the screen.

EXAMPLE:-

The program below is a simple reflex tester. Type it in carefully then RUN it.

After the title disappears, four boxes will be drawn. The word HERE will appear in one of the boxes and you need to point the lightpen to that word as quickly as you can. Ten times the computer will select a box at random. The total time will then be given, the lower the score, the better you have done. Our lowest was 2.85 seconds!

Try changing parts of it, if you want, or experiment with writing programs of your own.

```
10 MODE 1: BORDER 0: INK 0,26: INK 1,0: INK 2,12: INK 3,20
20 PRINT , , " TEST YOUR REFLEXES"
30 FOR I=1 TO 2000: NEXT: CLS
40 C=1: FOR I=1 TO 25 STEP 2: C=-C*(C<>3)+1: FOR X=24 TO 344
   STEP 320: FOR Y=16 TO 216 STEP 200: MOVE X+I,Y+I: DRAW
   X+I+250,Y+I,C: DRAW X+I+250,Y+I+150,C: DRAW X+I,Y+I+150,C:
   DRAW X+I,Y+I,C: NEXT Y,X,I
50 PEN 1: V=5: FOR N=1 TO 10: REM NUMBER OF TESTS
60 V1=INT(RND*4): IF V=V1 THEN 60
70 FOR I=1 TO INT(RND*3000)+1500: NEXT I
80 V=V1: X1=9+(V AND 1)*20: Y1=7+(V AND 2)*6: LOCATE X1,Y1:
   PRINT "HERE!"
90 T=TIME
100 LOCATE 18,13: PRINT INT((TIME-T)/3)/100; " "; GOSUB 10000: IF
   (Y-1<Y1 AND Y+3>Y1) AND (X-5<X1 AND X+1>X1) THEN 120
110 GOTO 100
120 LOCATE X1,Y1: PRINT " "; REM 5 SPACES
130 TT=TT+(TIME-T): NEXT N
140 LOCATE 8,13: PRINT "YOUR TIME WAS"; INT(TT/3)/100; "SECONDS."
150 FOR I=1 TO 3000: NEXT: LOCATE 1,13:
   PRINT " "; REM 5 SPACES
160 RUN 50
10000 OUT &1C00,17:L=INP(&1F00):OUT &1C00,16:H=INP(&1F00)
10010 L=H*256+L-12292:Y=L/40:X=L-Y*40
10020 RETURN
```


1.16 REVIEW OF GRAPHICS PACKAGE COMMANDS

This section is intended as a quick reference once you have gone through the rest of the manual. Use it in conjunction with section 1.17 showing all the menus and the menu numbers.

Menu 1:	Ikon 1	Load Screen from Tape	(Section 1.12)
	Ikon 2	Save Screen to Tape	(Section 1.12)
	Ikon 3	Load Screen from Disc	(Section 1.12)
	Ikon 4	Save Screen to Disc	(Section 1.12)
	Ikon 5	Goto Menu 2	
		(Ikons 3 and 4 will be missing on tape only systems)	
Menu 2:	Ikon 1	Clear Screen to White Background	(Section 1.3)
	Ikon 2	Calibrate Lightpen	(Section 1.3)
	Ikon 3	Goto Menu 3	
Menu 3:	Ikon 1	Draw Mode	(Section 1.3)
		(Use <ENTER> and SPACE BAR)	
	Ikon 2	Fill Mode	(Section 1.4)
		(Use <ENTER> to fill area)	
	Ikon 3	Select Ink Colour/Tone	(Section 1.3)
	Ikon 4	Select Pencil Texture and Size	(Section 1.3)
	Ikon 5	Goto Menu 4	
Menu 4:	Ikon 1	Rubber Bands	(Section 1.5 & 1.6)
		(Use <ENTER> for pins <COPY> to move rubber bands out, <ESC> to finish)	
	Ikon 2	Outline Rubber bands	(Section 1.5)
	Ikon 3	Select Ink Colour/Tone	(Section 1.3)
	Ikon 4	Select Pencil Texture and Size	(Section 1.3)
	Ikon 5	Goto Menu 5	

Menu 5:	Ikon 1	Draw Circles	(Section 1.6.1)
		Use first pin for centre, second pin to set radius)	
	Ikon 2	Draw Rectangles	(Section 1.6.2)
		(Use 2 pins to set diagonal)	
	Ikon 3	Copy, Shrink and Expand	(Section 1.7)
	Sub Menu:	Ikon 1 Expand or Copy	(Section 1.7.1)
		(Set magnification '1' to '4' then copy from green/light to blue/dark cursor)	
		Ikon 2 Shrink	(Section 1.7.2)
		(Set reduction factor '1' to '4' then copy from blue/dark to green/light cursor)	
	Ikon 4	Entering Text	(Section 1.8)
		(Select horizontal or vertical text from sub menu. Set colour if you want)	
	Ikon 5	Scratch Pad	(Section 1.9)
	Sub Menu:	Ikon 1 Screen to Scratch Pad	(Section 1.9)
		(Move the cursor then copy area of screen to scratch pad by pressing <ENTER>)	
		Ikon 2 Edit Scratch Pad	(Section 1.9)
		(Select a colour using keys '1' to '0', then use <ENTER> to plot pixels)	
		Ikon 3 Scratch Pad to Screen	(Section 1.9)
		(Press <ENTER> to copy scratch pad to area of screen outlined by cursor)	

1.17 MENU SCHEMATIC

GRAPHICS LIGHTPEN

