

Print 'n' Plotter

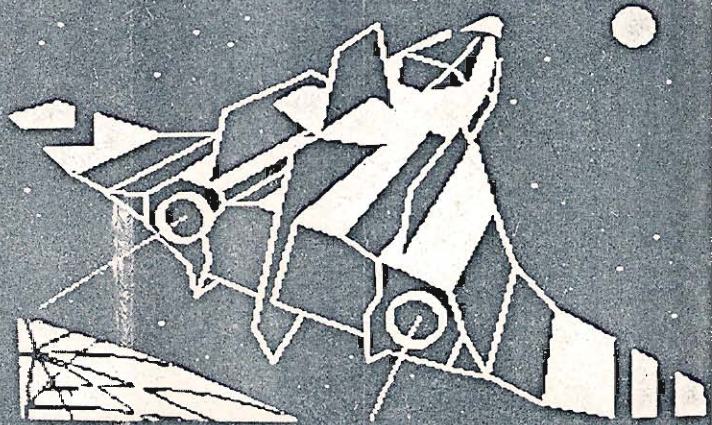
# PAINTBOX

THE MOST IMAGINATIVE GRAPHICS  
PROGRAMMING SOFTWARE FOR YOUR SPECTRUM.

Print 'n' Plotter  
Products

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## WELCOME TO THE WORLD OF YOUR PRINT 'N' PLOTTER PAINTBOX

Print 'n' Plotter PAINTBOX is a unique and ingenious graphics programming tool-kit for the 48K SPECTRUM.

In one comprehensive machine-code program you have all the facilities for performing graphic wonders on your computer — in practically every case achieving screen or UDG graphics that would appear almost impossible to produce!

However, don't get the impression that PAINTBOX is just for making pretty pictures . . . it is capable of much wider and useful applications for *your* programs — whether it be in the field of games, scientific, business, statistical or just plain computer fun!

There's never been graphics programming software so comprehensively written as PAINTBOX.

Every facility can be SAVE'd to use in your BASIC or M/C programs (procedures are documented in the instructions) and PAINTBOX has been written to be fully compatible with the famous Print 'n' Plotter JOTTER graphics planning pad.

So now, with Print 'n' Plotter Products you have the capability of powerful graphics with your ZX SPECTRUM.

The sort of graphics you wouldn't believe possible.

If you don't believe it, take a look at the DEMO side of your cassette before reading further . . . your eyes will light up!

## LOADING INSTRUCTIONS

SIDE 1. "PAINTBOX" SIDE 2. "DEMO"

### GENERAL INSTRUCTIONS

1. If your cassette recorder has a tone control, set it to maximum treble. Set the volume to about three-quarters maximum.
2. Make sure that the tape is fully rewound and that the EAR jack is securely connected. The MIC jack should be disconnected.
3. Press LOAD "" and ENTER and start the tape playing. The program will load and auto-run. Some adjustment of the volume may be necessary if a loading error occurs.

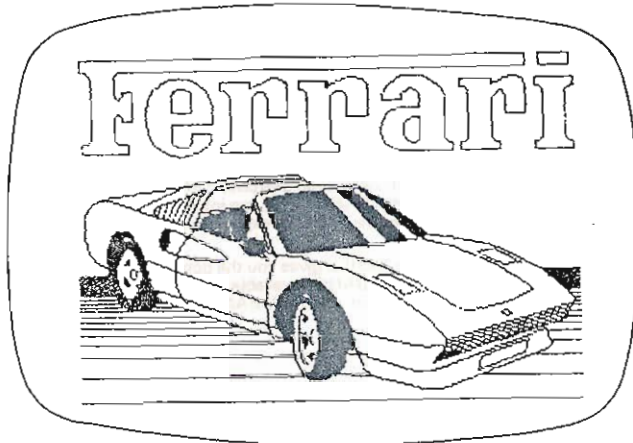
### SIDE 2. DEMO

This program shows what can be achieved with PAINTBOX. You can BREAK into it to see how the results could be utilised in your BASIC programs.

The program consists of a series of screen graphics held as memory blocks and called by the RANDOMIZE USR command, as well as a demonstration of simple animation generated in BASIC using the enhanced UDG character set available with PAINTBOX. These procedures are more fully explained later in this booklet.

### SIDE 1. PAINTBOX

Once you have Loaded PAINTBOX (see general instructions) you should acquaint yourself with the many facilities by following the instructions in sequence and testing the examples as you come to them.



## MAIN MENU

Once LOADED, PAINTBOX will display its main menu of facilities for you to start 'real' graphics programming!

Whichever your first choice from this menu you will be asked which mode you require for cursor control.

### CURSOR CHOICE

Your options are: **KEYBOARD CONTROL** (using the keys 5, 6, 7, 8) or **KEMPSTON JOYSTICK CONTROL**.

**Please note:** other joysticks which echo the cursor keys 5, 6, 7, 8 (and zero for fire) may be used — FOR THESE YOU MUST CHOOSE OPTION 1 (keyboard).

## MENU 1 — UDG EDITOR

To start to explore the possibilities of PAINTBOX select Menu choice 1 (UDG Editor) after selecting cursor choice (see above). This will immediately give you the sub-menu for the range of facilities available under this heading.

As you probably already know, the ZX SPECTRUM provides a facility for up to 21 user-definable graphic characters. Often you will require many more!

With PAINTBOX you can program up to 84 user definable characters without affecting the normal character set and locate this extended graphics set into any program you wish to write!

This is made possible by storing 4 BANKS of characters in memory and recalling at any time into the usual UDG area by a built-in short machine code routine (exact procedure explained later).

In reality this means that at least 84 UDG's can be used in your programs (168 if you count their INVERSE equivalents!) giving you enormous power to generate fantastic graphic games etc.

If using defined UDG characters to form whole screen prints even greater possibilities are described later under **SCREEN PLANNER**.

### VIEW BANKS

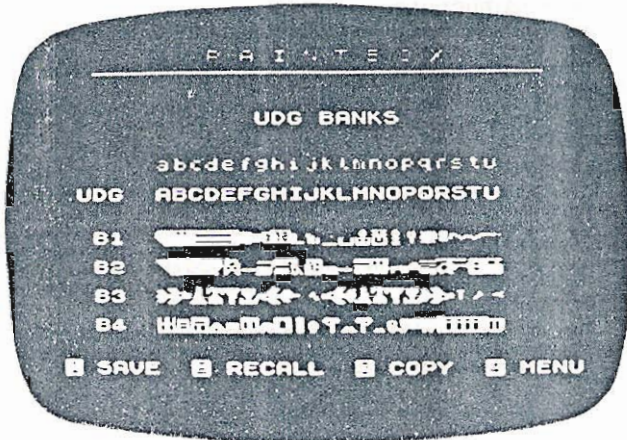
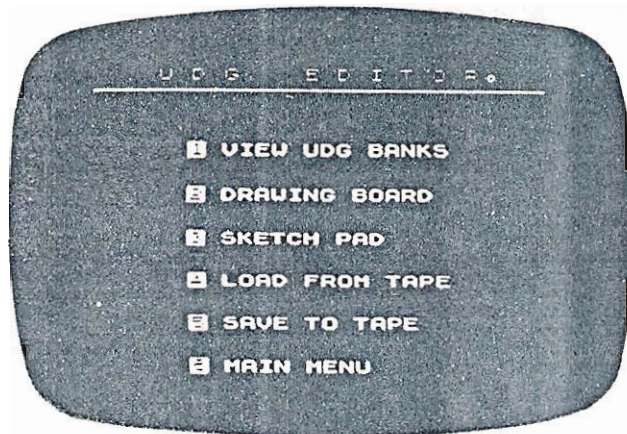
From the main menu try selecting item 1. Immediately on your screen are the UDG BANKS available for re-call or to re-define.

You will notice that the UDG area holds the letters A-U and these can be seen at the top. Below are UDG BANKS 1-4 with characters we have defined for demonstration purposes (you will, of course, be able to re-define to your own requirements).

### BANK RECALL

Key in RECALL (Key 2) and select as an exercise, BANK 1 by pressing Key 1. The set of characters contained in BANK 1 will jump into the current UDG file. This set will now be available from the keyboard for experimentation or use in screen planning.

**SAVE.** This option in VIEW BANKS gives you the opportunity of storing the current UDG BANK in any of the 4 BANKS available. It is not to SAVE the BANKS to tape — this facility is available from the VIEW BANKS menu.





## SKETCH PAD

As an exercise try the following:

Return to the menu by keying-in 4 (MENU). From the menu select SKETCH PAD (Key 3).

Now you will have on your screen a small, but useful, 'sketch' area in order to try out related characters before finally using them in screen graphics or programs.

At the top of the screen is the current UDG file. The flashing cursor on the screen may be moved in any direction by keyboard cursor keys or joystick and the character to be 'PRINTED' is initialised by pressing the appropriate key (A-U) on the keyboard. To 'wipe-out' a character you can overprint it with a SPACE.

*It is not necessary to use SHIFT or GRAPHIC for this operation!*

SKETCH PAD is a facility for you to use for experimenting with related multiple characters. At this point it is not possible to use characters from another BANK but this facility is available in SCREEN PLANNER (see later).

As an exercise, try reproducing our submarine using BANK 1 and SKETCH PAD. Press Key 4 to return to UDG EDITOR MENU.

## DRAWING BOARD

Of course, any graphics programming aid would be useless if all it contained was a set of pre-defined characters!

You can define any or all of the 84 characters available for your programs by selecting DRAWING BOARD from menu (choice 2). *This is where the work is done.*

You have the option of modifying any existing UDG character, any existing character from the SPECTRUM set, or to start afresh with a blank space.

For instance:

1. **Normal Character** will prompt you by asking which SPECTRUM set character you wish to modify. Your choice is entered by pressing the appropriate key on the keyboard AND CAPS SHIFT or SYMBOL SHIFT if necessary.

2. **UDG Character** does the same but relates to the current UDG BANK shown at the top. You can call any of these characters by pressing the appropriate keys A-U.

3. **BLANK** leaves you with a fresh space to start to define the character.

Whichever choice you make, a red cursor square appears at the top left of the 8x8 grid. This can be moved about by keyboard or joystick and the selected square can be filled-in (or cleared) by pressing zero or the joystick 'fire' button.

Experiment a little by selecting BLANK and moving the cursor, filling-in where appropriate.

On the screen you will also see: (1) the INVERSE equivalent of your character, (2) two actual-size characters — one inverse, the other normal, (3) a complete read-out of the decimal values for each line.

Once you have finished defining your character (try a PAC-MAN!) just press ENTER and the options you have are displayed.

**FILE WORK** (1) asks which character position the new character is to occupy and puts it in that position — but before you do this, you might like to try the following:

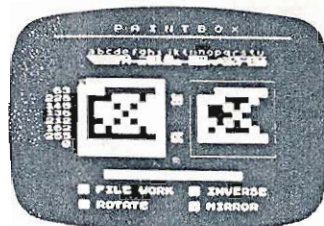
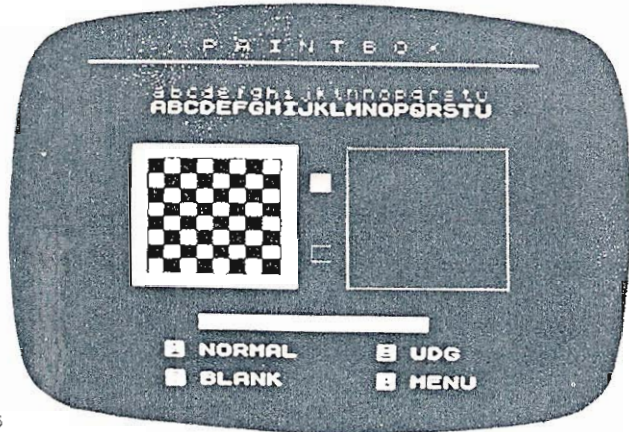
**INVERSE** (2) changes everything to give a negative effect.

**ROTATE** (3) spins the character so that it points in another direction (you can have wording that runs up the edge of the screen).

**MIRROR** flips the character from left to right.

Now that you have decided the exact character, press **FILE WORK** (1) and choose the position to store it!

When all of the current 21 user-definable characters have been programmed, return to the **VIEW BANK** facility and store it in any of the 4 BANKS available. You may also wish to send a copy to the Printer if attached.



## TAPE STORAGE OF UDG BANKS

The UDG Editor Menu has the facility to save all 4 BANKS to tape (5). When selected, a *filename* (up to 6 characters) is requested and the BANKS together with the machine code routine required to manipulate them from BASIC will be dumped to tape.

Similarly, a LOAD (4) facility allows pre-recorded BANKS to be re-loaded for modification.

## USING THE UDG BANKS FROM WITHIN A BASIC PROGRAM

You will, of course, wish at some time to use your 84 graphic characters in one of your programs.

If you are not using High-resolution Screen Files from PRECISION PLOTTER (see later instructions), make the first command in your program CLEAR 64567 to protect the UDG BANKS from corruption by your program.

LOAD "filename" CODE will then put the data for the user-defined characters above RAMTOP.

To make this clear: supposing you have a BASIC program called "BUGS" on tape and you have positioned your recording of the UDG characters called "CHARS" immediately following it.

Your LOADING instructions should be:—

CLEAR 64567: LOAD "BUGS": LOAD "CHARS" CODE

an alternative would be to put line 1 in "BUGS" as:

1 CLEAR 64567: LOAD "CHARS" CODE

and program "BUGS" to autorun by SAVING as:

SAVE "BUGS" LINE 1

## HOW TO ACCESS UDG BANKS FROM WITHIN A BASIC PROGRAM

Remember, you have FOUR UDG BANKS to call into use and each one needs a specific machine code call to make it current.

To access each you must preface your PRINT statements (when using the characters) with:

RANDOMIZE USR 65153	FOR BANK 1
RANDOMIZE USR 64958	FOR BANK 2
RANDOMIZE USR 64763	FOR BANK 3
RANDOMIZE USE 64568	FOR BANK 4

Characters from any of the 4 BANKS may be PRINTED on the screen at the same time provided the appropriate m/c call (above) has been made.

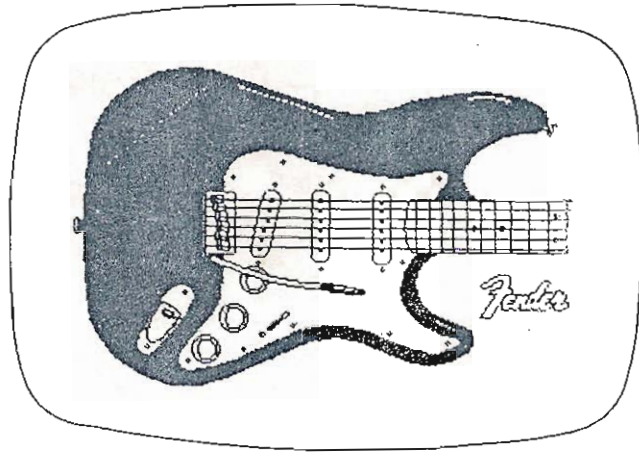
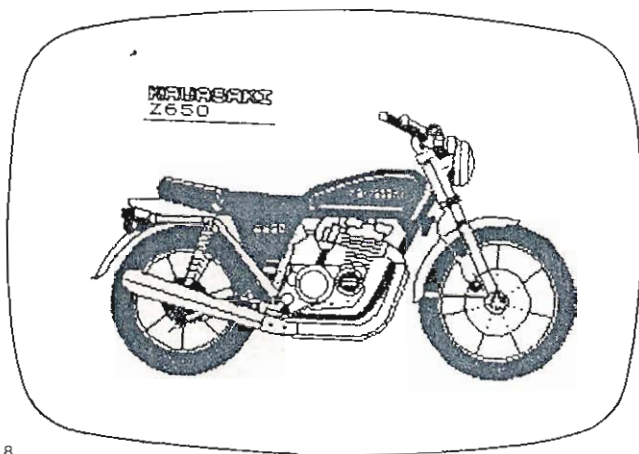
To make this clearer: SAVE your defined characters (or those already in the program), LOAD into memory and key in this program:

```
10 RANDOMIZE USR 65153: GOSUB 100
20 RANDOMIZE USR 64958: GOSUB 100
30 RANDOMIZE USR 64763: GOSUB 100
40 RANDOMIZE USR 64568: GOSUB 100
50 STOP
100 PRINT "ABCDEFGHIJKLMNOPQRSTU" (graphic shift characters)
110 RETURN
```

*Please note:* If your programs make use of the random number generator RAND; using RANDOMIZE USR to call machine code may upset the random number produced.

Instead, choose a variable . . . for instance R and use the form:

LET R = USR XXXXX as a substitute to call the various BANKS.



## PRECISION PLOTTER

This section of the program gives you an extremely accurate High-resolution Drawing Board for Screen Graphics on your 48K SPECTRUM. All facilities closely follow those in Sinclair BASIC, but instead of tediously working out PLOT, DRAW, CIRCLE etc. co-ordinates, a cursor is moved about the screen (using keyboard or joystick) and the commands are entered with one appropriate key!

Additional graphic facilities not available in Sinclair BASIC are also available: for instance ARC to draw a curved line and FILL to colour in an enclosed area.

To familiarise yourself with all the options available, choose PRECISION PLOTTER (2) from the MAIN MENU.

If it is the first time you have accessed the program, you will have to choose joystick or cursor . . . otherwise it will ask you whether you want BLANK SCREEN or LOAD FROM TAPE.

SAVING and LOADING will be explained later . . . at the moment choose BLANK SCREEN (1) for this test.

Options are requested for INK, PAPER and BRIGHT — these are the colours you will be using on the screen.

For this example, choose INK 7; PAPER 1; BRIGHT 1 (points about colours are made later).

The screen clears instantly and your drawing can start!

On the screen you should see: a complete blue background, a white cursor in the centre of the screen, a digital read-out of the current cursor PLOT position and the words LINE MODE bottom left.

Now, by using your joystick or cursor keys you can move the screen cursor around the entire area of the screen with a constant notation of your position!

You will note how smoothly and fast the cursor moves . . . but if you need to slow it down, you only have to keep SHIFT pressed during movement (this allows extremely accurate positioning on screen).

Now choose any point on the screen and try the following facilities:

### PLOT

Press Q on your keyboard (PLOT key) and you will PLOT a single pixel point at that position but you won't see it until the cursor is moved.

### DRAW

Now move the cursor to any other part of the screen and press W (DRAW key). A line is drawn from the PLOTTED point to the current cursor position. If you now move to another position on the screen and press W (DRAW) another line will be drawn from the end of the previous line! This is known as drawing sequentially in LINE MODE.

Using this facility, draw a small square box on the screen using the digital X,Y readout to measure the sides.

### FILL

Having drawn your box, move the cursor so that it is near to the centre within the enclosed box area. Now press key F. The box will be filled with the current INK colour.

### ERASE

Let's assume you have changed your mind about filling in the box, or that the FILL has gone berserk because you didn't "close" the box area completely (see appendix notes), then just press key E and the filling will disappear!

Some points to bear in mind before continuing:

ERASE will only cancel the last operation performed — not previous operations. FILL will fill an enclosed space, though it may need more than one position and command to do so (see appendix notes).

## CIRCLE

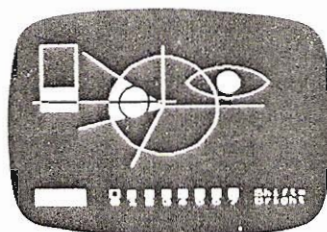
Place your cursor in a convenient position on screen and press H (CIRCLE key) you will be prompted to enter the required radius. Key in a figure and press ENTER. If the radius is too large, you will be told so and asked for another radius.

Any size of circle that can be drawn, will be drawn by the program with the centre point as your cursor operation.

## RADIAL MODE

Now let's be clever! With the cursor at the centre of your circle, press key R. This is the RADIAL MODE and any lines you draw from now on will always come from this point.

Press Q (PLOT) to initialise the pixel point and move your cursor to any part of the circumference of the circle (or anywhere on screen) and press W (DRAW). The line is drawn and you will note that the cursor has returned to the original position. Move it to another position and press DRAW again. You should be able to see the possibilities for all sorts of radial drawing (e.g. spokes of wheels etc.) with this mode!



## LINE MODE

You can, of course, go back to normal at any time by pressing key 3 (LINE).

## ARC

For this exercise revert to LINE MODE (3) and position your cursor anywhere on screen. Press PLOT (Q) to initialise the start position and then move the cursor to where you wish to draw the curve.

Press key A. You will be asked for the CURVE OF ARC number. In theory this can be any number negative or positive NOT zero, but the lower the number the more "curved" the result (1 = SEMICIRCLE). Numbers need not be integers — try 1.5 or 1.75 for instance.

The direction of the curve is determined by the original direction of the cursor (see appendix).

In general terms remember this:

CURSOR LEFT TO RIGHT =	Negative figs curve up
	Positive figs curve down
CURSOR RIGHT TO LEFT =	Negative figs curve down
	Positive figs curve up

Before serious programming you should familiarise yourself with the results of different "curve" numbers. Do this on screen and note the values. A copy can then be made for future reference (see COPY later).



#### PLEASE NOTE IMPORTANT:

The ARC facility is impossible to fully error check. In the event of an error (e.g. number too large or out of screen) then key RUN to restore program. Return to PRECISION PLOTTER and press ERASE (key E) to restore your "art" without the offending error!

Some of the other commands available with PRECISION PLOTTER that you will wish to experiment with are: -

#### INK

Key X (INK). You are presented with a choice of all the INK colours which can be normal or BRIGHT. Use CAPS SHIFT for BRIGHT.

#### OVER

Key N (OVER). Switches between OVER 1 and OVER 0 modes. Operates on PLOT, DRAW, ARC and CIRCLE but not FILL. This is useful for correcting minor mistakes in drawings or unplotting etc.

#### CURSOR CHOICE

Key K (+) chooses the normal crosswire screen cursor. Key M (.) selects the single pixel cursor for precision work.

#### PERMANENT MEMORY

Key P stores the current screen graphics in memory. This is useful for storing graphics in memory in stages while the final version is being developed (see appendix).

#### GRAPHICS

Key 9 (GRAPHICS) recalls the picture from PERMANENT MEMORY to the screen

#### BREAK

Key CAP SHIFT/SPACE exits to the main menu and automatically stores the screen graphics in PERMANENT MEMORY.

#### COPY

Sends a copy of the screen to a Printer if attached. Results depend on the type/condition of the Printer.

#### SAVE

Key S (SAVE) allows the screen to be SAVED to tape either as SCREEN\$ or MEMORY FILE with a filename of up to 6 characters (see USING SCREEN FILES).

#### LOAD

Key J (LOAD) here you may choose to LOAD from tape existing graphics held as SCREEN\$. This can be done without returning to the main menu, but previously initialised INK, PAPER choice will remain current.

#### LOAD facility from MAIN MENU

Loading a SCREEN FILE at this point loads to display file. However, on completion it is immediately dumped to PERMANENT MEMORY automatically. The rest of the sequence is as for BLANK SCREEN and the use of GRAPHIC Key is necessary to recall image to screen for modification.

#### CHANGING PAPER COLOURS — SPECIAL NOTES

Because of the restrictions of the low-resolution colour map of the SPECTRUM, the facility to change PAPER colours has been deliberately omitted as this would prove unpredictable.

However, there are two ways of achieving the same result — both giving greater degrees of control.

With PRECISION PLOTTER you should first note the x, y co-ordinates of the area to be changed and BREAK to the main menu. The new PAPER colour can then be selected upon re-entry to PRECISION PLOTTER and the single pixel cursor Key m (.) placed at the same x, y position on the BLANK SCREEN. The PERMANENT MEMORY is then recalled (Key 9 GRAPHICS) and the original picture will appear. As the cursor is moved about, it paints in the new colour without altering the INK colour already there. Use the single point cursor (Key M) for best accuracy.

If something goes wrong here, don't worry! The PERMANENT MEMORY (Key 9) will also have been corrupted, but the ERASE memory still contains a "copy" of the screen minus the last PLOT or DRAW operation. Just go back to the main menu and re-enter the PRECISION PLOTTER. Press ERASE (Key E), put back the missing PLOT or DRAW and press P to restore PERMANENT MEMORY.

The alternative is to call SCREEN PLANNER (see this section) and character cell blocks of any INK or PAPER colour can be "dropped" in by printing solid or blank spaces.



## SCREEN PLANNER

Choice of SCREEN PLANNER from the main menu will demonstrate the immense flexibility of PAINTBOX.

Not only do you have the facility of 84 UDG characters and high-resolution plotting, but you also have the results of these *combined* in SCREEN PLANNER!

Let's assume that you have defined your UDG's and started to draw your graphics using PRECISION PLOTTER. Now, with the choice of SCREEN PLANNER you will see your existing drawing on screen with one of the BANKS of UDG's at the bottom of the screen. (If you haven't used PRECISION PLOTTER, the results will, of course, be blank, or a random pattern).

First make this test: call any of the UDG BANKS by pressing 1-4 on your keyboard. This gives you immediate access to the range of UDG's.

The flashing cursor can be moved to any position on screen (Keyboard or Joystick) and the UDG character can be printed by using the appropriate A-U keys. GRAPHIC OR SHIFT IS NOT NECESSARY.

There is a read-out of the x (Column) and y (Line) position on the bottom right of your screen. These relate to the normal PRINT grid and also determine the low resolution colour positions of your SPECTRUM.

SCREEN PLANNER is used in a similar way to UDG SKETCH PAD, but with extended facilities to call *any* of the BANKS and the facility to change INK or PAPER colours.

For instance: Key X (INK) presents you with the choice of changes to INK or/and PAPER.

If you wish to 'rub-out' or correct your drawing you can overprint a character or use the SPACE key.

On completion, you can exit SCREEN PLANNER by using the BREAK key (SHIFT/SPACE). This also stores the screen in PERMANENT MEMORY.

You then have the option of saving the drawing to tape or returning to the MAIN MENU.

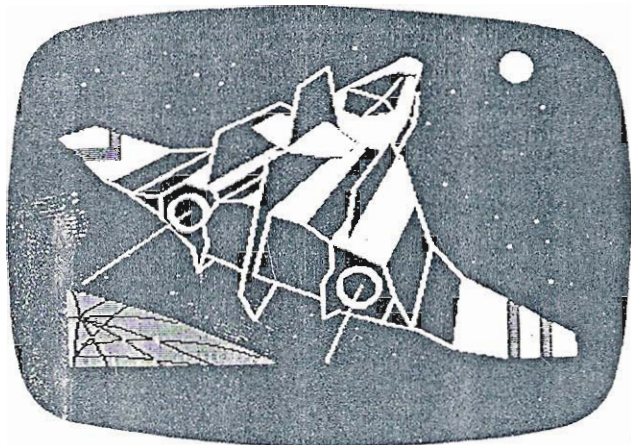
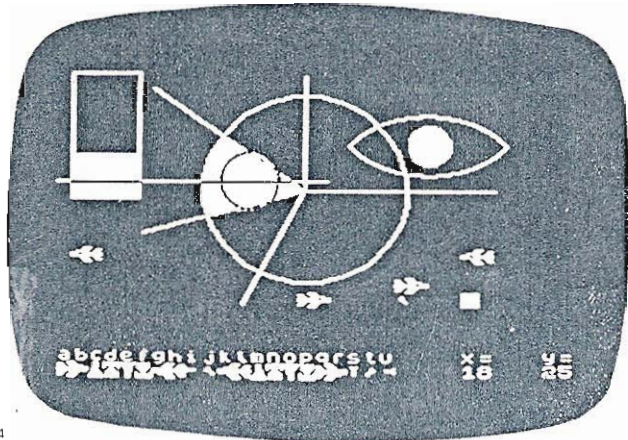
You will soon realise that by constantly switching between SCREEN PLANNER and PRECISION PLOTTER you can build-up incredible graphics on your screen. Because of the low-resolution colour map of the SPECTRUM however, be sure that you do not put INK or PAPER where it is not required! (see special note Page 13).

There is also a hidden facility in SCREEN PLANNER that will become obvious to the dedicated graphics programmer:

While you can use the current 84 UDG's at the same time in SCREEN PLANNER you can, by loading into the program from tape previously defined BANKS, call these to use.

By this method of having previously SAVED UDG's and loading them into the current file during development, you can have an *infinite* number on screen *at the same time*. This can be a great advantage for backgrounds to games or precise detail in drawings.

The finished picture can be SAVED to tape by using the same procedures as under PRECISION PLOTTER (See SAVING and SCREEN FILES).





## SAVING AND USING SCREEN FILES

You will already realise that saving your efforts to tape has been included at every stage of PRECISION PLOTTER and SCREEN PLANNER.

Two methods are available for use:

1. SCREEN\$ — the normal facility available from your SPECTRUM can dump the display file to tape with a filename. This is satisfactory but slow to load onto the screen and not directly useable from BASIC programs.

2. The alternative method is much more flexible and designed specifically for extensive use with BASIC or m/c programs. This method dumps the screen into memory and saves it as bytes which can be called to screen by short simple machine code routes.

## SAVING

Once you have chosen the SAVE option on completion of your drawing, you can choose SCREEN\$ or MEMORY FILE.

Either choice accepts a filename up to six characters and you should follow the normal procedures for SAVING on your cassette recorder. Upon completion the program will return to the main menu.

## LOADING INTO YOUR BASIC PROGRAM

### SCREEN\$.

If you are loading a SCREEN\$ file enter LOAD "filename" CODE and start the recorder. The report *bytes: filename* should appear on screen and the picture gradually build up. Once complete the graphics will stay on the screen until a command is given that clears the screen.

### MEMORY FILE

A saved MEMORY FILE contains your picture in a block of 6940 bytes together with its own machine code route for instant recall from BASIC. To load a MEMORY FILE into a BASIC program enter LOAD "filename" CODE and start the tape. In this case the picture will not build up on the screen while LOADING.

When the block has LOADED however, you can recall the picture to screen by using the command: RANDOMIZE USR 59980.

This can, of course, be used within your programs to recall the screen at any time.

You must therefore protect the MEMORY FILE from corruption by a program by lowering RAMTOP. In this case you can do it by the command: CLEAR 53059 at the beginning of your program.

By using this method of instant recall you can have backgrounds to games, screen menus, technical drawings etc available for "PRINTING" at any stage during a program!

## MULTIPLE SCREEN FILES

For the dedicated programmer, one screen is obviously not enough!

The 48K SPECTRUM can hold up to five full 6912 byte SCREEN FILES and still have about 6K left for a BASIC program.

With PAINTBOX, a MEMORY FILE has a short machine code routine tagged onto the end of it which, when called transfers the data to the screen as a picture. This data call can be held permanently above RAMTOP and called at any time.

To achieve MULTIPLE SCREEN FILES, you must familiarise yourself with the following procedures:

A MEMORY FILE can be loaded back into the computer at locations other than which it was SAVED (53060). First, RAMTOP must be lowered by the command: CLEAR location - 1, then LOAD "filename" CODE location.

Then the command RANDOMIZE USR location + 6920 will call the data to the display file.

However, the machine code routine still contains the address of the original (53060) location and this must be changed with two POKES.

The two locations to be POKEd are location + 6921 which we will call L, and location + 6922 which we will call H.

These can be calculated by the formulae:

$H = \text{INT}(\text{location}/256)$  and  $L = \text{location} - H * 256$

If you're confused, the following table gives the locations for five screens hung beneath a UDG BANK file at 64568.

SCREEN FILE	LOCATION	L	H
1	57628	28	225
2	50716	28	198
3	43804	28	171
4	36892	28	144
5	29980	28	117

The screens are then called by:

POKE 64549, L: POKE 64550, H: RANDOMIZE USR 64548

Similarly, SCREEN\$ files can be loaded to other locations by LOAD "filename" CODE location.

Note that we only need the machine code routine from SCREEN FILE 1 which must be a MEMORY FILE. Other screens can be MEMORY or SCREEN\$ files, but, if they are MEMORY files, each one will have its own redundant machine code routine that could overwrite the next file by 29 bytes. To overcome this, load MEMORY files in reverse order: i.e. LOAD FILE 5 before File 4 etc.

To SAVE a set of MULTIPLE FILES to tape, SAVE "filename" CODE lowest location, 65535 — lowest location and remember: lower RAMTOP before re-LOADING by CLEAR lowest location - 1. Study the listing of the DEMO program on Side 2 to see how it was done.

## APPENDIX

The following notes are for your guidance and are important to the correct use of PAINTBOX.

### 1. ERROR REPORTS

Some facilities are impossible to fully error-check under every eventuality. If an error report occurs (most common on ARC where this goes out of screen) then RUN the program (RUN/ENTER) and return via the menus. Restore the screen with ERASE (Key E).

### 2. FILL

This is used to fill an ENCLOSED area of any shape. Areas not fully closed will result in part screen fill! however, ERASE will take things back to normal for you to try again.

In complex shapes, more than one cursor position and command may be necessary. Small holes are best filled by PLOTting individual Pixels.

### 3. COPY

PAINTBOX drawings sent to the Printer may not always give the result intended. This depends on how they were coloured. Some Printers may have difficulty with solid areas.

### 4. CURSOR

You will have noticed that the cursor works in OVER 1 mode. Some choices of INK and PAPER may make this difficult to see (instance: INK3;PAPER2).

Cursor speed can be slowed by pressing SHIFT during operations and you have the choice of "Crosswire" (Key K) or single Pixel (Key M).

### 5. PICTURE DEVELOPMENT

When using PRECISION PLOTTER and/or SCREEN PLANNER it is best to break down your pictures into a series of small steps. As each step is completed, use PERMANENT MEMORY (P) to store the drawing at that stage. This means that you can return to it if things go wrong by calling GRAPHICS. This can be used in addition to the ERASE function which only deletes the last operation.

### 6. OVER1

Remember: in PRECISION PLOTTER, OVER1 will delete individual pixel points already DRAWN or PLOTTED.

### 7. PLOT

In PRECISION PLOTTER, if you change between drawing modes always operate PLOT to re-initialise the start of a DRAW or ARC.

### 8. INK COLOUR CHANGE

A good way of changing INK colours on something already drawn is to PLOT on top of it in the new colour!

### 9. LOADING

If using PRECISION PLOTTER, don't try to LOAD a MEMORY FILE into the program . . . it won't work . . . but it won't do any harm!

LOADING at this stage is confined to SCREEN\$ only, so it may be a good idea for you to append your filenames with an "S" or "M" to differentiate between SCREEN\$ and MEMORY. This also applies to using a "U" for UDG BANK files.

If LOADING from a previously saved SCREEN\$ for modification, make sure that the initial colours selected are the same as originally used, or the cursor will leave a trail of the new colour behind it. (see special note for changing PAPER colour Page 13).

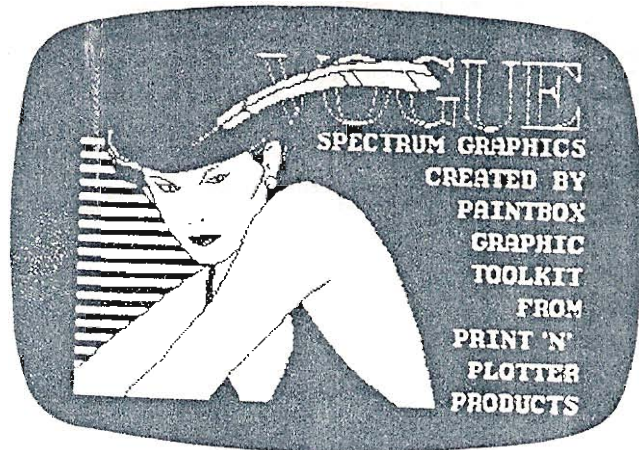
### 10. ARC

An indication of the results of ARC (n) are shown for your guidance. Please note that negative or positive numbers depend on the original direction of the cursor.

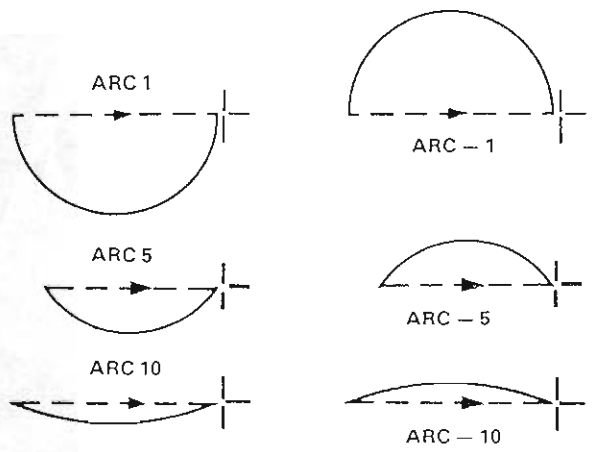
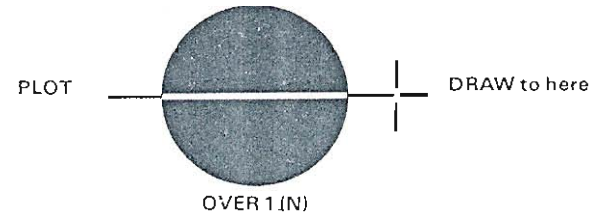
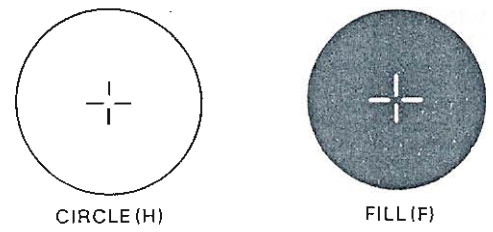
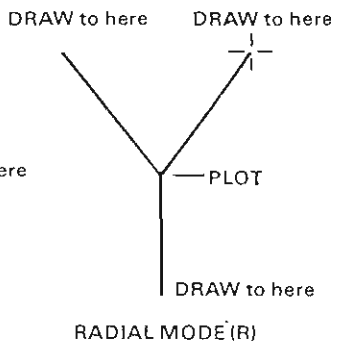
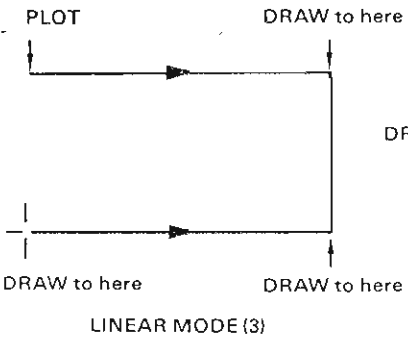
### 11. MEMORY

For the technically-minded, it may be an advantage to realise that during development of screen graphics using PRECISION PLOTTER and SCREEN PLANNER, "copies" of the screen are held in memory which allows flexible erase/amend. For instance, one "copy" is held as the ERASE memory which is constantly updated as you PLOT, DRAW, CIRCLE etc. PERMANENT MEMORY however, is stored only when you call this to use with key P (PERMANENT MEMORY). These memory blocks which to all intents and purposes hold your current graphics are quite separately located and in many cases can be manipulated to advantage in cases where you make an error (see as an example CHANGING PAPER COLOURS SPECIAL NOTES).

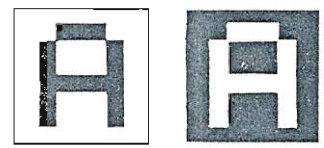
Diagrammatic representations of some of the PAINTBOX facilities are shown for your guidance.



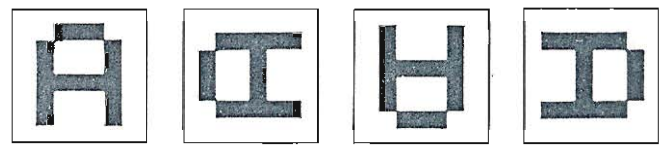




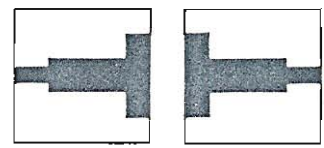
INVERSE



ROTATE



MIRROR



## USING PAINTBOX WITH OTHER PRINT 'N' PLOTTER PRODUCTS

PAINTBOX is ideally suited for use with the PRINT 'N' PLOTTER ZXISPECTRUM JOTTER PAD.

The JOTTER is a 100 page, big A3 size (16½" x 11¾") graphics planning pad that gives you the very best facilities for pre-planning of SPECTRUM graphics.

There are 50 pages of Hi-Res PLOT grids showing every co-ordinate number and pixel position together with 50 pages of PRINT (normal character) grids showing all column/line co-ordinates.

There's also 2400 small UDG character grids per pad — ideal for pre-planning before using the PAINTBOX UDG DRAWING BOARD!

The kit comes complete with a printed PIXEL RULER and a set of colour pens that closely match the computer colours, and is packaged in a corrugated tray for storage when not in use.

The paper used in the pad is high-quality artist's detail paper — translucent for you to overlay on to drawings, maps, charts, etc. and copy.

The PRINT grids are the ideal way of establishing the low-resolution colour map of the SPECTRUM in direct co-ordination with Hi-Res PLOT or DRAW.

PRINT 'N' PLOTTER JOTTERS are the *original* graphics planning pads for the ZX SPECTRUM and are available from a wide range of retailers, shops and stores.

Ask about them today at your local Computer Shop or write to Print 'n' Plotter Products Ltd. at the address shown on the back of this booklet.

