



point. If the x co-ordinate of the start point of the left-most line is 111, then we have to make a calculation based on this to find the relative offset to the end point. The FOR...NEXT loop in lines 8030-8060 shows this calculation, which is based on the step-length at the bottom of the screen and the start point on the horizon.

As before, it is useful to rough out the dimensions and co-ordinates of the design on paper before starting to write the code. The screen shot shows such a design:



The laser beams are drawn from the joystick port by moving to a point at the centre of the port and then DRAWing a line to a random point on the horizon, using a randomly-selected INK colour. By repeating the procedure with INVERSE 1, we can

rub out the line, making the beam appear for only a short interval (creating a lightning effect). However, when the line is rubbed out a problem occurs. Because the beam is drawn from a point at the centre of the port, it crosses the previously drawn graphics that depict the port itself. When the line is rubbed out, gaps appear in the joystick port graphics, and so it is necessary, when rubbing out the line, to redraw them.

Even though the end of any line drawn from the joystick port stops just short of the horizon line, the horizon is also affected. Because of the way the Spectrum controls colour, the portion of the horizon nearest the point where the beam ends takes on the same colour as that used to draw the line. This is because the Spectrum can support only one INK and one PAPER colour within any one character cell; any graphics already present within the cell take on the foreground colour of the new INK colour used in the cell. Therefore, in addition to redrawing the joystick port, the horizon line must also be redrawn after a beam line is erased. The routine continues to fire laser beams until a keypress is made, at which point program control is RETURNed to the main joystick port routine, after having reset the normal INK and PAPER colours.

The following line should be inserted in the main program to call this subroutine:

```
3845 GOSUB 8000:REM JOYSTICK PORT PICTURE
```

Implementing these two graphic screens on the Commodore 64 will be the subject of the next instalment in the project.

ALU Screen

```

7000 REM **** alu picture s/r ****
7010 INK 6: PAPER 0: CLS
7015:
7017 REM **** letter A ****
7020 FOR x=0 TO 55 STEP 5
7030 INVERSE 0
7040 FOR i=1 TO 2
7050 PLOT x,100
7060 DRAW 0,30
7070 DRAW 15,20
7080 DRAW 15,-20
7090 DRAW 0,-30
7095 DRAW 0,20
7096 DRAW -30,0
7110 IF x<55 THEN INVERSE 1
7115 NEXT i
7120 NEXT x
7130:
7140 REM **** letter L ****
7150 FOR y=100 TO 150 STEP 5
7152 INVERSE 0
7155 FOR i=1 TO 2
7160 PLOT 113,y
7170 DRAW 0,-50
7180 DRAW 30,0
7190 IF y<150 THEN INVERSE 1
7200 NEXT i
7210 NEXT y
7220:
7230 REM **** letter U ****
7240 FOR x=225 TO 170 STEP -5
7250 INVERSE 0
7260 FOR i=1 TO 2
7270 PLOT x,150
7280 DRAW 0,-50
7290 DRAW 30,0
7300 DRAW 0,50
7310 IF x<170 THEN INVERSE 1
7320 NEXT i
7330 NEXT x
7340:
7350 REM **** buttons ****
7360 PRINT AT 10,7:"AND"
7370 PRINT AT 10,15:"OR"
7380 PRINT AT 10,22:"NOT"
7390 INK 3: CIRCLE 70,80,5
7400 INK 4: CIRCLE 120,80,5
7410 INK 5: CIRCLE 185,80,5
7420:
7430 REM **** q mark ****
7435 INK 6
7440 PLOT 113,45
7450 DRAW 0,15
7460 DRAW 50,0
7470 DRAW 0,-20
7480 DRAW -15,0
7490 DRAW 0,-7
7500 FOR r=6 TO 0 STEP -2
7510 CIRCLE 120,23,r
7520 NEXT r
7530: r
7540 IF INKEY="" THEN GO TO 7540
7550 INK 0: PAPER 7: CLS
7560 RETURN
8000 REM **** joystick port pic s/r ****
8010 INK 6: PAPER 0: CLS
8020 REM **** foreground ****
8030 FOR n=1 TO 31
8040 PLOT 112+n,50
8050 DRAW 7*n-112,-50
8060 NEXT n
8070:
8080 REM **** horizon ****
8085 INK 6: INVERSE 0
8090 PLOT 0,50
8100 DRAW 255,0
8110:
8120 REM **** port ****
8130 PRINT AT 1,18:"JOYSTICK PORT"
8140 PRINT AT 3,20:" "
8150 PRINT AT 5,21:" "
8160 PLOT 150,152
8170 DRAW 75,0
8180 DRAW 1,-1
8190 DRAW 1,-1
8200 DRAW 0,-1
8210 DRAW -1,-1
8220 DRAW -10,-25
8230 DRAW -2,-2
8240 DRAW -52,0
8250 DRAW -2,2
8260 DRAW -10,25
8270 DRAW -1,1
8280 DRAW -1,1
8290 DRAW 0,1
8300 DRAW 1,1
8310:
8320 REM **** shoot ****
8340 INK RND*7
8350 LET x=RND*255-194
8360 LET y=-86
8365 INVERSE 0
8367 FOR i=1 TO 2
8370 PLOT 194,136
8380 DRAW x,y
8385 INVERSE 1
8387 NEXT i
8390:
8400 REM **** test for key ****
8410 IF INKEY="" THEN GO TO 8080
8415 INVERSE 0
8420 INK 0: PAPER 7: CLS
8430 RETURN

```

Joystick Port Screen