Elizabeth Wald's ingenious program sidesteps the Epson HX-20's internal microprinter.

Slipping sideways

The internal microprinter on the Epson HX-20 is a useful device for listing programs and printing results. But it is limited to a maximum of 24 characters per line, which means that program listings are difficult to read and wide program printout is impossible.

The sideways printing program given in Figure 1 creates the 'sideways printer', which has the device name 'SPTØ:' when used in Basic. This uses the microprinter to print out blocks of 16 lines of 80 characters sideways down the paper. A 'cutting line' is printed either side of the text, so that blocks of text may be cut up and pasted *together*.

The sideways printer is used in Basic by extending the interpreter to include subroutines which control it. Other items, for example disks or a bar-code reader, could also be added in the same way. The collection of subroutines required to control a particular device is known as a device driver.

This actually contains a table known as the device control block. This specifies the addresses of the control subroutines, the device name, and other essential information. The driver is linked to the interpreter via a second table containing the addresses of all the device control blocks. This second table has space for 16 entries of which seven are already defined.

To add any device driver to Basic it is loaded into the lowest end of memory, below MEMSET, and a small loader routine is executed. This loader routine moves all Basic programs and application files down, and copies the device driver into the resulting space at the top end of memory.

Application files are machine code programs permanently linked to the system and are normally linked to the menu. The loader routine then updates various system pointers to protect the driver from being overwritten by Basic, and finally executes a Basic warm start into program area 1. The computer is now in the same state as if Basic had been entered directly from the menu.

When Basic is entered via a warm start it executes an initialisation routine for each linked device in turn. This is contained within the driver, and ensures that the device is marked as being closed, and is also responsible for producing a new 'LOGIN' message. If the sideways printer cannot be initialised, for example if the user attempts to link in more than 16 devices, the normal 'LOGIN' message will be displayed.

Driver subroutines

The sideways printer driver contains subroutines to open and close 'SPTØ:' and to transfer a single character to the device from Basic.

Figure 1: Disassembled Machine Code listing

```
0A40 8E LDS   #04AF
0A43 7B TIM   $4078
0A46 27 BEQ    0A50
0A48 FE LDX    0138
0A4B AD JSR   X00
0A4D 71 AIM   $BF78
0A50 8D BSR    0A52
0A52 32 PUL A
0A53 33 PUL B
0A54 C3 ADD D #00CE
0A57 DD STA D $6A
0A59 CC LDA D #07A0
0A5C DD STA D $68
0A5E D3 ADD D $6A
0A60 DD STA D $6C
0A62 FC LDA D  012C
0A65 DD STA D $62
0A67 FC LDA D  0134
0A6A DD STA D $60
0A6C 93 SUB D $68
0A6E DD STA D $64
0A70 18 XDX
0A71 9C CPX   $6C
0A73 24 BCC    0A7D
0A75 CC LDA D #0605
0A78 BD JSR    FF64
0A7B 20 BRA    0AF9
0A7D 0F SEI
0A7E FF STX    0134
0A81 FC LDA D  0136
0A84 93 SUB D $68
0A86 FD STA D  0136
0A89 8D BSR    0B00
0A8B DC LDA D $6A
0A8D DD STA D $60
0A8F DC LDA D $6C
0A91 DD STA D $62
0A93 DC LDA D $64
0A95 FD STA D  012C
0A98 8D BSR    0B00
0A9A FE LDX    0134
0A9D 08 INX
0A9E 08 INX
0A9F 08 INX
0AA0 A6 LDA A X00
0AA2 81 CMP A #39
0AA4 27 BEQ    0AAD
0AA6 EE LDX   X01
0AA8 09 DEX
0AA9 09 DEX
0AAA 09 DEX
0AAB 20 BRA    0AA0
0AAD 86 LDA A #7E
0AAF A7 STA A X00
0AB1 FC LDA D  012C
0AB4 C3 ADD D #0003
0AB7 ED STA D X01
0AB9 CE LDX   #013C
0ABC A6 LDA A X01
0ABE 81 CMP A #45
0AC0 27 BEQ    0AF1
0AC2 DF STX   $6E
0AC4 A6 LDA A X01
0AC6 EE LDX   X02
0AC8 8C CPX   #FFFF
0ACB 27 BEQ    0AF1
0ACD 4D TST A
0ACE 2B BMI    0AD4
0AD0 18 XDX
0AD1 93 SUB D $68
0AD3 18 XDX
0AD4 18 XDX
0AD5 DE LDX   $6E
0AD7 ED STA D X02
0AD9 6D TST   X01
0ADB 2A BPL    0ADF
0ADD D3 ADD D $6E
0ADF 18 XDX
0AE0 A6 LDA A X01
0AE2 81 CMP A #45
0AE4 27 BEQ    0AF1
0AE6 4D TST A
0AE7 2B BMI    0AEF
0AE9 EC LDA D X04
0AEB 93 SUB D $68
0AED ED STA D X04
0AEF 20 BRA    0AC2
0AF1 FE LDX    0134
0AF4 FC LDA D  02CE
0AF7 ED STA D X0A
0AF9 0E CLI
0AFA 4F CLR A
0AFB FE LDX    8004
0AFE 6E JMP   X00
0B00 DE LDX   $60
0B02 9C CPX   $62
0B04 27 BEQ    0B14
0B06 A6 LDA A X00
0B08 08 INX
0B09 DF STX   $60
0B0B DE LDX   $64
0B0D A7 STA A X00
0B0F 08 INX
0B10 DF STX   $64
0B12 20 BRA    0B00
0B14 39 RTS
0B15 01 NOP
0B16 01 NOP
0B17 01 NOP
0B18 01 NOP
0B19 01 NOP
0B1A 01 NOP
0B1B 01 NOP
0B1C 01 NOP
0B1D 01 NOP
0B1E 01 NOP
0B1F 01 NOP
0B20 39 RTS
0B21 00 ***
0B22 00 ***
0B23 3C PSH X
0B24 8D BSR    0B26
0B26 38 PUL X
0B27 3C PSH X
0B28 18 XDX
0B29 C3 ADD D #006A
0B2C 37 PSH B
0B2D 36 PSH A
0B2E 38 PUL X
0B2F C3 ADD D #0020
0B32 ED STA D X05
0B34 C3 ADD D #007C
0B37 ED STA D X07
0B39 C3 ADD D #FFA0
0B3C ED STA D X0B
0B3E 6F CLR   X13
0B40 18 XDX
0B41 CE LDX    #0665
0B44 6D TST   X00
0B46 27 BEQ    0B53
0B48 08 INX
0B49 08 INX
0B4A 8C CPX    #0677
0B4D 26 BNE    0B44
0B4F 38 PUL X
0B50 38 PUL X
0B51 20 BRA    0B5C
0B53 ED STA D X00
0B55 32 PUL A
0B56 33 PUL B
0B57 38 PUL X
0B58 C3 ADD D #0038
0B5B 18 XDX
0B5C 20 BRA    0B20
0B5E D8 45 78 74  Ext
0B62 65 6E 64 65 ende
0B66 64 20 45 70 d Ep
0B6A 73 6F 6E 20 son
0B6E 42 41 53 49 BASI
0B72 43 0D 0A 77 C  w
0B76 69 74 68 20 ith
0B7A 53 50 54 30 SPT0
0B7E 3A 20 62 79 : by
0B82 20 45 20 57  E W
0B86 61 6C 64 0D ald
0B8A 0A 00 25 2C   %,
0B8E FF 8F 53 50  •SP
0B92 54 30 20 00 T0
0B96 00 00 00 8C    ▮
0B9A 70 00 00 8C p  ▮
0B9E 70 8C 70 00 p▮p
0BA2 00 00 00 00
0BA6 50 0E 46 80 P F+
0BAA 00 00 00 00
0BAE 00 00
0BB0 B6 LDA A   068A
0BB3 81 CMP A #20
0BB5 27 BEQ    0BBC
0BB7 C6 LDA B #33
0BB9 7E JMP    8433
0BBC 8D BSR    0C20
0BBE 6D TST   X13
0BC0 2B BMI    0BC7
0BC2 62 OIM   X8013
0BC5 20 BRA    0C19
0BC7 39 RTS
0BC8 00 ***
0BC9 8D BSR    0BB0
0BCB 32 PUL A
0BCC 8D BSR    0C20
0BCE 36 PSH A
0BCF 6D TST   X13
0BD1 27 BEQ    0BC9
0BD3 32 PUL A
0BD4 81 CMP A #0D
0BD6 27 BEQ    0C09
0BD8 81 CMP A #0A
0BDA 27 BEQ    0C09
0BDC 81 CMP A #20
0BDE 25 BCS    0C1D
0BE0 36 PSH A
0BE1 A6 LDA A X14
0BE3 C6 LDA B #50
0BE5 3D MUL
0BE6 36 PSH A
0BE7 A6 LDA A X15
0BE9 1B ABA
0BEA 16 TAB
0BEB 32 PUL A
0BEC 89 ADC A #00
0BEE 3C PSH X
0BEF 30 TSX
0BF0 E3 ADD D X00
0BF2 C3 ADD D #01D0
0BF5 37 PSH B
0BF6 36 PSH A
0BF7 30 TSX
0BF8 A6 LDA A X04
0BFA EE LDX   X00
0BFC A7 STA A X00
0BFE 38 PUL X
0BFF 38 PUL X
0C00 31 INS
0C01 6C INC   X15
0C03 E6 LDA B X15
0C05 C1 CMP B #50
0C07 26 BNE    0C1D
0C09 6F CLR   X15
0C0B 81 CMP A #0D
0C0D 27 BEQ    0C1D
```

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The sideways printer requires a 16×80 byte buffer to contain the ASCII codes for one block of text. The buffer is filled when characters are sent to 'SPTØ:' from Basic.

The subroutine which opens 'SPTØ:' fills the 16×80 character buffer with spaces and the device is marked as being open. A horizontal 'cutting line' is then printed. 'SPTØ:' is closed by a subroutine which prints any characters remaining in the buffer and then marks the device as being closed.

The subroutine which transfers a character to 'SPTØ:' places the ASCII code for the character in the buffer. When the buffer contains 16 lines of data, the contents of the buffer are printed out followed by a cutting line. The buffer is then filled with spaces ready for the next block of text.

To print the text block, the sideways printer routine extracts one column of characters at a time from the buffer and converts this to the equivalent 16×6 byte block of dot patterns. This dot information represents six lines of dots on the printer, and these are printed out using a routine in the Epson operating system.

Machine code routines

A listing of the machine code is provided in Figure 1. The program is totally relocatable, but for convenience is listed from location &HØA4Ø onwards. It is important to remember that when the driver loader routine is executed the machine code is copied to the top end of memory, and thus the addresses given will not be the correct ones. The device driver loader functions as follows:

ØA40-ØA7B Checks that space exists to link in extended Basic. If space exists then the program branches to ØA7D, otherwise it generates a beep and branches to ØAF9 to return to Basic.

ØA7D-ØA98 Copies all Basic programs and application files down and copies extended Basic into the space created at the top of memory.

ØA9A-ØAB7 Initialises the 'JMP' instruction to link the extended Basic into the interpreter (warm start hook).

ØAB9-ØAEF Updates the menu entries for the application files.

ØAF1-ØAF7 Resets MEMSET to the value before the Basic loader programs was run.

ØAF9-ØAFE Jumps to Basic warm start routine.

ØB00-ØB14 Block move subroutine.

The device driver functions as follows:

ØB20-ØB22 Warm start hook used to link in further extended Basics.

ØB23-ØB5C Device driver initialisation.

ØBB0-ØBC7 Opens the device.

ØBC9-ØC1D Transfers one byte from Basic to the device.

ØC20-ØC28 Calculates the address of the device control block.

ØC2C-ØC3C Closes the device.

ØC40-ØC50 Fills the character buffer with spaces.

Figure 1 (continued)

```
0C0F 6C INC    X14
0C11 E6 LDA B X14
0C13 C1 CMP B #10
0C15 25 BCS    0C1D
0C17 8D BSR    0C7C
0C19 8D BSR    0C5B
0C1B 8D BSR    0C40
0C1D 39 RTS
0C1E 00 ***
0C1F 00 ***
0C20 8D BSR    0C22
0C22 38 PUL X
0C23 18 XDX
0C24 83 SUB D #0092
0C27 18 XDX
0C28 39 RTS
0C29 00 ***
0C2A 00 ***
0C2B 00 ***
0C2C 8D BSR    0C20
0C2E 6D TST    X13
0C30 27 BEQ    0C3C
0C32 6F CLR    X13
0C34 6D TST    X14
0C36 26 BNE    0C17
0C38 6D TST    X15
0C3A 26 BNE    0C17
0C3C 39 RTS
0C3D 00 ***
0C3E 00 ***
0C3F 00 ***
0C40 8D BSR    0C20
0C42 6F CLR    X14
0C44 6F CLR    X15
0C46 18 XDX
0C47 C3 ADD D #01D0
0C4A 18 XDX
0C4B CC LDA D #0500
0C4E 36 PSH A
0C4F 86 LDA A #20
0C51 A7 STA A X00
0C53 08 INX
0C54 32 PUL A
0C55 83 SUB D #0001
0C58 26 BNE    0C4E
0C5A 39 RTS
0C5B 3C PSH X
0C5C 37 PSH B
0C5D 36 PSH A
0C5E 86 LDA A #85
0C60 8D BSR    0C6D
0C62 BD JSR    FF94
0C65 86 LDA A #20
0C67 8D BSR    0C6D
0C69 32 PUL A
0C6A 33 PUL B
0C6B 38 PUL X
0C6C 39 RTS
0C6D C6 LDA B #18
0C6F FE LDX    FFD2
0C72 08 INX
0C73 3C PSH X
0C74 A7 STA A X00
0C76 08 INX
0C77 5A DEC B
0C78 26 BNE    0C74
0C7A 38 PUL X
0C7B 39 RTS
0C7C 8D BSR    0C20
0C7E 18 XDX
0C7F C3 ADD D #01D0
0C82 DD STA D $6E
0C84 C3 ADD D #0500
0C87 DD STA D $6C
0C89 5F CLR B
0C8A 37 PSH B
0C8B 5F CLR B
0C8C 32 PUL A
0C8D 36 PSH A
0C8E 37 PSH B
0C8F 8D BSR    0CF8
0C91 DE LDX    $6C
0C93 3A ABX
0C94 B6 LDA A  0190
0C97 A7 STA A X00
0C99 B6 LDA A  0191
0C9C A7 STA A X10
0C9E B6 LDA A  0192
0CA1 A7 STA A X20
0CA3 B6 LDA A  0193
0CA6 A7 STA A X30
0CA8 B6 LDA A  0194
0CAB A7 STA A X40
0CAD B6 LDA A  0195
0CB0 A7 STA A X50
0CB2 33 PUL B
0CB3 5C INC B
0CB4 C1 CMP B #10
0CB6 26 BNE    0C8C
0CB8 5F CLR B
0CB9 37 PSH B
0CBA 86 LDA A #10
0CBC 3D MUL
0CBD D3 ADD D #6C
0CBF C3 ADD D #000E
0CC2 FE LDX    FFD2
0CC5 08 INX
0CC6 3C PSH X
0CC7 3C PSH X
0CC8 18 XDX
0CC9 8D BSR    0D18
0CCB 8D BSR    0D18
0CCD 8D BSR    0D18
0CCF 8D BSR    0D18
0CD1 8D BSR    0D18
0CD3 8D BSR    0D18
0CD5 8D BSR    0D18
0CD7 8D BSR    0D18
0CD9 38 PUL X
0CDA 38 PUL X
0CDB BD JSR    FF91
0CDE 33 PUL B
0CDF 25 BCS    0CED
0CE1 5C INC B
0CE2 C1 CMP B #06
0CE4 26 BNE    0CB9
0CE6 33 PUL B
0CE7 5C INC B
0CE8 C1 CMP B #50
0CEA 26 BNE    0C8A
0CEC 39 RTS
0CED C6 LDA B #35
0CEF 31 INS
0CF0 7E JMP    8433
0CF3 00 ***
0CF4 00 ***
0CF5 00 ***
0CF6 00 ***
0CF7 00 ***
0CF8 37 PSH B
0CF9 36 PSH A
0CFA DE LDX    $6E
0CFC 3C PSH X
0CFD 30 TSX
0CFE A6 LDA A X03
0D00 C6 LDA B #50
0D02 3D MUL
0D03 EB ADD B X02
0D05 89 ADC A #00
0D07 E3 ADD D X00
0D09 18 XDX
0D0A A6 LDA A X00
0D0C 38 PUL X
0D0D CE LDX    #0190
0D10 BD JSR    FF67
0D13 32 PUL A
0D14 33 PUL B
0D15 39 RTS
0D16 00 ***
0D17 00 ***
0D18 3C PSH X
0D19 A6 LDA A X00
0D1B 36 PSH A
0D1C E6 LDA B X01
0D1E 37 PSH B
0D1F 30 TSX
0D20 54 LSR B
0D21 54 LSR B
0D22 54 LSR B
0D23 EE LDX    X06
0D25 E7 STA B X00
0D27 33 PUL B
0D28 58 ASL B
0D29 49 ROL A
0D2A 59 ROL B
0D2B 49 ROL A
0D2C 59 ROL B
0D2D E7 STA B X01
0D2F 32 PUL A
0D30 A7 STA A X02
0D32 8D BSR    0D40
0D34 8D BSR    0D40
0D36 8D BSR    0D40
0D38 18 XDX
0D39 30 TSX
0D3A ED STA D X04
0D3C 38 PUL X
0D3D 09 DEX
0D3E 09 DEX
0D3F 39 RTS
0D40 E6 LDA B X00
0D42 86 LDA A #20
0D44 97 STA A $6B
0D46 4F CLR A
0D47 54 LSR B
0D48 24 BCC    0D4C
0D4A 9A ORA A $6B
0D4C 74 LSR    006B
0D4F 24 BCC    0D47
0D51 A7 STA A X00
0D53 08 INX
0D54 39 RTS
```

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0C5B-0C7B Fills the printer buffer with a character.

0C7C-0CF0 Prints a text block sideways down the paper.

0CF8-0D15 Reads a character from the text buffer and obtains the corresponding dot patterns.

0D18-0D54 converts 16 bytes of dot data to the 24 bytes required by the printer subroutine.

The Basic program

To link device 'SPTØ:' to Basic the program given in Figure 2 should be entered in any program area. Before running the program it should be saved on tape, together with any other important programs already in the computer. This is necessary in case the computer crashes as a result of typing errors. Once the program has been saved it can be run. If the HX-20 crashes it is necessary to initialise the computer using 'CTRL/@' (Section 4.2.1 of the Operation Manual). The device is added to Basic and a new 'LOGIN' message is displayed provided there is sufficient memory available, otherwise the computer beeps. However, if there are already 16 devices defined, 'SPTØ:' is not available until another device is released.

Demonstration program

A program is provided (Figure 3) to demonstrate sideways printing. The program uses the PRINT# statement, the device being opened in line 100 and closed in line 190.

To run the program enter it in any program area, turn the printer switch on and type RUN. The printout produced is shown in Figure 4. Programs can be listed sideways using LIST "SPTØ:".

Figure 2: Basic Loading program

```
100 REM "SPT0:" Initialization routine by E.J. Wald 1983
110 M1%=PEEK(&H136):M2%=PEEK(&H137):POKE &H2CE,M1%:POKE &H2CF,M2%
120 MEMSET 256*M1%+M2%+800
130 M%=256*PEEK(&H2CE)+PEEK(&H2CF)
140 FOR I%=M% TO M%+799:READ A$:POKE I%,VAL("&H"+A$):NEXT I%
150 EXEC M%
160 DATA 8E,4,AF,7B,40,78,27,8,FE,1,38,AD,0,71,BF,78,8D,0,32,33,C3,0,CE
170 DATA DD,6A,CC,7,A0,DD,68,D3,6A,DD,6C,FC,1,2C,DD,62,FC,1,34,DD,60,93,68
180 DATA DD,64,18,9C,6C,24,8,CC,6,5,BD,FF,64,20,7C,F,FF,1,34,FC,1,36,93
190 DATA 68,FD,1,36,8D,75,DC,6A,DD,60,DC,6C,DD,62,DC,64,FD,1,2C,8D,66,FE,1
200 DATA 34,8,8,8,A6,0,81,39,27,7,EE,1,9,9,9,20,F3,86,7E,A7,0,FC,1
210 DATA 2C,C3,0,3,ED,1,CE,1,3C,A6,1,81,45,27,2F,DF,6E,A6,1,EE,2,8C,FF
220 DATA FF,27,24,4D,2B,4,18,93,68,18,18,DE,6E,ED,2,6D,1,2A,2,D3,6E,18,A6
230 DATA 1,81,45,27,B,4D,2B,6,EC,4,93,68,ED,4,20,D1,FE,1,34,FC,2,CE,ED
240 DATA A,E,4F,FE,80,4,6E,0,DE,60,9C,62,27,E,A6,0,8,DF,60,DE,64,A7,0

250 DATA 8,DF,64,20,EC,39,1,1,1,1,1,1,1,1,1,1,1,1,39,0,0,3C,8D,0
260 DATA 38,3C,18,C3,0,6A,37,36,38,C3,0,20,ED,5,C3,0,7C,ED,7,C3,FF,A0,ED
270 DATA B,6F,13,18,CE,6,65,6D,0,27,B,8,8,8C,6,77,26,F5,38,38,20,9,ED
280 DATA 0,32,33,38,C3,0,38,18,20,C2,D8,45,78,74,65,6E,64,65,64,20,45,70,73
290 DATA 6F,6E,20,42,41,53,49,43,D,A,77,69,74,68,20,53,50,54,30,3A,20,62,79
300 DATA 20,45,20,57,61,6C,64,D,A,0,25,2C,FF,8F,53,50,54,30,20,0,0,0,0,0
310 DATA 8C,70,0,0,8C,70,8C,70,0,0,0,0,0,0,50,E,46,80,0,0,0,0,0,0
320 DATA B6,6,8A,81,20,27,5,C6,33,7E,84,33,8D,62,6D,13,2B,5,62,80,13,20,52
330 DATA 39,0,8D,E5,32,8D,52,36,6D,13,27,F6,32,81,D,27,31,81,A,27,2D,81,20
340 DATA 25,3D,36,A6,14,C6,50,3D,36,A6,15,1B,16,32,89,0,3C,30,E3,0,C3,1,D0
350 DATA 37,36,30,A6,4,EE,0,A7,0,38,38,31,6C,15,E6,15,C1,50,26,14,6F,15,81
360 DATA D,27,E,6C,14,E6,14,C1,10,25,6,8D,63,8D,40,8D,23,39,0,0,8D,0,38
370 DATA 18,83,0,92,18,39,0,0,0,8D,F2,6D,13,27,A,6F,13,6D,14,26,DF,6D,15
380 DATA 26,DB,39,0,0,0,8D,DE,6F,14,6F,15,18,C3,1,D0,18,CC,5,0,36,86,20
390 DATA A7,0,8,32,83,0,1,26,F4,39,3C,37,36,86,85,8D,B,BD,FF,94,86,20,8D
400 DATA 4,32,33,38,39,C6,18,FE,FF,D2,8,3C,A7,0,8,5A,26,FA,38,39,8D,A2,18

410 DATA C3,1,D0,DD,6E,C3,5,0,DD,6C,5F,37,5F,32,36,37,8D,67,DE,6C,3A,B6,1
420 DATA 90,A7,0,B6,1,91,A7,10,B6,1,92,A7,20,B6,1,93,A7,30,B6,1,94,A7,40
430 DATA B6,1,95,A7,50,33,5C,C1,10,26,D4,5F,37,86,10,3D,D3,6C,C3,0,E,FE,FF
440 DATA D2,8,3C,3C,18,8D,4D,8D,4B,8D,49,8D,47,8D,45,8D,43,8D,41,8D,3F,38,38
450 DATA BD,FF,91,33,25,C,5C,C1,6,26,D3,33,5C,C1,50,26,9E,39,C6,35,31,7E,84
460 DATA 33,0,0,0,0,0,37,36,DE,6E,3C,30,A6,3,C6,50,3D,EB,2,89,0,E3,0
470 DATA 18,A6,0,38,CE,1,90,BD,FF,67,32,33,39,0,0,3C,A6,0,36,E6,1,37,30
480 DATA 54,54,54,EE,6,E7,0,33,58,49,59,49,59,E7,1,32,A7,2,8D,C,8D,A,8D
490 DATA 8,18,30,ED,4,38,9,9,39,E6,0,86,20,97,6B,4F,54,24,2,9A,6B,74,0
500 DATA 6B,24,F6,A7,0,8,39,0,0,0,0,0,0,0,0,0,0,0
```

Figure 3: Demonstration program

```
100 OPEN "O",#1,"SPT0:"
110 PRINT#1:PRINT#1
120 PRINT#1,TAB(16);"┌";STRING$(46,"─");"┐"
130 GOSUB 200:GOSUB 200
140 PRINT#1,TAB(16);"|   Epson BASIC Sideways Print Demonstration   |"
150 GOSUB 200
160 FOR I=32 TO 128 STEP 32:GOSUB 210:NEXT I
170 GOSUB 200:GOSUB 200
180 PRINT #1,TAB(16);"└";STRING$(46,"─");"┘"
190 CLOSE#1:END
200 PRINT#1,TAB(16);"|";TAB(63);"|":RETURN
210 PRINT#1,TAB(16);"|   ";
220 FOR J=I TO I+31:PRINT#1,CHR$(J);:NEXT J
230 PRINT#1,"      |"
240 RETURN
```

Figure 4: Demonstration printout

```
Epson BASIC Sideways Print Demonstration

 !"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~
```