Ultimate Virtual Printer

User's Guide

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Introduction

1.1. Context

The virtual printer was first released as a new feature on 1541 Ultimate-II cartridge with firmware 3.0. With this functionality you can print from your Commodore 64/128 using a virtual IEC device #4 or #5.

This feature is now available on Ultimate-II, Ultimate-II+, Ultimate-II+L cartridges and also Ultimate64 family computer boards. In this document we use Ultimate to name all supported devices.

This virtual printer simulates a Commodore MPS-1550C printer with all the commands that this printer can understand. Not all commands are executed as some of them are hardware related and cannot obviously be implemented. The results are printed to PNG image files, one file per page. You can also choose to bypass the printer emulation and to send the raw data from #4 or #5 IEC device to a file.

The MPS-1550C was a mid-range 4 colors ink ribbon 9 needle matrix printer sold by Commodore in the late 80's. The MPS-1230 was the B&W version of this printer with the exact same characteristics. They were printers with both IEC and Centronics interfaces that could be used by Commodore 64 and Amiga personal computers.

These printers were compatible with nearly all the usual programs that have been edited for C64/C128. They can interpret 4 printer instruction sets:

- Commodore MPS-801
- Epson FX-80/JX-80
- IBM Graphics Printer
- IBM Proprinter

1.2. License

Ultimate Virtual Printer is released under the GNU General Public License 3.0. A full copy of the license is included in the root of the Ultimate firmware sources.

1.3. Purpose of this document

This document describes how to use and configure the Ultimate embedded virtual printer.

You will also find all the commands and charsets supported by the printer. Then you can add printer facility to your own BASIC programs!

Configuration

2.1. Overview

You will find all the configuration items for the printer in the configuration menu. In the Ultimate user interface, press F2 Configuration Menu to enter Ultimate configuration and then select "**Printer Settings**"

2.2. Printer settings

- **IEC printer**: Enabled or Disabled (default is Disabled)
  Virtual printer has to be enabled to be available on IEC bus. Printer can stay enabled even if you don't use it. There will be no impact on performances and resources of your Ultimate device.

- **Bus ID**: 4 or 5 (default is 4)
  This will assign device ID 4 or 5 to the printer on IEC bus.

- **Output file**: (default is */SD/*printer on Ultimate II or */Usb0/printer* on Ultimate II+)
  You can select file base name that the virtual printer will use to create the PNG files. If you choose to generate PNG files, they will be named *printer-001.png*, *printer-002.png*, and so on. If you chose the bypass the emulation and write RAW binary data to disk the file will be named *printer* with no extension. When using ASCII filter output, extension *.txt* will be appended to file name.

- **Output type**: PNG B&W, PNG COLOR, ASCII or RAW (default is PNG B&W)
  PNG are images created by the virtual printer each time a page is ejected from the printer. If a file with the same name already exists, it will not be overwritten. RAW is the data directly sent by the C64/128 to the IEC port and recorded as binary to a file. ASCII will keep and convert printable characters to ISO8859-1 standard. This output only makes sense if you are printing text as you will only get garbage with bitmap. In both RAW and ASCII output mode, if the file already exists, the new data will be appended to it. Changing from COLOR to B&W and backward will clear the page, the contents of the page are lost.

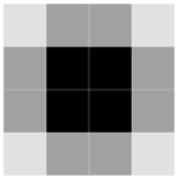
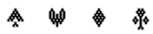
- **Ink density**: Low, Medium or High (default is Medium)
  You can consider this as "how strong is the needle impact on the paper". *Low* will only print very small dots and *High* larger dots. As a consequence, this will change the resulting contrast. *High* gives the best result for DRAFT character mode. *Medium* may be well suited for NLQ character mode. Just test and see what match your needs. *See table below for samples*.

- **Emulation**: Commodore MPS, Epson FX-80/JX-80, IBM Graphics Printer, IBM Proprinter (default is Commodore MPS)
  You can select which instruction set the virtual printer will recognize. Changing from one emulation to another will reset the printer attributes but the printer head stays at the same place and the page is neither cleared or ejected.

- **Commodore charset:** USA/UK, Denmark, France/Italy, Germany, Spain, Sweden, Switzerland (default is USA/UK)
  Select which charset to use when using Commodore MPS emulation. If you don't know which one to choose, USA/UK is the one you want. See Commodore charset description on chapter 21.

- **Epson charset:** Basic, USA, France, Germany, England, Denmark I, Sweden, Italy, Spain, Japan, Norway, Denmark II (default is Basic).
  Select which charset to use when using Epson FX-80/JX-80 emulation. See Epson charset description on chapter 0.

- **IBM table 2:** International 1, International 2, Israel, Greece, Portugal, Spain (default is International 1)
  Select which charset to use for Table2 when using IBM Graphics Printer or IBM Proprinter emulation. IBM printers can use 2 charsets: Table 1 and Table2. Table 1 cannot be modified and is the default charset. Table 2 is the one you chose with this parameter. See IBM charset description in chapter 0.

Ink Density	Low	Medium	High
Elementary Dot (x1)			
Elementary Dot (x300)			
Draft text	1541 ULTIMATE II	1541 ULTIMATE II	1541 ULTIMATE II
NLQ text	1541 ULTIMATE II	1541 ULTIMATE II	1541 ULTIMATE II
Draft graphic chars			
NLQ graphic chars			

Using the printer

3.1. Printing from the C64/C128

Just use your program and tell it that you have a connected printer compatible with MPS Commodore series (e.g.: MPS-801/MPS-803 are the most frequently supported commodore printers).

3.2. Flushing the printer spool

The printer has a very small buffer (256 bytes) and some data may still be in the buffer waiting to be printed when your print job is finished. The printer doesn't know that your job is finished and waits for more data to print until the end of the page.

You need to tell the printer that you want all the buffered data to be printed and to eject the current page. This works as the *Form Feed* button on the real MPS-1550C to eject the page.

Go to F5 Action Menu and select "**Printer ... Flush/Eject**". In PNG mode, this will make the current page to be written to a file. Next print job will start on a blank page. In RAW and ASCII mode this will write the buffered data to the file. While building the PNG image, a modal window with a progression bar will be displayed until the end of the file has been written to local storage.

3.3. Resetting the printer

You may need to reset printer to go back to an initial state. Go to F5 Action Menu and select "**Printer ... Reset**". Current data in printer buffer is lost. Current page that was being printed is also lost.

3.4. Turning the printer on or off

You can also enable or disable the printer temporally without modifying the power on settings. Go to F5 Action Menu and select **"Printer ... Turn On"** or **"Printer ... Turn Off"**. This implies a printer reset at power on. So, if you didn't flush/eject the current page before power off, the page is lost.

3.5. Performances

Composing a page full of text and creating the B&W PNG file will need approximatively 15 seconds on the Ultimate-II (28 seconds using NLQ mode). You may think it's slow but this is much faster than a real MPS-1550C printer (1 min in DRAFT mode, 4 min in NLQ mode)! In color mode, creating the PNG file can last three times longer, be patient.

The Ultimate cartridge middle button becomes unresponsive while composing a page. The green LED on the right of the cartridge is lit when printer is working. Be patient and look at the activity LED to stop blinking.

RAW and ASCII modes are nearly immediate. There is no process time to wait.

At this time, with firmware 3.10h, the virtual printer is much slower on Ultimate-II+ than on Ultimate-II as it is using a slower CPU. In fact, no processor cache is implemented yet in Ultimate-II+, this may change in a future firmware as CPU is implemented in FPGA using VHDL.

3.6. Color versus Black & White

Composing a B&W PNG page is faster than composing a color PNG page even if no color is used. That's why there is a PNG B&W output option. Most applications on C64/C128 don't know how to use the instructions of a color printer. My advice is to enable PNG Color only when you know that you will need a color printer. Color PNG generates also bigger files than B&W PNG, this is due to the pixel depth of the file, 8 bits for color and 2 bits for B&W. Composing a color page also needs more memory than composing a B&W page. Color mode is approximatively 2.5 slower than B&W mode.

Capabilities

This table summarize the printer capabilities depending on which printer emulation is active:

	Commodore MPS	Epson FX-80/JX-80	IBM Graphics Printer	IBM Proprinter
Draft	•	•	•	•
Color	•	•	•	•
Double strike	•	•	•	•
Bold	•	•	•	•
Italic *(draft only)*	•	•	•*	
NLQ	•	•	•	•
Underline	•	•	•	•
Double width	•	•	•	•
Superscript	•	•	•	•
Subscript	•	•	•	•
Reverse	•			
Overline				•
Backspace		•	•	•
Reverse page feed		•		
CR=CR+LF	•			*optional*
LF=CR+LF	•	•		
7 dot BIM	•			
8 dot BIM		•	•	•
9 dot BIM		•		
HT Program		•	•	•
VT Program		•		•
60 dpi BIM	• *(double width)*	•	•	•
75 dpi BIM		•		
80 dpi BIM		•		
90 dpi BIM		•		
120 dpi BIM		•	•	•
240 dpi BIM		•	•	•
Pica (10cpi)	•	•	•	•
Elite (12cpi)	•	•	•	•
Micro (15cpi)	•			
Condensed (17.1cpi)	•	•	•	•
Pica Compressed (20cpi)	•			
Elite Compressed (24 cpi)	•			
Micro Compressed (30 cpi)	•			

* Only in Ultimate Virtual Printer, not available on a real MPS-1550C printer

Commodore MPS commands

This chapter describes the commands the printer can understand when using the Commodore MPS emulation. You will find Commodore BASIC examples to explain you how to use them. This printer uses PETASCII. This is the only emulation to print reliably BASIC program listings.

5.1. Simple example

This will print a first line with HELLO WORLD! on it and a second line with HELLO printed with double width characters.

```
10 OPEN1,4
20 PRINT#1,"HELLO WORLD!"
30 PRINT#1,CHR$(14)"HELLO"
40 CLOSE1
```

```
HELLO WORLD!
HELLO
```

5.2. Secondary address

Only on Commodore MPS emulation, you can specify an optional secondary address on OPEN:

- **0** : Select PETASCII charset with uppercases and graphic chars
- **7** : Select PETASCII charset with lowercases and uppercases

If no secondary address is specified, 0 is the default.

5.3. Commands

5.3.1. Color printing

ESC B
27 98
1Bh 62h

Select the **Black** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(98);"BLACK"
30 CLOSE1
```

```
BLACK
```

ESC M
27 109
1Bh 6Dh

Select the **Magenta** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(109);"MAGENTA"
30 CLOSE1
```

```
MAGENTA
```

ESC C
27 99
1Bh 63h

Select the **Cyan** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(99);"CYAN"
30 CLOSE1
```

```
CYAN
```

ESC Y
27 121
1Bh 79h

Select the **Yellow** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(121);"YELLOW"
30 CLOSE1
```

YELLOW

ESC R n
27 114 n
1Bh 72h n

Select the ribbon color depending on parameter "n" as described on this table:

n	COLOR	
0	BLACK	1 pass
1	MAGENTA	1 pass
2	CYAN	1 pass
3	VIOLET	1 pass MAGENTA + 1 pass CYAN
4	YELLOW	1 pass
5	ORANGE	1 pass MAGENTA + 1 pass YELLOW
6	GREEN	1 pass CYAN + 1 pass YELLOW

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(114);CHR$(n);
30 CLOSE1
```

BLACK
MAGENTA
CYAN
VIOLET
YELLOW
ORANGE
GREEN

5.3.2. Graphical operations

ESC g
27 71
1Bh 47h

Select the **Double Strike** print mode. Characters are printed twice and paper is lifted 1/216" between the two passes.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(71);"DOUBLE STRIKE"
30 CLOSE1
```

double strike

ESC h
27 72
1Bh 48h

Disable **Double Strike** print mode

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(72);
30 CLOSE1
```

EN ON
14
0Eh

Select the **Double Width** print mode (Enhanced ON)

```
10 OPEN1,4
20 PRINT#1,CHR$(14);"DOUBLE WIDTH"
30 CLOSE1
```

DOUBLE WIDTH

EN OFF
15
0Fh

Disable the **Double Width** print mode (Enhanced OFF)

```
10 OPEN1,4
20 PRINT#1,CHR$(15);
30 CLOSE1
```

RVS ON
18
12h

Select the **Reverse** print mode. Each character is printed in negative.

```
10 OPEN1,4
20 PRINT#1,CHR$(18);"REVERSE"
30 CLOSE1
```

REVERSE

RVS OFF
146
92h

Disable the **reverse** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(146);
30 CLOSE1
```

ESC - 1
27 45 49
1Bh 2Dh 31h

Select the **Underline** print mode for all characters and spaces that follow.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"
30 CLOSE1
```

UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h

Disable the Underline print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);
30 CLOSE1
```

ESC e
27 69
1Bh 45h

Select the **Bold** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(69);"BOLD"
30 CLOSE1
```

BOLD

ESC f
27 70
1Bh 46h

Disable the Bold print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(70);
30 CLOSE1
```

ESC 4
27 52
1Bh 34h

Select the **Italic** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(52);"ITALIC"
30 CLOSE1
```

ITALIC

ESC 5
27 53
1Bh 35h

Disable the **Italic** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(53);
30 CLOSE1
```

ESC [n
27 91 n
1Bh 5Bh n

Select the spacing mode depending on parameter "n" as described on this table:

n	SPACING	
0	PICA	10 chars/inch
1	ELITE	12 chars/inch
2	MICRO	15 chars/inch
3	CONDENSED	17.1 chars/inch
4	PICA COMPRESSED	20 chars/inch
5	ELITE COMPRESSED	24 chars/inch
6	MICRO COMPRESSED	30 chars/inch

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(91);CHR$(n);
30 CLOSE1
```

```
PICA                    Draft Regular
ELITE                   Draft Regular
MICRO                   Draft Regular
CONDENSED               Draft Regular
PICA COMPRESSED         Draft Regular
ELITE COMPRESSED        Draft Regular
MICRO COMPRESSED        Draft Regular
```

ESC s 0
27 83 48
1Bh 53h 30h

Select the **Superscript** print mode. Characters are half high than the normal height and are printed on the upper half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(48);"SUPERSCRIPT"
30 CLOSE1
```

NORMAL SUPERSCRIPT

ESC s 1
27 83 49
1Bh 53h 31h

Select the **Subscript** print mode. Characters are half high than the normal height and are printed on the lower half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(49);"SUBSCRIPT"
30 CLOSE1
```

NORMAL SUBSCRIPT

ESC t
27 84
1Bh 54h

Disable Superscript and Subscript print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(84);
30 CLOSE1
```

ESC X n
27 120 n
1Bh 78h n

If n=0, select standard quality mode (Draft)
If n=1, select near letter quality mode (NLQ)

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(120);CHR$(n);
30 CLOSE1
```

NLQ ON
31
1Fh

Select the Near Letter Quality print mode (NLQ)

```
10 OPEN1,4
20 PRINT#1,CHR$(31);
30 CLOSE1
```

```
DRAFT QUALITY
NEAR LETTER QUALITY
```

NLQ OFF
159
9Fh

Disable the Near Letter Quality print mode (NLQ)

```
10 OPEN1,4
20 PRINT#1,CHR$(159);
30 CLOSE1
```

CRSR DWN
17
11h

Select PETASCII charset for uppercases/lowercases characters. With this charset, a limited number of graphical characters are available.

```
10 OPEN1,4
20 PRINT#1,CHR$(17);
30 CLOSE1
```

CRSR UP
145
91h

Select PETASCII charset for uppercases only characters. With this charset, all graphical characters are available.

```
10 OPEN1,4
20 PRINT#1,CHR$(145);
30 CLOSE1
```

5.3.3. Paper feeding

LF
10
0Ah

A **Line Feed** returns the print head to le left margin and advances the paper to the next line (behavior is LF+CR).

```
10 OPEN1,4,7
20 PRINT#1,CHR$(10);
30 CLOSE1
```

CR
13
0Dh

A **Carriage Return** returns the print head to le left margin and advances the paper to the next line (behavior is CR+LF).

```
10 OPEN1,4,7
20 PRINT#1,CHR$(13);
30 CLOSE1
```

FF
12
0Ch

A **Form Feed** prints the current page to a PNG file and then continues printing on the first line of a new blank page.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(12);
30 CLOSE1
```

CS
141
8Dh

Returns the print head to le left margin but stays in the same line (behavior is CR).

```
10 OPEN1,4,7
20 PRINT#1,CHR$(141);
30 CLOSE1
```

5.3.4. Format control

ESC c n
27 67 n
1Bh 43h n

Defines the page length in number of text lines (range 1-127).

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(67);CHR$(1-127);
30 CLOSE1
```

ESC c NUL n
27 67 0 n
1Bh 43h 00h n

Defines the page length in inches (range 1-22).

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(67);CHR$(0);CHR$(1-22);
30 CLOSE1
```

ESC n m
27 78 m
1Bh 4Eh m

Define the **Bottom of Form** (BOF) in number "m" of interlines at the end of the page that are not used to print and are automatically skipped.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(78);CHR$(m);
30 CLOSE1
```

ESC o
27 79
1Bh 4Fh

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(79);
30 CLOSE1
```

ESC 8
27 56
1Bh 38h

Disable the end of paper detector to be able to print until the end of the paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(56);
30 CLOSE1
```

ESC 9
27 57
1Bh 39h

Enable the end of paper detector.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(57);
30 CLOSE1
```

HTAB
9
09h

This is the traditional horizontal tabulation. Head jumps to the next tabulation stop. Stops are located every 8 PICA character position since the beginning of a line. This is fixed, not configurable.

```
10 OPEN1,4
20 PRINT#1,CHR$(9);"THIS IS THE PRINT POSITION 8"
30 CLOSE1
```

POS n_1 n_2
16 n_1 n_2
10h n_1 n_2

On the current line, jump to the horizontal position corresponding to the n_1n_2 decimal number of PICA characters since the beginning of the line. Each parameter is a value between 0 and 9. 00 is the position of the first character. n_1n_2 can range from 00 to 79. Does nothing is current position is already over the n_1n_2 position.

```
10 OPEN1,4
20 PRINT#1,CHR$(16);CHR$(2);CHR$(6);"THIS IS THE PRINT POSITION
26"
30 CLOSE1
```

ESC POS n_1 n_2
27 16 n_1 n_2
1Bh 10h n_1 n_2

On the current line, jump to the horizontal position corresponding to the dot position given by parameters n_1 and n_2 from the beginning of the line. Parameter is calculated using the formula n_1x256+n_2. Value range is 0 to 480

Examples:

n_1	n_2	POSITION
CHR$(0)	CHR$(20)	0 + 20 = 20
CHR$(1)	CHR$(0)	256 + 0 = 256
CHR$(1)	CHR$(224)	256 + 224 = 480

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(16);CHR$(1);CHR$(6);"THIS IS THE PRINT
POSITION 262"
30 CLOSE1
```

5.3.5. Graphic Bitmap

Printer can print graphic data using the Bit Image Mode (BIM). An image is defined by a bit array of 7 rows. Each column is encoded in a byte, LSB is up, MSB is not printed and always set to 1. Horizontal definition is 60 dpi. Vertical definition is 72 dpi.

Example for a 16 columns array:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	□	□	□	■	□	□	□	□	□	□	■	□	□	□	■	□
2	□	□	■	□	■	□	□	□	□	■	■	■	□	□	■	□
4	□	■	□	□	□	■	□	□	■	■	■	■	■	□	□	□
8	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
16	□	■	□	□	□	■	□	□	■	■	■	■	■	□	□	□
32	□	□	■	□	■	□	□	□	□	■	■	■	□	□	■	□
64	□	□	□	■	□	□	□	□	□	□	■	□	□	□	■	□
Total	136	148	162	193	162	148	136	136	156	190	255	190	156	136	235	136

Don't forget that bit 2^7 is <u>always</u> set, this adds 128 to each value.

First byte with 2^7 bit does not set mean that BIM data has ended. Printer is still on BIM mode as long as a printable character has not been sent. Commands with bit 2^7 not set are executed (CR, LF, …). As BIM is always printed using the double width mode, you can use code **EN OFF** (15 0Fh) to tell the printer that BIM data has ended.

When in BIM, interline is automatically set to 7 dot height.

BIT IMG
8
08h

Select the **Bit Image Mode**. Provided data is printed as an array of dots as described above. Maximum BIM data width that can be printed on printable area is 480 dots.

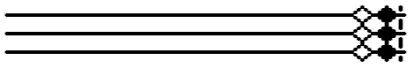
```
10 OPEN1,4,7
20 A$=""
30 FOR I=1 TO 16
40 READ A:A$=A$+CHR$(A)
50 NEXT I
60 FOR J=1 TO 3
70 PRINT#1,CHR$(8);A$
80 NEXT J
90 CLOSE1
100 END
110 DATA 136,148,162,193,162,148,136,136
120 DATA 156,186,255,186,156,136,235,136
```

BIT IMG SUB n
8 26 n
08h 1Ah n

Repeat n times the next byte while in Bit Image Mode. If you need to send many times the same byte you can use this command to tell how many times to repeat the same byte while in BIM data. If n=0 data will be repeated 256 times. If you need more than 256 repetitions, you will have to call SUB with the same data several times. Printer is still in BIM mode and a second SUB can be sent.

```
10 OPEN1,4,7
20 A$=""
```

```
30 FOR I=1 TO 16
40 READ A:A$=A$+CHR$(A)
50 NEXT I
60 FOR J=1 TO 3
70 PRINT#1,CHR$(8);CHR$(26);CHR$(100);A$
80 NEXT J
90 CLOSE1
100 END
110 DATA 136,148,162,193,162,148,136,136
120 DATA 156,186,255,186,156,136,235,136
```



5.3.6. Character creation, Down Line Loading (DLL)

On a MPS-1550C user can create from 1 to 94 custom characters to replace normal characters. These characters are loaded in RAM. Consecutive characters can be defined in a single sequence beginning by the first character. DLL has to be enabled in the configuration of a real MPS-1550C printer and RAM buffer is smaller as a part of the RAM is reserved for DLL.

On Ultimate Virtual Printer, DLL is not available but commands are correctly recognized and skipped with all their data.

ESC =
27 61
1Bh 3Dh

This code has to be followed by parameters **m n c s a** $\mathbf{p_1}$ $\mathbf{p_2}$...$\mathbf{p_{11}}$ which represents decimal byte codes to describe characters to load.

m and **n** are the number of bytes to load. Use the formula
t = (number of chars x 13) +2
then calculate m and n in order to have m + (n x 256) = t using formulas
n = t / 256 (keep entire part only)
m = t – (n x 256)

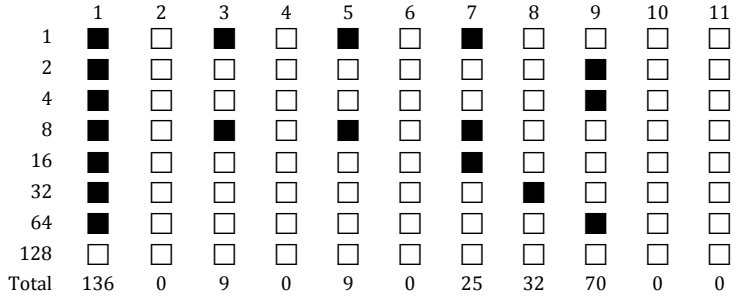
E.g.: for 94 characters,
t = (94 x 13) +2 = 1224
n = 1224 / 256 = 4
m = 1224 – (4 x 256) = 200

c Is the decimal ASCII code of the first character of the sequence. Only decimal codes from 33 to 126 can be used for DDL. Code 65 is "A"

s Is a constant value 20 (14h) (missing from official documentation but present in all examples)

a This parameter tells which needles have to be used to print that character. Head has 9 needles of which 8 can be used here.
a = 0 : use the 8 upper needles
a = 1 : use the 8 lower needles

$\mathbf{p_1}$ $\mathbf{p_2}$...$\mathbf{p_{11}}$ Represents the 11 columns defining the dots printed for the character.



	1	2	3	4	5	6	7	8	9	10	11
1	■	□	■	□	■	□	■	□	□	□	□
2	■	□	□	□	□	□	□	□	■	□	□
4	■	□	□	□	□	□	□	□	■	□	□
8	■	□	■	□	■	□	■	□	□	□	□
16	■	□	□	□	□	□	■	□	□	□	□
32	■	□	□	□	□	□	□	■	□	□	□
64	■	□	□	□	□	□	□	□	■	□	□
128	□	□	□	□	□	□	□	□	□	□	□
Total	136	0	9	0	9	0	25	32	70	0	0

This represents the real R character in DRAFT quality.
In the 8x11 matrix you have to remind that a dot active in a column cannot be active in the next column to let the head recycle. Ultimate Virtual Printer does not suffer from this limitation.

*Note from the author: I tested this command on a real MPS-1550C because explanations given by Commodore seems to be false. I can't make it work, example in the MPS-1550C manual prints nothing. Where are the 13 bytes by character? I only count 12 (**a p₁ p₂…p₁₁**)*

ESC i n
27 73 n
1Bh 49h n

Select the print quality depending on parameter "n"

- n=0 standard quality (draft) and normal characters
- n=2 near letter quality (NLQ) and normal characters
- n=4 standard quality (draft) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=0.
- n=6 near letter quality (NLQ) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=2.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(73);CHR$(n);
30 CLOSE1
```

DRAFT QUALITY
NEAR LETTER QUALITY

EPSON FX-80/JX-80 commands

This chapter describes the commands the printer can understand when using the Epson FX-80. JX-80 is the color version of the FX-80. This was one of the most popular printers in the 80's for its powerful graphic instruction set. With this emulation you can reach the maximum graphical resolution the printer can print (240x216dpi). This is still much lower than modern printers. This printer uses ASCII7.

6.1. Secondary address

Secondary address on OPEN command is not used by Epson emulation.

6.2. Commands

6.2.1. Color printing

ESC r n
27 114 n
1Bh 72h n

Select the ribbon color depending on parameter "n" as described on this table:

n	COLOR	
0	BLACK	1 pass
1	MAGENTA	1 pass
2	CYAN	1 pass
3	VIOLET	1 pass MAGENTA + 1 pass CYAN
4	YELLOW	1 pass
5	ORANGE	1 pass MAGENTA + 1 pass YELLOW
6	GREEN	1 pass CYAN + 1 pass YELLOW

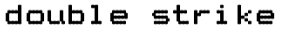
```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(114);CHR$(n);
30 CLOSE1
```

6.2.2. Graphical operations

ESC G
27 71
1Bh 47h

Select the **Double Strike** print mode. Characters are printed twice and paper is lifted 1/216" between the two passes.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(71);"DOUBLE STRIKE"
30 CLOSE1
```



ESC H
27 72
1Bh 48h

Disable **Double Strike** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(72);
30 CLOSE1
```

SO
14
0Eh

Select the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(14);"DOUBLE WIDTH"
30 CLOSE1
```

DOUBLE WIDTH

DC4
20
14h

Disable the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(20);
30 CLOSE1
```

ESC SO
27 14
1Bh 0Eh

Same as **SO** (Double Width print mode ON).

ESC W 1
27 87 1
1Bh 57h 01h

Same as **SO** (Double Width ON). 1 can be sent with ASCII code of '1' (49 - 31h)

ESC W 0
27 87 0
1Bh 57h 00h

Same as **DC4** (Double Width OFF). 0 can be sent with ASCII code of '0' (48 - 30h)

ESC – 1
27 45 49
1Bh 2Dh 31h

Select the **Underline** print mode for all characters and spaces that follow.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"
30 CLOSE1
```

UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h

Disable the Underline print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);
30 CLOSE1
```

ESC E
27 69
1Bh 45h

Select the **Bold** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(69);"BOLD"
30 CLOSE1
```

BOLD

ESC F
27 70
1Bh 46h

Disable the Bold print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(70);
30 CLOSE1
```

ESC 4
27 52
1Bh 34h

Select the **Italic** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(52);"ITALIC"
30 CLOSE1
```

ITALIC

ESC 5
27 53
1Bh 35h

Disable the **Italic** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(53);
30 CLOSE1
```

SI
15
0Fh

Select the **CONDENSED** spacing mode (17.1 chars/inch)

```
10 OPEN1,4
20 PRINT#1,CHR$(15);"CONDENSED"
30 CLOSE1
```

ESC SI
27 15
1Bh 0Fh

Same as **SI** (Condensed 17.1 chars/inch)

ESC M
27 77
1Bh 4Dh

Select the **ELITE** spacing mode (12 chars/inch).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(77);"PICA"
30 CLOSE1
```

DC2
18
12h

Select the **PICA** spacing mode (10 chars/inch). This is the default spacing.

```
10 OPEN1,4
20 PRINT#1,CHR$(18);"PICA"
30 CLOSE1
```

ESC P
27 80
1Bh 50h

Same as **DC2** (PICA 10 chars/inch)

ESC S 0
27 83 48
1Bh 53h 30h

Select the **Superscript** print mode. Characters are half high than the normal height and are printer on the upper half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(48);"SUPERSCRIPT"
30 CLOSE1
```

ESC S 1
27 83 49
1Bh 53h 31h

Select the **Subscript** print mode. Characters are half high than the normal height and are printer on the lower half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(49);"SUBSCRIPT"
30 CLOSE1
```

ESC T
27 84
1Bh 54h

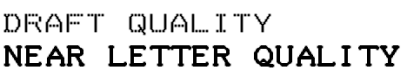
Disable Superscript and Subscript print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(84);
30 CLOSE1
```

ESC x n
27 120 n
1Bh 78h n

If n=0, select standard quality mode (Draft)
If n=1, select near letter quality mode (NLQ)

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(120);CHR$(n);
30 CLOSE1
```



ESC p n
27 112 n
1Bh 70h n

Proportional spacing ON/OFF
This command is ignored by Ultimate Virtual Printer.

ESC ! n
27 33 n
1Bh 21h n

Select graphical layout for text. This is a composite of multiple attributes set by only one command. Value n is taken from this table:

n	U	I	W	S	B	C	E
0							
1							•
2							
3							•
4						•	
5							•
6						•	
7							•
8					•		
9					•		•
10					•		
11					•		•
12					•	•	
13					•		•
14					•	•	
15					•		•
16				•			
17				•			•
18				•			
19				•			•
20				•		•	
21				•			•

n	U	I	W	S	B	C	E
86		•		•		•	
87		•		•			•
88		•		•	•		
89		•		•	•		•
90		•		•	•		
91		•		•	•		•
92		•		•	•	•	
93		•		•	•		•
94		•		•	•	•	
95		•		•	•		•
96		•	•				
97		•	•				•
98		•	•				
99		•	•				•
100		•	•			•	
101		•	•				•
102		•	•			•	
103		•	•				•
104		•	•		•		
105		•	•		•		•
106		•	•		•		
107		•	•		•		•

n	U	I	W	S	B	C	E
172	•		•		•	•	
173	•		•		•		•
174	•		•		•	•	
175	•		•		•		•
176	•		•	•			
177	•		•	•			•
178	•		•	•			
179	•		•	•			•
180	•		•	•		•	
181	•		•	•			•
182	•		•	•		•	
183	•		•	•			•
184	•		•	•	•		
185	•		•	•	•		•
186	•		•	•	•		
187	•		•	•	•		•
188	•		•	•	•	•	
189	•		•	•	•		•
190	•		•	•	•	•	
191	•		•	•	•		•
192	•	•					
193	•	•					•

22				•		•	
23				•			•
24				•	•		
25				•	•		•
26				•	•		
27				•	•		•
28				•	•	•	
29				•	•		•
30				•	•	•	
31				•	•		•
32			•				
33			•				•
34			•				
35			•				•
36			•			•	
37			•				•
38			•			•	
39			•				•
40			•		•		
41			•		•		•
42			•		•		
43			•		•		•
44			•		•	•	
45			•		•		•
46			•		•	•	
47			•		•		•
48			•	•			
49			•	•			•
50			•	•			
51			•	•			•
52			•	•		•	
53			•	•			•
54			•	•		•	
55			•	•			•
56			•	•	•		
57			•	•	•		•
58			•	•	•		
59			•	•	•		•
60			•	•	•	•	
61			•	•	•		•
62			•	•	•	•	
63			•	•	•		•
64		•					
65		•					•
66		•					
67		•					•
68		•				•	
69		•					•
70		•				•	
71		•					•
72		•			•		
73		•			•		•
74		•			•		
75		•			•		•
76		•			•	•	
77		•			•		•
78		•			•	•	
79		•			•		•
80		•		•			
81		•		•			•
82		•		•			
83		•		•			•
84		•		•		•	
85		•		•			•

108		•	•		•	•	
109		•	•		•		•
110		•	•		•	•	
111		•	•		•		•
112		•	•	•			
113		•	•	•			•
114		•	•	•			
115		•	•	•			•
116		•	•	•		•	
117		•	•	•			•
118		•	•	•		•	
119		•	•	•			•
120		•	•	•	•		
121		•	•	•	•		•
122		•	•	•	•		
123		•	•	•	•		•
124		•	•	•	•	•	
125		•	•	•	•		•
126		•	•	•	•	•	
127		•	•	•	•		•
128	•						
129	•						•
130	•						
131	•						•
132	•					•	
133	•						•
134	•					•	
135	•						•
136	•				•		
137	•				•		•
138	•				•		
139	•				•		•
140	•				•	•	
141	•				•		•
142	•				•	•	
143	•				•		•
144	•			•			
145	•			•			•
146	•			•			
147	•			•			•
148	•			•		•	
149	•			•			•
150	•			•		•	
151	•			•			•
152	•			•	•		
153	•			•	•		•
154	•			•	•		
155	•			•	•		•
156	•			•	•	•	
157	•			•	•		•
158	•			•	•	•	
159	•			•	•		•
160	•		•				
161	•		•				•
162	•		•				
163	•		•				•
164	•		•			•	
165	•		•				•
166	•		•			•	
167	•		•				•
168	•		•		•		
169	•		•		•		•
170	•		•		•		
171	•		•		•		•

194	•	•					
195	•	•					•
196	•	•				•	
197	•	•					•
198	•	•				•	
199	•	•					•
200	•	•			•		
201	•	•			•		•
202	•	•			•		
203	•	•			•		•
204	•	•			•	•	
205	•	•			•		•
206	•	•			•	•	
207	•	•			•		•
208	•	•		•			
209	•	•		•			•
210	•	•		•			
211	•	•		•			•
212	•	•		•		•	
213	•	•		•			•
214	•	•		•		•	
215	•	•		•			•
216	•	•		•	•		
217	•	•		•	•		•
218	•	•		•	•		
219	•	•		•	•		•
220	•	•		•	•	•	
221	•	•		•	•		•
222	•	•		•	•	•	
223	•	•		•	•		•
224	•	•	•				
225	•	•	•				•
226	•	•	•				
227	•	•	•				•
228	•	•	•			•	
229	•	•	•				•
230	•	•	•			•	
231	•	•	•				•
232	•	•	•		•		
233	•	•	•		•		•
234	•	•	•		•		
235	•	•	•		•		•
236	•	•	•		•	•	
237	•	•	•		•		•
238	•	•	•		•	•	
239	•	•	•		•		•
240	•	•	•	•			
241	•	•	•	•			•
242	•	•	•	•			
243	•	•	•	•			•
244	•	•	•	•		•	
245	•	•	•	•			•
246	•	•	•	•		•	
247	•	•	•	•			•
248	•	•	•	•	•		
249	•	•	•	•	•		•
250	•	•	•	•	•		
251	•	•	•	•	•		•
252	•	•	•	•	•	•	
253	•	•	•	•	•		•
254	•	•	•	•	•	•	
255	•	•	•	•	•		•

U: Underline, I:Italic, W:Double width, S:Double strike, B:Bold, C:Condensed, E:Elite

6.2.3. Paper feeding

LF
10
0Ah

A **Line Feed** returns the print head to le left margin and advances the paper to the next line (behavior is LF+CR).

```
10 OPEN1,4
20 PRINT#1,CHR$(10);
30 CLOSE1
```

CR
13
0Dh

A **Carriage Return** returns the print head to le left margin but stays on the same line (behavior is CR only, no LF).

```
10 OPEN1,4
20 PRINT#1,CHR$(13);
30 CLOSE1
```

FF
12
0Ch

A **Form Feed** prints the current page to a PNG file and then continues printing on the first line of a new blank page.

```
10 OPEN1,4
20 PRINT#1,CHR$(12);
30 CLOSE1
```

ESC 0
27 48
1Bh 30h

Select vertical spacing **1/8"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(48);
30 CLOSE1
```

ESC 1
27 49
1Bh 31h

Select vertical spacing **7/72"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(49);
30 CLOSE1
```

ESC 2
27 50
1Bh 32h

Select vertical spacing **1/6"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(50);
30 CLOSE1
```

ESC 3 n
27 51 n
1Bh 32h n

Select vertical spacing **n/216"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(51);CHR$(37)"37/216 inch"
30 CLOSE1
```

ESC A n
27 65 n
1Bh 41h n

Select vertical spacing **n/72"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(65);CHR$(8)"8/72 inch for one pass BIM"
30 CLOSE1
```

ESC J n
27 74 n
1Bh 4Ah n

Skip down **n/216"** of paper.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(74);CHR$(70)"70/216 inch skipped"
30 CLOSE1
```

ESC j n
27 106 n
1Bh 6Ah n

Reverse paper feed **n/216**" up.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(106);CHR$(70)"70/216 inch up"
30 CLOSE1
```

6.2.4. Format control

BS
8
08h

Backspace, go back one character. Left character is not erased and next character will be printed over it. You can combine characters this way.

```
10 OPEN1,4
20 PRINT#1,"a";CHR$(8)"^ to print a with a circumflex";
30 CLOSE1
```

ESC C n
27 67 n
1Bh 43h n

Defines the page length in number of lines (range 1-127). Current line spacing is used to calculate form length.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(1-127);
30 CLOSE1
```

ESC C NUL n
27 67 0 n
1Bh 43h 00h n

Defines the page length in inches (range 1-22).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(0);CHR$(1-22);
30 CLOSE1
```

ESC l n
27 108 n
1Bh 6Ch n

Defines the left margin in number of characters. Current char pitch is used to calculate margin position in the line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(108);CHR$(10)
30 PRINT#1,"MARGIN LEFT AT 10"
40 CLOSE1
```

ESC Q n
27 81 n
1Bh 51h n

Defines the right margin in number of characters. Current char pitch is used to calculate margin position in the line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(81);CHR$(70)
30 PRINT#1,"RIGHT MARGIN AT 70"
40 CLOSE1
```

ESC N m
27 78 m
1Bh 4Eh m

Define the **Bottom of Form** (BOF) in number "m" of lines at the end of the page that are skipped to jump over perforations when using continuous paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(78);CHR$(m);
30 CLOSE1
```

ESC O
27 79

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate Virtual Printer.

1Bh 4Fh

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(79);
30 CLOSE1
```

ESC 8
27 56
1Bh 38h

Disable the end of paper detector to be able to print until the end of the paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(56);
30 CLOSE1
```

ESC 9
27 57
1Bh 39h

Enable the end of paper detector.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(57);
30 CLOSE1
```

TAB
9
09h

This is the traditional **horizontal tabulation**. Head jumps to the next tabulation stop. Default stops are located every 8 PICA character position since the beginning of a line.

```
10 OPEN1,4
20 PRINT#1,CHR$(9);"THIS IS THE PRINT POSITION 8"
30 CLOSE1
```

VT
11
0Bh

Jump to next **vertical tabulation** stop. There is no Carriage Return. No default stops are defined. If no vertical stops are defined, it will jump one line, same as LF.

```
10 OPEN1,4
20 PRINT#1,CHR$(11);"JUMPED TO NEXT VERTICAL TAB STOP"
30 CLOSE1
```

ESC B n_1 … 0
27 66 n_1 … 0
1Bh 42h n_1 … 0

Define the **vertical tabulation stop program**. Each value **n** represents a line number where to set a vertical tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created. Current line spacing is used to calculate tab position in the page.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(66);CHR$(5);CHR$(10);CHR$(15);CHR$(0)
30 CLOSE1
```

ESC D n_1 … 0
27 68 n_1 … 0
1Bh 44h n_1 … 0

Define the **horizontal tabulation stop program**. Each value **n** represents a character position where to set a tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created. Current char pitch is used to calculate tab position in the line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(68);CHR$(10);CHR$(20);CHR$(30);CHR$(0)
30 CLOSE1
```

ESC b m n_1 ... 0
27 98 m n_1 ... 0
1Bh 62h m n_1 ... 0

Define a **vertical tabulation stop program**. You can define up to 8 programs (**m**=0-7). Each value **n** represents a line number where to set a vertical tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created per program. Current line spacing is used to calculate tab position in the page. Use **ESC /** to activate the program. Previous command **ESC B** modifies only the current program. Default current program is 0.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(98);CHR$(7);CHR$(5);CHR$(25);CHR$(0)
30 CLOSE1
```

ESC / n
27 47 n
1Bh 2Fh n

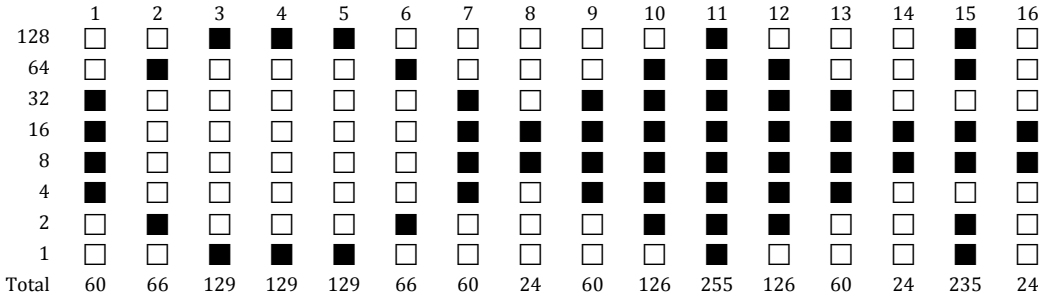
Activate one of the 8 possible vertical tabulation stop programs. Value **n** is program number from 0 to 7.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(47);CHR$(n);
30 CLOSE1
```

6.2.5. Graphic Bitmap

Epson emulation can print bitmap data. An image is defined by a bit array of 8 rows. Each column is encoded in a byte, MSB is up. Horizontal definition can be one of 60, 120 or 240 dpi. Vertical definition is 72 dpi.

Example for a 16 columns array:



Prior to BIM printing you need to change the line spacing to match the graphic height. Standard line height in graphic mode is 1/9" (8/72") if you use 8 dots or 7/27" if you use 7 dots.

ESC K ...
27 75 ...
1Bh 4Bh ...

Select the **Bit Image Mode** in simple density. You have to provide parameters **n m** $\mathbf{d_1}$ $\mathbf{d_2}$ **...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
$\mathbf{d_1}$ $\mathbf{d_2}$ **...** are the bitmap data to print. Default resolution using **ESC K** is 60 dpi but it can be changed using command **ESC ?**

```
10 OPEN1,4
20 A$=CHR$(27)+CHR$(75)+CHR$(16)+CHR$(0);
30 FOR I=1 TO 16
40 READ A:A$=A$+CHR$(A)
50 NEXT I
60 PRINT#1,CHR$(27);CHR$(65);CHR$(8);CHR$(10);CHR$(13)
70 FOR J=1 TO 3
80 PRINT#1,A$;A$;A$;A$;CHR$(10);CHR$(13)
90 NEXT J
```

```
100 CLOSE1
110 END
120 DATA 60,66,129,129,129,66,60,24
130 DATA 60,126,255,126,60,24,235,24
```

ESC L …
27 76 …
1Bh 4Ch …

Select the **Bit Image Mode** in double density, half speed. You have to provide parameters **n m d_1 d_2 …**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 … are the bitmap data to print. Default resolution using **ESC L** is 120 dpi but it can be changed using command **ESC ?**

```
10 OPEN1,4
20 A$=CHR$(27)+CHR$(76)+CHR$(16)+CHR$(0);
30 FOR I=1 TO 16
40 READ A:A$=A$+CHR$(A)
50 NEXT I
60 PRINT#1,CHR$(27);CHR$(65);CHR$(8);CHR$(10);CHR$(13)
70 FOR J=1 TO 3
80 PRINT#1,A$;A$;A$;A$;CHR$(10);CHR$(13)
90 NEXT J
100 CLOSE1
110 END
120 DATA 60,66,129,129,129,66,60,24
130 DATA 60,126,255,126,60,24,235,24
```

ESC Y …
27 89 …
1Bh 59h …

Select the **Bit Image Mode** in double density, normal speed.
On Ultimate Virtual Printer, **ESC Y** behaves the same as **ESC L**

ESC Z …
27 90 …
1Bh 5Ah …

Select the **Bit Image Mode** in quadruple density, half speed. You have to provide parameters **n m d_1 d_2 …**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 … are the bitmap data to print. Default resolution using **ESC Z** is 240 dpi but it can be changed using command **ESC ?**

```
10 OPEN1,4
20 A$=CHR$(27)+CHR$(90)+CHR$(16)+CHR$(0);
30 FOR I=1 TO 16
40 READ A:A$=A$+CHR$(A)
50 NEXT I
60 PRINT#1,CHR$(27);CHR$(65);CHR$(8);CHR$(10);CHR$(13)
70 FOR J=1 TO 3
80 PRINT#1,A$;A$;A$;A$;CHR$(10);CHR$(13)
90 NEXT J
100 CLOSE1
110 END
```

```
120 DATA 60,66,129,129,129,66,60,24
130 DATA 60,126,255,126,60,24,235,24
```

ESC * ...
27 42 ...
1Bh 2Ah ...

Select the **Bit Image Mode** with provided density. You have to provide parameters **d n m d_1 d_2 ...**
Value **d** is horizontal density as shown in this table :

d	DENSITY	DESCRIPTION	MAX DOTS/LINE
0	60 dpi	Single	480
1	120 dpi	Double	960
2	120 dpi	Hi-speed double (same as 1 in Ultimate)	960
3	240 dpi	Quadruple	1920
4	80 dpi	CRT screen	640
5	72 dpi	Plotter	576
6	90 dpi	Hi-res CRT	720

Values **n** and **m** are the 16 bit encoded amount of bitmap data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

ESC ? n m
27 63 n m
1Bh 3Fh n m

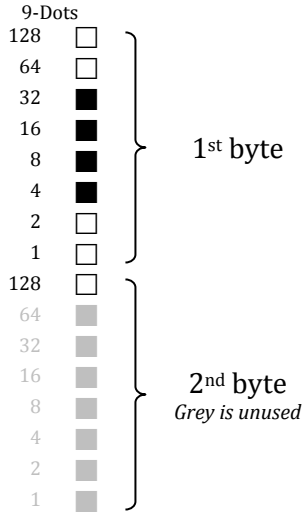
Change density for bitmap commands. Value **n** is one from **K**, **L**, **Y** or **Z**. Value m is the new density for the command (see table in **ESC *** description).

Example, to change density of ESC L to 80dpi :

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(63);"L";CHR$(4)
30 CLOSE1
```

ESC ^ …
27 94 …
1Bh 5Eh …

Select the **Bit Image Mode** using all the 9 pin of the head. You have to provide parameters **d n m h_1 l_1 h_2 l_2 …**
Value **d** is density. Only 0 and 1 are allowed for single (60dpi) or double density (120 dpi).
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
h_1 l_1 h_2 l_2 … are the bitmap data to print. Values **h_n** encode the upper 8 dots and values **l_n** encode the lower dot in the MSB bit (2^7=128). This needs double of data for just one more dot.



6.2.6. Charset selection

FX-80/JX-80 emulation uses ASCII7 to encode characters. This allows only 128 combinations to address characters. When MSB is set to 1 the character is printed using Italic (MSB is 2^7=128).

ESC 7
27 55
1Bh 37h

Select Basic character table. This is the default charset for FX-80/JX-80 printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(55);
30 CLOSE1
```

ESC R n
27 82 n
1Bh 52h n

Select National character table. Value **n** selects the character table:

n	NATIONAL CHARACTER TABLE
0	USA
1	France
2	Germany
3	UK
4	Denmark I
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
10	Denmark II

See national charset changes compared to basic charset in chapter 10.3

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(82);CHR$(1);"FRENCH CHARSET"
30 CLOSE1
```

ESC I 1
27 73 1
1Bh 49h 01h

Enable the extension of the character table. Parameter 1 can be passed using the '1' character (33, 31h). See table in chapter 10.2 for details about extended charset.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(73);CHR$(1);"EXTENDED CHARSET ENABLED"
30 CLOSE1
```

ESC I 0
27 73 0
1Bh 49h 00h

Disable the extension of the character table. Parameter 0 can be passed using the '0' character (32, 30h).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(73);CHR$(0);"EXTENDED CHARSET DISABLED"
30 CLOSE1
```

ESC 6
27 54
1Bh 36h

Extend only the italic part of the printable charset
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(54);
30 CLOSE1
```

6.2.7. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate Virtual Printer. The commands are understood and correctly interpreted but ignored to skip them gently.

ESC : 000
27 58 0 0 0
1Bh 3Ah 0 0 0

Copy standard character generator from ROM to RAM.
This command is ignored by Ultimate Virtual Printer.

ESC & 0
27 38 0
1Bh 26h 00h

This code has to be followed by parameters **n m a** $\mathbf{p_1}$ $\mathbf{p_2}$...$\mathbf{p_{11}}$ which represents decimal byte codes to describe characters to load.

0 is code 0, always present.
n ASCII code of first redefined char
m ASCII code of last redefined char (n=m if only one char to define)

next parameters are repeated for each defined char.

a This parameter tells which needles have to be used to print that character. Head has 9 needles of which 8 can be used here.
a = 0 : use the 8 upper needles
a = 1 : use the 8 lower needles

$\mathbf{p_1}$ $\mathbf{p_2}$...$\mathbf{p_{11}}$ Represents the 11 columns defining the dots printed for the character.

In the 8x11 matrix you have to remind that a dot active in a column cannot be active in the next column to let the head recycle. Ultimate Virtual Printer does not suffer from this limitation.

ESC % n
27 37 n
1Bh 25h n
If n=1 select RAM (special characters) and if n=0 select ROM (standard characters)
This command is ignored by Ultimate Virtual Printer.

6.2.8. Other commands

DC1
17
11h
Select the printer. Wake up the printer if the printer has been disabled with DC3.
This command is ignored by Ultimate Virtual Printer.

DC3
19
13h
Suspend the printer. The printer will ignore the input data until DC1 is sent.
This command is ignored by Ultimate Virtual Printer.

CAN
24
18h
Cancel the current job and clear printer buffer.
This command is ignored by Ultimate Virtual Printer.

ESC =
27 61
1Bh 3Dh
Force **bit 7** (MSB) to 0. All data received will have its bit 7 cleared except commands.
This command is ignored by Ultimate Virtual Printer.

ESC >
27 62
1Bh 3Eh
Force **bit 7** (MSB) to 1. All data received will have its bit 7 set except commands.
This command is ignored by Ultimate Virtual Printer.

ESC #
27 35
1Bh 23h
Clear **bit 7** (MSB) forcing.
This command is ignored by Ultimate Virtual Printer.

ESC <
27 60
1Bh 3Ch
Set **left to right** printing for one line.
This command is ignored by Ultimate Virtual Printer.

ESC @
27 64
1Bh 40h
Initialize the printer. Set all parameters to default values. Paper and head are not moved.

ESC U n
27 85 n
1Bh 30h n
Select **Mono/Bidirectional** printing.
This command is ignored by Ultimate Virtual Printer.
n=0 : bidirectional
n=1 : mono-directional (left to right) for better alignment.

ESC i n
27 105 n
1Bh 69h n
Immediate character printing ON/OFF like a typewriter.
This command is ignored by Ultimate Virtual Printer.
n=1 : immediate printing ON (incompatible with continuous paper feeding)
n=0 : immediate printing OFF

ESC s n
Half speed printing ON/OFF to make less noise.
This command is ignored by Ultimate Virtual Printer.
n=1 : half speed
n=0 : full speed

DEL
127
Delete the last printable character from buffer.
This command is ignored by Ultimate Virtual Printer.

7Fh

IBM Graphics Printer commands

This chapter describes the commands the printer can understand when using the IBM Graphics Printer emulation. The power of IBM printers resides in its charsets using ASCII8.

7.1. Secondary address

Secondary address on OPEN command is not used by IBM Graphics Printer emulation.

7.2. Commands

7.2.1. Color printing

ESC b
27 98
1Bh 62h

Select the **Black** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(98);"black"
30 CLOSE1
```

BLACK

ESC m
27 109
1Bh 6Dh

Select the **Magenta** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(109);"magenta"
30 CLOSE1
```

MAGENTA

ESC c
27 99
1Bh 63h

Select the **Cyan** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(99);"cyan"
30 CLOSE1
```

CYAN

ESC y
27 121
1Bh 79h

Select the **Yellow** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(121);"yellow"
30 CLOSE1
```

YELLOW

ESC r n
27 114 n
1Bh 72h n

Select the ribbon color depending on parameter "n" as described on this table:

n	COLOR	
0	BLACK	1 pass
1	MAGENTA	1 pass
2	CYAN	1 pass
3	VIOLET	1 pass MAGENTA + 1 pass CYAN
4	YELLOW	1 pass
5	ORANGE	1 pass MAGENTA + 1 pass YELLOW
6	GREEN	1 pass CYAN + 1 pass YELLOW

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(114);CHR$(n);
30 CLOSE1
```

BLACK
MAGENTA
CYAN
VIOLET
YELLOW
ORANGE
GREEN

7.2.2. Graphical operations

ESC G
27 71
1Bh 47h

Select the **Double Strike** print mode. Characters are printed twice and paper is lifted 1/216" between the two passes.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(71);"DOUBLE STRIKE"
30 CLOSE1
```

double strike

ESC H
27 72
1Bh 48h

Disable **Double Strike** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(72);
30 CLOSE1
```

SO
14
0Eh

Select the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(14);"DOUBLE WIDTH"
30 CLOSE1
```

DOUBLE WIDTH

DC4
20
14h

Disable the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(20);
30 CLOSE1
```

ESC SO
27 14
1Bh 0Eh

Same as **SO** (Double Width print mode ON).

ESC W 1
27 87 1
1Bh 57h 01h

Same as **SO** (Double Width ON). 1 can be sent with ASCII code of '1' (49 - 31h)

ESC W 0
27 87 0
1Bh 57h 00h

Same as **DC4** (Double Width OFF). 0 can be sent with ASCII code of '0' (48 - 30h)

ESC – 1
27 45 49
1Bh 2Dh 31h

Select the **Underline** print mode for all characters and spaces that follow.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"
30 CLOSE1
```

UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h

Disable the Underline print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);
30 CLOSE1
```

ESC E
27 69
1Bh 45h

Select the **Bold** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(69);"BOLD"
30 CLOSE1
```

BOLD

ESC F
27 70
1Bh 46h

Disable the Bold print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(70);
30 CLOSE1
```

ESC 4
27 52
1Bh 34h

Select the **Italic** print mode.
This feature has been added in Ultimate Virtual Printer and does not exist in a real MPS-1550C printer. Italic was not supported in IBM Graphics Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(52);"ITALIC"
30 CLOSE1
```

ITALIC

ESC 5
27 53
1Bh 35h

Disable the **Italic** print mode.
This feature has been added in Ultimate Virtual Printer and does not exist in a real MPS-1550C printer. Italic was not supported in IBM Graphics Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(53);
30 CLOSE1
```

SI
15
0Fh

Select the **CONDENSED** spacing mode (17.1 chars/inch)

```
10 OPEN1,4
20 PRINT#1,CHR$(15);"CONDENSED"
30 CLOSE1
```

ESC M
27 77
1Bh 4Dh

Select the **ELITE** spacing mode (12 chars/inch).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(77);"PICA"
30 CLOSE1
```

DC2
18
12h

Select the **PICA** spacing mode (10 chars/inch). This is the default spacing.

```
10 OPEN1,4
20 PRINT#1,CHR$(18);"PICA"
30 CLOSE1
```

ESC [n
27 91 n
1Bh 5Bh n

Select the spacing mode depending on parameter "n" as described on this table:

n	SPACING	
0	PICA	10 chars/inch
1	ELITE	12 chars/inch
2	MICRO	15 chars/inch
3	CONDENSED	17.1 chars/inch
4	PICA COMPRESSED	20 chars/inch
5	ELITE COMPRESSED	24 chars/inch
6	MICRO COMPRESSED	30 chars/inch

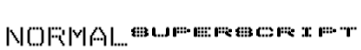
```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(91);CHR$(n);
30 CLOSE1
```

```
PICA                    Draft Regular
ELITE                   Draft Regular
MICRO                   Draft Regular
CONDENSED               Draft Regular
PICA COMPRESSED         Draft Regular
ELITE COMPRESSED        Draft Regular
MICRO COMPRESSED        Draft Regular
```

ESC S 0
27 83 48
1Bh 53h 30h

Select the **Superscript** print mode. Characters are half high than the normal height and are printer on the upper half interline.

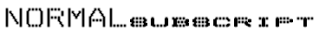
```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(48);"SUPERSCRIPT"
30 CLOSE1
```



ESC S 1
27 83 49
1Bh 53h 31h

Select the **Subscript** print mode. Characters are half high than the normal height and are printer on the lower half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(49);"SUBSCRIPT"
30 CLOSE1
```



ESC T
27 84
1Bh 54h

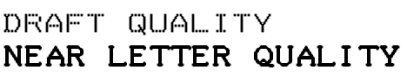
Disable Superscript and Subscript print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(84);
30 CLOSE1
```

ESC x n
27 120 n
1Bh 78h n

If n=0, select standard quality mode (Draft)
If n=1, select near letter quality mode (NLQ)

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(120);CHR$(n);
30 CLOSE1
```



ESC ! n
27 33 n
1Bh 21h n

Select graphical layout for text.
This feature has been added in Ultimate Virtual Printer and does not exist in a real MPS-1550C printer. See EPSON-FX80 command description page 24 for details.

7.2.3. Paper feeding

LF
10
0Ah

A **Line Feed** advances the paper to the next line (behavior is LF only, no CR).

```
10 OPEN1,4
20 PRINT#1,CHR$(10);
30 CLOSE1
```

CR
13
0Dh

A **Carriage Return** returns the print head to le left margin but stays on the same line (behavior is CR only, no LF).

```
10 OPEN1,4
20 PRINT#1,CHR$(13);
30 CLOSE1
```

FF
12
0Ch

A **Form Feed** prints the current page to a PNG file and then continues printing on the first line of a new blank page.

```
10 OPEN1,4
20 PRINT#1,CHR$(12);
30 CLOSE1
```

ESC 0
27 48
1Bh 30h

Select vertical spacing **1/8"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(48);
30 CLOSE1
```

ESC 1
27 49
1Bh 31h

Select vertical spacing **7/72"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(49);
30 CLOSE1
```

ESC 2
27 50
1Bh 32h

Select vertical spacing **1/6"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(50);
30 CLOSE1
```

ESC 3 n
27 51 n
1Bh 32h n

Select vertical spacing **n/216"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(51);CHR$(37)"37/216 inch"
30 CLOSE1
```

ESC A n
27 65 n
1Bh 41h n

Select vertical spacing **n/72"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(65);CHR$(8)"8/72 inch for one pass BIM"
30 CLOSE1
```

ESC J n
27 74 n
1Bh 4Ah n

Skip down **n/216"** of paper.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(74);CHR$(70)"70/216 inch skipped"
30 CLOSE1
```

7.2.4. Format control

BS
8
08h

Backspace, go back one character. Left character is not erased and next character will be printed over it. You can combine characters this way.

```
10 OPEN1,4
20 PRINT#1,"a";CHR$(8)"^ to print a with a circumflex";
30 CLOSE1
```

ESC C n

Defines the page length in number of lines (range 1-127). Current line spacing is

27 67 n
1Bh 43h n

used to calculate form length.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(1-127);
30 CLOSE1
```

ESC C NUL n
27 67 0 n
1Bh 43h 00h n

Defines the page length in inches (range 1-22).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(0);CHR$(1-22);
30 CLOSE1
```

ESC N m
27 78 m
1Bh 4Eh m

Define the **Bottom of Form** (BOF) in number "m" of lines at the end of the page that are skipped to jump over perforations when using continuous paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);CHR$(78);CHR$(m);
30 CLOSE1
```

ESC O
27 79
1Bh 4Fh

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(79);
30 CLOSE1
```

ESC 8
27 56
1Bh 38h

Disable the end of paper detector to be able to print until the end of the paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(56);
30 CLOSE1
```

ESC 9
27 57
1Bh 39h

Enable the end of paper detector.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(57);
30 CLOSE1
```

TAB
9
09h

This is the traditional **horizontal tabulation**. Head jumps to the next tabulation stop. Default stops are located every 8 PICA character position since the beginning of a line.

```
10 OPEN1,4
20 PRINT#1,CHR$(9);"THIS IS THE PRINT POSITION 8"
30 CLOSE1
```

VT
11
0Bh

The same behavior as **LF**. Advances the paper to the next line (no CR).

```
10 OPEN1,4
20 PRINT#1,CHR$(11);"JUMPED ONE LINE"
30 CLOSE1
```

ESC D n_1 ... 0
27 68 n_1 ... 0
1Bh 44h n_1 ... 0

Define the **horizontal tabulation stop program**. Each value **n** represents a character position where to set a tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created. Current char pitch is used to calculate tab position in the line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(68);CHR$(10);CHR$(20);CHR$(30);CHR$(0)
30 CLOSE1
```

7.2.5. Graphic Bitmap

IBM Graphics Printer emulation prints bitmap data the same way as EPSON. An image is defined by a bit array of 8 rows. Each column is encoded in a byte, MSB is up. Horizontal definition can be one of 60, 120 or 240 dpi. Vertical definition is 72 dpi. See Graphic Bitmap for EPSON page 29 for details.

ESC K ...
27 75 ...
1Bh 4Bh ...

Select the **Bit Image Mode** in simple density (60 dpi). You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 29 for an example.

ESC L ...
27 76 ...
1Bh 4Ch ...

Select the **Bit Image Mode** in double density (120 dpi), half speed. You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 30 for an example.

ESC Y ...
27 89 ...
1Bh 59h ...

Select the **Bit Image Mode** in double density (120 dpi), normal speed.
On Ultimate Virtual Printer, **ESC Y** behaves the same as **ESC L**

ESC Z ...
27 90 ...
1Bh 5Ah ...

Select the **Bit Image Mode** in quadruple density (240 dpi), half speed. You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 30 for an example.

7.2.6. Charset selection

IBM emulation uses ASCII8 to encode characters. This allows 256 combinations to address characters. IBM printers work with 2 character tables. Default is Table 1 described page 63. Table2 is configurable by the user in Ultimate Printer configuration menu from 6 possible international tables. A command can select Table 2 but no command can change the international setting.

ESC 7
27 55
1Bh 37h

Select **Table 1** character set. This is the default charset for IBM printers.

```
10 OPEN1,4
```

```
20 PRINT#1,CHR$(27);CHR$(55);
30 CLOSE1
```

ESC 6
27 54
1Bh 36h

Select **Table 2** character set. This is the international charset user configured.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(54);
30 CLOSE1
```

7.2.7. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate Virtual Printer. The commands are understood and correctly interpreted but ignored to skip them gently.

ESC =
27 61
1Bh 3Dh

This code has to be followed by parameters **m n** and data.
This command is ignored by Ultimate Virtual Printer.

m and **n** are the number of bytes to load in order to have n + (m x 256) = size

ESC I n
27 73 n
1Bh 49h n

Select the print quality depending on parameter "n"

- n=0 standard quality (draft) and normal characters
- n=2 near letter quality (NLQ) and normal characters
- n=4 standard quality (draft) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=0.
- n=6 near letter quality (NLQ) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=2.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(73);CHR$(n);
30 CLOSE1
```

DRAFT QUALITY
NEAR LETTER QUALITY

7.2.8. Other commands

BELL
7
07h

Make a short beep.
This command is ignored by Ultimate Virtual Printer.

CAN
24
18h

Cancel the current job and clear printer buffer.
This command is ignored by Ultimate Virtual Printer.

ESC <
27 60
1Bh 3Ch

Set **left to right** printing for one line.
This command is ignored by Ultimate Virtual Printer.

ESC @
27 64
1Bh 40h

Initialize the printer. Set all parameters to default values. Paper and head are not moved.
This feature has been added in Ultimate Virtual Printer and does not exist in a real

MPS-1550C printer.

ESC U n	Select **Mono/Bidirectional** printing.
27 85 n	This command is ignored by Ultimate Virtual Printer.
1Bh 30h n	n=0 : bidirectional
	n=1 : mono-directional (left to right) for better alignment.

IBM Proprinter commands

This chapter describes the commands the printer can understand when using the IBM Proprinter emulation. This is the less powerful emulation that the MPS-1550C can do. IBM Proprinter was a widely spread printer in the office and business world.

8.1. Secondary address

Secondary address on OPEN command is not used by IBM Proprinter emulation.

8.2. Commands

8.2.1. Color printing

ESC b
27 98
1Bh 62h

Select the **Black** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(98);"black"
30 CLOSE1
```

BLACK

ESC m
27 109
1Bh 6Dh

Select the **Magenta** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(109);"magenta"
30 CLOSE1
```

MAGENTA

ESC c
27 99
1Bh 63h

Select the **Cyan** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(99);"cyan"
30 CLOSE1
```

CYAN

ESC y
27 121
1Bh 79h

Select the **Yellow** ribbon color.

```
10 OPEN1,4,7
20 PRINT#1,CHR$(27);chr$(121);"yellow"
30 CLOSE1
```

YELLOW

8.2.2. Graphical operations

ESC G
27 71
1Bh 47h

Select the **Double Strike** print mode. Characters are printed twice and paper is lifted 1/216" between the two passes.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(71);"DOUBLE STRIKE"
30 CLOSE1
```

double strike

ESC H
27 72
1Bh 48h

Disable **Double Strike** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(27);chr$(72);
30 CLOSE1
```

SO
14
0Eh

Select the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(14);"DOUBLE WIDTH"
30 CLOSE1
```

DOUBLE WIDTH

DC4
20
14h

Disable the **Double Width** print mode

```
10 OPEN1,4
20 PRINT#1,CHR$(20);
30 CLOSE1
```

ESC W 1
27 87 1
1Bh 57h 01h

Same as **SO** (Double Width ON). 1 can be sent with ASCII code of '1' (49 - 31h)

ESC W 0
27 87 0
1Bh 57h 00h

Same as **DC4** (Double Width OFF). 0 can be sent with ASCII code of '0' (48 - 30h)

ESC – 1
27 45 49
1Bh 2Dh 31h

Select the **Underline** print mode for all characters and spaces that follow.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"
30 CLOSE1
```

UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h

Disable the Underline print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);
30 CLOSE1
```

ESC E
27 69
1Bh 45h

Select the **Bold** print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(69);"BOLD"
30 CLOSE1
```

BOLD

ESC F
27 70
1Bh 46h

Disable the Bold print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(70);
30 CLOSE1
```

SI
15
0Fh

Select the **CONDENSED** spacing mode (17.1 chars/inch)

```
10 OPEN1,4
20 PRINT#1,CHR$(15);"CONDENSED"
30 CLOSE1
```

DC2
18
12h

Select the **PICA** spacing mode (10 chars/inch). This is the default spacing.

```
10 OPEN1,4
20 PRINT#1,CHR$(18);"PICA"
30 CLOSE1
```

ESC :
27 58
1Bh 3Ah

Select the **ELITE** spacing mode (12 chars/inch).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(58);"ELITE"
30 CLOSE1
```

ESC S 0
27 83 48
1Bh 53h 30h

Select the **Superscript** print mode. Characters are half high than the normal height and are printer on the upper half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(48);"SUPERSCRIPT"
30 CLOSE1
```

NORMAL SUPERSCRIPT

ESC S 1
27 83 49
1Bh 53h 31h

Select the **Subscript** print mode. Characters are half high than the normal height and are printer on the lower half interline.

```
10 OPEN1,4
20 PRINT#1,"NORMAL";CHR$(27);CHR$(83);CHR$(49);"SUBSCRIPT"
30 CLOSE1
```

NORMAL SUBSCRIPT

ESC T
27 84
1Bh 54h

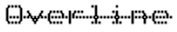
Disable Superscript and Subscript print mode.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(84);
30 CLOSE1
```

ESC _ n
27 95 n
1Bh 5Fh n

Overline ON/OFF. Will print a line over the text.
n=1: enable overline
n=0: disable overline

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(95);CHR$(1);"Overline"
30 CLOSE1
```



8.2.3. Paper feeding

LF
10
0Ah

A **Line Feed** advances the paper to the next line (behavior is LF only, no CR).

```
10 OPEN1,4
20 PRINT#1,CHR$(10);
30 CLOSE1
```

CR
13
0Dh

A **Carriage Return** returns the print head to le left margin but stays on the same line (behavior is CR only, no LF). You can change the LF behavior with **ESC 5** command.

```
10 OPEN1,4
20 PRINT#1,CHR$(13);
30 CLOSE1
```

FF
12
0Ch

A **Form Feed** prints the current page to a PNG file and then continues printing on the first line of a new blank page.

```
10 OPEN1,4
20 PRINT#1,CHR$(12);
30 CLOSE1
```

ESC 0
27 48
1Bh 30h

Select vertical spacing **1/8"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(48);
30 CLOSE1
```

ESC 1
27 49
1Bh 31h

Select vertical spacing **7/72"** between each printed line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(49);
30 CLOSE1
```

ESC 2
27 50
1Bh 32h

Select vertical spacing **1/6"** between each printed line or activate **ESC A** previously prepared line spacing.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(50);
30 CLOSE1
```

ESC 3 n

Select vertical spacing **n/216"** between each printed line.

27 51 n
1Bh 32h n

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(51);CHR$(37)"37/216 inch"
30 CLOSE1
```

ESC 5 n
27 53 n
1Bh 35h n

Automatic LF ON/OFF.
n=1: LF is added on each CR
n=0: LF is not added on each CR

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(53);CHR$(1)"NOW AUTO LF ENABLED"
30 CLOSE1
```

ESC A n
27 65 n
1Bh 41h n

Prepare vertical spacing **n/72"** between each printed line but you will need to activate it with command ESC 2

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(65);CHR$(8)"8/72 inch for one pass BIM"
30 CLOSE1
```

ESC J n
27 74 n
1Bh 4Ah n

Skip down **n/216"** of paper.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(74);CHR$(70)"70/216 inch skipped"
30 CLOSE1
```

8.2.4. Format control

BS
8
08h

Backspace, go back one character. Left character is not erased and next character will be printed over it. You can combine characters this way.

```
10 OPEN1,4
20 PRINT#1,"a";CHR$(8)"^ to print a with a circumflex";
30 CLOSE1
```

ESC C n
27 67 n
1Bh 43h n

Defines the page length in number of lines (range 1-127). Current line spacing is used to calculate form length.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(1-127);
30 CLOSE1
```

ESC C NUL n
27 67 0 n
1Bh 43h 00h n

Defines the page length in inches (range 1-22).

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(67);CHR$(0);CHR$(1-22);
30 CLOSE1
```

ESC N m
27 78 m
1Bh 4Eh m

Define the **Bottom of Form** (BOF) in number "m" of lines at the end of the page that are skipped to jump over perforations when using continuous paper.
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4,7
```

```
20 PRINT#1,CHR$(27);CHR$(78);CHR$(m);
30 CLOSE1
```

ESC O
27 79
1Bh 4Fh

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate Virtual Printer.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(79);
30 CLOSE1
```

ESC 4
27 52
1Bh 34h

Set Top Of Form (TOF). It uses the current print line as the top margin for next pages. This configuration is kept until power off or Printer Reset in the Ultimate action F5 menu.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(52);"NOW THIS IS TOP MARGIN"
30 CLOSE1
```

TAB
9
09h

This is the traditional **horizontal tabulation**. Head jumps to the next tabulation stop. Default stops are located every 8 PICA character position since the beginning of a line.

```
10 OPEN1,4
20 PRINT#1,CHR$(9);"THIS IS THE PRINT POSITION 8"
30 CLOSE1
```

VT
11
0Bh

Jump to next **vertical tabulation** stop. There is no Carriage Return. No default stops are defined. If no vertical stops are defined, it will jump one line, same as LF.

```
10 OPEN1,4
20 PRINT#1,CHR$(11);"JUMPED TO NEXT VERTICAL STOP"
30 CLOSE1
```

ESC B n_1 … 0
27 66 n_1 … 0
1Bh 42h n_1 … 0

Define the **vertical tabulation stop program**. Each value **n** represents a line number where to set a vertical tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created. Current line spacing is used to calculate tab position in the page.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(66);CHR$(5);CHR$(10);CHR$(15);CHR$(0)
30 CLOSE1
```

ESC D n_1 … 0
27 68 n_1 … 0
1Bh 44h n_1 … 0

Define the **horizontal tabulation stop program**. Each value **n** represents a character position where to set a tab stop in ascending order. Last one is 0 to tell that the sequence has ended. Up to 32 stops can be created. Current char pitch is used to calculate tab position in the line.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(68);CHR$(10);CHR$(20);CHR$(30);CHR$(0)
30 CLOSE1
```

ESC R
27 82
1Bh 52h

Clear tab stops. Horizontal stop are set to default (every 8 characters) and vertical stops are deleted.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(82);
30 CLOSE1
```

8.2.5. Graphic Bitmap

IBM Proprinter emulation prints bitmap data the same way as EPSON. An image is defined by a bit array of 8 rows. Each column is encoded in a byte, MSB is up. Horizontal definition can be one of 60, 120 or 240 dpi. Vertical definition is 72 dpi. See Graphic Bitmap for EPSON page 29 for details.

ESC K ...
27 75 ...
1Bh 4Bh ...

Select the **Bit Image Mode** in simple density (60 dpi). You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 29 for an example.

ESC L ...
27 76 ...
1Bh 4Ch ...

Select the **Bit Image Mode** in double density (120 dpi), half speed. You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 30 for an example.

ESC Y ...
27 89 ...
1Bh 59h ...

Select the **Bit Image Mode** in double density (120 dpi), normal speed.
On Ultimate Virtual Printer, **ESC Y** behaves the same as **ESC L**

ESC Z ...
27 90 ...
1Bh 5Ah ...

Select the **Bit Image Mode** in quadruple density (240 dpi), half speed. You have to provide parameters **n m d_1 d_2 ...**
Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d_1 d_2 ... are the bitmap data to print.

See EPSON command description page 30 for an example.

8.2.6. Charset selection

IBM emulation uses ASCII8 to encode characters. This allows 256 combinations to address characters. IBM printers work with 2 character tables. Default is Table 1 described page 63. Table2 is configurable by the user in Ultimate Printer configuration menu from 6 possible international tables. A command can select Table 2 but no command can change the international setting.

ESC 7
27 55
1Bh 37h

Select **Table 1** character set. This is the default charset for IBM printers.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(55);
30 CLOSE1
```

ESC 6
27 54
1Bh 36h

Select **Table 2** character set. This is the international charset user configured.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(54);
30 CLOSE1
```

ESC \ n
27 92 n
1Bh 5Ch n

Print **n** characters from extended table. In the next **n** data, commands will not be interpreted. If a code is not printable it will be replace with a space.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(92);CHR$(3);CHR$(27);CHR$(92);CHR$(54);
30 CLOSE1
```

ESC ^
27 94
1Bh 5Eh

Print **one** character from extended table. The next data byte will not be interpreted as a command. If the code is not printable it will be replace with a space.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(94);CHR$(13);
30 CLOSE1
```

8.2.7. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate Virtual Printer. The commands are understood and correctly interpreted but ignored to skip them gently.

ESC =
27 61
1Bh 3Dh

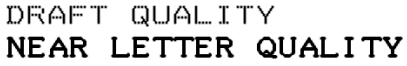
This code has to be followed by parameters **m n** and data.
m and **n** are the number of bytes to load in order to have n + (m x 256) = size
This command is ignored by Ultimate Virtual Printer.

ESC I n
27 73 n
1Bh 49h n

Select the print quality depending on parameter "n"

- n=0 standard quality (draft) and normal characters
- n=2 near letter quality (NLQ) and normal characters
- n=4 standard quality (draft) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=0.
- n=6 near letter quality (NLQ) and special characters created with Down Line Loading (DLL). Not supported on Ultimate Virtual Printer, same behavior as n=2.

```
10 OPEN1,4
20 PRINT#1,CHR$(27);CHR$(73);CHR$(n);
30 CLOSE1
```



8.2.8. Other commands

BELL
7
07h

Make a short beep.
This command is ignored by Ultimate Virtual Printer.

DC1 **17** **11h**	Printer selection. This command is ignored by Ultimate Virtual Printer.
DC3 **19** **13h**	No operation.
CAN **24** **18h**	**Cancel** the current job and clear printer buffer. This command is ignored by Ultimate Virtual Printer.
ESC < **27 60** **1Bh 3Ch**	Set **left to right** printing for one line. This command is ignored by Ultimate Virtual Printer.
ESC @ **27 64** **1Bh 40h**	**Initialize** the printer. Set all parameters to default values. Paper and head are not moved. This feature has been added in Ultimate Virtual Printer and does not exist in a real MPS-1550C printer.
ESC Q **27 81** **1Bh 51h**	De-select printer. This command is ignored by Ultimate Virtual Printer.
ESC U n **27 85 n** **1Bh 30h n**	Select **Mono/Bidirectional** printing. This command is ignored by Ultimate Virtual Printer. n=0 : bidirectional n=1 : mono-directional (left to right) for better alignment.

PETASCII character table

9.1. USA/UK

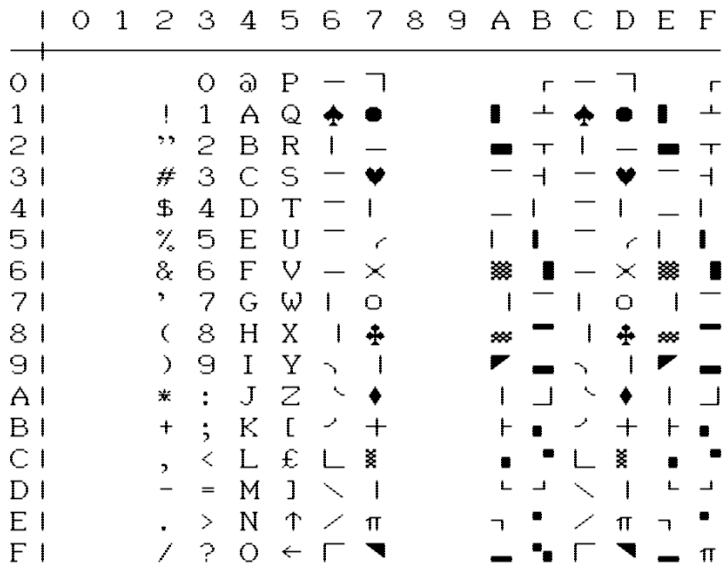


Table 1 : USA/UK Charset in Uppercase/Graphic Mode (Secondary address = 0)

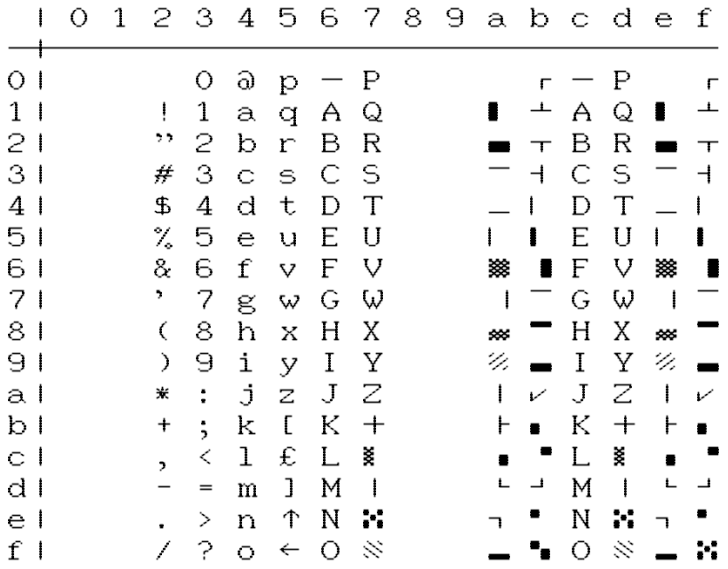


Table 2 USA/UK Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.2. Denmark

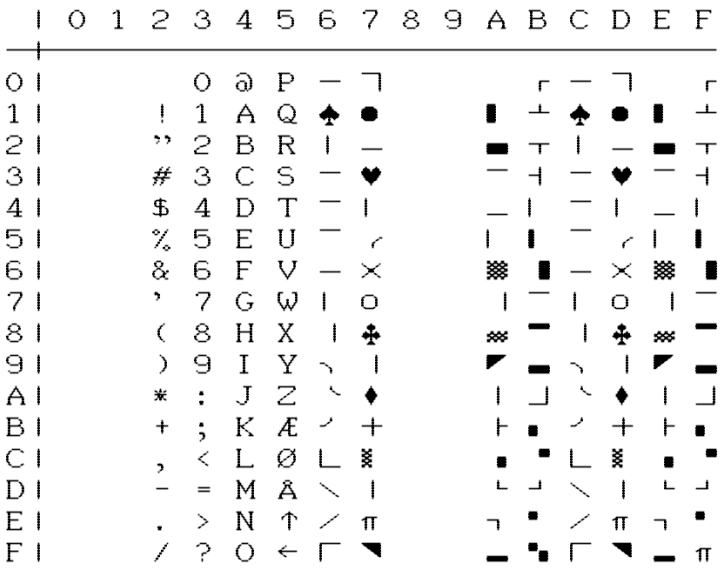


Table 3 : DENMARK Charset in Uppercase/Graphic Mode (Secondary address = 0)

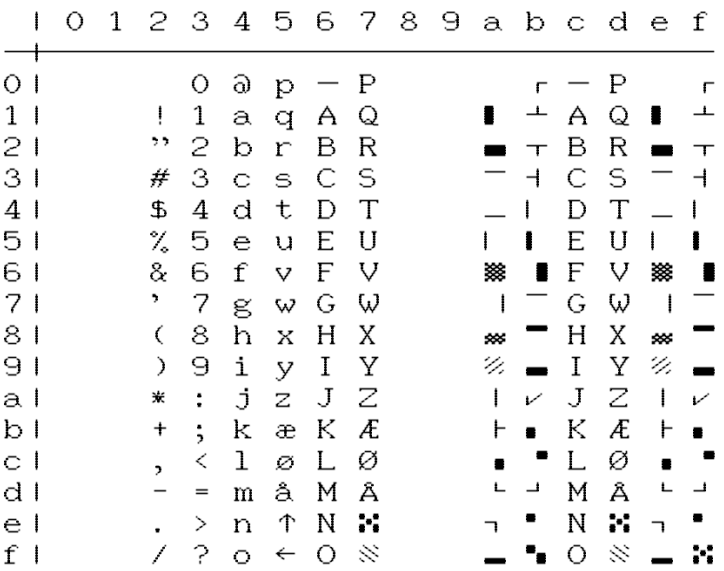


Table 4 DENMARK Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.3. France / Italy

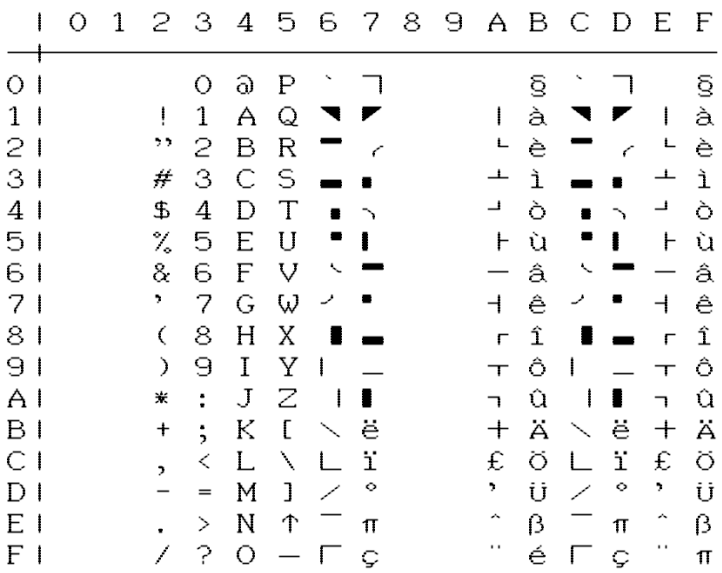


Table 5 : FRANCE/ITALY Charset in Uppercase/Graphic Mode (Secondary address = 0)

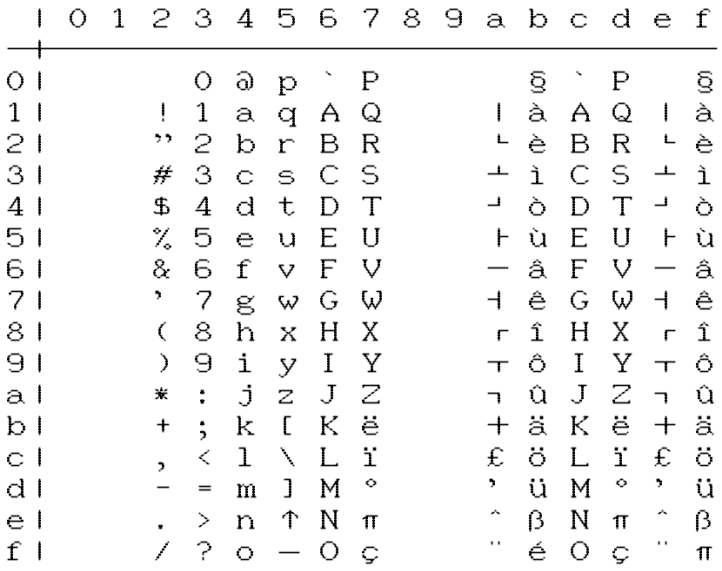


Table 6 FRANCE/ITALY Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.4. Germany

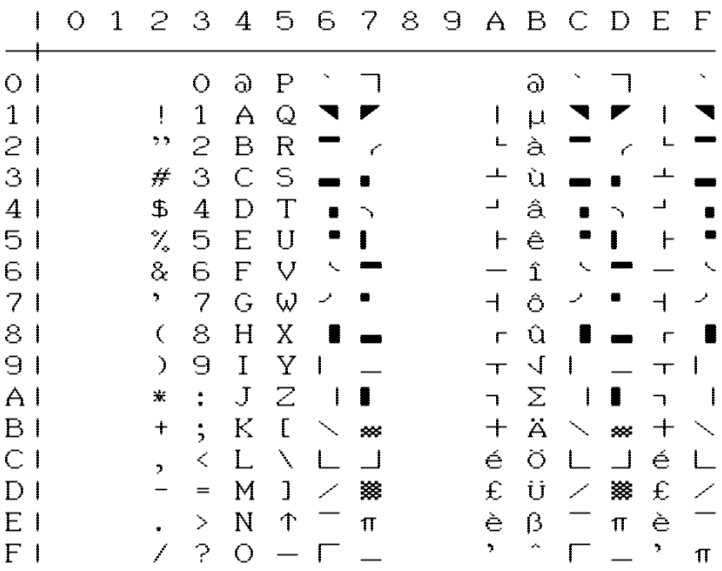


Table 7 : GERMANY Charset in Uppercase/Graphic Mode (Secondary address = 0)

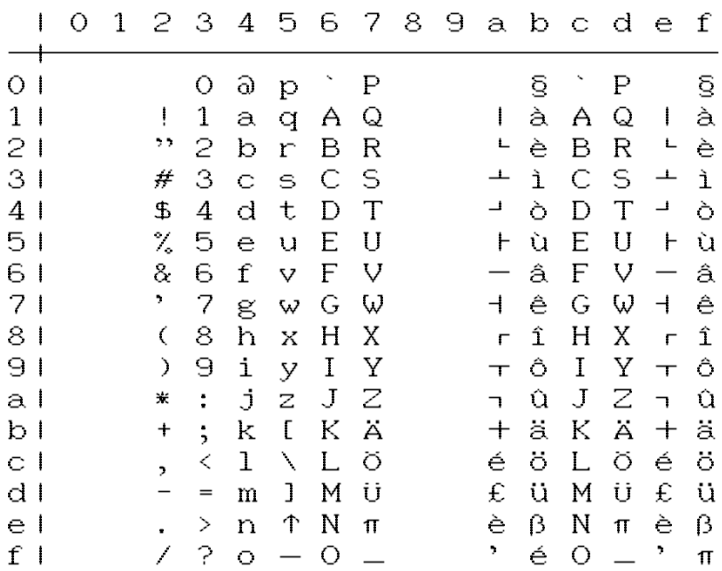


Table 8 GERMANY Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.5. Spain

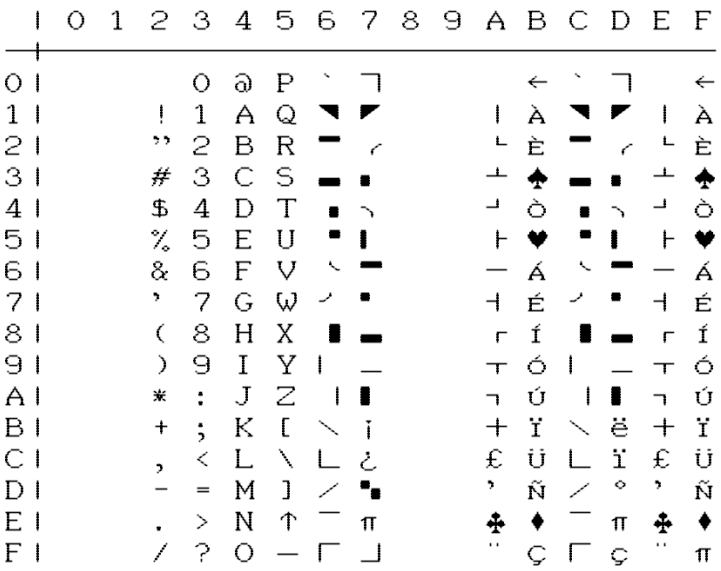


Table 9 : SPAIN Charset in Uppercase/Graphic Mode (Secondary address = 0)

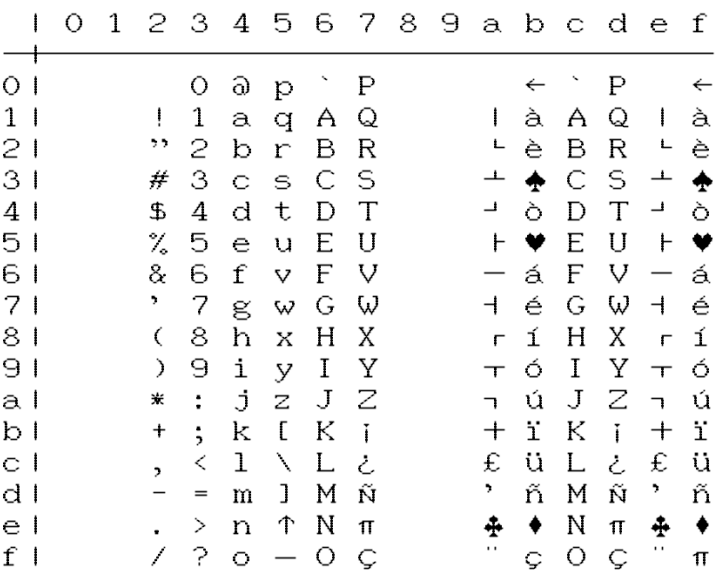


Table 10 SPAIN Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.6. Sweden

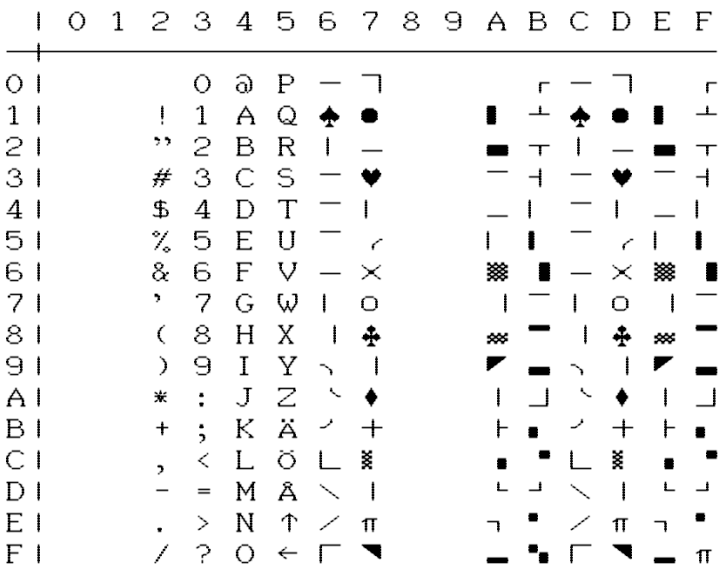


Table 11 : SWEDEN Charset in Uppercase/Graphic Mode (Secondary address = 0)

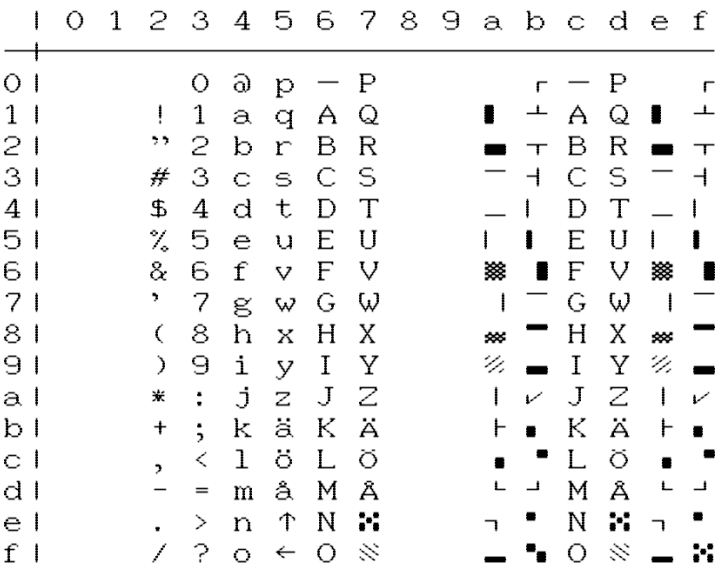


Table 12 SWEDEN Charset in Lowercase/Uppercase Mode (Secondary address = 7)

9.7. Switzerland

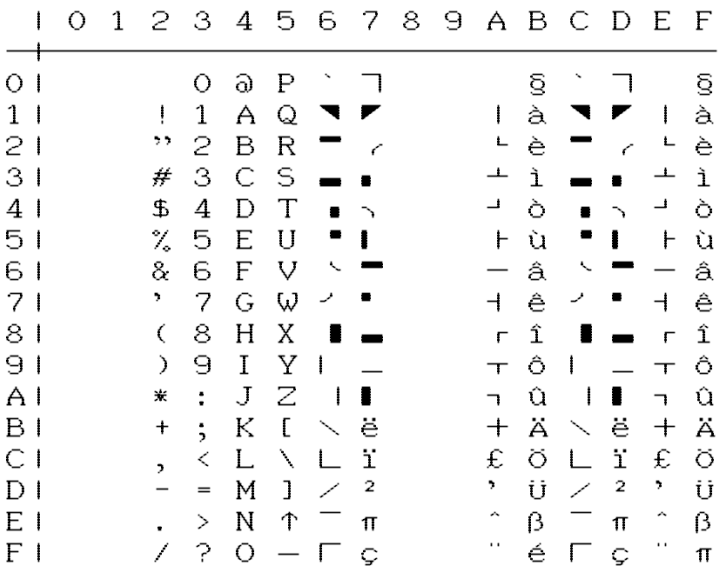


Table 13 : SWITZERLAND Charset in Uppercase/Graphic Mode (Secondary address = 0)

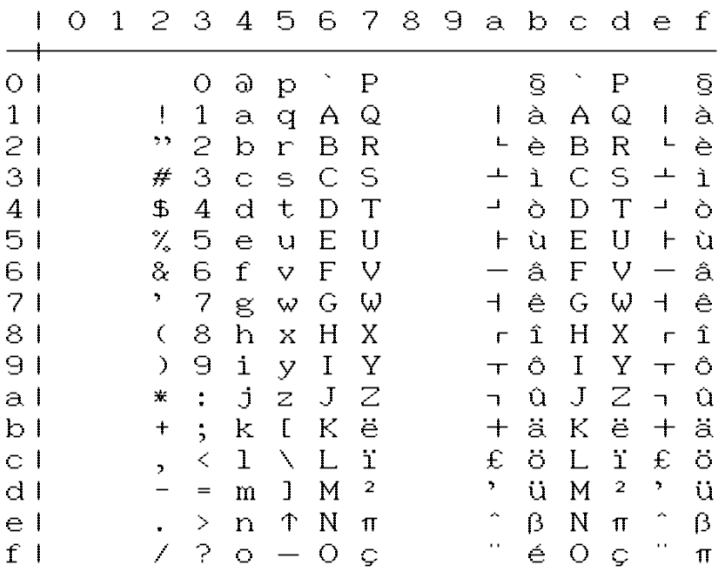
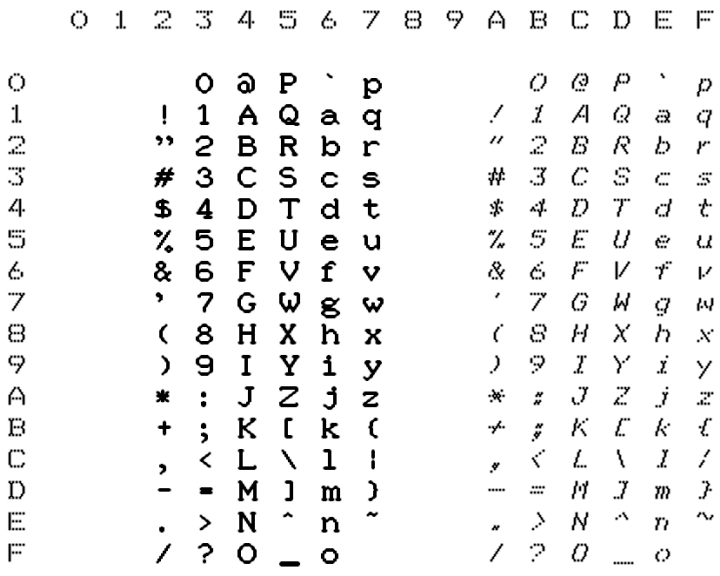


Table 14 SWITZERLAND Charset in Lowercase/Uppercase Mode (Secondary address = 7)

EPSON FX-80/JX-80 character table

10.1. Basic charset



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				0	@	P	`	p
1			!	1	A	Q	a	q			¡	1	A	Q	a	q
2			"	2	B	R	b	r			"	2	B	R	b	r
3			#	3	C	S	c	s			#	3	C	S	c	s
4			$	4	D	T	d	t			$	4	D	T	d	t
5			%	5	E	U	e	u			%	5	E	U	e	u
6			&	6	F	V	f	v			&	6	F	V	f	v
7			'	7	G	W	g	w			'	7	G	W	g	w
8			(	8	H	X	h	x			(	8	H	X	h	x
9			)	9	I	Y	i	y			)	9	I	Y	i	y
A			*	:	J	Z	j	z			*	:	J	Z	j	z
B			+	;	K	[	k	{			+	;	K	[	k	{
C			,	<	L	\	l	¦			,	<	L	\	l	¦
D			-	=	M	]	m	}			-	=	M	]	m	}
E			.	>	N	^	n	~			.	>	N	^	n	~
F			/	?	O	_	o				/	?	O	_	o	

10.2. Extended charset

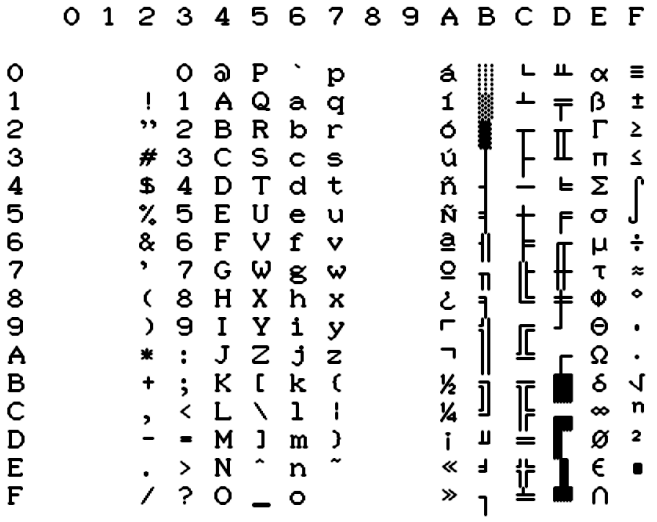
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	à	§		0	@	P	`	p	à	§		0	@	P	`	p
1	è	ß	!	1	A	Q	a	q	è	ß	¡	1	A	Q	a	q
2	ù		"	2	B	R	b	r	ù		"	2	B	R	b	r
3	ò		#	3	C	S	c	s	ò		#	3	C	S	c	s
4	ì		$	4	D	T	d	t	ì		$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u	°	Ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v	£	¨	&	6	F	V	f	v
7		Ä	'	7	G	W	g	w		Ä	'	7	G	W	g	w
8		Ö	(	8	H	X	h	x		ö	(	8	H	X	h	x
9		ù	)	9	I	Y	i	y		ù	)	9	I	Y	i	y
A		ä	*	:	J	Z	j	z		ä	*	:	J	Z	j	z
B			+	;	K	[	k	{			+	;	K	[	k	{
C		ü	,	<	L	\	l	¦		ü	,	<	L	\	l	¦
D		É	-	=	M	]	m	}		é	-	=	M	]	m	}
E		é	.	>	N	^	n	~		é	.	>	N	^	n	~
F		¥	/	?	O	_	o			¥	/	?	O	_	o	Ø

10.3. International charsets changes

CHARSET	23h	24h	40h	5Bh	5ch	5dh	5eh	60h	7Bh	7Ch	7Dh	7Eh
Basic	#	$	@	[	\	]	^	`	{	¦	}	~
USA	#	$	@	[	\	]	¨	`	{	¦	}	~
France	#	$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	`	{	¦	}	~
Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
Spain	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
Japan	#	$	@	[	¥	]	^	`	{	¦	}	~
Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

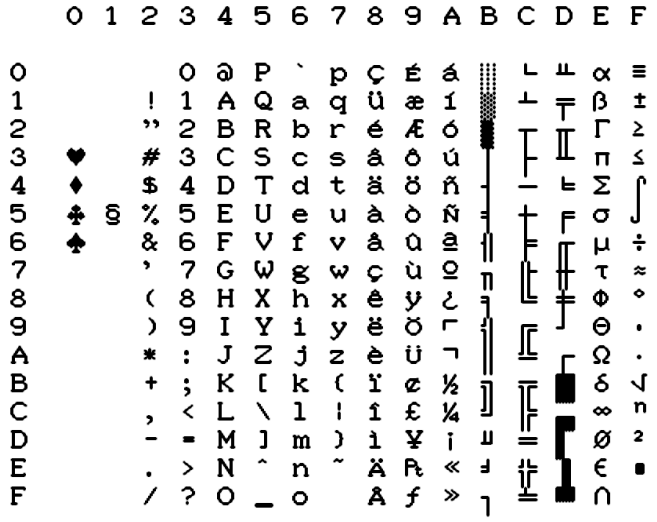
IBM character tables

11.1. Table 1

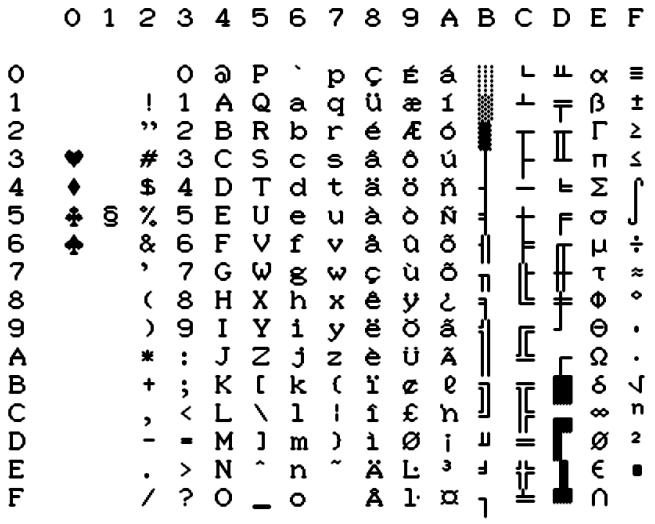


11.2. Table 2

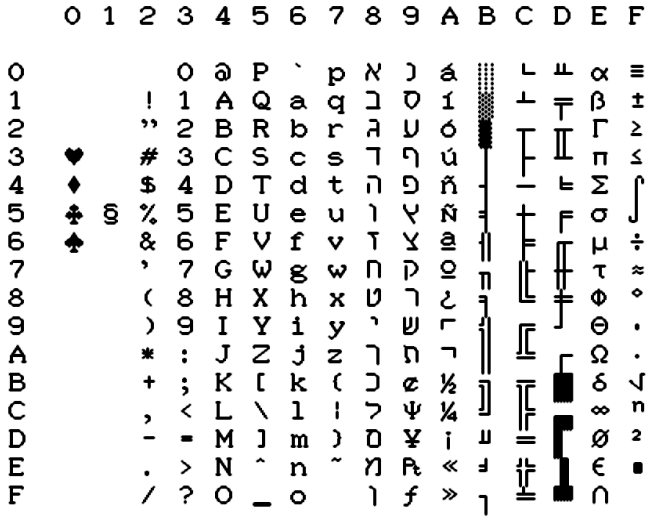
11.2.1. International 1



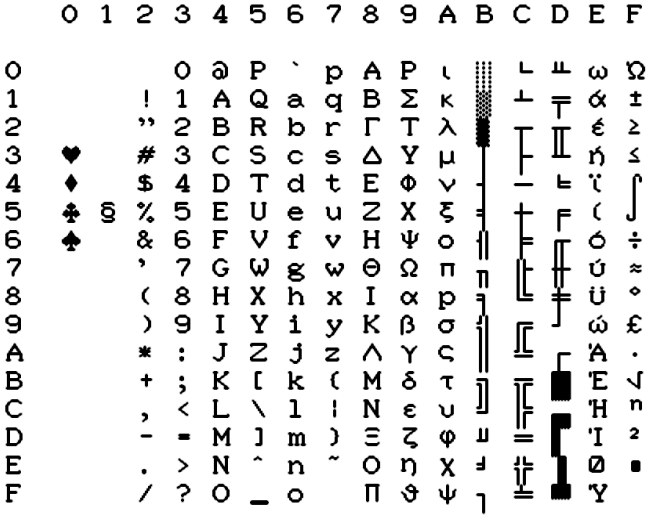
11.2.2. International 2



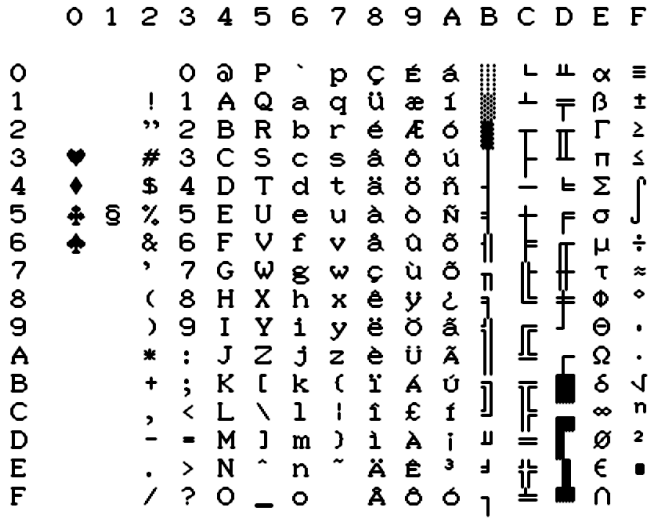
11.2.3. Israel



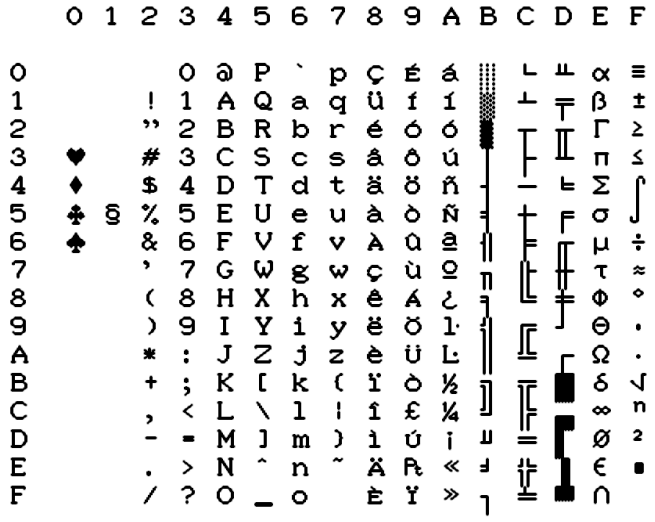
11.2.4. Greece



11.2.5. Portugal



11.2.6. Spain



Commodore commands reference

CODE ASCII	DEC	HEX	DESCRIPTION	PAGE
BIT IMG	8	08	Select graphic Bit Image Mode	18
BIM IMG SUB	8 26	08 1A	Select repeated graphic Bit Image Mode	18
HTAB	9	09	Horizontal tabulation	17
LF	10	0A	Line Feed	16
FF	12	0C	Form Feed	16
CR	13	0D	Carriage Return	16
EN ON	14	0E	Double width character ON	12
EN OFF	15	0F	Double width character OFF, Bitmap Image Mode OFF	13
POS	16	10	Jump to horizontal position in number of characters	17
CRSR DWN	17	11	Select Commodore charset with lowercases and uppercases	15
RVS ON	18	12	Negative character ON	13
ESC	27	1B	ASCII code for the Escape character	
NLQ ON	31	1F	Near Letter Quality ON	15
ESC POS	16	10	Jump to horizontal position in number of dots	17
ESC -	45	2D	Underline ON/OFF	13
ESC 4	52	34	Italic ON	13
ESC 5	53	35	Italic OFF	14
ESC 8*	56	38	Disable paper end sensor	17
ESC 9*	57	39	Enable paper end sensor	17
ESC =*	61	3D	Custom character definition using Down Line Loading (DLL)	19
ESC c	67	43	Set paper height in number of text lines	11
ESC c NUL	67 0	43 00	Set paper height in inches	16
ESC e	69	45	Bold character ON	13
ESC f	70	46	Bold character OFF	13
ESC g	71	47	Double Strike ON	12
ESC h	72	48	Double Strike OFF	12
ESC i	73	49	Select character print definition	20
ESC n*	78	4E	Define Bottom of Page (BOF)	16
ESC o*	79	4F	Disable Bottom of Page (BOF)	16
ESC s	83	53	Select Superscript or Subscript character mode	14
ESC t	84	54	Disable Superscript and Subscript character mode	15
ESC [	91	5B	Select character spacing (PICA, ELITE, …)	14
ESC B	98	62	Select black color	11
ESC C	99	63	Select cyan color	11
ESC M	109	6D	Select magenta color	11
ESC R	114	72	Select color	12
ESC X	120	78	Select NLQ or DRAFT	15
ESC Y	121	79	Select yellow color	12
CS	141	8D	Carriage Return with no Line Feed	16
CRSR UP	145	91	Select Commodore charset with uppercases and graphics	15
RVS OFF	146	92	Negative character OFF	13

* Ignored in the Ultimate Virtual Printer

CODE			DESCRIPTION	PAGE
ASCII	DEC	HEX		
NLQ OFF	159	9F	Near Letter Quality OFF	15

EPSON FX-80/JX-80 commands reference

CODE			DESCRIPTION	PAGE
ASCII	DEC	HEX		
BS	8	08	Backspace	27
TAB	9	09	Horizontal tabulation	28
LF	10	0A	Line Feed	25
VT	11	0B	Vertical tabulation	28
FF	12	0C	Form Feed	26
CR	13	0D	Carriage Return	26
SO	14	0E	Double width character ON	22
SI	15	0F	Condensed pitch 17.1 cpi ON	23
DC1*	17	11	Printer select	34
DC2	18	12	Condensed pitch 17.1 cpi OFF	23
DC3*	19	13	Printer suspend	34
DC4	20	14	Double width character OFF	22
CAN*	24	18	Clean print buffer	34
ESC	27	1B	ASCII code for the Escape character	
ESC SO	14	0E	Double width character ON	22
ESC SI	15	0F	Condensed pitch 17.1 cpi ON	23
ESC !	33	21	Select graphics layout types	24
ESC #*	35	23	Clear bit 7 forcing (MSB)	34
ESC %*	37	25	Select RAM (special chars) and ROM (standard chars)	34
ESC &*	38	26	Define special characters in RAM (DLL)	33
ESC -	45	2D	Underline ON/OFF	22
ESC /	47	2F	Vertical TAB stops program	29
ESC 0	48	30	Line spacing = 1/8"	26
ESC 1	49	31	Line spacing = 7/72"	26
ESC 2	50	32	Line spacing = 1/6"	26
ESC 3	51	33	Line spacing = n/216"	26
ESC 4	52	34	Italic ON	23
ESC 5	53	35	Italic OFF	23
ESC 6*	54	36	Extend printable character set	33
ESC 7	55	37	Select basic national characters table	32
ESC 8*	56	38	Disable paper end sensor	28
ESC 9*	57	39	Enable paper end sensor	28
ESC :*	58	3A	Copy standard character generator (ROM) into RAM	33
ESC <*	60	3C	Set left to right printing for one line	34
ESC =*	61	3D	Force bit 7 (MSB) to "0"	34
ESC >*	62	3E	Force bit 7 (MSB) to "1"	34
ESC ?	63	3F	Change BIM density selected by graphics commands	31
ESC @	64	40	Initialize printer (main reset)	34
ESC A	65	41	Line spacing = n/72"	26
ESC B	66	42	Vertical TAB stops program	28
ESC C	67	43	Set paper height in number of text lines	27
ESC C NUL	67 0	43 00	Set paper height in inches	27
ESC D	68	44	Horizontal TAB stops program	28
ESC E	69	45	Bold character ON	22
ESC F	70	46	Bold character OFF	23
ESC G	71	47	Double Strike ON	21

* Ignored in the Ultimate Virtual Printer

CODE ASCII	DEC	HEX	DESCRIPTION	PAGE
ESC H	72	48	Double Strike OFF	22
ESC I	73	49	Extend printable characters set	33
ESC J	74	4A	Skip n/216" of paper	26
ESC K	75	4B	Set normal density graphics	29
ESC L	76	4C	Set double density graphics	30
ESC M	77	4D	Elite pitch 12 cpi ON	23
ESC N*	78	4E	Define Bottom of Page (BOF)	27
ESC O*	79	4F	Disable Bottom of Page (BOF)	27
ESC P	80	50	Elite pitch 12 cpi OFF	23
ESC Q	81	51	Define right margin	27
ESC R	82	52	Select national character set	21
ESC S	83	53	Select Superscript or Subscript character mode	24
ESC T	84	54	Disable Superscript and Subscript character mode	24
ESC U*	85	55	Mono/Bidirectional printing	34
ESC W	87	57	Double width characters ON/OFF	22
ESC Y	89	59	Double density BIM selection, normal speed	30
ESC Z	90	5A	Four times density BIM selection	30
ESC ^	94	5E	9-dot high strips BIM printing	32
ESC b	98	62	Select up to 8 vertical tab stops programs	29
ESC i*	105	69	Immediate character printing ON/OFF	34
ESC j	106	6A	Reverse paper feed n/216"	27
ESC l	108	6C	Define left margin	27
ESC p*	112	70	Proportional spacing ON/OFF	24
ESC r	114	72	Select color	21
ESC s*	115	73	Half speed printing ON/OFF	34
ESC x	120	78	Select NLQ or DRAFT	24
DEL*	127	7F	Clear last printable character	34

* Ignored in the Ultimate Virtual Printer

IBM Graphics Printer commands reference

CODE			DESCRIPTION	PAGE
ASCII	DEC	HEX		
BELL*	7	07	Beep	44
BS	8	08	Backspace	41
TAB	9	09	Horizontal tabulation	42
LF	10	0A	Line Feed	40
VT	11	0B	Line Feed	42
FF	12	0C	Form Feed	41
CR	13	0D	Carriage Return	40
SO	14	0E	Double width character ON	37
SI	15	0F	Condensed pitch 17.1 cpi ON	39
DC2	18	12	Condensed pitch 17.1 cpi OFF	39
DC4	20	14	Double width character OFF	37
CAN*	24	18	Clean print buffer	44
ESC	27	1B	ASCII code for the Escape character	
ESC SO	14	0E	Double width character ON	38
ESC ! †	33	21	Select graphics layout types	40
ESC -	45	2D	Underline ON/OFF	38
ESC 0	48	30	Line spacing = 1/8"	41
ESC 1	49	31	Line spacing = 7/72"	41
ESC 2	50	32	Line spacing = 1/6"	41
ESC 3	51	33	Line spacing = n/216"	41
ESC 4†	52	34	Italic ON	38
ESC 5†	53	35	Italic OFF	39
ESC 6	54	36	IBM Table 2 charset selection	44
ESC 7	55	37	IBM Table 1 charset selection	43
ESC 8*	56	38	Disable paper end sensor	42
ESC 9*	57	39	Enable paper end sensor	42
ESC <*	60	3C	Set left to right printing for one line	44
ESC =*	61	3D	Down Line Loading of user characters (DLL)	44
ESC @†	64	40	Initialize printer (main reset)	44
ESC A	65	41	Line spacing = n/72"	41
ESC C	67	43	Set paper height in number of text lines	36
ESC C NUL	67 0	43 00	Set paper height in inches	42
ESC D	68	44	Horizontal TAB stops program	43
ESC E	69	45	Bold character ON	38
ESC F	70	46	Bold character OFF	38
ESC G	71	47	Double Strike ON	37
ESC H	72	48	Double Strike OFF	37
ESC I	73	49	Select print definition	44
ESC J	74	4A	Skip n/216" of paper	41
ESC K	75	4B	Set normal density graphics	43
ESC L	76	4C	Set double density graphics	43
ESC M	77	4D	Elite pitch 12 cpi ON	36
ESC N	78	4E	Define Bottom of Page (BOF)	42
ESC O	79	4F	Disable Bottom of Page (BOF)	42
ESC S	83	53	Select Superscript or Subscript character mode	40

* Ignored in the Ultimate Virtual Printer
† Only in the Ultimate Virtual Printer, not in a real MPS-1550C

CODE ASCII	DEC	HEX	DESCRIPTION	PAGE
ESC T	84	54	Disable Superscript and Subscript character mode	40
ESC U*	85	55	Mono/Bidirectional printing	45
ESC W	87	57	Double width characters ON/OFF	38
ESC Y	89	59	Double density BIM selection, normal speed	36
ESC Z	90	5A	Four times density BIM selection	43
ESC [	91	5B	Set horizontal spacing	39
ESC b	98	62	Select black color	36
ESC c	99	63	Select cyan color	36
ESC m	109	6D	Select magenta color	36
ESC r	114	72	Select color	37
ESC x	120	78	Select NLQ or DRAFT	40
ESC y	121	79	Select yellow color	36

* Ignored in the Ultimate Virtual Printer

IBM Proprinter commands reference

CODE			DESCRIPTION	PAGE
ASCII	DEC	HEX		
BELL*	7	07	Beep	53
BS	8	08	Backspace	50
TAB	9	09	Horizontal tabulation	51
LF	10	0A	Line Feed	49
VT	11	0B	Vertical tabulation	51
FF	12	0C	Form Feed	49
CR	13	0D	Carriage Return	49
SO	14	0E	Double width character ON	47
SI	15	0F	Condensed pitch 17.1 cpi	48
DC1*	17	11	Printer selection	54
DC2	18	12	Pica pitch 10 cpi	48
DC3	19	13	No operation	54
DC4	20	14	Double width character OFF	47
CAN*	24	18	Clean print buffer	54
ESC	27	1B	ASCII code for the Escape character	
ESC -	45	2D	Underline ON/OFF	47
ESC 0	48	30	Line spacing = 1/8"	49
ESC 1	49	31	Line spacing = 7/72"	49
ESC 2	50	32	Line spacing = 1/6" or **ESC A** command execution	49
ESC 3	51	33	Line spacing = n/216"	49
ESC 4	52	34	Set Top Of Form (TOF)	51
ESC 5	53	35	Automatic LF: ON/OFF	50
ESC 6	54	36	IBM Table 2 charset selection	53
ESC 7	55	37	IBM Table 1 charset selection	52
ESC :	58	3A	Elite pitch 12 cpi	48
ESC =*	61	3D	Down Line Loading of user characters (DLL)	53
ESC @†	64	40	Initialize printer (main reset)	54
ESC A	65	41	Line spacing = n/72"	50
ESC B	66	42	Vertical tab stops program	46
ESC C	67	43	Set paper height in number of text lines	46
ESC C NUL	67 0	43 00	Set paper height in inches	50
ESC D	68	44	Horizontal TAB stops program	51
ESC E	69	45	Bold character ON	47
ESC F	70	46	Bold character OFF	48
ESC G	71	47	Double Strike ON	46
ESC H	72	48	Double Strike OFF	47
ESC I	73	49	Select print definition	53
ESC J	74	4A	Skip n/216" of paper	50
ESC K	75	4B	Set normal density graphics	52
ESC L	76	4C	Set double density graphics	52
ESC N	78	4E	Define Bottom of Page (BOF)	50
ESC O	79	4F	Disable Bottom of Page (BOF)	51
ESC Q*	81	51	De-select printer	54
ESC R	82	52	Clear tab stops	52
ESC S	83	53	Select Superscript or Subscript character mode	48

* Ignored in the Ultimate Virtual Printer
† Only in the Ultimate Virtual Printer, not in a real MPS-1550C

CODE ASCII	DEC	HEX	DESCRIPTION	PAGE
ESC T	84	54	Disable Superscript and Subscript character mode	48
ESC U*	85	55	Mono/Bidirectional printing	54
ESC W	87	57	Double width characters ON/OFF	47
ESC Y	89	59	Double density BIM selection, normal speed	46
ESC Z	90	5A	Four times density BIM selection	52
ESC b	98	62	Select black color	46
ESC c	99	63	Select cyan color	46
ESC m	109	6D	Select magenta color	46
ESC y	121	79	Select yellow color	46
**ESC **	92	5C	Print n characters from extended table	53
ESC ^	94	5E	Print one character from extended table	53
ESC _	95	5F	Overline: ON/OFF	49

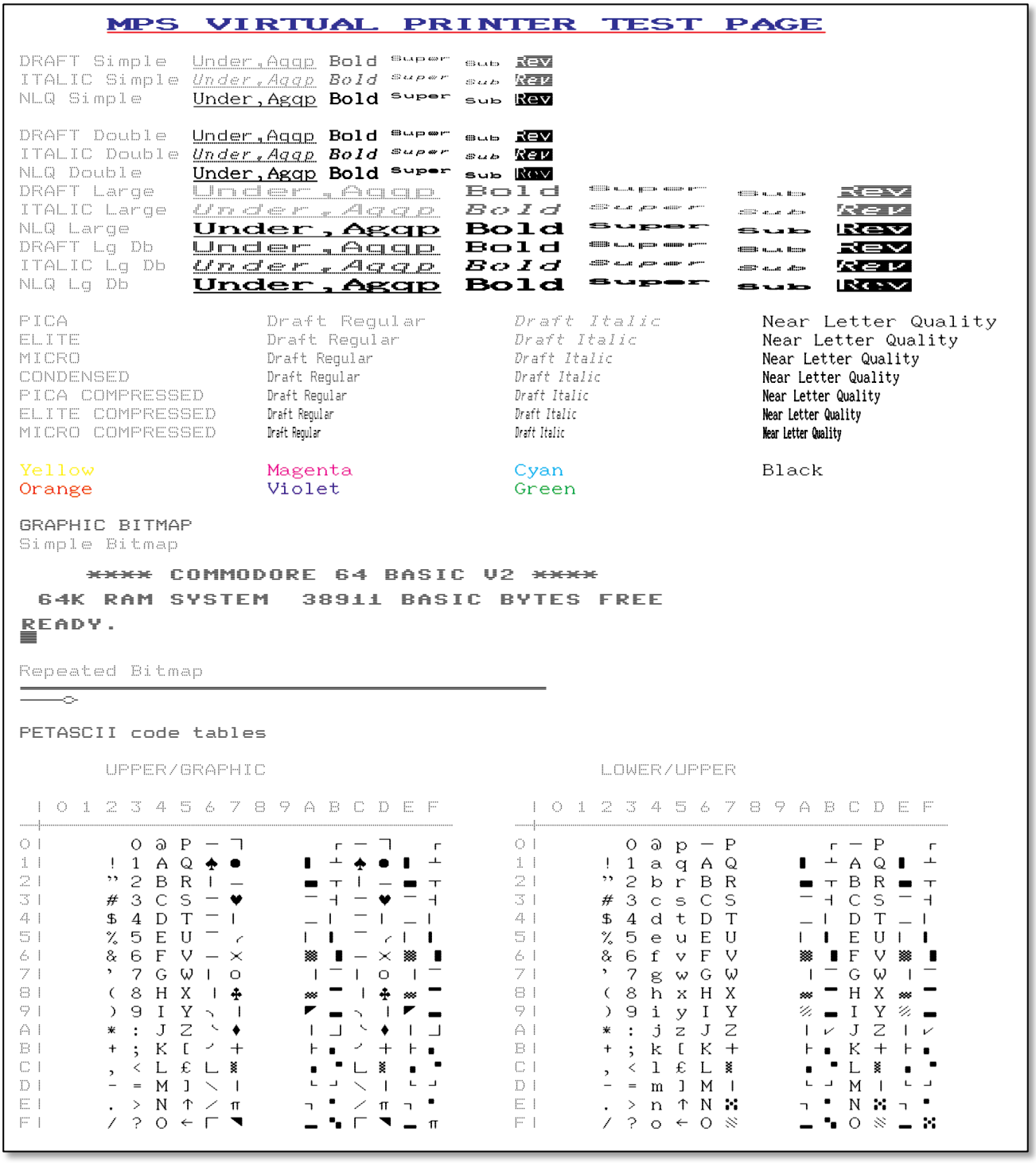
* Ignored in the Ultimate Virtual Printer

Technical Specifications

Output Type	PNG file 2-bit depth (4 grey levels) or 8-bit depth (256 color palette) with lossless compression using LodePNG written by Lode Vandevenne (http://lodev.org/lodepng/) typical file size range is 30kB - 140kB
Page size	1984 x 2580
Printable area size	1920 x 2160 (80 PICA characters and 60 lines at 1/6")
Horizontal Resolution	240 dpi
Vertical Resolution	216 dpi
Physical ratio	A4 (21cm x 29,7cm)
Character matrix	8V x 11H in draft mode 16V x 12H in NLQ mode
Print pitches	Pica, 10 char/in, 80 char/line Elite, 12 char/in, 96 char/line Micro, 15 char/in, 120 char/line Condensed, 17.1 char/in, 137 char/line Pica Compressed, 20 char/in, 160 char/line Elite Compressed, 24 char/in, 192 char/line Micro Compressed, 30 char/in, 240 char/line
Printing styles	Color Boldface Double width Superscript Subscript Double strike Underlined Italic Reversed Overlined

Print Sample

With Printer Ink Density set to Medium. Emulation is Commodore MPS.



Document Revisions

Revision	Date	Author	Description
1.0.0	May 27, 2016	René Garcia	Initial release
1.0.1	May 30, 2016	René Garcia	Corrected capabilities table and options BIT IMG SUB corrected Ink Density samples
1.1	February 18, 2018	René Garcia	Rename MPS Printer Emulation to Virtual Printer New feature: ASCII output format
1.2	November 23, 2018	René Garcia	Fixed German charset for FX-80 emulation
1.3	May 1, 2019	René Garcia	New feature: Color printer based on MPS-1550C
1.4	May 11, 2023	René Garcia	New configuration and action menu. Rename Ultimate-II Virtual Printer to Ultimate Virtual Printer.