
Ultimate-II Virtual Printer

User's Guide

René Garcia

All rights reserved.

Table of Contents

1. Introduction.....	5
1.1. Context.....	5
1.2. License.....	5
1.3. Purpose of this document.....	5
2. Configuration.....	6
2.1. Overview.....	6
2.2. Enable the printer	6
2.3. Printer configuration items	6
3. Using the printer	8
3.1. Printing from the C64/C128.....	8
3.2. Flushing the printer spool	8
3.3. Resetting the printer.....	8
3.4. Performances.....	8
4. Capabilities.....	9
5. Commodore MPS commands.....	10
5.1. Simple example	10
5.2. Secondary address.....	10
5.3. Commands	10
5.3.1. Graphical operations.....	10
5.3.2. Paper feeding.....	14
5.3.3. Format control.....	14
5.3.4. Graphic Bitmap	16
5.3.5. Character creation, Down Line Loading (DLL).....	17
6. EPSON FX-80 commands.....	19
6.1. Secondary address.....	19
6.2. Commands	19
6.2.1. Graphical operations.....	19
6.2.2. Paper feeding.....	23
6.2.3. Format control.....	24
6.2.4. Graphic Bitmap	26
6.2.5. Charset selection.....	29
6.2.6. Character creation, Down Line Loading (DLL).....	30
6.2.7. Other commands.....	30

7. IBM Graphics Printer commands	32
7.1. Secondary address.....	32
7.2. Commands	32
7.2.1. Graphical operations.....	32
7.2.2. Paper feeding.....	35
7.2.3. Format control.....	36
7.2.4. Graphic Bitmap.....	37
7.2.5. Charset selection.....	38
7.2.6. Character creation, Down Line Loading (DLL).....	38
7.2.7. Other commands.....	39
8. IBM Proprinter commands.....	40
8.1. Secondary address.....	40
8.2. Commands	40
8.2.1. Graphical operations.....	40
8.2.2. Paper feeding.....	42
8.2.3. Format control.....	43
8.2.4. Graphic Bitmap.....	45
8.2.5. Charset selection.....	46
8.2.6. Character creation, Down Line Loading (DLL).....	46
8.2.7. Other commands.....	47
9. PETASCII character table.....	48
9.1. USA/UK	48
9.2. Denmark	49
9.3. France / Italy.....	50
9.4. Germany.....	51
9.5. Spain	52
9.6. Sweden	53
9.7. Switzerland.....	54
10. EPSON FX-80 character table.....	55
10.1. Basic charset.....	55
10.2. Extended charset.....	55
10.3. International charsets changes.....	55
11. IBM character tables.....	56
11.1. Table 1	56
11.2. Table 2	56
11.2.1. International 1	56
11.2.2. International 2	57

11.2.3. Israel.....	57
11.2.4. Greece	57
11.2.5. Portugal.....	58
11.2.6. Spain.....	58
12. Commodore commands reference	59
13. EPSON FX-80 commands reference.....	60
14. IBM Graphics Printer commands reference.....	62
15. IBM Proprinter commands reference	64
16. Technical Specifications.....	66
17. Print Sample	67
18. Document Revisions	68

1. Introduction

1.1. Context

The virtual printer is an Ultimate-II feature since 3.0 firmware. With this functionality you can print from your Commodore 64/128 using a virtual IEC device #4 or #5.

This emulation simulates a Commodore MPS-1230 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.

MPS-1230 was a mid-range black ink ribbon 9 needle matrix printer sold by Commodore in the late 80's.

This printer is compatible with nearly all the usual programs that have been edited for C64/C128. It can interpret 4 printer instruction sets:

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

1.2. License

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-II firmware sources.

1.3. Purpose of this document

This document describes how to use and configure the Ultimate-II 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!

2. Configuration

2.1. Overview

You will find all the configuration items for the printer in the IEC configuration menu.

2.2. Enable the printer


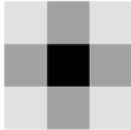
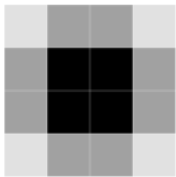






To enable the printer, you need to enable the software IEC feature in the Ultimate-II:

- Use the F2 Menu to enter Ultimate-II configuration and then select “**Software IEC Settings**”
- Then on item “**IEC Drive and Printer**” select “**Enabled**”

2.3. Printer configuration items

- **Printer Bus ID:** 4 or 5 (default is 4)
This will assign device ID 4 or 5 to the printer.
- **Printer 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.
- **Printer output type:** PNG, ASCII or RAW (default is PNG)
PNG are images created by the printer emulator each time a page is ejected from the printer. Caution, if a file with the same name already exists, it will not be overwritten and the page is lost. 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.
- **Printer ink density:** Low, Medium or High (default is Medium)
You can consider this as “how strong is the pin 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.*
- **Printer emulation:** Commodore MPS, Epson FX-80, IBM Graphics Printer, IBM Proprinter (default is Commodore MPS)
You can select which instruction set the emulator 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 not ejected.

- Printer 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 19.
- Printer 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 emulation. See Epson charset description on chapter 10.
- Printer 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 11.

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			

3. 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-1230 to eject the page.

Go to F5 Menu and select "**Flush Printer/Eject Page**". 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.

3.3. Resetting the printer

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

3.4. Performances

Composing a page full of text and creating the 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-1230 printer (1 min in DRAFT mode, 4 min in NLQ mode) !

The Ultimate-II 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 3.2, The virtual printer is 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.

4. Capabilities

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

	Commodore MPS	Epson FX-80	IBM Graphics Printer	IBM Proprinter
Draft	•	•	•	•
Double strike	•	•	•	•
Bold	•	•	•	•
Italic (<i>draft only</i>)	•	•	•*	
NLQ	•	•	•	•
Underline	•	•	•	•
Double width	•	•	•	•
Superscript	•	•	•	•
Subscript	•	•	•	•
Reverse	•			
Overline				•
Backspace		•	•	•
Reverse page feed		•		
CR=CR+LF	•			<i>optional</i>
LF=CR+LF	•	•		
7 dot BIM	•			
8 dot BIM		•	•	•
9 dot BIM		•		
HT Program		•	•	•
VT Program		•		•
60 dpi BIM	• (<i>double width</i>)	•	•	•
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-II Virtual Printer, not available on a real MPS-1230 printer

5. 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.

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

15

0Fh

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

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

18

12h

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

REVERSE

RVS OFF Disable the **reverse** print mode

146

92h

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

ESC - 1 Select the **Underline** print mode for all characters and spaces that follow.

27 45 49

1Bh 2Dh 31h

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

UNDERLINE

ESC - 0 Disable the Underline print mode.

27 45 48

1Bh 2Dh 30h

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

ESC e Select the **Bold** print mode.

27 69

1Bh 45h

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

BOLD

ESC f Disable the Bold print mode.

27 70

1Bh 46h

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

ESC 4 Select the **Italic** print mode.

27 52

1Bh 34h

```
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 printer on the upper half interline.

10 OPEN1,4

20 PRINT#1,”NORMAL”;CHR\$(27);CHR\$(83);CHR\$(48);”SUPERSCRIP”

30 CLOSE1

NORMAL^{SUPERSCRIP}

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 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

5.3.2. Paper feeding

LF 10 0Ah	A Line Feed returns the print head to the 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 the 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 the left margin but stays in the same line (behavior is CR). 10 OPEN1,4,7 20 PRINT#1,CHR\$(141); 30 CLOSE1

5.3.3. 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-II 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-II Virtual Printer.

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

ESC 8

Disable the end of paper detector to be able to print until the end of the paper.

27 56

This command is ignored by Ultimate-II Virtual Printer.

1Bh 38h

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

ESC 9

Enable the end of paper detector.

27 57

This command is ignored by Ultimate-II Virtual Printer.

1Bh 39h

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

HTAB

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.

9**09h**

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

POS n₁ n₂

On the current line, jump to the horizontal position corresponding to the n₁n₂ 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. n₁n₂ can range from 00 to 79. Does nothing if current position is already over the n₁n₂ position.

16 n₁ n₂**10h n₁ n₂**

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

ESC POS n₁ n₂

On the current line, jump to the horizontal position corresponding to the dot position given by parameters n₁ and n₂ from the beginning of the line. Parameter is calculated using the formula n₁x256+n₂. Value range is 0 to 480

27 16 n₁ n₂**1Bh 10h n₁ n₂**

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
```

5.3.4. 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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
16	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
64	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Total	136	148	162	193	162	148	136	136	156	190	255	190	156	136	235	136

Don't forget that bit 2⁷ is always set, this adds 128 to each value.

First byte with 2⁷ 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 2⁷ 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$=""

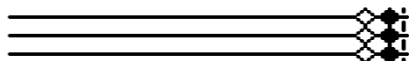
```



```

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

```



5.3.5. Character creation, Down Line Loading (DLL)

On a MPS-1230 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-1230 printer and RAM buffer is smaller as a part of the RAM is reserved for DLL.

On Ultimate-II 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 a p₁ p₂...p₁₁** which represents decimal byte codes to describe characters to load.

m and **n** are the number of bytes to load. Use the formula
 $t = (\text{number of chars} \times 13) + 2$
 then calculate m and n in order to have $m + (n \times 256) = t$ using formulas
 $n = t / 256$ (keep entire part only)
 $m = t - (n \times 256)$

E.g.: for 94 characters,
 $t = (94 \times 13) + 2 = 1224$
 $n = 1224 / 256 = 4$
 $m = 1224 - (4 \times 256) = 200$

c Is the decimal ASCII code of the first character of the sequence. Only decimal codes from 33 to 126 can be used for DLL. 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

p₁ p₂...p₁₁ 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-II Virtual Printer does not suffer from this limitation.**

Note from the author: I tested this command on a real MPS-1230 because explanations given by Commodore seems to be false. I can't make it work, example in the MPS-1230 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-II 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-II 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

6. EPSON FX-80 commands

This chapter describes the commands the printer can understand when using the Epson 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 FX-80 emulation.

6.2. Commands

6.2.1. 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 <u>UNDERLINE</u>
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 <i>ITALIC</i>
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);"SUPERSCRIP" 30 CLOSE1 NORMAL SUPERSCRIP T
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 T
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

DRAFT QUALITY NEAR LETTER QUALITY

ESC p n
27 112 n
1Bh 70h n

Proportional spacing ON/OFF

This command is ignored by Ultimate-II 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				•			•
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		•			•		•

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		•	•		•		•
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	•			•	•		•

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	•	•					•
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	•	•	•	•			•

74		.			.		
75		.			.		.
76		.			.	.	
77		.			.		.
78		.			.	.	
79		.			.		.
80		.		.			
81		.		.			.
82		.		.			
83		.		.			.
84		.		.		.	
85		.		.			.

160	.		.				
161	.		.				.
162	.		.				
163	.		.				.
164	.		.			.	
165	.		.				.
166	.		.			.	
167	.		.				.
168	.		.		.		
169	.		.		.		.
170	.		.		.		
171	.		.		.		.

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

6.2.2. Paper feeding

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

10
0Ah

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

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

13
0Dh

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

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

12
0Ch

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

ESC 0 Select vertical spacing **1/8"** between each printed line.

27 48
1Bh 30h

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

ESC 1 Select vertical spacing **7/72"** between each printed line.

27 49
1Bh 31h

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

ESC 2 Select vertical spacing **1/6"** between each printed line.

27 50
1Bh 32h

```
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 A n

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

27 65 n

1Bh 41h n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(65);CHR\$(8)"8/72 inch for one pass BIM"

30 CLOSE1

ESC J n

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

27 74 n

1Bh 4Ah n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(74);CHR\$(70)"70/216 inch skipped"

30 CLOSE1

ESC j n

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

27 106 n

1Bh 6Ah n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(106);CHR\$(70)"70/216 inch up"

30 CLOSE1

6.2.3. Format control

BS

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

8

08h

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 used to calculate form length.

27 67 n

1Bh 43h n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(67);CHR\$(1-127);

30 CLOSE1

ESC C NUL n

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

27 67 0 n

1Bh 43h 00h n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(67);CHR\$(0);CHR\$(1-22);

30 CLOSE1

ESC l n

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

27 108 n

1Bh 6Ch n

10 OPEN1,4

20 PRINT#1,CHR\$(27);CHR\$(108);CHR\$(10)

30 PRINT#1,"MARGIN LEFT AT 10"

40 CLOSE1

ESC Q n

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

27 81 n

1Bh 51h n

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-II 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-II 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-II 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-II 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 n₁ ... 0
27 66 n₁ ... 0
1Bh 42h n₁ ... 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 n₁ ... 0
27 68 n₁ ... 0
1Bh 44h n₁ ... 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 n₁ ... 0
27 98 m n₁ ... 0
1Bh 62h m n₁ ... 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
```

6.2.4. 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:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
128	□	□	■	■	■	□	□	□	□	□	■	■	■	□	□	□
64	□	■	□	□	□	■	□	□	□	■	■	■	□	□	■	□
32	■	□	□	□	□	□	■	□	■	■	■	■	■	□	□	□
16	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
8	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
4	■	□	□	□	□	□	■	□	■	■	■	■	■	□	□	□
2	□	■	□	□	□	■	□	□	□	■	■	■	□	□	■	□
1	□	□	■	■	■	□	□	□	□	□	■	□	□	□	■	□
Total	60	66	129	129	129	66	60	24	60	126	255	126	60	24	235	24

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 ... Select the **Bit Image Mode** in simple density. You have to provide parameters **n m**
27 75 ... **d₁ d₂ ...**

1Bh 4Bh ...

Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... 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 ...**

Select the **Bit Image Mode** in double density, half speed. You have to provide parameters **n m d₁ d₂ ...**

27 76 ...**1Bh 4Ch ...**

Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... 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 ...**

Select the **Bit Image Mode** in double density, normal speed.

27 89 ...

On Ultimate-II Virtual Printer, ESC Y behaves the same as ESC L

1Bh 59h ...**ESC Z ...**

Select the **Bit Image Mode** in quadruple density, half speed. You have to provide parameters **n m d₁ d₂ ...**

27 90 ...**1Bh 5Ah ...**

Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... 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 d₁ d₂ ...**
 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
d₁ d₂ ... 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

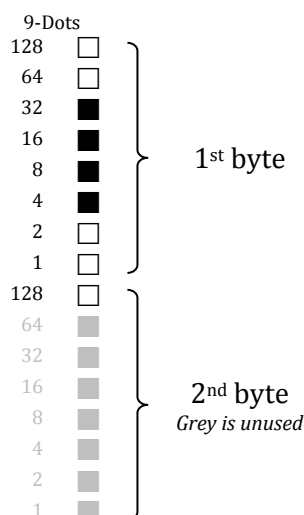
```

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 h₁ l₁ h₂ l₂ ...**

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
h₁ l₁ h₂ l₂ ... 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 (2⁷=128). This needs double of data for just one more dot.



6.2.5. Charset selection

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

27 55

1Bh 37h

```
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-II Virtual Printer.

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

6.2.6. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate-II 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-II Virtual Printer.

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

This code has to be followed by parameters **n m a p₁ p₂...p₁₁** 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

p₁ p₂...p₁₁ 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-II 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-II Virtual Printer.

6.2.7. 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-II 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-II Virtual Printer.
CAN 24 18h	Cancel the current job and clear printer buffer. This command is ignored by Ultimate-II 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-II 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-II Virtual Printer.
ESC # 27 35 1Bh 23h	Clear bit 7 (MSB) forcing. This command is ignored by Ultimate-II Virtual Printer.
ESC < 27 60 1Bh 3Ch	Set left to right printing for one line. This command is ignored by Ultimate-II 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-II 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-II 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-II Virtual Printer. n=1 : half speed n=0 : full speed
DEL 127 7Fh	Delete the last printable character from buffer. This command is ignored by Ultimate-II Virtual Printer.

7. 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. Graphical operations

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

27 71

1Bh 47h

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

double strike

ESC H Disable **Double Strike** print mode

27 72

1Bh 48h

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

SO Select the **Double Width** print mode

14

0Eh

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

DOUBLE WIDTH

DC4 Disable the **Double Width** print mode

20

14h

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

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

27 14

1Bh 0Eh

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

27 87 1

1Bh 57h 01h

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

27 87 0

1Bh 57h 00h

ESC - 1 27 45 49 1Bh 2Dh 31h	<p>Select the Underline print mode for all characters and spaces that follow.</p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(45);CHR\$(49);"UNDERLINE" 30 CLOSE1</pre> <p><u>UNDERLINE</u></p>
ESC - 0 27 45 48 1Bh 2Dh 30h	<p>Disable the Underline print mode.</p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(45);CHR\$(48); 30 CLOSE1</pre>
ESC E 27 69 1Bh 45h	<p>Select the Bold print mode.</p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(69);"BOLD" 30 CLOSE1</pre> <p>BOLD</p>
ESC F 27 70 1Bh 46h	<p>Disable the Bold print mode.</p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(70); 30 CLOSE1</pre>
ESC 4 27 52 1Bh 34h	<p>Select the Italic print mode.</p> <p><i>This feature has been added in Ultimate-II Virtual Printer and does not exist in a real MPS-1230 printer. Italic was not supported in IBM Graphics Printer.</i></p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(52);"ITALIC" 30 CLOSE1</pre> <p><i>ITALIC</i></p>
ESC 5 27 53 1Bh 35h	<p>Disable the Italic print mode.</p> <p><i>This feature has been added in Ultimate-II Virtual Printer and does not exist in a real MPS-1230 printer. Italic was not supported in IBM Graphics Printer.</i></p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(27);CHR\$(53); 30 CLOSE1</pre>
SI 15 0Fh	<p>Select the CONDENSED spacing mode (17.1 chars/inch)</p> <pre>10 OPEN1,4 20 PRINT#1,CHR\$(15);"CONDENSED" 30 CLOSE1</pre>

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
```

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 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 DRAFT QUALITY NEAR LETTER QUALITY
ESC ! n 27 33 n 1Bh 21h n	Select graphical layout for text. This feature has been added in Ultimate-II Virtual Printer and does not exist in a real MPS-1230 printer. See EPSON-FX80 command description page 22 for details.

7.2.2. 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 the 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

7.2.3. 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-II Virtual Printer. 10 OPEN1,4,7 20 PRINT#1,CHR\$(27);CHR\$(78);CHR\$(m);

30 CLOSE1

ESC 0
27 79
1Bh 4Fh

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate-II 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-II 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-II 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 n₁ ... 0
27 68 n₁ ... 0
1Bh 44h n₁ ... 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

7.2.4. Graphic Bitmap

IBM Graphics Printer emulation prints bitmap data the same way as EPSON FX-80. 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 26 for details.

ESC K ...
27 75 ... Select the **Bit Image Mode** in simple density (60 dpi). You have to provide parameters **n m d₁ d₂ ...**

1Bh 4Bh ...	Values n and m are the 16 bit encoded amount of data (n is LSB) total = $n + m \times 256$ d₁ d₂ ... are the bitmap data to print. <i>See EPSON command description page 26 for an example.</i>
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 d₁ d₂ ... Values n and m are the 16 bit encoded amount of data (n is LSB) total = $n + m \times 256$ d₁ d₂ ... are the bitmap data to print. <i>See EPSON command description page 27 for an example.</i>
ESC Y ... 27 89 ... 1Bh 59h ...	Select the Bit Image Mode in double density (120 dpi), normal speed. On Ultimate-II 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 d₁ d₂ ... Values n and m are the 16 bit encoded amount of data (n is LSB) total = $n + m \times 256$ d₁ d₂ ... are the bitmap data to print. <i>See EPSON command description page 27 for an example.</i>

7.2.5. 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 56. 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

7.2.6. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate-II 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-II Virtual Printer. m and n are the number of bytes to load in order to have $n + (m \times 256) = \text{size}$
--	--

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-II 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-II 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

7.2.7. Other commands

BELL
7
07h

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

CAN
24
18h

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

ESC <
27 60
1Bh 3Ch

Set **left to right** printing for one line.
This command is ignored by Ultimate-II 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-II Virtual Printer and does not exist in a real MPS-1230 printer.

ESC U n
27 85 n
1Bh 30h n

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

8. 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-1230 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. 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 <u>UNDERLINE</u>
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 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 _ 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
```

Overline

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

27 48

1Bh 30h

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

ESC 1 Select vertical spacing **7/72"** between each printed line.

27 49

1Bh 31h

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

ESC 2 Select vertical spacing **1/6"** between each printed line or activate **ESC A** previously prepared line spacing.

27 50

1Bh 32h

```
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 Automatic LF ON/OFF.

27 53 n

1Bh 35h n

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

27 65 n

1Bh 41h n

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

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

27 74 n

1Bh 4Ah n

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

8.2.3. Format control

BS

Backspace, go back one character. Left character is not erased and next character

8 08h	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-II 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-II 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 $n_1 \dots 0$
27 66 $n_1 \dots 0$
1Bh 42h $n_1 \dots 0$ 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 $n_1 \dots 0$
27 68 $n_1 \dots 0$
1Bh 44h $n_1 \dots 0$ 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
```

8.2.4. Graphic Bitmap

IBM Proprinter emulation prints bitmap data the same way as EPSON FX-80. 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 26 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 d₁ d₂ ...**
 Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... are the bitmap data to print.

See EPSON command description page 26 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 d₁ d₂ ...**
 Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... are the bitmap data to print.

See EPSON command description page 27 for an example.

ESC Y ...
27 89 ...
1Bh 59h ... Select the **Bit Image Mode** in double density (120 dpi), normal speed.
On Ultimate-II Virtual Printer, ESC Y behaves the same as ESC L

ESC Z ... Select the **Bit Image Mode** in quadruple density (240 dpi), half speed. You have to

27 90 ... provide parameters **n m d₁ d₂ ...**
1Bh 5Ah ... Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
d₁ d₂ ... are the bitmap data to print.

See EPSON command description page 27 for an example.

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

27 55

1Bh 37h 10 OPEN1,4
 20 PRINT#1,CHR\$(27);CHR\$(55);
 30 CLOSE1

ESC 6 Select **Table 2** character set. This is the international charset user configured.

27 54

1Bh 36h 10 OPEN1,4
 20 PRINT#1,CHR\$(27);CHR\$(54);
 30 CLOSE1

ESC \ 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.

27 92 n

1Bh 5Ch n 10 OPEN1,4
 20 PRINT#1,CHR\$(27);CHR\$(92);CHR\$(3);CHR\$(27);CHR\$(92);CHR\$(54);
 30 CLOSE1

ESC ^ 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.

27 94

1Bh 5Eh 10 OPEN1,4
 20 PRINT#1,CHR\$(27);CHR\$(94);CHR\$(13);
 30 CLOSE1

8.2.6. Character creation, Down Line Loading (DLL)

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

ESC = This code has to be followed by parameters **m n** and data.
27 61 **m** and **n** are the number of bytes to load in order to have n + (m x 256) = size
1Bh 3Dh This command is ignored by Ultimate-II 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-II 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-II 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

8.2.7. Other commands

BELL
7
07h

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

DC1
17
11h

Printer selection.
This command is ignored by Ultimate-II Virtual Printer.

DC3
19
13h

No operation.

CAN
24
18h

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

ESC <
27 60
1Bh 3Ch

Set **left to right** printing for one line.
This command is ignored by Ultimate-II 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-II Virtual Printer and does not exist in a real MPS-1230 printer.

ESC Q
27 81
1Bh 51h

De-select printer.
This command is ignored by Ultimate-II Virtual Printer.

ESC U n
27 85 n
1Bh 30h n

Select **Mono/Bidirectional** printing.
This command is ignored by Ultimate-II Virtual Printer.

n=0 : bidirectional
 n=1 : mono-directional (left to right) for better alignment.

9. PETASCII character table

9.1. USA/UK

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|				0	@	P	-	⌈				⌈	-	⌈		⌈
1	|		!	1	A	Q	♠	●				■	⊕	♠	●	■	⊕
2	|		”	2	B	R	|	-				■	⊕	|	-	■	⊕
3	|		#	3	C	S	-	♥				-	⊕	-	♥	-	⊕
4	|		\$	4	D	T	-	|				-	|	-	|	-	|
5	|		%	5	E	U	-	/				|	|	-	/	|	|
6	|		&	6	F	V	-	×				■	■	-	×	■	■
7	|		'	7	G	W	|	o				|	-	|	o	|	-
8	|		(	8	H	X	|	♣				■	-	|	♣	■	-
9	|		)	9	I	Y	\	|				■	-	\	|	■	-
A	|		*	:	J	Z	\	♦				|	⌈	\	♦	|	⌈
B	|		+	;	K	[/	+				⌈	■	/	+	⌈	■
C	|		,	<	L	£	L	■				■	■	L	■	■	■
D	|		-	=	M	]	\	|				⌈	⌈	\	|	⌈	⌈
E	|		.	>	N	↑	/	π				⌈	■	/	π	⌈	■
F	|		/	?	O	←	⌈	■				-	■	⌈	■	-	π

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

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

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

9.2. Denmark

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			0	@	P	—	┐					┐	—	┐		┐
1		!	1	A	Q	♠	●				┐	┐	♠	●	┐	┐
2		”	2	B	R	|	—				┐	┐	|	—	┐	┐
3		#	3	C	S	—	♥				┐	┐	—	♥	┐	┐
4		\$	4	D	T	—	|				┐	┐	—	|	┐	┐
5		%	5	E	U	—	┐				┐	┐	—	┐	┐	┐
6		&	6	F	V	—	×				┐	┐	—	×	┐	┐
7		'	7	G	W	|	o				┐	┐	|	o	┐	┐
8		(	8	H	X	|	♣				┐	┐	|	♣	┐	┐
9		)	9	I	Y	┐	|				┐	┐	┐	|	┐	┐
A		*	:	J	Z	┐	♦				┐	┐	┐	♦	┐	┐
B		+	;	K	Æ	┐	+				┐	┐	┐	+	┐	┐
C		,	<	L	Ø	L	⌘				┐	┐	L	⌘	┐	┐
D		-	=	M	Å	┐	|				┐	┐	┐	┐	┐	┐
E		.	>	N	↑	┐	π				┐	┐	┐	π	┐	┐
F		/	?	O	←	┐	▯				┐	┐	┐	▯	┐	┐

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

	0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0			0	@	p	—	P					┐	—	P		┐
1		!	1	a	q	A	Q				┐	┐	A	Q	┐	┐
2		”	2	b	r	B	R				┐	┐	B	R	┐	┐
3		#	3	c	s	C	S				┐	┐	C	S	┐	┐
4		\$	4	d	t	D	T				┐	┐	D	T	┐	┐
5		%	5	e	u	E	U				┐	┐	E	U	┐	┐
6		&	6	f	v	F	V				┐	┐	F	V	┐	┐
7		'	7	g	w	G	W				┐	┐	G	W	┐	┐
8		(	8	h	x	H	X				┐	┐	H	X	┐	┐
9		)	9	i	y	I	Y				┐	┐	I	Y	┐	┐
a		*	:	j	z	J	Z				┐	┐	J	Z	┐	┐
b		+	;	k	æ	K	Æ				┐	┐	K	Æ	┐	┐
c		,	<	l	ø	L	Ø				┐	┐	L	Ø	┐	┐
d		-	=	m	å	M	Å				┐	┐	M	Å	┐	┐
e		.	>	n	↑	N	⌘				┐	┐	N	⌘	┐	┐
f		/	?	o	←	O	⌘				┐	┐	O	⌘	┐	┐

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

9.3. France / Italy

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|			0	@	P	`	7				8	`	7		8	
1	|		!	1	A	Q	◀	▶				|	à	◀	▶	|	à
2	|		”	2	B	R	—	◊				◊	è	—	◊	◊	è
3	|		#	3	C	S	—	◊				◊	ì	—	◊	◊	ì
4	|		\$	4	D	T	—	◊				◊	ò	—	◊	◊	ò
5	|		%	5	E	U	—	◊				◊	ù	—	◊	◊	ù
6	|		&	6	F	V	—	◊				◊	â	—	◊	◊	â
7	|		'	7	G	W	◊	◊				◊	ê	◊	◊	◊	ê
8	|		(	8	H	X	◊	◊				◊	î	◊	◊	◊	î
9	|		)	9	I	Y	—	—				◊	ô	—	—	◊	ô
A	|		*	:	J	Z	—	◊				◊	û	—	◊	◊	û
B	|		+	;	K	[	◊	◊				◊	ä	◊	◊	◊	ä
C	|		,	<	L	\	L	ï				£	ö	L	ï	£	ö
D	|		-	=	M	]	◊	◊				◊	ü	◊	◊	◊	ü
E	|		.	>	N	↑	—	π				◊	β	—	π	◊	β
F	|		/	?	O	—	◊	◊				◊	é	◊	◊	◊	é

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

		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0	|			0	@	p	`	P				8	`	P		8	
1	|		!	1	a	q	A	Q				|	à	A	Q	|	à
2	|		”	2	b	r	B	R				◊	è	B	R	◊	è
3	|		#	3	c	s	C	S				◊	ì	C	S	◊	ì
4	|		\$	4	d	t	D	T				◊	ò	D	T	◊	ò
5	|		%	5	e	u	E	U				◊	ù	E	U	◊	ù
6	|		&	6	f	v	F	V				◊	â	F	V	◊	â
7	|		'	7	g	w	G	W				◊	ê	G	W	◊	ê
8	|		(	8	h	x	H	X				◊	î	H	X	◊	î
9	|		)	9	i	y	I	Y				◊	ô	I	Y	◊	ô
a	|		*	:	j	z	J	Z				◊	û	J	Z	◊	û
b	|		+	;	k	[	K	ë				◊	ä	K	ë	◊	ä
c	|		,	<	l	\	L	ï				£	ö	L	ï	£	ö
d	|		-	=	m	]	M	°				◊	ü	M	°	◊	ü
e	|		.	>	n	↑	N	π				◊	β	N	π	◊	β
f	|		/	?	o	—	O	ç				◊	é	O	ç	◊	é

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

9.4. Germany

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|			0	@	P	`	7					@	`	7		`
1	|		!	1	A	Q	◀	▶				!	μ	◀	▶	!	◀
2	|		”	2	B	R	—	/				!	à	—	/	!	—
3	|		#	3	C	S	■	■				±	ù	■	■	±	■
4	|		\$	4	D	T	■	◊				±	â	■	◊	±	■
5	|		%	5	E	U	■	■				±	ê	■	■	±	■
6	|		&	6	F	V	◊	—				—	î	◊	—	—	◊
7	|		'	7	G	W	◊	■				±	ô	◊	■	±	◊
8	|		(	8	H	X	■	—				±	û	■	—	±	■
9	|		)	9	I	Y	!	—				±	√	!	—	±	!
A	|		*	:	J	Z	!	■				±	Σ	!	■	±	!
B	|		+	;	K	[	\	■				±	Ä	\	■	±	\
C	|		,	<	L	\	L	◊				±	Ö	L	◊	±	L
D	|		-	=	M	]	/	■				±	Ü	/	■	±	/
E	|		.	>	N	↑	—	π				±	β	—	π	±	—
F	|		/	?	O	—	◊	—				±	^	◊	—	±	π

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

		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0	|			0	@	p	`	P				g	`	P		g	
1	|		!	1	a	q	A	Q				!	à	A	Q	!	à
2	|		”	2	b	r	B	R				!	è	B	R	!	è
3	|		#	3	c	s	C	S				±	ì	C	S	±	ì
4	|		\$	4	d	t	D	T				±	ò	D	T	±	ò
5	|		%	5	e	u	E	U				±	ù	E	U	±	ù
6	|		&	6	f	v	F	V				—	â	F	V	—	â
7	|		'	7	g	w	G	W				±	ê	G	W	±	ê
8	|		(	8	h	x	H	X				±	î	H	X	±	î
9	|		)	9	i	y	I	Y				±	ô	I	Y	±	ô
a	|		*	:	j	z	J	Z				±	û	J	Z	±	û
b	|		+	;	k	[	K	Ä				±	ä	K	Ä	±	ä
c	|		,	<	l	\	L	Ö				±	ö	L	Ö	±	ö
d	|		-	=	m	]	M	Ü				±	ü	M	Ü	±	ü
e	|		.	>	n	↑	N	π				±	β	N	π	±	β
f	|		/	?	o	—	O	—				±	é	O	—	±	π

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

9.5. Spain

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|			0	@	P	`	┐					←	`	┐		←
1	|		!	1	A	Q	▴	▴					┐	À	▴	┐	À
2	|		”	2	B	R	▬	┐					┐	È	▬	┐	È
3	|		#	3	C	S	▬	▬					┐	♠	▬	▬	♠
4	|		\$	4	D	T	▬	▬					┐	Ò	▬	▬	Ò
5	|		%	5	E	U	▬	▬					┐	♥	▬	▬	♥
6	|		&	6	F	V	`	▬					┐	Á	`	▬	Á
7	|		'	7	G	W	┐	▬					┐	É	┐	▬	É
8	|		(	8	H	X	▬	▬					┐	Í	▬	▬	Í
9	|		)	9	I	Y	▬	▬					┐	Ó	▬	▬	Ó
A	|		*	:	J	Z	▬	▬					┐	Ú	▬	▬	Ú
B	|		+	;	K	[	▬	▬					┐	ÿ	▬	▬	ÿ
C	|		,	<	L	\	▬	▬					┐	Ü	▬	▬	Ü
D	|		-	=	M	]	▬	▬					┐	Ñ	▬	▬	Ñ
E	|		.	>	N	↑	▬	▬					┐	♣	▬	▬	♣
F	|		/	?	O	▬	▬	▬					┐	Ç	▬	▬	Ç

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

		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0	|			0	@	p	`	P					←	`	P		←
1	|		!	1	a	q	A	Q					┐	à	A	Q	┐
2	|		”	2	b	r	B	R					┐	è	B	R	┐
3	|		#	3	c	s	C	S					┐	♠	C	S	┐
4	|		\$	4	d	t	D	T					┐	ò	D	T	┐
5	|		%	5	e	u	E	U					┐	♥	E	U	┐
6	|		&	6	f	v	F	V					┐	á	F	V	┐
7	|		'	7	g	w	G	W					┐	é	G	W	┐
8	|		(	8	h	x	H	X					┐	í	H	X	┐
9	|		)	9	i	y	I	Y					┐	ó	I	Y	┐
a	|		*	:	j	z	J	Z					┐	ú	J	Z	┐
b	|		+	;	k	[	K	[					┐	ÿ	K	[┐
c	|		,	<	l	\	L	\					┐	ü	L	\	┐
d	|		-	=	m	]	M	]					┐	ñ	M]	┐
e	|		.	>	n	↑	N	↑					┐	♣	N	↑	┐
f	|		/	?	o	▬	O	▬					┐	Ç	O	▬	┐

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

9.6. Sweden

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|			0	@	P	-	7					r	-	7		r
1	|		!	1	A	Q	♠	●				█	└	♠	●	█	└
2	|		"	2	B	R	|	-				█	└	|	-	█	└
3	|		#	3	C	S	-	♥				-	└	-	♥	-	└
4	|		\$	4	D	T	-	|				-	|	-	|	-	|
5	|		%	5	E	U	-	/				|	|	-	/	|	|
6	|		&	6	F	V	-	×				█	█	-	×	█	█
7	|		'	7	G	W	|	o				|	-	|	o	|	-
8	|		(	8	H	X	|	♣				█	-	|	♣	█	-
9	|		)	9	I	Y	\	|				█	-	\	|	█	-
A	|		*	:	J	Z	\	♦				|	└	\	♦	|	└
B	|		+	;	K	Ä	/	+				└	█	/	+	└	█
C	|		,	<	L	Ö	L	≡				█	█	L	Ö	█	█
D	|		-	=	M	Å	\	|				L	└	\	|	L	└
E	|		.	>	N	↑	/	π				└	█	/	π	└	█
F	|		/	?	O	←	Γ	▴				-	█	Γ	▴	-	π

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

		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0	|			0	@	p	-	P					r	-	P		r
1	|		!	1	a	q	A	Q				█	└	A	Q	█	└
2	|		"	2	b	r	B	R				█	└	B	R	█	└
3	|		#	3	c	s	C	S				-	└	C	S	-	└
4	|		\$	4	d	t	D	T				-	|	D	T	-	|
5	|		%	5	e	u	E	U				|	|	E	U	|	|
6	|		&	6	f	v	F	V				█	█	F	V	█	█
7	|		'	7	g	w	G	W				|	-	G	W	|	-
8	|		(	8	h	x	H	X				█	-	H	X	█	-
9	|		)	9	i	y	I	Y				█	-	I	Y	█	-
a	|		*	:	j	z	J	Z				|	└	J	Z	|	└
b	|		+	;	k	ä	K	Ä				└	█	K	Ä	└	█
c	|		,	<	l	ö	L	Ö				█	█	L	Ö	█	█
d	|		-	=	m	å	M	Å				L	└	M	Å	L	└
e	|		.	>	n	↑	N	≡				└	█	N	≡	└	█
f	|		/	?	o	←	O	≡				-	█	O	≡	-	█

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

9.7. Switzerland

		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|			0	@	P	`	7				8	`	7		8	
1	|		!	1	A	Q	▴	▴				l	à	▴	▴	l	à
2	|		”	2	B	R	▬	✓				l	è	▬	✓	l	è
3	|		#	3	C	S	▬	■				±	ì	▬	■	±	ì
4	|		\$	4	D	T	▬	▬				±	ò	▬	▬	±	ò
5	|		%	5	E	U	▬	▬				±	ù	▬	▬	±	ù
6	|		&	6	F	V	▬	▬				±	â	▬	▬	±	â
7	|		'	7	G	W	▬	▬				±	ê	▬	▬	±	ê
8	|		(	8	H	X	▬	▬				±	î	▬	▬	±	î
9	|		)	9	I	Y	▬	▬				±	ô	▬	▬	±	ô
A	|		*	:	J	Z	▬	▬				±	û	▬	▬	±	û
B	|		+	;	K	[	▬	▬				±	ä	▬	▬	±	ä
C	|		,	<	L	\	L	ï				£	ö	L	ï	£	ö
D	|		-	=	M	]	▬	▬				'	ü	▬	▬	'	ü
E	|		.	>	N	↑	▬	▬				^	β	▬	▬	^	β
F	|		/	?	O	▬	▬	ç				"	é	▬	▬	"	π

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

		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
0	|			0	@	p	`	P				8	`	P		8	
1	|		!	1	a	q	A	Q				l	à	A	Q	l	à
2	|		”	2	b	r	B	R				l	è	B	R	l	è
3	|		#	3	c	s	C	S				±	ì	C	S	±	ì
4	|		\$	4	d	t	D	T				±	ò	D	T	±	ò
5	|		%	5	e	u	E	U				±	ù	E	U	±	ù
6	|		&	6	f	v	F	V				±	â	F	V	±	â
7	|		'	7	g	w	G	W				±	ê	G	W	±	ê
8	|		(	8	h	x	H	X				±	î	H	X	±	î
9	|		)	9	i	y	I	Y				±	ô	I	Y	±	ô
a	|		*	:	j	z	J	Z				±	û	J	Z	±	û
b	|		+	;	k	[	K	ë				±	ä	K	ë	±	ä
c	|		,	<	l	\	L	ï				£	ö	L	ï	£	ö
d	|		-	=	m	]	M	²				'	ü	M	²	'	ü
e	|		.	>	n	↑	N	π				^	β	N	π	^	β
f	|		/	?	o	▬	O	ç				"	é	O	ç	"	π

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

10. EPSON FX-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	â		0	@	P	`	p	à	â		0	@	P	`	p
1	è	é	!	1	A	Q	a	q	è	é	/	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	°	%	5	E	U	e	u		°	%	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	Û	)	9	I	Y	i	y		Û	)	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		

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	Å	Ö	Ä	Ü	é	ä	ö	å	ü
Italy	#	\$	@	°	\	é	^	ù	à	ò	è	ì
Spain	¤	\$	@	í	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

11. IBM character tables

11.1. Table 1

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

11.2. Table 2

11.2.1. International 1

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

11.2.2. International 2

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Ç	É	Á	|||	L	£	α	≡
1			!	1	A	Q	a	q	Ü	æ	í	||||	⌣	⌣	β	±
2			”	2	B	R	b	r	é	Æ	ó	||||	⌣	⌣	Γ	±
3	♥		#	3	C	S	c	s	ä	ø	ú	||||	⌣	⌣	Π	±
4	♦		\$	4	D	T	d	t	å	ö	ñ	||||	⌣	⌣	Σ	±
5	♣	8	%	5	E	U	e	u	à	ö	ñ	||||	⌣	⌣	σ	±
6			&	6	F	V	f	v	â	ü	ö	||||	⌣	⌣	μ	±
7			'	7	G	W	g	w	ç	ü	ö	||||	⌣	⌣	τ	±
8			(	8	H	X	h	x	ë	ö	ä	||||	⌣	⌣	φ	±
9			)	9	I	Y	i	y	è	ü	ä	||||	⌣	⌣	Θ	±
A			*	:	J	Z	j	z	é	ü	Ä	||||	⌣	⌣	Ω	±
B			+	;	K	[	k	l	í	ø	h	||||	⌣	⌣	δ	±
C			,	<	L	\	l	m	i	l	i	||||	⌣	⌣	8	±
D			-	=	M	]	m	n	í	l	í	||||	⌣	⌣	ø	±
E			.	>	N	^	n	o	Ä	L	í	||||	⌣	⌣	€	±
F			/	?	O	_	o	o	Ä	L	í	||||	⌣	⌣	∅	±

11.2.3. Israel

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	ן	י	á	|||	L	£	α	≡
1			!	1	A	Q	a	q	ל	ו	í	||||	⌣	⌣	β	±
2			”	2	B	R	b	r	א	ו	ó	||||	⌣	⌣	Γ	±
3	♥		#	3	C	S	c	s	ת	ו	ú	||||	⌣	⌣	Π	±
4	♦		\$	4	D	T	d	t	י	ו	ñ	||||	⌣	⌣	Σ	±
5	♣	8	%	5	E	U	e	u	י	ו	ñ	||||	⌣	⌣	σ	±
6			&	6	F	V	f	v	י	ו	ñ	||||	⌣	⌣	μ	±
7			'	7	G	W	g	w	י	ו	ñ	||||	⌣	⌣	τ	±
8			(	8	H	X	h	x	י	ו	ñ	||||	⌣	⌣	φ	±
9			)	9	I	Y	i	y	י	ו	ñ	||||	⌣	⌣	Θ	±
A			*	:	J	Z	j	z	י	ו	ñ	||||	⌣	⌣	Ω	±
B			+	;	K	[	k	l	י	ו	ñ	||||	⌣	⌣	δ	±
C			,	<	L	\	l	m	י	ו	ñ	||||	⌣	⌣	8	±
D			-	=	M	]	m	n	י	ו	ñ	||||	⌣	⌣	ø	±
E			.	>	N	^	n	o	י	ו	ñ	||||	⌣	⌣	€	±
F			/	?	O	_	o	o	י	ו	ñ	||||	⌣	⌣	∅	±

11.2.4. Greece

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Α	Ρ	ι	|||	L	£	ω	Ω
1			!	1	A	Q	a	q	Β	Σ	κ	||||	⌣	⌣	α	±
2			”	2	B	R	b	r	Γ	Τ	λ	||||	⌣	⌣	ε	±
3	♥		#	3	C	S	c	s	Δ	Υ	μ	||||	⌣	⌣	η	±
4	♦		\$	4	D	T	d	t	Ε	Φ	ν	||||	⌣	⌣	ι	±
5	♣	8	%	5	E	U	e	u	Ζ	Χ	ξ	||||	⌣	⌣	ο	±
6			&	6	F	V	f	v	Η	Ψ	ο	||||	⌣	⌣	ύ	±
7			'	7	G	W	g	w	Θ	Ω	π	||||	⌣	⌣	ώ	±
8			(	8	H	X	h	x	Ι	α	ρ	||||	⌣	⌣	Α	±
9			)	9	I	Y	i	y	Κ	β	σ	||||	⌣	⌣	Ε	±
A			*	:	J	Z	j	z	Λ	γ	τ	||||	⌣	⌣	Η	±
B			+	;	K	[	k	l	Μ	δ	υ	||||	⌣	⌣	Ι	±
C			,	<	L	\	l	m	Ν	ε	φ	||||	⌣	⌣	Θ	±
D			-	=	M	]	m	n	Ξ	ζ	χ	||||	⌣	⌣	Υ	±
E			.	>	N	^	n	o	Ο	η	ψ	||||	⌣	⌣	Υ	±
F			/	?	O	_	o	o	Π	θ	ψ	||||	⌣	⌣	Υ	±

11.2.5. Portugal

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Ç	É	Á	|||	L	£	α	≡
1			!	1	A	Q	a	q	Ü	Ê	Î	||||	⌈	⌈	β	±
2			”	2	B	R	b	r	é	Ô	Ó	||||	⌋	⌋	Γ	±
3	♥		#	3	C	S	c	s	â	Ö	Ô	||||	⌋	⌋	Π	±
4	♦		\$	4	D	T	d	t	ä	Ø	Õ	||||	⌋	⌋	Σ	±
5	♣	§	%	5	E	U	e	u	à	Ò	Ö	||||	⌋	⌋	σ	±
6	♠		&	6	F	V	f	v	â	Ù	Ö	||||	⌋	⌋	μ	±
7			'	7	G	W	g	w	ç	Û	Ö	||||	⌋	⌋	τ	±
8			(	8	H	X	h	x	ê	Ý	Ç	||||	⌋	⌋	φ	±
9			)	9	I	Y	i	y	ë	Ö	À	||||	⌋	⌋	Θ	±
A			*	:	J	Z	j	z	è	Ü	Á	||||	⌋	⌋	Ω	±
B			+	;	K	[	k	(	í	£	Ú	||||	⌋	⌋	δ	±
C			,	<	L	\	l	)	ï	€	Í	||||	⌋	⌋	ø	±
D			-	=	M	]	m	~	í	Å	Ê	||||	⌋	⌋	²	±
E			.	>	N	^	n		Ä	Ë	³	||||	⌋	⌋	€	±
F			/	?	O	_	o		Å	Ö	ó	||||	⌋	⌋	∅	±

11.2.6. Spain

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Ç	É	Á	|||	L	£	α	≡
1			!	1	A	Q	a	q	Ü	Ê	Î	||||	⌈	⌈	β	±
2			”	2	B	R	b	r	é	Ô	Ó	||||	⌋	⌋	Γ	±
3	♥		#	3	C	S	c	s	â	Ö	Ô	||||	⌋	⌋	Π	±
4	♦		\$	4	D	T	d	t	ä	Ø	Õ	||||	⌋	⌋	Σ	±
5	♣	§	%	5	E	U	e	u	à	Ò	Ö	||||	⌋	⌋	σ	±
6	♠		&	6	F	V	f	v	â	Ù	Ö	||||	⌋	⌋	μ	±
7			'	7	G	W	g	w	ç	Û	Ö	||||	⌋	⌋	τ	±
8			(	8	H	X	h	x	ê	Ý	Ç	||||	⌋	⌋	φ	±
9			)	9	I	Y	i	y	ë	Ö	À	||||	⌋	⌋	Θ	±
A			*	:	J	Z	j	z	è	Ü	Á	||||	⌋	⌋	Ω	±
B			+	;	K	[	k	(	í	£	Ú	||||	⌋	⌋	δ	±
C			,	<	L	\	l	)	ï	€	Í	||||	⌋	⌋	ø	±
D			-	=	M	]	m	~	í	Å	Ê	||||	⌋	⌋	²	±
E			.	>	N	^	n		Ä	Ë	³	||||	⌋	⌋	€	±
F			/	?	O	_	o		Å	Ö	ó	||||	⌋	⌋	∅	±

12. Commodore commands reference

CODE			DESCRIPTION	PAGE
ASCII	DEC	HEX		
BIT IMG	8	08	Select graphic Bit Image Mode	16
BIM IMG SUB	8 26	08 1A	Select repeated graphic Bit Image Mode	16
HTAB	9	09	Horizontal tabulation	15
LF	10	0A	Line Feed	14
FF	12	0C	Form Feed	14
CR	13	0D	Carriage Return	14
EN ON	14	0E	Double width character ON	10
EN OFF	15	0F	Double width character OFF, Bitmap Image Mode OFF	11
POS	16	10	Jump to horizontal position in number of characters	15
CRSR DWN	17	11	Select Commodore charset with lowercases and uppercases	13
RVS ON	18	12	Negative character ON	11
ESC	27	1B	ASCII code for the Escape character	
NLQ ON	31	1F	Near Letter Quality ON	13
ESC POS	16	10	Jump to horizontal position in number of dots	15
ESC -	45	2D	Underline ON/OFF	11
ESC 4	52	34	Italic ON	11
ESC 5	53	35	Italic OFF	12
ESC 8*	56	38	Disable paper end sensor	15
ESC 9*	57	39	Enable paper end sensor	15
ESC =*	61	3D	Custom character definition using Down Line Loading (DLL)	17
ESC c	67	43	Set paper height in number of text lines	14
ESC c NUL	67 0	43 00	Set paper height in inches	14
ESC e	69	45	Bold character ON	11
ESC f	70	46	Bold character OFF	11
ESC g	71	47	Double Strike ON	10
ESC h	72	48	Double Strike OFF	10
ESC i	73	49	Select character print definition	18
ESC n*	78	4E	Define Bottom of Page (BOF)	14
ESC o*	79	4F	Disable Bottom of Page (BOF)	14
ESC s	83	53	Select Superscript or Subscript character mode	12
ESC t	84	54	Disable Superscript and Subscript character mode	13
ESC [	91	5B	Select character spacing (PICA, ELITE, ...)	12
ESC X	120	78	Select NLQ or DRAFT	13
CS	141	8D	Carriage Return with no Line Feed	14
CRSR UP	145	91	Select Commodore charset with uppercases and graphics	13
RVS OFF	146	92	Negative character OFF	11
NLQ OFF	159	9F	Near Letter Quality OFF	13

* Ignored in the Ultimate-II Virtual Printer

13. EPSON FX-80 commands reference

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

* Ignored in the Ultimate-II Virtual Printer

ASCII	CODE		DESCRIPTION	PAGE
	DEC	HEX		
ESC H	72	48	Double Strike OFF	19
ESC I	73	49	Extend printable characters set	29
ESC J	74	4A	Skip n/216" of paper	24
ESC K	75	4B	Set normal density graphics	26
ESC L	76	4C	Set double density graphics	27
ESC M	77	4D	Elite pitch 12 cpi ON	21
ESC N*	78	4E	Define Bottom of Page (BOF)	25
ESC O*	79	4F	Disable Bottom of Page (BOF)	25
ESC P	80	50	Elite pitch 12 cpi OFF	21
ESC Q	81	51	Define right margin	24
ESC R	82	52	Select national character set	29
ESC S	83	53	Select Superscript or Subscript character mode	21
ESC T	84	54	Disable Superscript and Subscript character mode	21
ESC U*	85	55	Mono/Bidirectional printing	31
ESC W	87	57	Double width characters ON/OFF	19
ESC Y	89	59	Double density BIM selection, normal speed	27
ESC Z	90	5A	Four times density BIM selection	27
ESC ^	94	5E	9-dot high strips BIM printing	28
ESC b	98	62	Select up to 8 vertical tab stops programs	26
ESC i*	105	69	Immediate character printing ON/OFF	31
ESC j	106	6A	Reverse paper feed n/216"	24
ESC l	108	6C	Define left margin	24
ESC p*	112	70	Proportional spacing ON/OFF	22
ESC s*	115	73	Half speed printing ON/OFF	31
ESC x	120	78	Select NLQ or DRAFT	21
DEL*	127	7F	Clear last printable character	31

* Ignored in the Ultimate-II Virtual Printer

14. IBM Graphics Printer commands reference

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

* Ignored in the Ultimate-II Virtual Printer

† Only in the Ultimate-II Virtual Printer, not in a real MPS-1230

ASCII	CODE		DESCRIPTION	PAGE
	DEC	HEX		
ESC T	84	54	Disable Superscript and Subscript character mode	35
ESC U*	85	55	Mono/Bidirectional printing	39
ESC W	87	57	Double width characters ON/OFF	32
ESC Y	89	59	Double density BIM selection, normal speed	38
ESC Z	90	5A	Four times density BIM selection	38
ESC [	91	5B	Set horizontal spacing	34
ESC x	120	78	Select NLQ or DRAFT	35

* Ignored in the Ultimate-II Virtual Printer

15. IBM Proprinter commands reference

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

* Ignored in the Ultimate-II Virtual Printer

† Only in the Ultimate-II Virtual Printer, not in a real MPS-1230

ASCII	CODE		DESCRIPTION	PAGE
	DEC	HEX		
ESC T	84	54	Disable Superscript and Subscript character mode	42
ESC U*	85	55	Mono/Bidirectional printing	47
ESC W	87	57	Double width characters ON/OFF	40
ESC Y	89	59	Double density BIM selection, normal speed	45
ESC Z	90	5A	Four times density BIM selection	45
ESC \	92	5C	Print n characters from extended table	46
ESC ^	94	5E	Print one character from extended table	46
ESC _	95	5F	Overline: ON/OFF	42

* Ignored in the Ultimate-II Virtual Printer

16. Technical Specifications

Output Type	PNG file 2-bit depth (4 grey levels) 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	Boldface Double width Superscript Subscript Double strike Underlined Italic Reversed Overlined

17. Print Sample

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

MPS EMULATION PRINT TEST PAGE

DRAFT Simple Under,Aggp **Bold** *Super* *sub* **Rev**
 ITALIC Simple Under,Aggp **Bold** *Super* *sub* **Rev**
 NLQ Simple Under,Aggp **Bold** *Super* *sub* **Rev**

DRAFT Double Under,Aggp **Bold** *Super* *sub* **Rev**
 ITALIC Double Under,Aggp **Bold** *Super* *sub* **Rev**
 NLQ Double Under,Aggp **Bold** *Super* *sub* **Rev**

DRAFT Large Under,Aggp **Bold** *Super* *sub* **Rev**
 ITALIC Large Under,Aggp **Bold** *Super* *sub* **Rev**
 NLQ Large Under,Aggp **Bold** *Super* *sub* **Rev**

DRAFT Lg Db Under,Aggp **Bold** *Super* *sub* **Rev**
 ITALIC Lg Db Under,Aggp **Bold** *Super* *sub* **Rev**
 NLQ Lg Db Under,Aggp **Bold** *Super* *sub* **Rev**

PICA	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
ELITE	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
MICRO	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
CONDENSED	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
PICA COMPRESSED	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
ELITE COMPRESSED	Draft Regular	<i>Draft Italic</i>	Near Letter Quality
MICRO COMPRESSED	Draft Regular	<i>Draft Italic</i>	Near Letter Quality

GRAPHIC BITMAP
 Simple Bitmap

***** COMMODORE 64 BASIC V2 *****

64K RAM SYSTEM 38911 BASIC BYTES FREE

READY.

Repeated Bitmap

PETASCII code tables

UPPER/GRAPHIC																LOWER/UPPER																	
I	O	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	I	O	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0|			0	@	P	-	|					r	-	|		r	0|			0	@	p	-	P				r	-	P		r	
1|		!	1	A	Q	♠	●				■	+	♠	●	■	+	1|		!	1	a	q	A	Q			■	+	A	Q	■	+	
2|		"	2	B	R	|	-				■	+	|	-	■	+	2|		"	2	b	r	B	R			■	+	B	R	■	+	
3|		#	3	C	S	-	♥				-	+	-	♥	-	+	3|		#	3	c	s	C	S			-	+	C	S	-	+	
4|		\$	4	D	T	-	|				-	|	-	|	-	|	4|		\$	4	d	t	D	T			-	|	D	T	-	|	
5|		%	5	E	U	-	|				|	-	|	-	|	|	5|		%	5	e	u	E	U			|	-	E	U	|	|	
6|		&	6	F	V	-	x				■	■	-	x	■	■	6|		&	6	f	v	F	V			■	■	F	V	■	■	
7|		'	7	G	W	|	o				|	-	|	o	|	-	7|		'	7	g	w	G	W			|	-	G	W	|	-	
8|		(	8	H	X	|	♣				■	-	|	♣	■	-	8|		(	8	h	x	H	X			■	-	H	X	■	-
9|		)	9	I	Y	-	|				■	-	|	-	■	-	9|		)	9	i	y	I	Y			■	-	I	Y	■	-
A|		*	:	J	Z	-	♦				|	+	-	♦	|	+	A|		*	:	j	z	J	Z			|	+	J	Z	|	+	
B|		+	;	K	[	-	+				+	-	+	+	+	+	B|		+	;	k	[	K	+			+	-	K	+	+	+
C|		,	<	L	£	L	■				■	-	L	■	■	■	C|		,	<	l	£	L	■			■	-	L	■	■	■	
D|		-	=	M]	-					■	-]	-	■	■	D|		-	=	m]	M]			■	-]	M]	■	■
E|		.	>	N	↑	-	■				■	-	↑	■	■	■	E|		.	>	n	↑	N	↑			■	-	N	↑	■	■	
F|		/	?	O	←	□	■				■	-	□	■	■	■	F|		/	?	o	←	O	←			■	-	O	←	■	■	

18. 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