Ultimate-II MPS Printer Emulation

User's Guide

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Version 1.0, May 27th 2016

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1. Introduction

1.1. Context

The printer emulation is a new feature on 3.0 firmware. With this functionality you can print from your Commodore 64/128 using an emulated 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 emulate 4 printer instruction sets:

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

1.2. Purpose of this document

This document describes how to use and configure the Ultimate-II embedded printer emulation.

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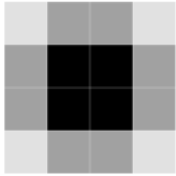
To enable the printer, you need to enable the software IEC feature in the Ultimate-II:

- 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*
  You can select file base name that the printer emulation will use to create the PNG files. If you choose to generate PNG files they will be named */SD/printer-001.png*, */SD/printer-002.png*, and so on. If you chose the bypass the emulation and write raw data to disk the file will be named */SD/printer* with no extension.

- **Printer output type**: PNG 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 to a file. 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 (128 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 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) !

At this time, with firmware 3.0 beta, 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 mode is nearly immediate. There is no process time to wait.

4. Capabilities

This table summarize 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 (draft only)	●	●	●*	
NLQ	●	●	●	●
Underline	●	●	●	●
Double width	●	●	●	●
Superscript	●	●	●	●
Subscript	●	●	●	●
Reverse	●			
Overline				●
Backspace		●	●	●
Reverse page feed		●		
CR=CR+LF	●			optional
LF=CR+LF	●	●		
7 dot BIM	●			
8 dot BIM		●	●	●
9 dot BIM		●		
HT Program		●	●	●
VT Program		●		●
60 dpi BIM	● (double width)	●	●	●
75 dpi BIM		●		
80 dpi BIM		●		
90 dpi BIM		●		
120 dpi BIM		●	●	●
240 dpi BIM		●	●	●
Pica (10cpi)	●	●	●	●
Elite (12cpi)	●	●	●	●
Micro (15cpi)	●			
Condensed (17.1cpi)	●	●	●	●
Pica Compressed (20cpi)	●			
Elite Compressed (24 cpi)	●			
Micro Compressed (30 cpi)	●			

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* Only in Ultimate-II MPS Printer Emulation, 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
15
0Fh
	Disable the **Double Width** print mode (Enhanced OFF)
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(15);`
	`30 CLOSE1`

RVS ON
18
12h
	Select the **Reverse** print mode. Each character is printed in negative.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(18);"REVERSE"`
	`30 CLOSE1`

REVERSE

RVS OFF
146
92h
	Disable the **reverse** print mode
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(146);`
	`30 CLOSE1`

ESC - 1
27 45 49
1Bh 2Dh 31h
	Select the **Underline** print mode for all characters and spaces that follow.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"`
	`30 CLOSE1`

UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h
	Disable the Underline print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);`
	`30 CLOSE1`

ESC e
27 69
1Bh 45h
	Select the **Bold** print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(69);"BOLD"`
	`30 CLOSE1`

BOLD

ESC f
27 70
1Bh 46h
	Disable the Bold print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(70);`
	`30 CLOSE1`

ESC 4
27 52
1Bh 34h
	Select the **Italic** print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(52);"ITALIC"`

```
             30 CLOSE1
```

ITALIC

ESC 5
27 53
1Bh 35h
	Disable the **Italic** print mode.
	
	```10 OPEN1,4```
	```20 PRINT#1,CHR$(27);CHR$(53);```
	```30 CLOSE1```

ESC [n
27 91 n
1Bh 5Bh n

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

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

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

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

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

Select the **Superscript** print mode. Characters are half high than the normal height and are 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
```

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 le left margin and advances the paper to the next line (behavior is LF+CR).

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

CR
13
0Dh

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

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

FF
12
0Ch

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

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

CS
141
8Dh

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

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

5.3.3. 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 MPS Printer Emulation.

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

ESC o
27 79

Disable the **Bottom of Form** (BOF).
This command is ignored by Ultimate-II MPS Printer Emulation.

1Bh 4Fh

```
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 MPS Printer Emulation.
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 MPS Printer Emulation.
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.
9   Stops are located every 8 PICA character position since the beginning of a line. This
09h   is fixed, not configurable.

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

POS n_1 n_2   On the current line, jump to the horizontal position corresponding to the $n_1 n_2$
16 n_1 n_2   decimal number of PICA characters since the beginning of the line. Each parameter
10h n_1 n_2   is a value between 0 and 9. 00 is the position of the first character. $n_1 n_2$ can range
                      from 00 to 79. Does nothing is current position is already over the $n_1 n_2$ position.

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

ESC POS n_1 n_2   On the current line, jump to the horizontal position corresponding to the dot
27 16 n_1 n_2   position given by parameters n_1 and n_2 from the beginning of the line. Parameter is
1Bh 10h n_1 n_2   calculated using the formula $n_1 \times 256 + n_2$. Value range is 0 to 480

Examples:

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

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

5.3.4. 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	□	□	□	■	□	□	□	□	□	□	■	□	□	□	■	□
2	□	□	■	□	■	□	□	□	□	■	■	■	□	□	■	□
4	□	■	□	□	□	□	□	□	■	■	■	■	■	□	□	□
8	■	□	□	□	□	□	■	■	■	■	■	■	■	■	□	■
16	□	■	□	□	□	■	□	■	■	■	■	■	■	□	□	□
32	□	□	■	□	■	□	□	□	■	■	■	■	□	□	■	□
64	□	□	□	■	□	□	□	□	□	■	■	□	□	□	■	□
Total	136	148	162	193	162	148	136	136	156	190	255	190	156	136	235	136

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

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

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

BIT IMG
8
08h

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

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

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

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

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

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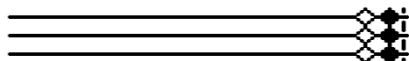

5.3.5. Character creation, Down Line Loading (DLL)

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 MPS Printer Emulation, DLL is not available but commands are correctly recognized and skipped with all their data.

ESC = **27 61** **1Bh 3Dh**	This code has to be followed by parameters **m n c s a p_1 p_2…p_{11}** which represents decimal byte codes to describe characters to load.

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

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

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

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

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

p_1 p_2…p_{11} Represents the 11 columns defining the dots printed for the character.

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

This represents the real R character in DRAFT quality.
In the 8x11 matrix you have to remind that a dot active in a column cannot be active in the next column to let the head recycle. Ultimate-II MPS Printer emulator 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 p_1 $p_2...p_{11}$)

ESC i n   Select the print quality depending on parameter "n"
27 73 n   n=0   standard quality (draft) and normal characters
1Bh 49h n   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 MPS Printer Emulation, 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 MPS Printer Emulation, 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
```

ITALIC

ESC 5 **27 53** **1Bh 35h**	Disable the **Italic** print mode.

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

SI **15** **0Fh**	Select the **CONDENSED** spacing mode (17.1 chars/inch)

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

ESC SI
27 15
1Bh 0Fh

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

ESC M
27 77
1Bh 4Dh

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

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

DC2
18
12h

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

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

ESC P
27 80
1Bh 50h

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

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

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

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

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 p n	**Proportional** spacing ON/OFF
27 112 n	This command is ignored by Ultimate-II MPS Printer Emulation.
1Bh 70h n	

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		•			•		•
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	•			•	•	•	•
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	•	•	•	•		•	•

#	U	I	W	S	B	C	E
74	●		●				
75	●		●		●		
76	●		●	●			
77	●		●		●		
78	●		●	●			
79	●		●		●		
80	●	●					
81	●	●			●		
82	●	●					
83	●	●			●		
84	●	●		●			
85	●	●			●		

#	U	I	W	S	B	C	E
160	●		●				
161	●		●				●
162	●		●				
163	●		●				●
164	●		●		●		
165	●		●				●
166	●		●		●		
167	●		●				●
168	●		●	●			
169	●		●	●			●
170	●		●	●			
171	●		●	●			●

#	U	I	W	S	B	C	E
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
10
0Ah

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

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

CR
13
0Dh

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

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

FF
12
0Ch

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

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

ESC 0
27 48
1Bh 30h

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

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

ESC 1
27 49
1Bh 31h

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

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

ESC 2
27 50
1Bh 32h

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

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

ESC 3 n
27 51 n
1Bh 32h n

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

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

```
                        30 CLOSE1
```

ESC A n   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
8   will be printed over it. You can combine characters this way.
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
27 67 n   used to calculate form length.
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
27 108 n   calculate margin position in the line.
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
27 81 n   calculate margin position in the line.
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 MPS Printer Emulation.

```
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 MPS Printer Emulation.

```
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 MPS Printer Emulation.

```
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 MPS Printer Emulation.

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

TAB
9
09h

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

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

VT
11
0Bh

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

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

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

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

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

ESC D 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 car 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 …
27 75 …

Select the **Bit Image Mode** in simple density. 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 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
27 76 ...	parameters **n m d₁ d₂ ...**
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 MPS Printer Emulation, **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
27 90 ...	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. 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 * ...	Select the **Bit Image Mode** with provided density. You have to provide parameters **d**
27 42 ...	**n m d₁ d₂ ...**
1Bh 2Ah ...	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	Change density for bitmap commands. Value **n** is one from **K**, **L**, **Y** or **Z**. Value m is the
27 63 n m	new density for the command (see table in **ESC *** description).
1Bh 3Fh n m	

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

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

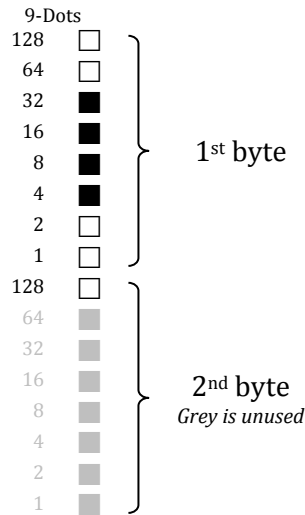|	
ESC ^ ...	Select the **Bit Image Mode** using all the 9 pin of the head. You have to provide
27 94 ...	parameters **d n m h₁ l₁ h₂ l₂ ...**
1Bh 5Eh ...	Value **d** is density. Only 0 and 1 are allowed for single (60dpi) or double density (120 dpi).

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 **hₙ** encode the upper 8 dots and values **lₙ** encode the lower dot in the MSB bit (2^7=128). This needs double of data for just one more dot.

9-Dots

128 □ ⎫
64 □ ⎪
32 ■ ⎪
16 ■ ⎬ 1st byte
8 ■ ⎪
4 ■ ⎪
2 □ ⎪
1 □ ⎭

128 □ ⎫
64 ■ ⎪
32 ■ ⎪
16 ■ ⎬ 2nd byte
8 ■ ⎪ *Grey is unused*
4 ■ ⎪
2 ■ ⎪
1 ■ ⎭

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 **27 55** **1Bh 37h**	Select Basic character table. This is the default charset for FX-80 printer.

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

ESC R n
27 82 n
1Bh 52h n

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

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

See national charset changes compared to basic charset in chapter 10.3

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

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

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

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

ESC I 0 **27 73 0** **1Bh 49h 00h**	Disable the extension of the character table. Parameter 0 can be passed using the '0' character (32, 30h).

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

ESC 6 **27 54** **1Bh 36h**	Extend only the italic part of the printable charset This command is ignored by Ultimate-II MPS Printer Emulation.

```
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 MPS Printer Emulation. 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 MPS Printer Emulation.

ESC & 0 **27 38 0** **1Bh 26h 00h**	This code has to be followed by parameters **n m a p_1 p_2…p_{11}** which represents decimal byte codes to describe characters to load.

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

next parameters are repeated for each defined char.
      a   This parameter tells which needles have to be used to print that character. Head has 9 needles of which 8 can be used here.
                 a = 0 : use the 8 upper needles
                 a = 1 : use the 8 lower needles

p_1 p_2…p_{11} Represents the 11 columns defining the dots printed for the character.

In the 8x11 matrix you have to remind that a dot active in a column cannot be active in the next column to let the head recycle. Ultimate-II MPS Printer emulator 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 MPS Printer Emulation.

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 MPS Printer Emulation.

DC3   **Suspend the printer**. The printer will ignore the input data until DC1 is sent.
19   This command is ignored by Ultimate-II MPS Printer Emulation.
13h

CAN   **Cancel** the current job and clear printer buffer.
24   This command is ignored by Ultimate-II MPS Printer Emulation.
18h

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

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

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

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

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

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

ESC i n   Immediate character printing ON/OFF like a typewriter.
27 105 n   This command is ignored by Ultimate-II MPS Printer Emulation.
1Bh 69h n   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 MPS Printer Emulation.
                 n=1 : half speed
                 n=0 : full speed
DEL   Delete the last printable character from buffer.
127   This command is ignored by Ultimate-II MPS Printer Emulation.
7Fh

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
27 71
1Bh 47h

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

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

double strike

ESC H
27 72
1Bh 48h

Disable **Double Strike** print mode

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

SO
14
0Eh

Select the **Double Width** print mode

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

DOUBLE WIDTH

DC4
20
14h

Disable the **Double Width** print mode

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

ESC SO
27 14
1Bh 0Eh

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

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

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

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

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

ESC – 1
27 45 49
1Bh 2Dh 31h
	Select the **Underline** print mode for all characters and spaces that follow.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(45);CHR$(49);"UNDERLINE"`
	`30 CLOSE1`
	
	UNDERLINE

ESC - 0
27 45 48
1Bh 2Dh 30h
	Disable the Underline print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(45);CHR$(48);`
	`30 CLOSE1`

ESC E
27 69
1Bh 45h
	Select the **Bold** print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(69);"BOLD"`
	`30 CLOSE1`
	
	BOLD

ESC F
27 70
1Bh 46h
	Disable the Bold print mode.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(70);`
	`30 CLOSE1`

ESC 4
27 52
1Bh 34h
	Select the **Italic** print mode.
	This feature has been added in Ultimate-II MPS Printer Emulation and does not exist in a real MPS-1230 printer. Italic was not supported in IBM Graphics Printer.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(52);"ITALIC"`
	`30 CLOSE1`
	
	ITALIC

ESC 5
27 53
1Bh 35h
	Disable the **Italic** print mode.
	This feature has been added in Ultimate-II MPS Printer Emulation and does not exist in a real MPS-1230 printer. Italic was not supported in IBM Graphics Printer.
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(27);CHR$(53);`
	`30 CLOSE1`

SI
15
0Fh
	Select the **CONDENSED** spacing mode (17.1 chars/inch)
	
	`10 OPEN1,4`
	`20 PRINT#1,CHR$(15);"CONDENSED"`
	`30 CLOSE1`

ESC M
27 77
1Bh 4Dh

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

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

DC2
18
12h

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

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

ESC [n
27 91 n
1Bh 5Bh n

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

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

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

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

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

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

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

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   If n=0, select standard quality mode (Draft)
27 120 n   If n=1, select near letter quality mode (NLQ)
1Bh 78h n

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

```
DRAFT QUALITY
NEAR LETTER QUALITY
```

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

7.2.2. Paper feeding

LF   A **Line Feed** advances the paper to the next line (behavior is LF only, no CR).
10
0Ah

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

CR   A **Carriage Return** returns the print head to le left margin but stays on the same
13   line (behavior is CR only, no LF).
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
12   the first line of a new blank page.
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 **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 MPS Printer Emulation. 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 MPS Printer Emulation.

```
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 MPS Printer Emulation.

```
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 MPS Printer Emulation.

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

TAB
9
09h

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

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

VT
11
0Bh

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

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

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

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

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

7.2.4. 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 ...

Select the **Bit Image Mode** in simple density (60 dpi). You have to provide

27 75 ...	parameters **n m d$_1$ d$_2$ ...**
1Bh 4Bh ...	Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
	d$_1$ d$_2$ ... are the bitmap data to print.

See EPSON command description page 26 for an example.

ESC L ...	Select the **Bit Image Mode** in double density (120 dpi), half speed. You have to
27 76 ...	provide parameters **n m d$_1$ d$_2$ ...**
1Bh 4Ch ...	Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
	d$_1$ d$_2$ ... are the bitmap data to print.

See EPSON command description page 27 for an example.

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

ESC Z ...	Select the **Bit Image Mode** in quadruple density (240 dpi), half speed. You have to
27 90 ...	provide parameters **n m d$_1$ d$_2$ ...**
1Bh 5Ah ...	Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
	d$_1$ d$_2$ ... are the bitmap data to print.

See EPSON command description page 27 for an example.

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	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`

7.2.6. Character creation, Down Line Loading (DLL)

All the commands related to character creation are ignored in the Ultimate-II MPS Printer Emulation. 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	This command is ignored by Ultimate-II MPS Printer Emulation.
1Bh 3Dh	
	m and **n** are the number of bytes to load in order to have n + (m x 256) = size

ESC I n   Select the print quality depending on parameter "n"
27 73 n   n=0   standard quality (draft) and normal characters
1Bh 49h n   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 MPS Printer Emulation, 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 MPS Printer Emulation, 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   Make a short beep.
7   This command is ignored by Ultimate-II MPS Printer Emulation.
07h

CAN   **Cancel** the current job and clear printer buffer.
24   This command is ignored by Ultimate-II MPS Printer Emulation.
18h

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

ESC @   **Initialize** the printer. Set all parameters to default values. Paper and head are not
27 64   moved.
1Bh 40h   This feature has been added in Ultimate-II MPS Printer Emulation and does not exist
                    in a real MPS-1230 printer.

ESC U n   Select **Mono/Bidirectional** printing.
27 85 n   This command is ignored by Ultimate-II MPS Printer Emulation.
1Bh 30h n   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 printer on the upper half interline.

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

NORMAL SUPERSCRIPT

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

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

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

NORMAL SUBSCRIPT

ESC T
27 84
1Bh 54h

Disable Superscript and Subscript print mode.

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

ESC _ n
27 95 n
1Bh 5Fh n

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

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

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 le left margin but stays on the same line (behavior is CR only, no LF). You can change the LF behavior with **ESC 5** command.

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

FF
12
0Ch

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

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

ESC 0   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
27 50   prepared line spacing.
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   n=1: LF is added on each CR
1Bh 35h n   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
27 65 n   activate it with command ESC 2
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 MPS Printer Emulation.
	
	`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 MPS Printer Emulation.
	
	`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 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 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 MPS Printer Emulation, **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 d$_1$ d$_2$ ...**
1Bh 5Ah ...	Values **n** and **m** are the 16 bit encoded amount of data (n is LSB) total = n + m x 256
	d$_1$ d$_2$ ... are the bitmap data to print.

See EPSON command description page 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
27 55
1Bh 37h

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

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

ESC 6
27 54
1Bh 36h

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

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

ESC \ n
27 92 n
1Bh 5Ch n

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

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

ESC ^
27 94
1Bh 5Eh

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

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

8.2.6. Character creation, Down Line Loading (DLL)

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

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

ESC I n	Select the print quality depending on parameter "n"
27 73 n	n=0 standard quality (draft) and normal characters
1Bh 49h n	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 MPS Printer Emulation, 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 MPS Printer Emulation, 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 MPS Printer Emulation.
DC1 **17** **11h**	Printer selection. This command is ignored by Ultimate-II MPS Printer Emulation.
DC3 **19** **13h**	No operation.
CAN **24** **18h**	**Cancel** the current job and clear printer buffer. This command is ignored by Ultimate-II MPS Printer Emulation.
ESC < **27 60** **1Bh 3Ch**	Set **left to right** printing for one line. This command is ignored by Ultimate-II MPS Printer Emulation.
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 MPS Printer Emulation 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 MPS Printer Emulation.
ESC U n **27 85 n** **1Bh 30h n**	Select **Mono/Bidirectional** printing. This command is ignored by Ultimate-II MPS Printer Emulation. n=0 : bidirectional n=1 : mono-directional (left to right) for better alignment.

9. PETASCII character table

9.1. USA/UK

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

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

9.2. Denmark

```
  |  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  |  ○        |  ─  |  ○  |  ─
8 |        (  8  H  X  |  ♣        ▩  ▬  |  ♣  ▩  ▬
9 |        )  9  I  Y  ╲  |        ◤  ▬  ╲  |  ◤  ▬
A |        *  :  J  Z  ╲  ♦        |  ⌐  ╲  ♦  |  ⌐
B |        +  ;  K  Æ  ╱  +        ├  ▪  ╱  +  ├  ▪
C |        ,  <  L  Ø  └  ▓        ▪  ▪  └  ▓  ▪  ▪
D |        ─  =  M  Å  ╲  |        ╚  ⌐  ╲  |  ╚  ⌐
E |        .  >  N  ↑  ╱  π        ⌐  ▪  ╱  π  ⌐  ▪
F |        /  ?  O  ←  ┌  ◣        ▬  ▪  ┌  ◣  ▬  π
```

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 ` ⌐       § ` ⌐     §
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 [ ╲ ë     + Ä ╲ ë + Ä
C |   , < L \ └ ï     £ Ö └ ï £ Ö
D |   - = M ] ╱ °     ' Ü ╱ ° ' Ü
E |   . > N ↑ ─ π     ^ ß ─ π ^ ß
F |   / ? O ─ ⌐ ç     ¨ é ⌐ ç ¨ π
```

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       § ` P     §
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     ^ ß N π ^ ß
f |   / ? o ─ O ç     ¨ é O ç ¨ π
```

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 ` ⌐       @ ` ⌐     `
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 \ ┗ ┛     é Ö ┗ ┛ é ┗
D |   - = M ] ╱ ▓     £ Ü ╱ ▓ £ ╱
E |   . > N ↑ ▔ π     è ß ▔ π è ▔
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       ß ` P     ß
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     é ö L Ö é ö
d |   - = m ] M Ü     £ ü M Ü £ ü
e |   . > n ↑ N π     è ß N π è ß
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 [ ╲ ¡       + Ï ╲ ë   +   Ï
C |     , < L \ └ ¿       £ Ü └ ï   £   Ü
D |     - = M ] ╱ ▛       ' Ñ ╱ °   '   Ñ
E |     . > N ↑ ─ π       ♣ ♦ ─ π   ♣   ♦
F |     / ? O ─ ⌐ ⌟       ¨ Ç ⌐ ç   ¨   π
```

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   |   à
2 |     " 2 b r B R       ∟ è B R   ∟   è
3 |     # 3 c s C S       ⊥ ♠ C S   ⊥   ♠
4 |     $ 4 d t D T       ⌐ ò D T   ⌐   ò
5 |     % 5 e u E U       ⊦ ♥ E U   ⊦   ♥
6 |     & 6 f v F V       ─ á F V   ─   á
7 |     ' 7 g w G W       ┤ é G W   ┤   é
8 |     ( 8 h x H X       ┌ í H X   ┌   í
9 |     ) 9 i y I Y       ┬ ó I Y   ┬   ó
a |     * : j z J Z       ┐ ú J Z   ┐   ú
b |     + ; k [ K ¡       + ï K ¡   +   ï
c |     , < l \ L ¿       £ ü L ¿   £   ü
d |     - = m ] M ñ       ' ñ M ñ   '   ñ
e |     . > n ↑ N π       ♣ ♦ N π   ♣   ♦
f |     / ? o ─ O Ç       ¨ ç O Ç   ¨   π
```

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

10.3. International charsets changes

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

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     L  ╨  α  ≡
1       !  1  A  Q  a  q        í     ┴  ╤  β  ±
2       "  2  B  R  b  r        ó     ┬  ╥  Γ  ≥
3       #  3  C  S  c  s        ú     ├  ╨  π  ≤
4       $  4  D  T  d  t        ñ     ─  ╘  Σ  ⌠
5       %  5  E  U  e  u        Ñ     ┼  ╒  σ  ⌡
6       &  6  F  V  f  v        ª     ╞  ╓  µ  ÷
7       '  7  G  W  g  w        º     ╟  ╫  τ  ≈
8       (  8  H  X  h  x        ¿     ╚  ╪  Φ  °
9       )  9  I  Y  i  y        ⌐     ╔  ┘  Θ  ·
A       *  :  J  Z  j  z        ¬     ╩  ┌  Ω  ·
B       +  ;  K  [  k  {        ½     ╦     δ  √
C       ,  <  L  \  l  |        ¼     ╠     ∞  ⁿ
D       -  =  M  ]  m  }        ¡     ═     Ø  ²
E       .  >  N  ^  n  ~        «     ╬     ∈  ■
F       /  ?  O  _  o           »     ╧     ∩
```

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     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  â  ô  ú     ├  ╨  π  ≤
4    ♦  $  4  D  T  d  t  ä  ö  ñ     ─  ╘  Σ  ⌠
5    ♣ §  %  5  E  U  e  u  à  ò  Ñ     ┼  ╒  σ  ⌡
6    ♠  &  6  F  V  f  v  å  û  ª     ╞  ╓  µ  ÷
7       '  7  G  W  g  w  ç  ù  º     ╟  ╫  τ  ≈
8       (  8  H  X  h  x  ê  ÿ  ¿     ╚  ╪  Φ  °
9       )  9  I  Y  i  y  ë  Ö  ⌐     ╔  ┘  Θ  ·
A       *  :  J  Z  j  z  è  Ü  ¬     ╩  ┌  Ω  ·
B       +  ;  K  [  k  {  ï  ¢  ½     ╦     δ  √
C       ,  <  L  \  l  |  î  £  ¼     ╠     ∞  ⁿ
D       -  =  M  ]  m  }  ì  ¥  ¡     ═     Ø  ²
E       .  >  N  ^  n  ~  Ä  ₧  «     ╬     ∈  ■
F       /  ?  O  _  o     Å  ƒ  »     ╧     ∩
```

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 ▒ └ ╨ α ≡
1      ! 1 A Q a q ü æ í ▒ ┴ ╤ ß ±
2      " 2 B R b r é Æ ó ▒ ┬ ╥ Γ ≥
3    ♥ # 3 C S c s å ô ú   ├ ╙ π ≤
4    ♦ $ 4 D T d t ä ö ñ ─ ─ ╘ Σ ⌠
5    ♣ § % 5 E U e u à ò Ñ ╪ ┼ ╒ σ ⌡
6    ♠ & 6 F V f v å û ö ╢ ╞ ╫ μ ÷
7      ' 7 G W g w ç ù ö ╖ ╟ ╪ τ ≈
8      ( 8 H X h x ê ÿ ¿ ╕ ╚ ╧ Φ °
9      ) 9 I Y i y ë Ö ⌐ ╣ ╔ ╝ Θ ·
A      * : J Z j z è Ü ¬ ║ ╩ ╛ Ω ·
B      + ; K [ k ( ï ¢ ½ ╗ ╦ ■ δ √
C      , < L \ l ¦ î £ ¼ ╝ ╠ ▐ ∞ ⁿ
D      - = M ] m ) ì Ø ¡ ╜ ═ ▌ ø ²
E      . > N ^ n ~ Ä ⌐ ³ ╛ ╬ ▄ ∈ ■
F      / ? O _ o   Å ¹ ¤ ┐ ╧ ▐ ∩
```

11.2.3. Israel

```
     0 1 2 3 4 5 6 7 8 9 A B C D E F
0        0 @ P ` p א ] á ▒ └ ╨ α ≡
1      ! 1 A Q a q ב ∂ í ▒ ┴ ╤ ß ±
2      " 2 B R b r ג ע ó ▒ ┬ ╥ Γ ≥
3    ♥ # 3 C S c s ד ף ú   ├ ╙ π ≤
4    ♦ $ 4 D T d t ה פ ñ ─ ─ ╘ Σ ⌠
5    ♣ § % 5 E U e u ו ץ Ñ ╪ ┼ ╒ σ ⌡
6    ♠ & 6 F V f v ז צ ª ╢ ╞ ╫ μ ÷
7      ' 7 G W g w ח ק º ╖ ╟ ╪ τ ≈
8      ( 8 H X h x ט ר ¿ ╕ ╚ ╧ Φ °
9      ) 9 I Y i y י ש ⌐ ╣ ╔ ╝ Θ ·
A      * : J Z j z ך ת ¬ ║ ╩ ╛ Ω ·
B      + ; K [ k ( כ ¢ ½ ╗ ╦ ■ δ √
C      , < L \ l ¦ ל Ψ ¼ ╝ ╠ ▐ ∞ ⁿ
D      - = M ] m ) ם ¥ ¡ ╜ ═ ▌ ø ²
E      . > N ^ n ~ ן ℞ « ╛ ╬ ▄ ∈ ■
F      / ? O _ o   נ ƒ » ┐ ╧ ▐ ∩
```

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 ▒ └ ╨ ω Ώ
1      ! 1 A Q a q Β Σ κ ▒ ┴ ╤ ά ±
2      " 2 B R b r Γ Τ λ ▒ ┬ ╥ έ ≥
3    ♥ # 3 C S c s Δ Υ μ   ├ ╙ ή ≤
4    ♦ $ 4 D T d t Ε Φ ν ─ ─ ╘ ϊ ⌠
5    ♣ § % 5 E U e u Ζ Χ ξ ╪ ┼ ╒ ί ⌡
6    ♠ & 6 F V f v Η Ψ ο ╢ ╞ ╫ ό ÷
7      ' 7 G W g w Θ Ω π ╖ ╟ ╪ ύ ≈
8      ( 8 H X h x Ι α ρ ╕ ╚ ╧ ϋ °
9      ) 9 I Y i y Κ β σ ╣ ╔ ╝ ώ £
A      * : J Z j z Λ Υ ς ║ ╩ ╛ Ά ·
B      + ; K [ k ( Μ δ τ ╗ ╦ ■ Έ √
C      , < L \ l ¦ Ν ε υ ╝ ╠ ▐ Ή ⁿ
D      - = M ] m ) Ξ ζ φ ╜ ═ ▌ Ί ²
E      . > N ^ n ~ Ο η χ ╛ ╬ ▄ Ό ■
F      / ? O _ o   Π ϑ ψ ┐ ╧ ▐ Ύ
```

11.2.5. Portugal

11.2.6. Spain

12. Commodore commands reference

ASCII	CODE DEC	HEX	DESCRIPTION	PAGE
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 MPS Printer Emulation

13. EPSON FX-80 commands reference

ASCII	CODE DEC	HEX	DESCRIPTION	PAGE
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 MPS Printer Emulation

ASCII	CODE DEC	HEX	DESCRIPTION	PAGE
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 MPS Printer Emulation

14. IBM Graphics Printer command reference

ASCII	CODE DEC	HEX	DESCRIPTION	PAGE
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 MPS Printer Emulation
[†] Only in the Ultimate-II MPS Printer Emulation, not in a real MPS-1230

| CODE | | | DESCRIPTION | PAGE |
ASCII	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 MPS Printer Emulation

15. IBM Proprinter command reference

ASCII	CODE DEC	HEX	DESCRIPTION	PAGE
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 MPS Printer Emulation
[†] Only in the Ultimate-II MPS Printer Emulation, 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 MPS Printer Emulation

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     Draft Italic     Near Letter Quality
ELITE             Draft Regular     Draft Italic     Near Letter Quality
MICRO             Draft Regular     Draft Italic     Near Letter Quality
CONDENSED         Draft Regular     Draft Italic     Near Letter Quality
PICA COMPRESSED   Draft Regular     Draft Italic     Near Letter Quality
ELITE COMPRESSED  Draft Regular     Draft Italic     Near Letter Quality
MICRO COMPRESSED  Draft Regular     Draft Italic     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

  | 0 1 2 3 4 5 6 7 8 9 A B C D E F      | 0 1 2 3 4 5 6 7 8 9 A B C D E F
```

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