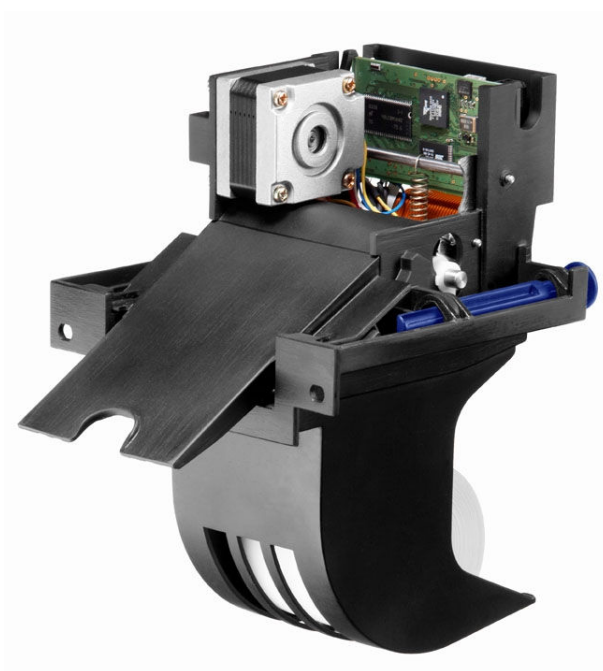


HENGSTLER



**Emulation
Command Set
Manual**

Thermal Printer C-56

**Firmware 1.30 (USB)
Firmware 2.01 (RS232)
Firmware 3.00 (USB/RS232)
Firmware 3.01 (USB/RS232)
Firmware 3.02 (USB/RS232)**

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Document History

Revision	Date	Init	Status	Description
1.0	2004 OCT 12	HOR	Closed	Initial version: - Copied from D684015_EmulationCommand-Set_SPM56-E_V1.30.doc - Printer name changed from SPM56 to C-56
1.1	2004 NOV 08	HOR	Closed	Correction of error text "16x24" font to "12x24"
1.2	2005 MAR 15	HOR	Closed	Extended with: - Firmware C56 V2.00 (pre release) - RS-232 communication
1.3	2005 JUN 02	HOR	Closed	Extended with: - Anomaly list for C56 firmware V2.01 - Firmware C56 V2.02k (pre release) - Emulation command "dot history burn factor" added - Emulation command "wide character index" added
1.4	2005 AUG 16	HOR	Closed	Extended functions for beta1 firmware 3.00, that is capable of handling both RS-232 and USB boards. Firware 2.02 of document version 1.3 is cancelled.
	2006 JAN 12	HOR	Closed	Extended functions for beta2 firmware 3.00, that has been extended with KS5601 korean wide font and with position stamp set/feed command
	2006 MAR 21	HOR	Closed	Position stamp set/feed command cancelled until future releases; new flash write protect command; UART flow controls SW and NONE enabled
	2006 APR 03	HOR	Closed	Bar code plain text subtitle setting command added
	2006 MAY 19	HOR	Closed	Customer flags command added
	2006 AUG 16	HOR	Closed	Document released
1.5	2008 JUN 23	HOR	Closed	Adapted to firmware R7-V3.01-2008JUN23: - Command "Jam Detection Setting" added. - "Paper in chute" bit in the status DWORD
1.6	2009 MAR 31	HOR	Closed	Adapted to firmware R8-V3.02-2009MAR11: No modifications

Comments

List of known missing or uncompleted parts:

- Function Mark Detection Execution “GS <” is not functional in firmware V1.30/1.31 and V2.00/2.01 and is to be regarded unsupported. All data sent after command “GS <” is not printed in the actual implementation. In test cases, this command can only be used as the last command in a print job.
- Following anomalies have been found in firmware version 2.00/2.01:

Id	Anomaly	Comment
C56V201#AN01 [C56Atp05]	Print data may be lost if printing large amounts of text (e.g. more than a 40 inches) in a burst at once in firmware V2.01	Do not issue large printouts at once. Include delays in printouts
C56V201#AN02 [C56Atp08]	Emulation command for backward N line-feed (ESC 2 + [n]) is malfunctioning in firmware V2.01	Do not use this command
C56V201#AN03 [C56Atp08]	Emulation command for backward paper feed (ESC K + [n]) is malfunctioning in firmware V2.01	Do not use this command
C56V201#AN04 [C56Atp24]	Emulation command for mark detection execution (GS <) is malfunctioning in firmware V2.01	Do not use this command
C56V201#AN05 [C56Atp22]	Print data may temporary be ignored when sending registered character sets and images that are to be stored in C56 flash memory using firmware V2.01	Include delays when sending registered images or character sets
C56V201#AN06 [C56Atp06]	Emulation command for print mode (ESC ! + [n]) does not handle 2X, 4X, 6X, 8X magnification of character sets.	Do not use the character magnification feature of the print mode command and leave bit b2 and b3 zero

- All C-56 firmwares with extension ‘a’, ‘b’, ‘c’, etc. (e.g. 3.00c) are beta versions that are untested and never released. These firmwares are to be used for evaluation purposes only. A final release will never have the extension ‘a’, ‘b’, etc. A C-56 printer that contains an unreleased or beta firmware may not be operated unattendedly.
- Currently following C-56 firmware versions are released :
 - Version 1.31 for USB type boards
 - Version 2.01 for RS232 type boards
 - Version 3.00 for both USB and RS232 type boards
 - Version 3.01 for both USB and RS232 type boards
 - Version 3.02 for both USB and RS232 type boards
 Previously released and discontinued firmware versions are :
 - Version 1.30 for USB type boards (replaced by version 1.31)
 - Version 2.00 for RS232 type boards (replaced by version 2.01)

Safety Precautions

- Please read and understand these specifications thoroughly before using the C-56 printer. Please keep the specifications carefully in a place where they may be easily consulted when the printer is used.
- Please do not modify or service this printer as this may cause unpredictable faults to occur.
- The product is not intended to be installed in devices such as those used in life-support medical equipment, undersea relays, and aerospace applications or for nuclear power control, in which extremely high reliability is required. If you are considering such applications, please consult our customer service department.
- There is a general possibility of component failure. Every effort has been made to improve product quality but such failures cannot be completely excluded. Please assume that such failure may occur before using this printer.
- Take care that the contents of this document matches the firmware of your C-56 printer.

We would urge that these specifications should be thoroughly understood and the printer used safely in your company or associated organization. Please indicate or describe in your products and in the user manuals those items, which are related to the prevention or avoidance of danger and draw these to the attention of the eventual client (the user).

This manual is only intended to be additional to the product related manual. Any approval or order based upon this manual will not be accepted by HENGSTLER. Any approval must be made upon samples of the product.

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1 Introduction

This reference manual describes the emulation command set of the Hengstler C-56 thermal printer.

Read this reference manual thoroughly before using the C-56 and communicating with the firmware.

Comments:

- The communication with the host computer is done either through USB or RS232
- C-56 can print graphic data non-compressed.
- Burn time can be set to control the printing intensity
- A Windows 2000 and XP driver is available for easy operation by PC. The driver contains an API for easy integration in host application.
- Upload of firmware is done with the windows 2000 and XP driver.

2 C-56 Functional Overview

2.1 General

Notice, when data is sent from the external equipment to the printer controller, all data has to be sent as binary file. If data is being sent as a character file, and some data in the file is equal to EOF, the rest will not be received.

2.2 Board types

The C56 printer either has an USB or an RS232 connection through which it communicates with the host system.

2.3 USB communication

The USB type board has a build in USB interface that is 100% compliant to USB 1.0 and 1.1 and fully approved by the USB organization.

By plugging the USB cable, the Windows 2000/XP host system will recognize the Hengstler C-56 interface board and, from V2.0x and up, it prompt for installation of the driver. See the Windows 2000/XP driver manual for more information on installing the driver.

The interface board works as a Universal Serial Bus (USB) node controller compatible with USB specification 1.0 and 1.1. A total of seven endpoint pipes are supported: one bi-directional for the mandatory control EP0 and an additional six for unidirectional endpoints to support USB interrupt, bulk and asynchronous data transfer.

The transceiver meets the performance requirements described in Chapter 7 of the USB 1.1 specification.

2.4 RS232 communication.

The RS232 type board has and serial connector that can be setup to:

Baudrate:	4800, 9600, 19200, 38400, 57600, 115200
Stopbits:	1,2
Databits:	8
Parity:	Odd, Even, None
Flow Control:	Hardware, Software, None

Use the C-56 Configuration Tool (C56ConfigTool) to setup the communication parameter.

2.5 Printing speed

The maximum printing speed of 220 mm/sec, can be obtained when following special conditions are met:

- Ambient temperature: 25°C
- Low sensitive thermal paper
- Constant Voltage applied at 24VDC
- 12,5% printing ratio.
- Standard printing density (print quality low, impressed energy 60).
- No peak limitation applied.
- No less than 5 Amps available.

2.6 Firmware upgrade.

The C-56 firmware can be updated through USB and RS232 using the W2K and XP driver properties dialog. Currently a firmware upgrade can not be done though any other operating systems than W2K and XP.

Note that any registered image will be lost after upload of firmware.

2.7 Auto form feed handling

When no paper is present, it is possible to form feed new paper automatic by inserting paper at the back of the C56 printer.

If so, the paper will feed approximately 25 cm and print initial firmware and configuration information.

These settings can be changed by appropriate commands.

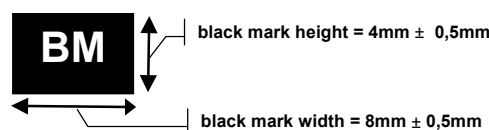
2.8 Black mark detection function

The black mark, that is preprinted on the coated side of the thermal paper, is detected by the paper end detection sensor.

This paper-end sensor is used for:

- Detecting paper-available
- Detecting paper-end
- Detecting paper-near-end
- Processing black mark detection execution

By default, the black mark dimensions must be:

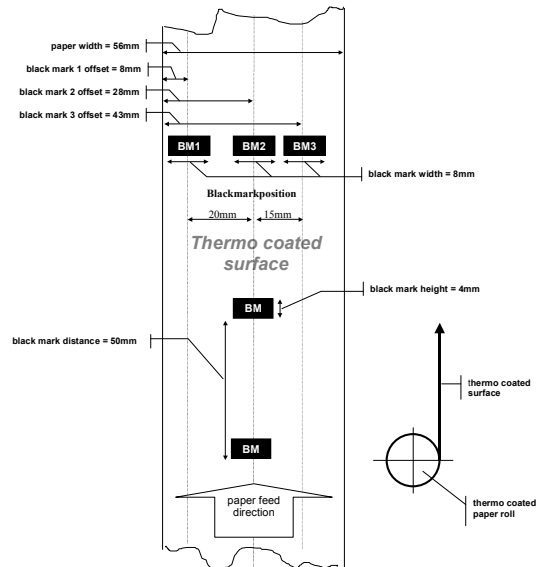


When paper end is detected during initialization, the sensor may be on the black mark. If so, paper is fed paper for the maximum blackmark height, which by default is 8 mm and retracted if a black mark is

detected. If no paper is detected after having fed the maximum blackmark height, the printer signals paper end status and printer stops.

If black mark detection is executed and a black mark is not detected within the predefined page length, the detection automatically stops.

The black marks on the paper roll are to be positioned as follows:



Following commands for black marks are used to:

- Specify minimum and maximum height of a black mark (default 2-8 mm)
- Initiates black mark detection function (move to next black mark)
- Specifies the maximum black mark distance (page length specification)
- Disables/enables the paper-end detection
- Disables/enables the paper-near-end detection

3 Printer Commands Overview (Emulation)

Each command is explained using the following conventions:

[Name]	Command name
[Function]	Function of command
[Code]	Control code represented in hexadecimal or decimal notation.
	[X] ¹⁶ Hexadecimal notation ('0'..'9', 'A'..'F')
	[X] ¹⁰ Decimal notation ('0'..'9')
	[X] ² Binary notation ('0'..'1')
[Description]	Explanation of command function

3.1 Emulation command set

The following commands are use when communicating with the printer controller. All other commands are ignored

3.1.1 HT**Horizontal tab**

[Name]	Horizontal tab
[Function]	This command command moves the printing position to the next horizontal tab position.
[Code]	[09] ¹⁶ [09] ¹⁰

[Description]

- [1] Command "HT" moves the printing position to the next tab position.
- [2] The horizontal tab positions are set with command "ESC D".
- [3] If the next horizontal tab position is not set, the HT command is ignored.
- [4] If the next horizontal tab position is outside the printing area, the printing position is shifted to the next line.

3.1.2 LF**Line feed**

[Name] Line feed

[Function] This command prints the data already contained in the print buffer, then sets the next-data receive position at the left most column on the next line.

[Code] [0A]¹⁶
[10]¹⁰

[Description]

- [1] The "LF" command prints the data already contained in the print buffer, then sets the next-data receive position at the leftmost column on the next line.
- [2] In the initial state, the line spacing is set to approx. 1/8 inch.
- [3] When there is no data in the print buffer, only a line feed operation is executed.
- [4] When different-height character typefaces are to be printed on the same line, these character typefaces are arranged so that their bottom ends are aligned at the same level.
- [5] If line spacing during printing/line-feeding is shorter than the character height, a length equal to the character height feeds the paper.

3.1.3 FF**Forms feed (new page)**

[Name]	Forms feed (new page)
[Function]	This command feeds paper by the specified page length.
[Code]	[0C] ¹⁶ [12] ¹⁰

[Description]

- [1] The "FF" command prints the data already contained in the print buffer, then sets the next-data receive position at the leftmost column on the next page.
- [2] In the initial state, the page length is set to approx. 143 mm. (44 lines).

3.1.4 ESC [CD]+[01]+[80]+[n]**Feed reduction**

[Name] Feed reduction

[Function] This command species the amount of motor speed reduction, when paper is fed forward or backwards during paper insertion or out of paper handling

[Code] $[1B]^{16} + [CD]^{16} + [01]^{16} + [80]^{16} + [n]$
 $[27]^{10} + [205]^{10} + [01]^{10} + [128]^{10} + [n]$

[Description]

- [1] Command "ESC [CD]+[01]+[80]+[n]" sets the motor speed reduction in percent of nominal speed when paper feeding
- [2] Parameter [n] defines the feed reduction in percent of actual print speed.
- [3] Parameter [n] must match following condition:
 $[20]^{10} \leq [n] \leq [100]^{10}$
- [4] The setting of this command is used for both forward and backwards paper feeding
- [5] The default value for feed reduction (parameter [n] = $[20]^{10}$) is 40 percent

3.1.5 ESC [CD]+[02]+[81]+[n]+[m] Feed length specification

[Name]	Feed length specification
[Function]	This command specifies the feed length when inserting paper, and when out of paper is detected
[Code]	$[1B]^{16} + [CD]^{16} + [02]^{16} + [81]^{16} + [n] + [m]$ $[27]^{10} + [205]^{10} + [02]^{10} + [129]^{10} + [n] + [m]$

[Description]

- [1] Command "ESC [CD]+ [02]+ [81]+ [n]+[m]" sets lengths for forward and backwards feeding
- [2] Parameter [n] defines the amount of forward paper feed when paper is inserted
- [3] Parameter [n] must match following condition: $[0]^{10} \leq [n] \leq [255]^{10}$
- [4] Parameter [m] defines the amount of reverse paper feeding when out of paper is detected
- [5] Parameter [m] must match following condition: $[0]^{10} \leq [m] \leq [255]^{10}$
- [6] Both parameters define feed length in 1/10-inch resolution
- [7] Parameter [m] is masked and only values from $[1]^{10}$ to $[127]^{10}$ is used
- [8] If parameter [m] contains values from $[128]^{10}$ to $[255]^{10}$, then the amount of backward feeding of is only defined for the current printout.
- [9] The default value for parameter [n] is $[100]^{10}$
- [10] The default value for parameter [m] is $[15]^{10}$

3.1.6 ESC [CD]+[00]+[70]**End of page**

[Name] End of page

[Function] This command indicates the end of a single page.

[Code] $[1B]^{16} + [CD]^{16} + [00]^{16} + [70]^{16}$
 $[27]^{10} + [205]^{10} + [00]^{10} + [112]^{10}$

[Description]

- [1] Command "ESC [CD]+[00]+[70]" is used to inform the printer, that all data of a single page has been sent completely.
- [2] After reception of this command the printer suspends processing of further commands until all buffered data have been printed completely.
- [3] Normally this function is used in advance of setting print quality, impressed energy and print speed, to assure that previously buffered data is not affected by these commands.

3.1.7 ESC [CD]+[00]+[71]**End of document**

[Name]	End of document
[Function]	This command indicates the end of a single printout.
[Code]	$[1B]^{16} + [CD]^{16} + [00]^{16} + [71]^{16}$ $[27]^{10} + [205]^{10} + [00]^{10} + [113]^{10}$

[Description]

- [1] Command "ESC [CD]+[00]+[71]" is used to inform the printer, that all data of a single printout (one or more pages) has been sent completely.
- [2] After reception of this command the printer suspends processing of further commands until all buffered data has been printed completely.
- [3] After all buffered data has been printed, the paper retract position is initialized.
- [4] The printer will retract the paper to the retract position during the next printout, when an end-of-paper is detected during this printout.

3.1.8 ESC [CD]+[01]+ [82]+ [n] Print info enable/disable

[Name] Print Info enable/disable
[Function] This command enables or disables printout of firmware information when paper is inserted
[Code] $[1B]^{16} + [CD]^{16} + [01]^{16} + [82]^{16} + [n]$
 $[27]^{10} + [205]^{10} + [01]^{10} + [130]^{10} + [n]$

[Description]

- [1] The “ESC [CD]+[01]+[82]+[n]” command enables or disables printout of firmware information when paper is inserted
- [2] Parameter [n] must match following condition: $[0]^{10} \leq [n] \leq [1]^{10}$
- [3] If parameter [n] is different to $[0]^{10}$, then firmware and additional print information will be printed when paper is inserted
- [4] The default value for parameter [n] is $[1]^{10}$ (print info on)
- [5] Currently the print info contains: firmware version and active communication interface.

3.1.9 ESC RS**Black-white reversed printing specification**

[Name] Black-white reversed printing specification

[Function] This command command sets black-white reversed printing.

[Code] [1B]¹⁶ + [1E]¹⁶
[27]¹⁰ + [30]¹⁰

[Description]

- [1] The “*ESC RS*” command enables black-white reversed printing.
- [2] The command can be used in all character modes and all character sets.
- [3] The line-spacing (line pitch) area does not appear in reverse format.
- [4] A single text-line can contain both normal printed characters and reverse printed characters.
- [5] All character spacing except from character blanks (e.g. tabs, margins), do not appear in reverse.

3.1.10 ESC US Black-white reversed printing cancellation

[Name] Black-white reversed printing cancellation
[Function] This command cancels black-white reversed printing.
[Code] [1B]¹⁶ + [1F]¹⁶
[27]¹⁰ + [31]¹⁰

[Description]

[1] The "ESC US" command disables the reverse printing mode.

3.1.11 ESC ! +[n] Printing mode specification

[Name] Printing mode specification
 [Function] This command specifies printing mode for text output.
 [Code] $[1B]^{16} + [21]^{16} + [n]$
 $[27]^{10} + [33]^{10} + [n]$

[Description]

- [1] The "ESC !+[n]" command specifies printing mode.
- [2] The following figure shows the relationship between the bits of parameter [n] and printing mode:

Parameter [n], bit	Value	Printing mode
b0 (LSB) b1	$[00]^2$	08x16-dot ANK character typeface
	$[01]^2$	12x24-dot ANK character typeface
	$[10]^2$	16x16-dot ANK character typeface
	$[11]^2$	24x24-dot ANK character typeface
b2 b3	$[00]^2$	No magnification
	$[01]^2$	2 X magnification (from firmware V2.01)
	$[10]^2$	3 X magnification (from firmware V2.01)
	$[11]^2$	4 X magnification (from firmware V2.01)
b4	0	double width disabled
	1	double width enabled
b5	0	double height disabled
	1	double height enabled
b6	unused	
b7 (MSB)		

- [3] When both the double width and double height are specified, characters with the double height and width character typeface are printed.
- [4] When one line contains different-height character typefaces, the character typefaces are arranged so that their bottom ends are aligned at the same level.
- [5] The 16x16-dot ANK character typeface is represented by a double width 8x16-dot ANK character typeface.
- [6] The 24x24-dot ANK character typeface is represented by a double width 12x24-dot ANK character typeface.
- [7] The 2X,3X,4X magnification in bits b2 and b3 are available from firmware V2.01.

3.1.12 ESC %+[n] External registration character set selection/cancellation

[Name] External registration character set selection /cancellation
 [Function] This command selects or cancels registered external characters.
 [Code] $[1B]^{16} + [25]^{16} + [n]$
 $[27]^{10} + [37]^{10} + [n]$
 [Description]

- [1] The "ESC %+[n]" command selects whether the internal character set (system-defined font) or the registered external character set (user-defined font).
- [2] If parameter [n] is $[0]^{10}$, then the internal character set is selected.
- [3] If parameter [n] is $[1]^{10}$, then the external registered character set stored in FROM is selected (see command "ESC & +...").
- [4] The type of internal/external character set (e.g. 8x16, 12x24, 16x16, 24x24) required, is selected with the print mode command (see "ESC ! + ...").

Printing mode specification (command "ESC ! + ..", lower 3 bits)	Internal character set	External registered character set
08 x 16 ANK	08 x 16 ANK	08 x 16 registered
12 x 24 ANK	12 x 24 ANK	12 x 24 registered
16 x 16 ANK	08 x 16 ANK double width	08 x 16 registered double width
24 x 24 ANK	16 x 24 ANK double width	16 x 24 registered double width

- [5] A character in the external registered character set is regarded undefined if all dots are raised (e.g. it's complete byte content is $[FF]^{16}$).
- [6] When the external registered character set is selected (set 8x16 or 12x24 depending on the printing mode), and the character code (index) has been received for an undefined character, then the corresponding character code of the internal character set (e.g. 8x16 or 12x24) is printed instead.

**3.1.13 ESC & +NUL+[c1]+[c2]+ NUL+ [d1]..[dn]
External registration character definition**

[Name] External registration character definition
 [Function] This command is used to specify one or more subsequent characters of the 8x16 or 12x24 external registration character set.
 [Code] $[1B]^{16} + [26]^{16} + [00]^{16} + [c1] + [c2] + [00]^{16} + [d1]..[dn]$
 $[27]^{10} + [38]^{10} + [00]^{10} + [c1] + [c2] + [00]^{10} + [d1]..[dn]$

[Description]

- [1] The “ESC & ..” command defines one or more external characters to be registered in the external registration character sets 8x16 or 12x24..
- [2] Parameter [d] specifies the data of the character(s) that are to be defined.
- [3] Parameter [c1] and [c2] are character codes and specify the start and the end of the character(s) area that is to be defined.
- [4] Both parameter [c1] and [c2] values must satisfy the following conditions:
 $[20]^{16} \leq [c1] \leq [c2] \leq [FF]^{16}$
- [5] To define a single character, parameter [c1] and [c2] must be equal.
- [6] To define two or more subsequent characters, parameter [c1] contains the character code of the first character and parameter [c2] contains the character code of the last character.
- [7] The data block [d1]..[dn] contains exactly the amount of bytes to define “[c2] – [c1] + 1” characters for either the 8x16 or the 12x24 character set.
- [8] If “[c2] < [c1]” is detected, then the characters [c2]..[FF]¹⁶ and [00]¹⁶..[c1] are expected in the data block.
- [9] The external registered character set, for which one or more registration character are to be defined, is selected with the printing mode specification (command “ESC !+[n]”):

Printing mode specification (command “ESC ! + ..”, lower 3 bits)	External registered character set
08 x 16 ANK or 16 x 16 ANK	08 x 16 registered
12 x 24 ANK or 24 x 24 ANK	12 x 24 registered

- [10] The length of the data required to define a single external registration character depends on the character typeface specified with the printing mode specification (command “ESC ! + [n]”).

Printing mode specification (command “ESC ! + ..”, lower 3 bits)	Data length n [d1] .. [dn] for a single character
08 x 16 ANK or 16 x 16 ANK	16 (16 lines, 1 byte each)
12 x 24 ANK or 24 x 24 ANK	48 (24 lines, 2 bytes each)

[11] For a single 8x16 character definition, 16 bytes are required, whereas the layout of the data block [d1]..[dn] is (note that 16 subsequent [FF]¹⁶ bytes as data block for this character set are not allowed):

Dot	1	2	3	4	5	6	7	8	d1 .. dn
Line									
1									0
2									1
3									2
4									3
5									4
6									5
7									6
8									7
9									8
10									9
11									10
12									11
13									12
14									13
15									14
16									15
	7	6	5	4	3	2	1	0	Byte Bit

[12] For a single 12x24 character definition, 48 bytes are required, whereas the layout of the data block [d1]..[dn] is (note that 48 subsequent [FF]¹⁶ bytes as data block for this character set are not allowed):

Dot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	d1 .. dn		
Line																			
1													UNUSED (always 1)					0 + 1	
2																			2 + 3
3																			4 + 5
4																			6 + 7
5																			8 + 9
6																			10 + 11
7																			12 + 13
8																			14 + 15
9																			16 + 17
10																			18 + 19
11																			20 + 21
12																			22 + 23
13																			24 + 25
14																			26 + 27
15																			28 + 29
16																			30 + 31
17																			32 + 33
18																			34 + 35
19																			36 + 37
20																			38 + 39
21																			40 + 41
22																			42 + 43
23																			44 + 45
24																			46 + 47
	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2		Byte	
	7	6	5	4	3	2	1	0	7	6	7	6	3	2	1	0		Bit	

3.1.14 ESC 2 1/6-inch line pitch setting

[Name] 1/6-inch line pitch setting
[Function] This command sets the single line pitch to 1/6 inch.
[Code] [1B]¹⁶ + [32]¹⁶
[27]¹⁰ + [50]¹⁰

[Description]

- [1] The "ESC 2" command sets single line pitch to 1/6 inch.
- [2] This command invalidates the line pitch previously set with the "ESC 3+.." command.
- [3] This command invalidates the line spacing previously set with the "ESC A+.." command.

3.1.15 ESC 3+[n] Line pitch setting

[Name] Line pitch setting
[Function] This command sets single line pitch in dot lines.
[Code] $[1B]^{16} + [33]^{16} + [n]$
 $[27]^{10} + [51]^{10} + [n]$

[Description]

- [1] The “ESC 3+[n]” command sets single line pitch to n dot lines.
- [2] This command invalidates the line pitch previously set with the “ESC 2” command.
- [3] This command invalidates the line spacing previously set with the “ESC A+..” command.
- [4] Parameter [n] defines the line pitch in dot lines.
- [5] Parameter [n] must match following condition:
 $[0]^{10} \leq [n] \leq [255]^{10}$
- [6] In line feed with printing, paper is fed by at least the height of the character currently specified. In line feed without printing, paper is fed only by the specified line spacing. For example, when line spacing of 10 dot lines is specified for a character of which height is 24 dot lines, paper is fed by 24 dot lines (in line feed with printing) or 10 dot lines (in line feed without printing).

3.1.16 ESC ?+NUL External registration character set clearing

[Name] External registration character set clearing
 [Function] This command clears all previously registered characters in a specified external registration character set .
 [Code] [1B]¹⁶ + [3F]¹⁶ + [00]¹⁶
 [27]¹⁰ + [63]¹⁰ + [0]¹⁰
 [Description]

- [1] The command "ESC ? + NUL" clears all 256 characters in a specified external character set:.
- [2] An external character is regarded to be undefined (i.e. deleted / cleared), if all dots (e.g. bits) of that character are raised (e.g. all bytes in the character are [FF]¹⁶)
- [3] After deletion of a character , the corresponding internal character is printed.
- [4] The external registration character set (8x16 or 12x24), which is cleared, is selected with the print mode specification (command "ESC ! + [n]":

Printing mode specification (command "ESC ! + ..", lower 3 bits)	External registered character set selected
08 x 16 ANK or 16 x 16 ANK	08 x 16 registered
12 x 24 ANK or 24 x 24 ANK	12 x 24 registered

3.1.17 ESC ?+[n] External registration character deletion

[Name] External registration character deletion
 [Function] This command deletes a single external registration character from a specified external registration character set.
 [Code] $[1B]^{16} + [3F]^{16} + [n]$
 $[27]^{10} + [63]^{10} + [n]$
 [Description]

- [5] The “ESC ?+[n]” command deletes a single external registration character from a specified external registration character set.
- [6] Parameter [n] specifies character code (index) of the character that is to be deleted.
- [7] To delete a single character from the selected external registration character set (8x16 or 12x24) parameter [n] must satisfy the following condition:
 $[20]^{16} \leq [n] \leq [FF]^{16}$
 Note, that if parameter [n] is zero, command “ESC ?+NUL” is initiated, which clears all characters of the corresponding character set.
- [8] An external character is regarded undefined (e.g. deleted / cleared), if all dots (i.e. bits) of that character are raised (e.g. all bytes in the character are $[FF]^{16}$).
- [9] After deletion, the corresponding internal character is printed.
- [10] The external registration character set (8x16 or 12x24), from which a registration character is to be deleted is selected with the print mode specification (command “ESC !+[n]”):

Printing mode specification (command “ESC ! + ..”, lower 3 bits)	External registered character set selected
08 x 16 ANK or 16 x 16 ANK	08 x 16 registered
12 x 24 ANK or 24 x 24 ANK	12 x 24 registered

3.1.18 ESC @ Printer resetting

[Name] Printer resetting
[Function] This command initializes/resets the printer.
[Code] [1B]¹⁶ + [40]¹⁶
[27]¹⁰ + [64]¹⁰

[Description]

- [1] The "ESC @" command resets various printer settings and resets everything to default.
- [2] Default is the status at which the printer is after initial power up.
- [3] The ESC @ command prints the data contained in the print buffer before resetting.
- [4] When the ESC @ command is executed, following is done or initialized:
 - 1) Print buffer clear
 - 2) Line pitch set to 26 dot lines
 - 3) Line spacing set to zero
 - 4) Page size set to 44
 - 5) Tabs set to 32 tab positions of 8 characters each
 - 6) Internal font selected
 - 7) Print mode set to 12 x 24 font, single width and height
 - 8) Reverse printing disabled
 - 9) Rotation set to zero degrees (text, images and bitmaps)
 - 10) Left margin set to zero
 - 11) Barcode height set to 60 dots
 - 12) Barcode width set to 2 dots for narrow bars, and 6 dots for wide bars
 - 13) Barcode width magnification set to 1x
 - 14) Forward feeding distance set to 254 mm
 - 15) Reverse feeding distance set to 15 mm
 - 16) Reverse feed after last printout enabled
 - 17) Printing speed set to 130 mm/s
 - 14) Print quality set to low
 - 15) Impressed energy correction set to 0
 - 16) End of paper handling enabled
 - 17) Black mark detection handling enabled
 - 18) Feed reduction set to 40%
 - 19) Turning time for motor excitation set to 10
 - 20) Upside down printing canceled
 - 21) Black mark size set to 2-8 mm
 - 22) Paper jam distance set to 3 mm

3.1.19 ESC A+[n] Line spacing setting

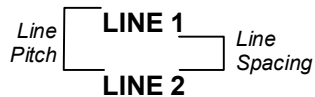
[Name] Line spacing setting

[Function] This command sets the line spacing to a specific amount of dot lines.

[Code] $[1B]^{16} + [41]^{16} + [n]$
 $[27]^{10} + [65]^{10} + [n]$

[Description]

- [1] The “ESC A+[n]” command sets the line spacing to [n] dot lines.
- [2] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [3] If this command is set two or more times for the same line, the last set line spacing is valid.
- [4] When line pitch is set with the “ESC 3” or “ESC 2” command, the line spacing set with this command is invalidated.
- [5] Note the difference between line pitch and line spacing:



3.1.20 ESC C+[n] Page length setting

[Name] Page length setting

[Function] This command sets the page length to a specific amount of character lines.

[Code] $[1B]^{16} + [43]^{16} + [n]$
 $[27]^{10} + [67]^{10} + [n]$

[Description]

- [1] The "ESC C+[n]" command sets the page length to [n] lines (current character set).
- [2] Condition $[0]^{10} \leq [n] \leq [63]^{10}$ must be satisfied.
- [3] When parameter [n] specifies $[0]^{10}$, the page length is reset to it's default-
- [4] The default page length is 44 lines.
- [5] If the value of parameter [n] is incorrect, the page length setting is ignored.
- [6] Note that the effective amount of dot lines fed after a form feed, depends on following settings
 - page length setting (this command)
 - character set selected (character height, set with printing mode command)
 - line pitch or line spacing

3.1.21 ESC D+[d1]..[dn]+NUL Horizontal tab position setting

[Name]	Horizontal tab position setting
[Function]	This command sets one or more horizontal tab positions or deletes all tab position.
[Code]	[1B] ¹⁶ + [44] ¹⁶ + [d1] to [dn] + [00] ¹⁶ [27] ¹⁰ + [68] ¹⁰ + [d1] to [dn] + [0] ¹⁰

[Description]

- [1] Command "ESC D+[d1]..[dn]+NUL " sets one or more tab positions, which are used in the horizontal tab command "HT".
- [2] Condition $[1]^{10} \leq [d] \leq [255]^{10}$ must be satisfied (tab position).
- [3] Condition $[1]^{10} \leq [n] \leq [32]^{10}$ must be satisfied (number of tabs).
- [4] The horizontal tab position is set to the position that is "[d] x ANK-character-width" distant from the head of the line in the printing area.
- [5] When character-width is satisfied to double-width (printing mode selection), the horizontal tab position is applied double- character width.
- [6] Even if the character width is changed after the horizontal tab position is set, the set horizontal tab position is not changed.
- [7] When the horizontal tab is set with this command, the horizontal tab positions already set are cancelled.
- [8] When horizontal position $[d]=[8]^{10}$ is set, executing a "HT" command moves the next print position to column 9.
- [9] Up to 32 horizontal tab positions can be set. If more than 32 horizontal tab positions are set, the data at the excessive tab positions is handled as ordinary data.
- [10] The [d] values must be entered in ascending order, and must end with NUL.
- [11] All horizontal tab positions can be cancelled with the "ESC D+NUL" command.
- [12] When the power to the printer is turned on or the printer is reset, the horizontal tab positions are set for intervals of 8 characters selected in the initial state.

3.1.22 ESC J+[n]**Forward paper feed**

[Name] Forward paper feed
[Function] This command feeds paper in the forward direction.
[Code] [1B]¹⁶ + [4A]¹⁶ + [n]
[27]¹⁰ + [74]¹⁰ + [n]

[Description]

- [1] The "ESC J+[n]" command feeds paper in the forward direction by [n] dot lines.
- [2] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [3] When there is data in the print buffer, the data in the print buffer is printed after which paper is fed in the forward direction.
- [4] When parameter [n] specifies $[0]^{10}$, the data contained in the buffer is printed but paper is not fed.

3.1.23 ESC K+[n] Backward paper feed

[Name] Backward paper feed
[Function] This command feeds paper in the backward direction.
[Code] $[1B]^{16} + [4B]^{16} + [n]$
 $[27]^{10} + [75]^{10} + [n]$

[Description]

- [5] The "ESC K+[n]" command feeds paper in the backward direction by [n] dot lines.
- [6] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [7] When there is data in the print buffer, the data in the print buffer is printed after which paper is fed in the backward direction.
- [8] When parameter [n] specifies $[0]^{10}$, the data contained in the buffer is printed but paper is not fed.
- [9] If paper back-feed is executed, paper jam may occur.
- [10] If paper back-feed is executed, the upper part of character will be smashed by gear's backrush. When printing after back feeding, feed the paper forward with amount more than backrush to prevent character smashing.
- [11] When this command is executed, the paper must not come off from the rubber roller.

3.1.24 ESC V+[n]+[m] Text, image and barcode rotation

[Name] Text, image and barcode rotation
 [Function] This command specifies the rotation angle for text, images and barcodes.
 [Code] $[1B]^{16} + [56]^{16} + [n] + [m]$
 $[27]^{10} + [86]^{10} + [n] + [m]$
 [Description]

- [1] The “ESC V+[n]+[m]” command specifies the rotation angle for:
- text rotation: 0°, 90°, 180° and 270°
 - image rotation: 0°, 90°, 180° and 270°
 - barcode rotation: 0° and 90°

- [2] Parameter [n] defines what is affected by the rotation:

Parameter [n]	Rotation
$[48]^{10} / [30]^{16}$	Text
$[49]^{10} / [31]^{16}$	Images
$[51]^{10} / [33]^{16}$	Barcodes

- [3] Parameter [m] defines the angle of rotation:

Parameter [m]	Angle of rotation
$[00]^{10}$	0°
$[01]^{10}$	90°
$[02]^{10}$	180°
$[03]^{10}$	270°

- [4] Text can be rotated all available directions, only the individual characters are rotated, not the complete text.
 [5] The upside down printing command is cancelled when using the “ESC V+..” command for text rotation.
 [6] Barcodes can only be rotated 0° and 90°.
 [7] The left upper position for barcode printing is defined by the actual line and left margin of the paper (command “ESC L+...”).
 [8] All barcode settings (height, width, magnification) are effective when printing barcodes.
 [9] Registered bitmaps can be rotated all available directions, whereas the left upper position is defined by the actual line and left margin of the paper (command “ESC L+...”).

3.1.25 ESC X+NUL+[m]**Setting the turning time of
the motor excitation**

[Name]	Setting the turning time of the motor excitation
[Function]	This command defines the turning off time of the motor excitation.
[Code]	[1B] ¹⁶ + [58] ¹⁶ + [00] ¹⁶ + [m] [27] ¹⁰ + [88] ¹⁰ + [00] ¹⁰ + [m]
[Description]	

- [1] Command "ESC X+[n]+[m]" sets the time to keep the motor exciting after feeding or printing.
- [2] Parameter [m] defines the excitation time in 0,5 seconds.
- [3] The range for Parameter [m] is
[0]¹⁰ ≤ [m] ≤ [120]¹⁰ (60 sec)
- [4] An initial value for parameter [m]= is [40]¹⁰, which sets the excitation time 20 sec.

3.1.26 ESC d+[n] Forward n-line feed

[Name]	Forward n-line feed
[Function]	This command prints the data and feeds a line, then feeds the paper by [n] lines.
[Code]	$[1B]^{16} + [64]^{16} + [n]$ $[27]^{10} + [100]^{10} + [n]$

[Description]

- [1] The "ESC d+[n]" command feeds paper by a line count specified with parameter [n].
- [2] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [3] After [n] lines are fed, the next to print position is at the left edge on the line.
- [4] When there is data in the print buffer, the data contained in the buffer is printed after which paper is fed by [n] lines.
- [5] Pitch or spacing are also taken into account.

3.1.27 ESC e+[n] Backward n-line feed

[Name]	Backward n-line feed
[Function]	This command prints the data and feeds a line, then feeds the paper in the backward direction by [n] lines.
[Code]	$[1B]^{16} + [65]^{16} + [n]$ $[27]^{10} + [101]^{10} + [n]$

[Description]

- [1] The "ESC e+[n]" command feeds paper in the backward direction by the line count specified with parameter [n].
- [2] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [3] After [n] lines are fed, the next to print position is at the left edge on the line.
- [4] When the value of parameter [n] is $[0]^{10}$, the data contained in the buffer is printed but the paper is not fed.
- [5] If paper back-feed is executed, a paper jam may occur.
- [6] If paper back-feed is executed, the upper part of character will be smashed by gear's backrush. When printing after back feeding, feed the paper forward with amount more than backrush to prevent character smashing.
- [7] When this command is executed, the paper must not come off from the rubber roller.
- [8] Pitch or spacing are also taken into account.

3.1.28 ESC s+[n] Printing speed setting

[Name] Printing speed setting
 [Function] This command sets printing speed.
 [Code] $[1B]^{16} + [73]^{16} + [n]$
 $[27]^{10} + [115]^{10} + [n]$

[Description]

- [9] The “ESC s+[n]” command sets the printing speed.
 [10] The end-of-page command should precede the printing speed command to assure, that all data in the print buffer is flushed before print speed change becomes effective.
 [11] When the same printing speed as the current printing speed is specified with this command, no change occurs.
 [12] The relationship between parameter [n] and the specified printing speed is as follows:

Parameter [n]	Print speed	
	$[96]^{10} / [60]^{16}$	High-speed printing	160 mm/s
$[97]^{10} / [61]^{16}$	Medium-2-speed printing	130 mm/s
$[98]^{10} / [62]^{16}$	Medium-1-speed printing	100 mm/s
$[99]^{10} / [63]^{16}$	Low-speed printing	65 mm/s

- [13] If a parameter value not listed in the above table is set, the newly set printing speed is invalidated. The previous printing speed is validated.
 [14] The default printing speed is 130 mm/sec
 [15] The C56 automatically limits the print speed if case of dot history is enabled and/or multi strobe burning is enabled.

3.1.29 ESC {+[n] Upside-down printing setting/cancellation

[Name] Upside-down printing setting/cancellation
 [Function] This command sets or cancels upside-down printing.
 [Code] $[1B]^{16} + [7B]^{16} + [n]$
 $[27]^{10} + [123]^{10} + [n]$

[Description]

- [1] This “ESC {+n” command sets or cancels upside-down printing.
 [2] The bits of parameter [n] specifies upside down setting/cancellation as follows:

Parameter [n]	Upside down printing
$[00]^{10}$	Upside-down printing cancellation (rotation 0°)
$[01]^{10}$	Upside-down printing setting (rotation 180°)
otherwise	Ignored

- [3] The “ESC {+[n]” command can be used in all character modes.
 [4] Any text rotation previously set with the rotation command (command “ESC V+..”) is cancelled.
 [5] The “ESC {+n” command can also be used in bit image printing.
 [6] Any image rotation previously set with the rotation command (command “ESC V+..”) is cancelled.
 [7] The character base line is at the bottom of the character typeface. Print character typefaces are arranged so that their bottom ends are aligned at the same level.

3.1.30 FS 9+[n] Detection function enable/disable setting

[Name] Detection function enable/disable setting
 [Function] This command enables or disables various detection functions.
 [Code] [1C]¹⁶ + [39]¹⁶ + [n]
 [28]¹⁰ + [57]¹⁰ + [n]

[Description]

- [1] The "FS 9 + [n]" command enables or disables detection functions for detecting paper end and paper low/near end.
- [2] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [3] The bits of parameter [n] specify the following information:

Parameter [n], bit	Value	Detection function
b0 (LSB) b1 b2 b3 b4	unused, always 0	
b5	0	Paper near-end detection disabled
	1	Paper near-end detection enabled (default)
b6	0	Paper-out detection disabled
	1	Paper- out detection enabled (default)
b7 (MSB)	unused, always 0	

- [4] In the initial state, all of the detection functions are enabled by default.
- [5] If paper-out detection is disabled, then:
 - paper is expected to be present at all time
 - printing is done regardless of paper being present
 - the status of the paper end sensor is ignored
 - the paper end flag in the status double word is always lowered
 - this could damage your printer

3.1.31 FS E+[n] Correction of impressed energy

[Name]	Correction of impressed energy
[Function]	This command allows correction of impressed energy.
[Code]	[1C] ¹⁶ + [45] ¹⁶ + [n] [28] ¹⁰ + [69] ¹⁰ + [n]

[Description]

- [1] The "FS E+[n]" command allows a correction of the impressed energy which, together with the actual print quality, is used to determine the burn time for the thermal print head.
- [2] The impressed energy correction value is set by parameter [n].
- [3] Condition $[0]^{10} \leq [n] \leq [255]^{10}$ must be satisfied.
- [4] Impressed energy grows by the value of [n] large.
- [5] Please note that the life of the head shortens when the impressed energy is too large. There is danger to which the head is disconnected for $[n] \geq [128]^{10}$.
- [6] The initial value for parameter [n], is $[100]^{10}$.
- [7] The estimated burn time is calculated from the print quality and the impressed energy correction according following algorithm:
 - "estimated burn time" = "burn time from print quality" + ("impressed energy value" - $[53]^{10}$) * $[3]^{10}$ us.
 - whereas:
 - "burn time from print quality" = $[220]^{10}$ us for print quality LOW, $[350]^{10}$ us for HIGH.
 - "impressed energy value" = parameter [n] in "FS E+[n]" command.
- [8] The estimated burn time is limited to the maximum burn time, which depends on the actual print head temperature and is calculated according following algorithm:
 - "maximum burn time" = $[390]^{10}$ us + $[40]^{10}$ us + ($[25]^{10}$ °C - "print head temperature") * $[1.5]^{10}$ us
 - whereas:
 - "print head temperature" = measured temperature at print head in °C.

3.1.32 GS &+[m]+[x]+[y1]+[y2]+[d1]..[dn]

Registration of image data

[Name]	Registration of image data
[Function]	This command registers image data.
[Code]	[1D] ¹⁶ + [26] ¹⁶ + [m] + [x] + [y1] + [y2] + [d1]..[dn] [29] ¹⁰ + [38] ¹⁰ + [m] + [x] + [y1] + [y2] + [d1]..[dn]

[Description]

- [1] The “GS &+[m]+[x]+[y1]+[y2]+[d1]..[dn]” command is used to register image data which is stored into flash memory.
- [2] Parameter [m] specifies the unique identification number of the registered image, which is used when printing the image.
- [3] The range of Parameter [m], the identification number, is $[1]^{10} \leq [m] \leq [255]^{10}$.
- [4] If an image which equal identification number already exists, then the command is ignored and no image is registered.
- [5] Parameter [x] defines the image width in number of bytes, whereas the width of each image must exactly be a multiple of $[8]^{10}$ dots (e.g. $[8]^{10}$, $[16]^{10}$, $[24]^{10}$, $[32]^{10}$, etc. dots)
- [6] The range of parameter [x], the image width, is $[1]^{10} \leq [x] \leq [255]^{10}$.
- [7] Parameter [y1] and [y2] define the length of the image in dot lines, whereas the number of dot lines is calculated with following formula:
 “Image length in dot lines” = $[y1] + [y2] \times [256]^{10}$
- [8] The range of parameter [y1] and [y2] is as follows $[0]^{10} \leq [y1] \leq [255]^{10}$, $[0]^{10} \leq [y2] \leq [255]^{10}$, whereas [y1] and [y2] may not be $[0]^{10}$ simultaneously.
- [9] Because the data is registered in flash memory, the image data is not deleted by the power supply cutting.
- [10] The maximum image size is 64KB.
- [11] The storage capacity reserved in flash for storage of images is 128KB. Please note that no more images are stored when this capacity is exhausted.
- [12] Note that the “GS &+[m]+[x]+[y1]+[y2]+[d1]..[dn]” command, with a NUL value for [m], [x], [y1] and [y2], represents the command “GS &+NUL+NUL+NUL+NUL”, which deletes all registered images.
- [13] The image identification number may only be used once in registration.

3.1.33 GS &+NUL+NUL+NUL+NUL**Deletion of
registered image data**

[Name] Deletion of registered image data
[Function] This command deletes all registered image data.
[Code] [1D]¹⁶ + [26]¹⁶ + [00]¹⁶ + [00]¹⁶ + [00]¹⁶ + [00]¹⁶
[29]¹⁰ + [38]¹⁰ + [0]¹⁰ + [0]¹⁰ + [0]¹⁰ + [0]¹⁰

[Description]

- [1] The "GS &+NUL+NUL+NUL+NUL " command is used to delete all registered image data which is stored in flash memory.
- [2] Note, that there is no command available for deleting single bitmaps.

3.1.34 GS '+[m]+[n] Print registered image data

[Name] Print registered image data
 [Function] This command causes registered image data to be printed.
 [Code] $[1D]^{16} + [27]^{16} + [m] + [n]$
 $[29]^{10} + [39]^{10} + [m] + [n]$

[Description]

- [1] The “GS '+[m]+[n]” command causes registered image data, stored in flash, to be printed.
- [2] Parameter [m] specifies the identification number of the printed registration image.
- [3] The range of parameter [m], the identification number, is $[1]^{10} \leq [m] \leq [255]^{10}$.
- [4] If no registered image with corresponding identification number is found, then the command is ignored.
- [5] Parameter [n] specifies the mode for printing which can be:

Parameter [n]		Print mode	Caption
$[00]^{10}$	$[48]^{10}$	Normal	The registered image data is printed by the registered size.
$[01]^{10}$	$[49]^{10}$	Double width	The registered image data is printed by double width.
$[02]^{10}$	$[50]^{10}$	Double height	The registered image data is printed by double height.
$[03]^{10}$	$[51]^{10}$	Double width and height	The registered image data is printed by double width and height.

- [6] Other values for Parameter [m] and [n] as described above, causes the command to be ignored.

3.1.35 ESC [CD]+[02]+[88]+[n]+[m]**Set black mark size**

[Name]	Set black mark size
[Function]	This command sets the maximum and minimum size (height) of a black mark
[Code]	$[1B]^{16} + [CD]^{16} + [02]^{16} + [88]^{16} + [n] + [m]$ $[27]^{10} + [205]^{10} + [02]^{10} + [136]^{10} + [n] + [m]$

[Description]

- [1] Function "ESC [CD]+[02]+[88]+[n]+[m]" defines the minimum and maximum size of a black mark in 1/100-inch resolution.
- [2] Parameter [n] defines the minimum black mark size in 1/100-inch resolution.
- [3] Parameter [m] defines the maximum black mark size in 1/100-inch resolution.
- [4] The ranges of both parameter [n] and [m], the minimum and maximum black mark size, are $[1]^{10} \leq [n] \leq [m] \leq [255]^{10}$.
- [5] All detected black marks, which size is smaller than minimum size defined, are ignored.
- [6] All detected black marks, which size is larger than maximum size defined, are regarded as an out of paper situation
- [7] The default value for parameter [n] is $[8]^{10}$ (approx. 2 mm)
- [8] The default value for Parameter [m] is $[31]^{10}$ (approx. 8 mm)

3.1.36 GS < Mark detection execution

[Name] Mark detection execution

[Function] This command feeds paper up to the next black mark position.

[Code] [1D]¹⁶ + [3C]¹⁶
[29]¹⁰ + [60]¹⁰

[Description]

- [1] The "GS <" command feeds paper up to the next black mark position.
- [2] If no mark is found within the specified page length from the mark-detection-execution starting point, an error is assumed and the page feed stops.
- [3] The size of a black mark can be set with command "ESC [CD]+[02]+[88]+[n]+[m]"
- [4] The mark detection function is available from firmware V3.00 and up

3.1.37 GS E+[n] Print quality setting

[Name] Print quality setting
 [Function] This command sets the print quality
 [Code] $[1D]^{16} + [45]^{16} + [n]$
 $[29]^{10} + [69]^{10} + [n]$

[Description]

- [1] The “GS E+[n]” command sets print quality.
- [2] The print quality defines the basic burn time for the powering of the print head.
- [3] Parameter [n] defines following print qualities:

Parameter [n]	Print Quality	Burn Time
$[00]^{10}$	Low	220us
$[01]^{10}$	High	350us

- [4] The estimated burn time is calculated from the print quality and the impressed energy correction according following algorithm:
 - “estimated burn time” = “burn time from print quality” + (“impressed energy value” – $[53]^{10}$) * $[3]^{10}$ us.
 - whereas:
 - “burn time from print quality” = $[220]^{10}$ us for print quality LOW, $[350]^{10}$ us for HIGH.
 - “impressed energy value” = parameter [n] in “FS E+[n]” command.
- [5] The estimated burn time is limited to the maximum burn time, which depends on the actual print head temperature and is calculated according following algorithm:
 - “maximum burn time” = $[390]^{10}$ us + $[40]^{10}$ us + ($[25]^{10}$ °C - “print head temperature”) * $[1.5]^{10}$ us
 - whereas:
 - “print head temperature” = measured temperature at print head in °C.

3.1.38 GS e+[n]+[m] Bar code width setting

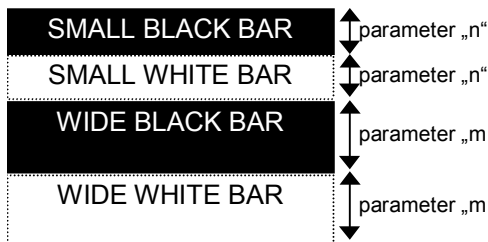
[Name] Bar code width setting

[Function] This command sets the width of the bar code black and wide bars.

[Code] $[1D]^{16} + [65]^{16} + [n] + [m]$
 $[29]^{10} + [101]^{10} + [n] + [m]$

[Description]

- [1] Command "GS e+[n]+[m]" defines the width of the bar code bars.
- [2] The bars in a bar code can be wide or narrow and black or wide.



- [3] Parameter [n] specifies the width of a narrow white/black bar in dots.
- [4] Parameter [m] specifies the width of a wide white/black bar in dots.
- [5] When the code does not consist of wide bars and/or narrow bars, the value of parameter [n] is set as the minimum width.
- [6] The initial value of parameter [n] is $[2]^{10}$.
- [7] The initial value of Parameter [m] is $[6]^{10}$.
- [8] The following conditions must be satisfied:
 $[1]^{10} \leq [n] \leq [255]^{10}$ and $[1]^{10} \leq [m] \leq [255]^{10}$

3.1.39 GS h+[n] Bar code height setting

[Name] Bar code height setting
[Function] This command sets the height of a bar code.
[Code] $[1D]^{16} + [68]^{16} + [n]$
 $[29]^{10} + [104]^{10} + [n]$

[Description]

- [1] Command "GS h+[n]" defines the height of a bar code.
- [2] Parameter [n] specifies the height of a bar code in dots.
- [3] The following conditions must be satisfied:
 $[1]^{10} \leq [n] \leq [255]^{10}$.
- [4] The initial value of parameter [n] is $[60]^{10}$.

3.1.40 GS w+[n] Bar code width magnification setting

[Name] Bar code width magnification setting
[Function] This command sets the width magnification of a bar code.
[Code] [1D]¹⁶ + [77]¹⁶ + [n]
[29]¹⁰ + [109]¹⁰ + [n]

[Description]

- [1] Command "GS w+[n]" specifies the width magnification of a bar code.
- [2] Parameter [n] specifies the horizontal magnification of a bar code.
- [3] The following conditions must be satisfied:
 $[1]^{10} \leq [n] \leq [255]^{10}$.
- [4] The initial value of parameter [n] is [1]¹⁰.
- [5] Both the widths of a narrow bar and a wide bar (black and white) are multiplied by [n].

3.1.41 GS k+[m]+[n]+[d1]..[dn] Bar code printing

[Name] Bar code printing

[Function] This command selects a bar code type and prints a bar code.

[Code] $[1D]^{16} + [6B]^{16} + [m] + [n] + [d1]..[dn]$
 $[29]^{10} + [107]^{10} + [m] + [n] + [d1]..[dn]$

[Description]

- [1] Command "GS k+[m]+[n]+[d1]..[dn]" selects a bar code type and prints a bar code.
- [2] Parameter [m] specifies the type of bar codes to be printed, which can be UPCA, UPCE, EAN13, EAN8, Code39, ITF, Codabar and Code 128.
- [3] The command configuration, code, definition area, and part of the conditions depend on parameter [m].
- [4] Parameter [n] specifies number of barcode characters, which depends on the type of barcode.
- [5] If the print data exceeds the printing area of which width is one line, the overflowing part of the data printed on the next line.
- [6] If the bar code is higher than the line spacing set with the ESC 2 or ESC 3 command, paper is fed by the bar code height without regard to the specified line spacing.
- [7] When NUL is specified at the check digit position or when an odd number of data records is specified in ITF with Parameter [m]=[5]¹⁰, the check digit is calculated automatically. The calculation results are added to the bar code. When data other than NUL is specified at the check digit position, the received data is expanded in the bar code without modifications.
- [8] When one line contains both a bar code and characters to be printed, the bottom of these characters and the bottom of the bar code are aligned at the same level.
- [9] Two or more bar codes cannot be contained on the same line. If this GS command is received when there is a bar code in the print buffer, the data contained in the print buffer is automatically printed, after which the command is accepted.

Parameter [m]	Type of Barcode	Number of barcode characters	Value of parameter "d"
[65] ¹⁰	UPCA	[11] ¹⁰ <=n<= [12] ¹⁰	[48] ¹⁰ <=d<=[57] ¹⁰
[66] ¹⁰	UPCE	[11] ¹⁰ <=n<= [12] ¹⁰	[48] ¹⁰ <=d<=[57] ¹⁰
[67] ¹⁰	EAN13	[12] ¹⁰ <=n<= [13] ¹⁰	[48] ¹⁰ <=d<=[57] ¹⁰
[68] ¹⁰	EAN8	[7] ¹⁰ <=n<= [8] ¹⁰	[48] ¹⁰ <=d<=[57] ¹⁰
[69] ¹⁰	Code39	Variable	Space, \$, %, +, -, ., /, 0-9, A-Z
[70] ¹⁰	ITF	Variable	Even number, 0-9
[71] ¹⁰	Codabar	Variable	'0' ~ '9', '-', '\$', ':', '/', ',', '+', 'A', '~', 'D' ('A' or 'D' are end characters)
[73] ¹⁰	Code128	Variable	0 to 105

- [10] Restrictions and notes to UPCA:
if n is [11]¹⁰ then the board calculate the checksum.
- [11] Restrictions and notes to EAN8:
if n is [7]¹⁰ then the board calculate the checksum.
- [12] Restrictions and notes to EAN13:
if n is [12]¹⁰ then the board calculate the checksum.
- [13] Restrictions and notes to Code 39:
The first and last character must be "*" (according code 39 syntax).

[14] Restrictions and notes to Code 128.

There are three subset of Code128 (Code128A, Code128B and Code128C).

The start character specifies which character set to be used.

The start character must be either 103 (subset A), 104 (subset B), 105 (subset C).

The following table shows the value between data (d) and barcode.

Code128 barcode table

data 'd'	subset A	subset B	subset C	data 'd'	subset A	subset B	subset C
[0] ¹⁰	Space	Space	0	[52] ¹⁰	T	T	52
[1] ¹⁰	!	!	1	[53] ¹⁰	U	U	53
[2] ¹⁰	“	“	2	[54] ¹⁰	V	V	54
[3] ¹⁰	#	#	3	[55] ¹⁰	W	W	55
[4] ¹⁰	\$	\$	4	[56] ¹⁰	X	X	56
[5] ¹⁰	%	%	5	[57] ¹⁰	Y	Y	57
[6] ¹⁰	&	&	6	[58] ¹⁰	Z	Z	58
[7] ¹⁰	‘	‘	7	[59] ¹⁰	[	[	59
[8] ¹⁰	(	(	8	[60] ¹⁰	\	\	60
[9] ¹⁰	)	)	9	[61] ¹⁰	]	]	61
[10] ¹⁰	*	*	10	[62] ¹⁰	^	^	62
[11] ¹⁰	+	+	11	[63] ¹⁰	_	_	63
[12] ¹⁰	,	,	12	[64] ¹⁰	NUL	`	64
[13] ¹⁰	-	-	13	[65] ¹⁰	SOH	a	65
[14] ¹⁰	.	.	14	[66] ¹⁰	STX	b	66
[15] ¹⁰	/	/	15	[67] ¹⁰	ETX	c	67
[16] ¹⁰	0	0	16	[68] ¹⁰	EOT	d	68
[17] ¹⁰	1	1	17	[69] ¹⁰	ENQ	e	69
[18] ¹⁰	2	2	18	[70] ¹⁰	ACK	f	70
[19] ¹⁰	3	3	19	[71] ¹⁰	BEL	g	71
[20] ¹⁰	4	4	20	[72] ¹⁰	BS	h	72
[21] ¹⁰	5	5	21	[73] ¹⁰	HT	i	73
[22] ¹⁰	6	6	22	[74] ¹⁰	LF	j	74
[23] ¹⁰	7	7	23	[75] ¹⁰	VT	k	75
[24] ¹⁰	8	8	24	[76] ¹⁰	FF	l	76
[25] ¹⁰	9	9	25	[77] ¹⁰	CR	m	77
[26] ¹⁰	:	:	26	[78] ¹⁰	SO	n	78
[27] ¹⁰	;	;	27	[79] ¹⁰	SI	o	79
[28] ¹⁰	<	<	28	[80] ¹⁰	DLE	p	80
[29] ¹⁰	=	=	29	[81] ¹⁰	DC1	q	81
[30] ¹⁰	>	>	30	[82] ¹⁰	DC2	r	82
[31] ¹⁰	?	?	31	[83] ¹⁰	DC3	s	83
[32] ¹⁰	@	@	32	[84] ¹⁰	DC4	t	84
[33] ¹⁰	A	A	33	[85] ¹⁰	NAK	u	85
[34] ¹⁰	B	B	34	[86] ¹⁰	SYN	v	86
[35] ¹⁰	C	C	35	[87] ¹⁰	ETB	w	87

[36] ¹⁰	D	D	36	[88] ¹⁰	CAN	x	88
[37] ¹⁰	E	E	37	[89] ¹⁰	EM	y	89
[38] ¹⁰	F	F	38	[90] ¹⁰	SUB	z	90
[39] ¹⁰	G	G	39	[91] ¹⁰	ESC	{	91
[40] ¹⁰	H	H	40	[92] ¹⁰	FS	|	92
[41] ¹⁰	I	I	41	[93] ¹⁰	GS	}	93
[42] ¹⁰	J	J	42	[94] ¹⁰	RS	~	94
[43] ¹⁰	K	K	43	[95] ¹⁰	US	DEL	95
[44] ¹⁰	L	L	44	[96] ¹⁰	FNC3	FNC3	96
[45] ¹⁰	M	M	45	[97] ¹⁰	FNC2	FNC2	97
[46] ¹⁰	N	N	46	[98] ¹⁰	SHIFT	SHIFT	98
[47] ¹⁰	O	O	47	[99] ¹⁰	Code C	Code C	99
[48] ¹⁰	P	P	48	[100] ¹⁰	Code B	FNC 4	Code B
[49] ¹⁰	Q	Q	49	[101] ¹⁰	FNC 4	Code A	Code A
[50] ¹⁰	R	R	50	[102] ¹⁰	FNC 1	FNC 1	FNC1
[51] ¹⁰	S	S	51				

3.1.42 GS a+[n] Setting and cancellation of auto status transmission

[Name] Setting and cancellation of auto status transmission
 [Function] This command sets and cancels the auto status transmission.
 [Code] [1D]¹⁶ + [61]¹⁶ + [n]
 [29]¹⁰ + [97]¹⁰ + [n]

[Description]

- [1] The "GS a+[n]" sets and cancels the auto status transmission.
- [2] The status transmitted by the printer are 4 bytes of data.
- [3] The relation of the target status for parameter [n] and the transmission is as follows.

Parameter [n]	Automatic Status Transmission
[16] ¹⁶ / [22] ¹⁰	Enabled (status request)
[01] ¹⁶ / [01] ¹⁰	Firmware version request (from firmware V2.01)
Otherwise	Disabled

- [4] The default value for parameter [n] = 0.
- [5] The printer transmits status upon:
 - receiving this "GS a+[n]" command
 - receiving the "FS r+[n]" parameter command
 - detecting a status which requires an automatic transmission (status bits changed)
- [6] There is a possibility to cause the delay between reception of command and sending of status.
- [7] The following four status bytes are transmitted:

Printer status: first byte

Bit	Status	Caption	
0	Unused	0: Fixation	
1	Paper in chute	0: No paper in chute	1: Paper in chute
2	Temperature alert	0: No temperature alert	1: Temperature alert
3	Printout lost	0: No printout lost	1: Last printout lost
4	Paper jam	0: No paper jammed	1: Paper jammed
5	Paper low	0: No black mark detected	1: Black mark detected
6	Paper out	0: Paper present	1: Paper out
7	Power	1: On-line	

Notes:

- 1) A temperature alert will occur when print head temperature exceeds 70°C. In this case no printout should be done until the temperature gets below 70°C. A printout which is initiated when the print head temperature is above 70°C might seriously damage the printer.
- 2) A paper jam will occur when the printer is not able to retract the paper after detecting end of paper. This flag is raised if no paper is detected for "maximum black mark size" + 3 mm.
- 3) The "paper in chute" bit number 1 is available from firmware version 3.01 and is only correct when the printer has a chute sensor and when bit number 0 is zero.

Printer status: second byte

Bit	Status	Caption	
0	Reserved	N/A	
1	Reserved	N/A	
2	Reserved	N/A	
3	Reserved	N/A	
4	Reserved	N/A	
5	Customer flag #1	0: ON	1: OFF
6	Customer flag #2	0: ON	1: OFF
7	Fixed	0: Fixation	

Notes:

- 1) Customer flags are specified with the customer flags setting command.

Printer status: third byte

Bit	Status	Caption
0-6	Temperature	Temperature in degrees celcius
7	Fixed	0: Fixation

Notes:

- 1) The temperature is transmitted in degrees, whereas the 8th bit must be raised (2 complement negative) if the value exceeds 80°C (e.g. temp = (char) (byte + (byte >=80 ? 0x80 : 0x00)))

Printer status: fourth byte

Bit	Status	Caption
0-6	Parameter	Parameter
7	Fixed	0: Fixation

Notes:

- 1) The parameter represents the echoed value [n] specified with the parameter transmission command "FS r+[n]".
- 2) Escape sequence [1D]¹⁶ [61]¹⁶ [16]¹⁶ requests status information

- [8] If the parameter [n] is set to [01]¹⁶ / [01]¹⁰ then the firmware V2.01 will respond in sending the current firmware version in four status bytes. If the lower 2 bits of the status DWORD are raised, then the contents of the DWORD is the version number of the C-56 firmware.

Printer status: first byte

Bit	Status	Caption	
0	Version indication	1: Fixation	
1		1: Fixation	
2	Temperature alert	0: No temperature alert	1: Temperature alert
3	Printout lost	0: No printout lost	1: Last printout lost
4	Paper jam	0: No paper jammed	1: Paper jammed
5	Paper low	0: No black mark detected	1: Black mark detected
6	Paper out	0: Paper present	1: Paper out
7	Power	1: On-line	

Printer status: second byte

Bit	Status	Caption
0-6	Major version number	0..N (e.g. 2 in V2.01a)
7	Fixed	0: Fixation

Printer status: third byte

Bit	Status	Caption
0-6	Minor version number	0..N (e.g. 1 in V2.01a)
7	Fixed	0: Fixation

Printer status: fourth byte

Bit	Status	Caption
0-6	Beta indicator	0 if not beta, 1..N if beta (e.g. 1 in V2.01a)
7	Fixed	0: Fixation

Notes:

- 1) The parameter represents the echoed value [n] specified with the parameter transmission command "FS r+[n]".
- 2) Escape sequence [1D]¹⁶ [61]¹⁶ [01]¹⁶ requests version information

3.1.43 FS r+[n] Parameter transmission

[Name]	Parameter transmission
[Function]	This command specifies the parameter which is replied as 4 th byte in the automatic status transmission
[Code]	[1C] ₁₆ + [72] ₁₆ + [n] [28] ₁₀ + [114] ₁₀ + [n]

[Description]

- [1] The "FS r+[n]" command is used to transmit a parameter to the printer, whereas this parameter is echoed in the last byte of the printer status.
- [2] The reply parameter is specified by parameter [n].
- [3] An initial value for parameter [n] is [0]¹⁰.
- [4] The range of parameter [n] is:
[0]¹⁰ ≤ [n] ≤ [127]¹⁰.
- [5] The printer status is automatically transmitted when this command is received.
- [6] The reply data follows the format of the automatic status transmission (see command "GS a+[n]")
- [7] As soon as the parameter is sent within the status transmission, the value of the parameter is reset to [0]¹⁰.
- [8] In normal, the parameter command is sent at the end of a print job to inquire, if the printout has completed (e.g. parameter echoed) and if it has been successful (e.g. no printout lost).

3.1.44 ESC [CD]+[38]+[08]+[d1]..[d56]**Print raw uncompressed graphics**

[Name] Print raw uncompressed graphics

[Function] This command allows printout of a single dot line as uncompressed graphics directly.

[Code] $[1B]^{16} + [CD]^{16} + [38]^{16} + [08]^{16} + [d1]..[d56]$
 $[27]^{10} + [205]^{10} + [56]^{10} + [08]^{10} + [d1]..[d56]$

[Description]

- [1] The "ESC [CD]+[38]+[08]+[d1]..[d56]" command specifies a single dot line (448 dots) in 56 bytes.
- [2] There are 56 data bytes which contains on/off information for all 448 dots (56 bytes * 8 bits = 448 dots).
- [3] The left most dot in a dot line is represented by the MSB of byte d0 (first data byte)
- [4] The right most dot in a dot line is represented by the LSB of byte d55 (last data byte)
- [5] A dot is on if it's corresponding bit is 1 and off otherwise.
- [6] Any other setting like inverse, double width, etc. have no effect.

3.1.45 GS L+[n]+[m] Left margin specification

[Name] Left margin specification

[Function] This command allows specification of a left margin.

[Code] [1D]¹⁶ + [4C]¹⁶ + [n] + [m]
[29]¹⁰ + [76]¹⁰ + [n] + [m]

[Description]

- [1] The "GS L+[n]+[m]" command specifies the left margin in dots.
- [2] Both parameter [n] and [m] specifies the left margin, whereas this margin is calculated as follows:
"left margin" = [n] + [m] * [256]¹⁰.
- [3] The range of parameter [n] is [0]¹⁰ ≤ [n] ≤ [255]¹⁰.
- [4] The range of parameter [m] is [0]¹⁰ ≤ [m] ≤ [255]¹⁰.

3.1.46 ESC [CD]+[02]+[E0]+[n]+[m]

Dot history pre-burn factor

[Name]	Dot history burn factor
[Function]	This command allows specification of the dot history burn factor
[Code]	[1B] ¹⁶ + [CD] ¹⁶ + [02] ¹⁶ + [E0] ¹⁶ + [n] + [m] [27] ¹⁰ + [205] ¹⁰ + [02] ¹⁰ + [224] ¹⁰ + [n] + [m]

[Description]

- [5] The "ESC [CD]+[02]+[E0]+[n]+[m]" command specifies the dot history pre-burn factor, which is defined as a percentage of the total burn time.
- [6] The dot history pre-burn factor is available from firmware V3.00 or higher.
- [7] Dot history is useful in preventing the over-heating of large, dark areas that are caused by individual heating element in the thermal printhead building up residual heat due to repeated, sequential firings, (also called "burns").
- [8] If dot history is enabled, then each dot line is burned in two phases: a pre-burn phase and a main-burn phase. During the pre-burn phase, only those required dots that were not burned in printing the previous dot line are burned. During the main-burn phase all required dots are burned.
- [9] Both the duration of the pre-burn phase and the main-burn phase are defined by the dot history burn factor, which specifies the percentage of the total burn time that is used for pre-burning.
- [10] The default dot history pre-burn factor is stored in flash memory, whereas it's value can be 0 to 99 percent. Dot history is enabled if the dot history burn factor is not equal to zero, and is disabled if the dot history burn factor equals zero.
- [11] Parameter [m] defines the dot history burn factor in percentage of the total burn time. The range of parameter [m] is $[0]^{10} \leq [m] \leq [100]^{10}$, whereas
 $[0]^{10}$ disables dot history
 $[1]^{10}$ to $[99]^{10}$ specifies a current dot history pre-burn factor that is 1 to 99 percent of the total burn time
 $[100]^{10}$ selects the default dot history pre-burn factor that is already stored in flash as the current dot history pre-burn factor
- [12] Parameter [n] specifies whether the dot history pre-burn factor is to be stored as the default in flash memory or if it is only to be used temporarily. If parameter [n] equals $[1]^{10}$, then the dot history pre-burn factor is stored in flash; otherwise its value is discarded after power down. The range of parameter [n] is $[0]^{10} \leq [n] \leq [1]^{10}$. The dot history pre-burn factor is only stored in flash if the parameter [m] is in range $[0]^{10}$ to $[99]^{10}$.
- [13] The general information that is printed after paper insertion, also contains information on the dot history pre-burn factor, provided that dot history is enabled.
- [14] The print speed must be limited to a maximum of 130 mm/s if dot history is enabled and limited to a maximum of 100 mm/s if multi strobe burning is also enabled (Note that the C56 automatically limits the print speed if this feature is enabled).

[15] Examples:

- a) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E0]^{16}+[0]^{10}+[30]^{10}$, enables dot history with a pre-burn factor of 30% but does not save the value to flash. The printer will use the 30% pre-burn factor until the printer is powered down.
- b) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E0]^{16}+[1]^{10}+[20]^{10}$, enables dot history with a dot history pre-burn factor of 20% and saves the new setting in flash memory. Dot history will be enabled with a pre-burn factor of 20% after power cycling the printer.
- c) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E0]^{16}+[0]^{10}+[100]^{10}$, selects the default dot history pre-burn factor stored in flash memory.
- d) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E0]^{16}+[1]^{10}+[0]^{10}$, disables dot history pre-burn and saves the new setting in flash memory. Dot history will be disabled after power cycling the printer.

3.1.47 ESC [CD]+[02]+[E1]+[n]+[m]

Wide font printing

[Name]	Wide font printing with standard/GB2312-Chinese/KS5601-Korean index.
[Function]	This command enables/disables wide font printing with standard/ GB2312-Chinese/KS5601-Korean character sets.
[Code]	[1B] ¹⁶ + [CD] ¹⁶ + [02] ¹⁶ + [E1] ¹⁶ + [n] + [m] [27] ¹⁰ + [205] ¹⁰ + [02] ¹⁰ + [225] ¹⁰ + [n] + [m]

[Description]

- [1] The "ESC [CD]+[02]+[E1]+[n]+[m]" command enables/disables wide font printing, where the wide font is represented by 7000+ characters, each made up of 24X24 or 20X20 dots.
- [2] Wide font printing is available for RS232 type boards with firmware V3.00 or higher later only, where the wide font has been previously uploaded into the second half of the 1 MB flash memory.
- [3] If wide font printing is enabled, then each character in this font is represented by a specific 2 byte code, which correlates to a specific wide font character. The selected wide font index specifies how the two byte code is mapped onto an entry in the wide font.
- [4] Four wide font indexes are available: standard 24X24, GB2312-Chinese 24X24, standard 20X20 and KS5601-Korean 20X20. Wide font printing is automatically enabled if one of these indexes is selected.
- [5] For both standard indexes, each two consecutive bytes that exceed [E0]¹⁶[00]¹⁶ are regarded as wide font character code references, whereas the corresponding character in the wide font is selected by subtracting [E0]¹⁶[00]¹⁶ (e.g. [E0]¹⁶[00]¹⁶ is the 1st character, [E0]¹⁶[01]¹⁶ is the 2nd character, ..., [E0]¹⁶[FF]¹⁶ is the 256th character, [E1]¹⁶[00]¹⁶ is the 257th character, etc.).
- [6] For the GB2312-Chinese index, each two consecutive bytes that exceed [A0]¹⁶[00]¹⁶ are regarded as wide font character code references, whereas the corresponding character in the wide font is selected according to the "GB2312" Simplified Chinese character map. The GB2312-Chinese index operates with a special preprocessed GB2312 type font only.
- [7] For the KS5601-Korean index, each two consecutive bytes that exceed [A0]¹⁶[00]¹⁶ are regarded as wide font character code references, whereas the corresponding character in the wide font is selected according to the "KS5601" Korean character map. The KS5601-Korean index operates with a special preprocessed KS5601 type font only.
- [8] Bytes that are not regarded as wide font character code references, are regarded as normal single byte references in the internal/external character sets. If received, then the corresponding internal/external character is printed.
- [9] Escape commands that affect the internal/external character set (e.g. print mode) also affect the wide font printing (e.g. double width, 3X magnification, etc.).
- [10] The default wide font index is stored in flash memory. Its value can be wide font disabled, wide font enabled with standard index or wide font enabled with chinese index.
- [11] Parameter [m] defines the wide font index, where the range of this parameter is $[0]^{10} \leq [m] \leq [4]^{10}$ or $[7]^{10}$. If parameter [m] is $[0]^{10}$ then wide font printing is disabled. If parameter [m] is $[1]^{10}$, then wide font printing is enabled with standard 24X24 index. If parameter [m] is $[2]^{10}$, then wide font printing is enabled with GB3212-Chinese 24X24 index. If parameter [m] is $[3]^{10}$, then wide font printing is enabled with standard 20X20 index. If parameter [m] is $[2]^{10}$, then wide font printing is enabled with KS5601-Korean 20X20 index. If parameter [m] is $[7]^{10}$, then the wide font printing index is reset to its default value, which is stored in flash memory.
- [12] Parameter [n] defines if the wide font index is to be stored as the default in flash memory or if it is only to be used temporarily. If parameter [n] equals $[1]^{10}$, then the wide font index is stored in to flash; otherwise it is lost on power down. The range of parameter [n] is $[0]^{10} \leq [n] \leq [1]^{10}$. The wide font index is only stored in flash if the parameter [m] is in the range $[0]^{10}$ to $[2]^{10}$.
- [13] The general information that is printed after paper insertion, also contains information on the selected wide font index, provided that wide font printing is enabled.
- [14] Sample wide fonts (standard and KS5601-Korean) are provided in the driver package.

[15] Examples:

a) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E1]^{16}+[0]^{10}+[1]^{10}$, enables wide font printing with standard index, but does not save the value to flash memory.

b) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E1]^{16}+[1]^{10}+[2]^{10}$, enables wide font printing with GB3212-chinese index, and saves the new setting as the default in flash memory. Wide font printing with the chinese index will automatically be enabled upon powering up the printer.

c) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E1]^{16}+[0]^{10}+[7]^{10}$, selects default wide font index from flash memory.

d) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E1]^{16}+[1]^{10}+[0]^{10}$, disables wide font printing and saves the new setting as the default in flash memory. Wide font printing will be automatically disabled after power cycling the printer .

3.1.48 ESC [CD]+[0C]+[E2]+[n]+[m1]..[m11]

Burn time correction
specification

[Name]	Specification of temperature-dependent burn time corrections
[Function]	This command specifies burn time corrections for printhead temperatures from -30°C to +70°C.
[Code]	$[1B]^{16} + [CD]^{16} + [0C]^{16} + [E2]^{16} + [n] + [m1]..[m11]$ $[27]^{10} + [205]^{10} + [12]^{10} + [226]^{10} + [n] + [m1]..[m11]$

[Description]

- [1] The “ESC [CD]+[0C]+[E2]+[n]+[m1]..[m11]” command specifies the burn time corrections in micro seconds for printhead temperatures ranging from -30°C up to +70°C in 10°C intervals. By specifying temperature-dependent (TD) burn time corrections, the printout on a specific paper type can be optimized for various operating temperatures.
- [2] Burn time correction specification is available for boards with firmware V3.00 or higher only,
- [3] Temperature-dependent burn time corrections are stored in flash memory and are loaded after printer power is applied. By default this TD burn time correction feature is disabled.
- [4] The printhead temperature is measured at the start of a printout and the TD burn time correction for this temperature is then added – or subtracted if negative - to the calculated burn time.
- [5] Parameters [m1]..[m11] specify 11 TD burn time corrections in microseconds as single byte, two-complement values in the range -128us to +127us. Parameter [m1] represents the burn time correction for -30°C, parameter [m2] the burn time correction for -20°C, etc.
- [6] Parameter [n] specifies whether the TD burn time corrections are to be stored as the default values in flash memory or if they are only to be used temporarily. If parameter [n] equals $[1]^{10}$, then all 11 TD burn time corrections are stored in to flash; otherwise the corrections are lost at power down. The range for parameter [n] is $[0]^{10} \leq [n] \leq [1]^{10}$.
- [7] The general information that is printed after paper insertion, also contains information on the burn time corrections, provided that one of those burn time corrections is unequal zero.
- [8] Examples:

a) $[1B]^{16} + [CD]^{16} + [0C]^{16} + [E2]^{16} + [0]^{10} + [-30]^{10} + [-20]^{10} + [-10]^{10} + [0]^{10} + [10]^{10} + [20]^{10} + [30]^{10} + [40]^{10} + [50]^{10} + [60]^{10} + [70]^{10}$, sets the TD burn time corrections for N°C to N us (e.g. +20°C has correction +20us), but does not save them to flash memory.

b) $[1B]^{16} + [CD]^{16} + [0C]^{16} + [E2]^{16} + [1]^{10} + [-30]^{10} + [-20]^{10} + [-10]^{10} + [0]^{10} + [10]^{10} + [20]^{10} + [30]^{10} + [40]^{10} + [50]^{10} + [60]^{10} + [70]^{10}$, sets the TD burn time corrections for N°C to N us, and saves the corrections to flash memory as the new default values that will be used on power up.

Note: In examples a) and b) above, the correction values used match the corresponding temperature to aid in understanding of the command. While this is technically acceptable, in actual use, the lower temperatures would have a longer TD burn time correction (a positive value) and higher temperatures would have a negative TD burn time correction (a negative value).

3.1.49 ESC [CD]+[08]+[E3]+[n]+[m1]..[m7] RS-232 Communication Parameter Specification

[Name]	RS-232 communication parameter specification
[Function]	This command is used to specify the RS-232 communication parameters such as baud rate, stop bits, data bits, parity and flow control.
[Code]	$[1B]^{16} + [CD]^{16} + [08]^{16} + [E3]^{16} + [n] + [m1] \dots [m7]$ $[27]^{10} + [205]^{10} + [08]^{10} + [227]^{10} + [n] + [m1] \dots [m7]$

[Description]

- [1] The "ESC [CD]+[08]+[E3]+[n]+[m1]..[m7]" command specifies the communication parameters for the serial port (UART) of RS-232 type boards.
- [2] This RS-232 communication parameter specification command is available for RS-232 type boards with firmware V3.00 or higher only.
- [3] Following serial communication parameters are specified in [m1]..[m7] as follows: baud rate in [m1], parity on/off in [m2], parity odd/even in [m3], data bits in [m4], stop bits in [m5], flow control in [m6] and an additional block host TX (CTS signal low/XOFF) on paper out flag [m7]
- [4] Parameter [m1] specifies the baud rates as follows:

[00] ¹⁰	=	4800
[01] ¹⁰	=	9600
[02] ¹⁰	=	19200
[03] ¹⁰	=	38400
[04] ¹⁰	=	57600
[05] ¹⁰	=	115200
[06] ¹⁰	=	230400 (UNSUPPORTED)
[07] ¹⁰	=	460800 (UNSUPPORTED)

 An unsupported or undefined value will select 115200 baud.
- [5] Parameter [m2] specifies the parity on/off as follows:

[00] ¹⁰	=	PARITY OFF
[01] ¹⁰	=	PARITY ON

 An unsupported or undefined value will select PARITY OFF.
- [6] Parameter [m3] specifies the parity even/odd as follows:

[00] ¹⁰	=	PARITY ODD
[01] ¹⁰	=	PARITY EVEN

 An unsupported or undefined value will select PARITY ODD.
Parity even/odd is ignored unless parity is ON.
- [7] Parameter [m4] specifies the data bits as follows:

[00] ¹⁰	=	7 DATA BITS (UNSUPPORTED)
[01] ¹⁰	=	8 DATA BITS

 An unsupported or undefined value will select 8 DATA BITS.
- [8] Parameter [m5] specifies the stop bits as follows:

[00] ¹⁰	=	1 STOP BIT
[01] ¹⁰	=	2 STOP BITS

 An unsupported or undefined value will select 1 STOP BIT.
- [9] Parameter [m6] specifies the control flow as follows:

[00] ¹⁰	=	NO FLOW CONTROL
[01] ¹⁰	=	HARDWARE FLOW CONTROL – RTS / CTS
[02] ¹⁰	=	SOFTWARE FLOW CONTROL - XON/XOFF

 An unsupported or undefined value will select HARDWARE FLOW CONTROL – RTS / CTS.
(RTS = Ready To Send, CTS = Clear To Send)

[10] Parameter [m7] specifies if the host transmission (TX) must be blocked if the C56 detects out-of-paper.

[00]¹⁰ = HOST TX NOT BLOCKED ON PAPER OUT

[01]¹⁰ = HOST TX BLOCKED ON PAPER OUT

An unsupported or undefined value will select HOST TX NOT BLOCKED ON PAPER OUT. This feature is used in combination with the hardware/software flow control only. For hardware flow control, the host is blocked by lowering the CTS signal. For software flow control, the host is blocked by sending an XOFF character.

Note that it does not explicitly indicate paper-out when the host detects TX blocked (CTS low/XOFF). The C56 also blocks the host TX when it's internal buffers are full or when it is processing data.

Also note that most host computers (e.g. MS-Windows, Linux) will stop RS232 communication if they detect host TX blocked. Note that, if a host TX block on paper out is enabled, these computers are not able to communicate with the C56 (e.g. inquire printer status) in case paper out. Therefore it is strongly recommended to evaluate if usage of this feature makes sense, with respect to the operational environment.

[11] The new RS-232 communication parameters become effective only after removing and then restoring power to the C-56.

[12] Parameter [n] specifies whether the RS-232 communication parameters are to be stored in flash memory. A value of [1]¹⁰ causes the parameters to be stored and to become the default RS-232 parameters after the power is turned off and then back on. Since the new RS-232 parameters only take effect after the power is cycled, this value must always be a [1]¹⁰ for this command to take effect.

[13] The default settings are 115200 baud, parity on, parity even, 8 data bits, 1 stop bit, hardware flow control and host TX not blocked on paper-out.

[14] Please note that in several cases above, there is only one valid choice. The other choices are included to allow for possible future changes to the C-56 and for reuse of software modules with other printers.

[15] The flash is write protected by default if the flow control is set to "NO FLOW CONTROL". Upload of firmware and fonts as well as usage of commands that modify flash contents (e.g. registering images) will be without any effect if the flash write protection is enabled. Flash write protection can be disabled with the "flash write protection" command, whereas disabling should only be done when specifying new RS-232 communication parameter (e.g. selecting hardware/software handshake). Always use a hardware/software handshake when uploading firmware, fonts, registering images, etc.

[16] If flow control is set to "SOFTWARE FLOW CONTROL", then special XON ([11]¹⁶), XOFF ([13]¹⁶) and DLE ([16]¹⁶) characters are transmitted by the C56 to control host data transmission. An XOFF character is transmitted to indicate receive buffer full (host should stop transmission); an XON character to indicate receive buffer empty (host may restart transmission). Each status byte in the C56 status data, that equals an XON, XOFF or DLE character, is added a preceding DLE character, whereas the 6th bit of the corresponding status byte is raised (e.g. C56 status data that equals [86]¹⁶ [11]¹⁶ [13]¹⁶ [16]¹⁶ is transmitted as [86]¹⁶ [16]¹⁶ [51]¹⁶ [16]¹⁶ [53]¹⁶ [16]¹⁶ [56]¹⁶).

[17] Examples:

a) [1B]¹⁶+ [CD]¹⁶+ [08]¹⁶+ [E3]¹⁶+ [01]¹⁰+ [05]¹⁰+ [01]¹⁰+ [01]¹⁰+ [01]¹⁰+ [00]¹⁰+ [01]¹⁰+ [00]¹⁰ selects a baud rate of 115200, parity on, parity even, 8 data bits, 1 stop bit, hardware flow control and no CTS lowered on paper-out.

3.1.50 ESC [CD]+[10]+[E4]+[m1]..[m16] Customer-Specific Part Number Specification

[Name] Customer-specific part number specification
 [Function] This command is used to specify a 16 character maximum customer part number.
 [Code] $[1B]^{16} + [CD]^{16} + [10]^{16} + [E4]^{16} + [m1] \dots [m16]$
 $[27]^{10} + [205]^{10} + [16]^{10} + [228]^{10} + [m1] \dots [m16]$

[Description]

- [1] The “ESC [CD]+[10]+[E4]+[m1]..[m16]” command specifies an alphanumeric customer-specific part number.
- [2] This customer-specific part number specification is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] The customer specific part number may be up to 16 alphanumeric characters long. The values of [m1] to [m16] should be printable ASCII characters, with the exception of the null character [0]¹⁶. The part number must have a following ASCII null character (e.g. [0]¹⁶) if its length is less than 16 characters. If the first character [m1] is a zero character, then the customer specific part number is treated as undefined.
- [4] If defined, then the C-56 prints the customer-specific part number when paper is inserted into the C-56.
- [5] The customer specific part number is stored in flash memory and is printed with the header data every time the header data is printed.
- [6] Example:
 - a) $[1B]^{16} + [CD]^{16} + [10]^{16} + [E4]^{16} + [43]^{16} + [35]^{16} + [36]^{16} + [2D]^{16} + [50]^{16} + [52]^{16} + [49]^{16} + [4E]^{16} + [54]^{16} + [45]^{16} + [52]^{16} + [00]^{16} + [00]^{16} + [00]^{16} + [00]^{16} + [00]^{16}$
 sets the customer specific part number to “C56-PRINTER”.

3.1.51 ESC [CD]+[10]+[E5]+[m1]..[m16]**Customer-Specific
Serial Number Specification**

[Name]	Customer-specific serial number specification
[Function]	This command is used to specify a 16 character maximum customer serial number.
[Code]	$[1B]^{16} + [CD]^{16} + [10]^{16} + [E5]^{16} + [m1] \dots [m16]$ $[27]^{10} + [205]^{10} + [16]^{10} + [229]^{10} + [m1] \dots [m16]$

[Description]

- [1] The “ESC [CD]+[10]+[E5]+[m1]..[m16]” command specifies an alphanumeric customer-specific serial number.
- [2] This customer-specific serial number specification is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] The customer specific serial number may be up to 16 alphanumeric characters long. The values of [m1] to [m16] should be printable ASCII characters, with the exception of the null character [0]¹⁶. The serial number must be padded with following ASCII null characters (e.g. [0]¹⁰) if its length is less then 16 characters. If the first character [m1] is a zero character, then the customer-specific serial number is treated as undefined.
- [4] If defined, then the C56 prints the customer-specific serial number when paper is inserted into the C56. If defined, then this serial number is also available via the USB port parameter
- [5] The customer specific serial number is stored in flash memory and is printed with the header data every time the header data is printed.
- [6] Examples:
 - a) $[1B]^{16} + [CD]^{16} + [10]^{16} + [E5]^{16}$
 $+ [30]^{16} + [31]^{16} + [32]^{16} + [33]^{16} + [34]^{16} + [35]^{16} + [36]^{16} + [37]^{16}$
 $+ [38]^{16} + [39]^{16} + [00]^{16} + [00]^{16} + [00]^{16} + [00]^{16} + [00]^{16}$
 sets the customer specific serial number to “0123456789”.

3.1.52 ESC [CD]+[N]+[07]+[d1]..[dN]

Print raw RLE8 compressed graphics

[Name] Print raw RLE 8 compressed graphics

[Function] This command allows printout of a single graphic dot line that is RLE8 compressed.

[Code] $[1B]^{16} + [CD]^{16} + [N] + [07]^{16} + [d1]..[dN]$
 $[27]^{10} + [205]^{10} + [N] + [07]^{10} + [d1]..[dN]$

[Description]

- [1] The "ESC [CD]+[N]+[07]+[d1]..[dN]" command specifies a single RLE8 compressed dot line (448 dots) in 56 bytes.
- [2] The print raw RLE8 compressed graphics command is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] RLE8 is an 8-bit run length encoded compression method, where the dot lines are compressed into a repeated sequence of one header byte and one or more data bytes. The most significant bit of the header byte indicates if the data byte(s) represent a run - multiple occurrence of the same character - (bit raised), or a repeated sequence of characters (bit lowered). The lower 7 bits of the header byte represents the number of characters in the run or sequence. N represents the total number of bytes needed to encode the entire 56 byte dot line, including the header byte(s). It is possible to have more than one header byte in a single command; if the first header byte and the number of data bytes defined by it are fewer in total than N, then the next byte will be interpreted as a header byte.
 Examples:
 - Header $[83]^{16}$, followed by a single data byte $[44]^{16}$, indicates that the data byte is to be interpreted as run of 3 of the same bytes. ($[83]^{16}$ has the msb high, indicating a multiple occurrence of the same character, and the lower seven bits equal "3".) The data byte $[44]^{16}$ is an ASCII "D", so uncompressed this produces "DDD".
 - Header $[03]^{16}$, followed by three data bytes $[44]^{16}[45]^{16}[46]^{16}$, indicates that the following data bytes are a 3 byte sequence. ($[03]^{16}$ has the msb low, indicating a sequence of characters, and the lower seven bits equal "3".) The data bytes are ASCII characters "D", "E" and "F", so uncompressed this produces "DEF".
- [4] The uncompressed dot line contains 56 bytes, whereas the leftmost dot is represented by the most significant bit of the first byte. The right most dot in a dot line is represented by the least significant bit of the last byte.
- [5] [N] represents the number of bytes that are required to RLE8 compress the 56 bytes dot line. If, for example, an RLE8 compressed dot line results in 10 bytes, then the RLE8 compression command becomes: $[1B]^{16} + [CD]^{16} + [0A]^{16} + [07]^{16} + [d1]..[dA]$
- [6] If the number of bytes required for RLE8 compression exceeds 56, then it is faster to use the "Print raw uncompressed graphics" command "ESC [CD]+[38]+[08]+[d1]..[d56]" instead.
- [7] A dot is considered to be on (black) if its corresponding bit is 1 and off if the bit is 0.
- [8] Any settings like inverse, double width, etc. have no effect on this command.

Examples:

- a) $[1B]^{16} + [CD]^{16} + [02]^{16} + [07]^{16} + [B8]^{16} + [00]^{16}$ represents a complete blank line
- b) $[1B]^{16} + [CD]^{16} + [02]^{16} + [07]^{16} + [B8]^{16} + [FF]^{16}$ represents a complete black line
- c) $[1B]^{16} + [CD]^{16} + [05]^{16} + [07]^{16} + [02]^{16} + [FF]^{16} + [F0]^{16} + [B6]^{16} + [00]^{16}$ represents a near completely blank line, whereas only the leftmost 12 dots are black. Here $[02]^{16}$ is the first header specifying that the following 2 data bytes ($[FF]^{16}[F0]^{16}$) are in sequence. Since N=5, but the first header and its data bytes only used a total of three bytes, the next byte ($[B6]^{16}$) is treated as a header byte. This second header is $[B6]^{16}$, which specifies that the next byte $[00]^{16}$ is a 54 byte run of $[00]^{16}$.

3.1.53 ESC SP+[n] Character spacing specification

[Name] Character spacing specification
[Function] This command specifies the character spacing in dots.
[Code] $[1B]^{16} + [20]^{16} + [n]$
 $[27]^{10} + [32]^{10} + [n]$

[Description]

- [1] The "ESC SP+[n]" command specifies the spacing between characters in dots.
- [2] The character spacing specification command is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] Parameter [n] specifies the number of blank dots between for all adjacent characters.
- [4] Condition $[0]^{10} \leq [n] \leq [32]^{10}$ must be satisfied.
- [5] Initially the value for [n] is $[0]^{10}$ (no character spacing).

3.1.54 ESC ‘-’+[n] Character underlining specification

[Name] Character spacing specification
[Function] This command specifies the character underlining in dots.
[Code] [1B]¹⁶ + [2D]¹⁶ + [n]
[27]¹⁰ + [45]¹⁰ + [n]

[Description]

- [1] The “ESC ‘-’+[n]” command specifies the character underlining in dots.
- [2] The character underlining specification command is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] Parameter [n] specifies the number of underlines for all adjacent characters.
- [4] Condition $[0]^{10} \leq [n] \leq [3]^{10}$ must be satisfied.
- [5] Initially the value for [n] is $[0]^{10}$ (no underlining).

3.1.55 ESC 'E'+[n] Bold character enable/disable

[Name] Bold character enable/disable

[Function] This command specifies the bold characters enabled/disabled.

[Code] $[1B]^{16} + [45]^{16} + [n]$
 $[27]^{10} + [69]^{10} + [n]$

[Description]

- [1] The "ESC 'E'+[n]" command specifies the bold characters enabled/disabled.
- [2] The bold character enable/disable command is only available with C-56 printer control boards incorporating firmware V3.00 or higher.
- [3] Parameter [n] specifies bold characters enabled $[1]^{10}$ and bold characters disabled otherwise.
- [4] Condition $[0]^{10} \leq [n] \leq [1]^{10}$ must be satisfied.
- [5] Initially the value for [n] is $[0]^{10}$ (bold characters disabled).

3.1.56 ESC [CD]+[02]+[E6]+[n]+[m]

Multi strobe burn factor

[Name] Multi strobe burn factor

[Function] This command allows specification of the multi-strobe burn factor

[Code] [1B]¹⁶ + [CD]¹⁶ + [02]¹⁶ + [E6]¹⁶ + [n] + [m]
 [27]¹⁰ + [205]¹⁰ + [02]¹⁰ + [230]¹⁰ + [n] + [m]

[Description]

- [1] The "ESC [CD]+[02]+[E6]+[n]+[m]" command specifies the multi strobe burn factor
- [2] The multi strobe burn factor is available from firmware V3.00 or higher.
- [3] Multi-strobe burning is useful if the peak current must be limited, E.G., in the case of a power supply of restricted capacity. If, for example, the multi-strobe burn factor indicates double burn, then only half the peak power is consumed by the print head
- [4] If multi-strobe burning is enabled, then the dot line burning is divided into two or more sequential burn cycles (e.g. double burn: burn left part first, then burn right part). In the current implementation, the maximum number of burn cycles are limited to 2 (double burn).
- [5] The default multi strobe burn factor is stored in flash memory, whereas it's value can be 1 to 2 percent. The default multi-strobe burn factor is stored in flash memory, whereas it's value can be 1 or 2. Multi-strobe burning is enabled if the multi strobe burn factor is not equal to 1, and is disabled if the multi strobe burn factor equals 1.
- [6] defines the multi-strobe factor in dot line burn cycles. The range of parameter [m] is $[0]^{10} \leq [m] \leq [2]^{10}$, whereas
 $[0]^{10}$ selects the default multi-strobe burn factor that is already stored in flash as the current multi-strobe burn factor.
 $[1]^{10}$ disables multi-strobe burning
 $[2]^{10}$ sets the multi-strobe burn factor to double burn (2X)
- [7] Parameter [n] specifies whether the multi-strobe burn factor is to be stored as the default in flash memory or if it is only to be used temporarily. If parameter [n] equals $[1]^{10}$, then the multi-strobe burn factor is stored in flash; otherwise its value is discarded after power down. The range of parameter [n] is $[0]^{10} \leq [n] \leq [1]^{10}$. The multi-strobe burn factor is only stored in flash if the parameter [m] is in the range $[1]^{10}$ to $[2]^{10}$.
- [8] The general information that is printed after paper insertion also contains information on the multi-strobe burn factor, provided that the multi-strobe burning is enabled.
- [9] The print speed must be limited to a maximum of 130 mm/s if multi-strobe burning is enabled, and limited to a maximum of 100 mm/s if dot history is also enabled. (Note that the C56 automatically limits the print speed if this feature is enabled).
- [10] Examples:
- a) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E6]^{16}+[0]^{10}+[02]^{10}$, enables multi strobe burning with a multi strobe burn factor of 2 (double burn) but does not save the value to flash. The printer will do a double strobe burn (left part/right part) for each dot line.
- b) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E6]^{16}+[1]^{10}+[01]^{10}$, disables multi strobe burning and saves the new setting in flash memory. Multi strobe burning will be disabled after power cycling the printer.
- c) $[1B]^{16}+[CD]^{16}+[02]^{16}+[E0]^{16}+[0]^{10}+[00]^{10}$, selects the default multi strobe burn factor that is stored in flash memory.

3.1.57 ESC [CD]+[01]+[42]+[n]**Extended printing speed setting**

[Name] Extended printing speed setting
[Function] This extended command sets the target printing speed.
[Code] $[1B]^{16} + [CD]^{16} + [01]^{16} + [42]^{16} + [n]$
 $[27]^{10} + [205]^{10} + [01]^{10} + [66]^{10} + [n]$

[Description]

- [1] The “ESC [CD]+[02]+[42]+[n]+[m]” command sets the target printing speed in mm/s.
- [2] The extended printing speed setting is available from firmware V3.00 or higher.
- [3] The end-of-page command should precede the printing speed command to assure, that all data in the print buffer is flushed before print speed change becomes effective.
- [4] When the same printing speed as the current printing speed is specified with this command, no change occurs.
- [5] Parameter [n] defines the required printing speed in mm/s. The domain for parameter [n] is $[60]^{10} \text{ mm/s} \leq [n] \leq [220]^{10} \text{ mm/s}$.
- [6] The default printing speed is 130 mm/sec.
- [7] The C56 automatically limits the print speed if dot history is enabled and/or multi strobe burning is enabled.

3.1.58 ESC [CD]+[01]+[E7]+[n] Bar code plain text subtitle setting

[Name] Bar code plain text subtitle setting
 [Function] This command allows enabling or disabling of the bar code plain text subtitle
 [Code] $[1B]^{16} + [CD]^{16} + [01]^{16} + [E7]^{16} + [n]$
 $[27]^{10} + [205]^{10} + [01]^{10} + [231]^{10} + [n]$

[Description]

- [1] The “ESC [CD]+[01]+[E7]+[n]” command enables/disables bar code plain text subtitling and specifies it’s appearance.
- [2] Parameter [n] specifies bar code plain text subtitling enabled/disabled, font size 8x16/12x24 and font source primary/secondary character set.
- [3] Parameter [n] has following bit map:

Bit	Status	Caption	
0	Bar Code Plain Text Subtitle	0: Disabled	1: Enabled
1	Font size	0: 08x16	1: 12x24
2	Font source	0: Primary	1: Secondary
3-7	Reserved	0 (this value should always be set to "0")	

- [4] Bar code plain text subtitling is disabled by default.
- [5] Bar code plain text subtitling is not available when bar code rotation is enabled.
- [6] The bar code plain text subtitling may be unreadable or incorrect if the bar code dimension exceeds the paper width.
- [7] Since the internal primary or secondary font is used for bar code plain text subtitling, a replacement of the default fonts might result in an incorrect subtitling.

3.1.59 ESC [CD]+[00]+[EB]**Position stamp setting
(CANCELLED)**

[Name]	Position stamp setting
[Function]	This command sets the current paper position stamp
[Code]	$[1B]^{16} + [CD]^{16} + [00]^{16} + [EB]^{16}$ $[27]^{10} + [205]^{10} + [00]^{10} + [235]^{10}$

[Description]

- [1] The "ESC [CD]+[00]+[EB]" sets the current paper position stamp in millimetres. This position stamp is used as a reference position for subsequent commands such as position stamp feed.
- [2] The position stamp setting command waits until all print buffers are flushed until the stamp is initiated. The position stamp set command is to be placed at start of the printout. The command might interrupt fluent printout if placed elsewhere.
- [3] The position stamp setting command is available from firmware V3.00 or higher.
- [4] The position stamp setting command is cancelled (disabled) in V3.00

3.1.60 ESC [CD]+[02]+[EC]+[n]+[m]

Position stamp feed
(CANCELLED)

[Name] Position stamp feed

[Function] This command feeds paper from last paper position stamp.

[Code] $[1B]^{16} + [CD]^{16} + [02]^{16} + [EC]^{16} + [n] + [m]$
 $[27]^{10} + [205]^{10} + [02]^{10} + [236]^{10} + [n] + [m]$

[Description]

- [1] The "ESC [CD]+[02]+[EC]+[n]+[m]" command initiates a paper feed using the latest paper position stamp (see position stamp set command) as reference position. This position stamp is normally used to assure a minimal length ticket printout (e.g. to assure that the ticket exceeds the length of the shoot).
- [2] Parameter [n] and [m] specify the amount of feed required in millimetres. Parameter [n] is the MSB and parameter [m] the LSB (e.g. [n]=[03] and [m]=[E8] indicates a 1000 mm feed). The maximum amount of feed required is limited to 1000 millimetres.
- [3] The position stamp feed command waits until all print buffers are flushed until the feed is initiated. Therefore the fluent printout will shortly interrupt before the feed is performed.
- [4] The command will not be executed if the distance from the current paper position to the paper position stamp exceeds the amount of feed required.
- [5] The position stamp feed command is available from firmware V3.00 or higher.
- [6] The position stamp feed command is cancelled (disabled) in V3.00

3.1.61 ESC [CD]+[01]+[EA]+[n]**Flash write protect
enable/disable**

[Name] Flash write protect enable/disable

[Function] This command enables/disables flash write protection

[Code] $[1B]^{16} + [CD]^{16} + [01]^{16} + [EA]^{16} + [n]$
 $[27]^{10} + [205]^{10} + [02]^{10} + [234]^{10} + [n]$

[Description]

- [1] The “ESC [CD]+[01]+[EA]+[n]” command enables/disables flash write protection.
- [2] Parameter [n] specifies if flash write protection is to be enabled or disabled. If [n] equals ‘E’, then write protection is enabled. If [n] equals ‘D’, then write protection is disabled.
- [3] The flash write protection setting remains valid until a hard/software reset is issued or until paper is inserted. In those cases the flash write protection to be set to it’s default.
- [4] The default flash write protection after hard/software reset or paper insertion depends on the board type. By default flash write protection is disabled on RS232 type boards with flow control only and enabled otherwise. Disabling the flash is done to prevent erroneous characters sequences to damage flash contents.
- [5] The flash write protection feature is especially implemented for RS232 type boards that are operated without flow control, whereas the disabling should prevent the flash contents for being corrupted by erroneous commands. Applications can use the flash write protect command in advance to an RS232 communication parameter specification command to enable RS232 hardware/software flow control. The command is not intended to be used to enable flow control for firmware and font uploads on RS232 type boards without flow control.
- [6] The flash write protection enable/disable command is available from firmware V3.00 or higher.

3.1.62 ESC [CD]+[02]+[ED]+[n1]+[n2]

Customer Flags Setting

[Name] Customer flags setting command
 [Function] This command specifies the customer flags
 [Code] $[1B]^{16} + [CD]^{16} + [02]^{16} + [ED]^{16} + [n1] + [n2]$
 $[27]^{10} + [205]^{10} + [02]^{10} + [237]^{10} + [n1] + [n2]$

[Description]

- [7] The "ESC [CD]+[02]+[ED]+[n1]+[n2]" command is used to specify the state of up to 16 customer flags.
- [8] The customer-flags setting is stored in flash memory, whereas each defined flag can either be 1 or 0.
- [9] The customer flags are to be used to distinguish multiple printers that are connected to a single host. The printer echoes the flags in it status DWORD (see command "GS a + [n]", setting and cancellation of auto status transmission)
- [10] Customer flags are to be specified in a 16 bit word, whereas the least significant bit is the 1st flag and the most significant bit is the 16th flag. Parameter [n1] is the most significant byte of this 16 bit word. Parameter [n2] is the least significant byte of this 16 bit word.
- [11] Following customer flags are defined:

Bit	Description	Contents	
0	Customer status flag #1 for the C56 status message (see "GS a+[n]")	0: Disabled	1: Enabled
1	Customer status flag #2 for the C56 status message (see "GS a+[n]")	0: Disabled	1: Enabled
2-15	Reserved	0 (this value should always be set to "0")	

- [12] The customer flags settings command is available from firmware V3.00 or higher.

3.1.63 ESC [CD]+[02]+[EE]+[n1]+[n2]

Jam Detection Setting

[Name] Jam detection setting command
 [Function] This command specifies the jam detection setting
 [Code] $[1B]^{16} + [CD]^{16} + [02]^{16} + [EE]^{16} + [n1] + [n2]$
 $[27]^{10} + [205]^{10} + [02]^{10} + [238]^{10} + [n1] + [n2]$

[Description]

- [1] The "ESC [CD]+[02]+[EE]+[n1]+[n2]" command is used to enable/disable up to 16 jam detections.
- [2] The jam detection setting is stored in flash memory.
- [3] Currently jam detection is only available when the C-56 printer contains a chute sensor
- [4] The jam detection setting is specified in a 16 bit word, whereas parameter [n1] is the most significant byte of this 16 bit word. Parameter [n2] is the least significant byte of this 16 bit word.
- [5] Following jam detections are defined:

Bit	Description	Contents	
0	Jam detection during paper load	0: Disabled	1: Enabled
1	Jam detection after power on	0: Disabled	1: Enabled
2	Jam detection during print	0: Disabled	1: Enabled
3-15	Reserved	0 (this value should always be set to "0")	

- [6] The customer flags setting command is available from firmware V3.01 or higher.

3.2 List of character sets

From firmware V1.30, following character sets are available:

- Internal 8X16 ANK character set
- Internal 12x24 ANK character set
- Internal 16x16 ANK character set
- Internal 24x24 ANK character set
- External registered 8X16 character set
- External registered 12x24 character set
- External registered 16x16 character set
- External registered 24x24 character set
- Wide 24X24/20X20 character set
- Wide 20X20 character set

Notes:

- The internal character sets are part of the firmware and are loaded into flash memory during firmware upload.
- Although all internal character sets are regarded to be fixed font, a modified set can be integrated in the firmware binary and made effective through upload.
- The external registered character sets can be uploaded into the flash memory with corresponding commands (see command "ESC & + ...").
- A default external character set is available in firmware 3.00 and up.
- All 16x16 and 24x24 character sets are represented by a double width 8x16 and 12x24.
- The wide 24X24 character set is available only for RS232 boards with firmware 3.00 or more.
- The internal character set is also called "primary font".
- The external character set is also called "secondary font".

3.2.1 Internal 8x16 ANK character set

The internal 8X16 ANK character set has 256 characters, whereas the size of each character is:

- Width: 8 dots
- Height: 16 dots

The top row characters 0 to 31 ([1F]¹⁶) are control characters and are not used.

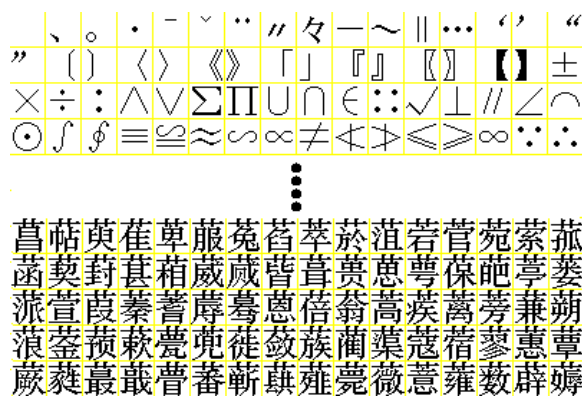
3.2.9 Wide 24X24 and 20X20 character sets

Beginning with firmware V3.00 and up, the RS-232 boards can contain a "wide character set" (so called because two bytes are required to index it). Two different wide character sets types are supported: 24x24 and 20x20. The 24x24 wide character set may contain up to 7280 characters, each 24 x 24 dots. The 20x20 wide character set may contain up to 8640 characters, each 20 x 20 dots

The 24X24 wide character set has been implemented to offer a GB2312-Chinese compatible Chinese character set, but can be used for other 24X24 character sets, as well. Currently there are two ways of indexing the 24X24 wide character set: standard (linear) .and GB2312-Chinese.

The 20X20 wide character set has been implemented to offer a KS5601-Korean compatible Chinese character set, but can be used for other 20X20 character sets, as well. Currently there are two ways of indexing the 20X20 wide character set: standard (linear) .and KS5601-Korean

See the command "Wide Font Printing" for more information on wide font indexing.



24X24 wide character set
 containing 16 * 455 characters
 (firmware version 3.00 and up / RS232 boards only)

By default, there is no wide character set provided in the C-56. The C-56 driver V1.08 allows the upload of a wide character set , where the character set is imported from a standard windows bitmap.

For the 24X24 type wide characters, this bitmap contains exactly 16 x 455 characters that are separated by a line (yellow in the above sample). Each character is 24 x 24 dots, whereas, due to the separator, the X/Y origin starts on a multiple of 25 dots. The total dimension of the wide character set bitmap is 400 pixels horizontally and 11375 pixels vertically.

For the 20X20 type wide characters, this bitmap contains exactly 16 x 540 characters that are separated by a line (yellow in the above sample). Each character is 20 x 20 dots, whereas, due to the separator, the X/Y origin starts on a multiple of 25 dots. The total dimension of the wide character set bitmap is 336 pixels horizontally and 11340 pixels vertically.

All magnification and other settings that affect the appearance of the internal character set will also affect the appearance of the wide character set (e.g. double width, magnification, rotation, etc.).

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

賄	劃	獲	宐	橫	鑛	曄	嚙	孝	效	戮	曉	梟	淳	淆	
爻	肴	醇	驍	侯	候	厚	后	吼	喉	嗅	悞	後	朽	煦	煦
瑒	迓	助	勳	墳	堯	焗	燻	燻	訓	暈	薨	喧	喧	畦	畦
萱	卉	喙	毀	彙	徽	揮	暉	輝	譚	輝	靡	休	携	休	畦
虧	恤	譎	鷓	兇	匈	洵	胸	黑	昕	欣	忻	痕	吃	吃	畦
紇	訖	欠	欽	欽	吸	恰	洽	翁	興	僖	熙	喜	噫	藟	藟
嬉	希	愆	愆	戲	晞	曦	熙	熹	熹	熹	熹	熹	熹	詰	詰

20X20 wide character set
 containing 16 * 540 characters
 (firmware version 3.00 and up / RS232 boards only)

3.3 Escape sequences, overview.

Escape Sequence (HEX)	Description	Available from firmware
HT	Horizontal tab	ALL
LF	Line feed with printing	ALL
FF	Forms feed	ALL
ESC [CD]+[01]+[80]+[n]	Feed reduction	ALL
ESC [CD]+[02]+[81]+[n]+[m]	Feed lengths	ALL
ESC [CD]+[00]+[70]	End of page	ALL
ESC [CD]+[01]+[82]+[n]	Print info	ALL
ESC RS	Black-white reversed printing specification	ALL
ESC US	Black-white reversed printing cancellation	ALL
ESC !+[n]	Printing mode specification	ALL
ESC %+[n]	Download character set specification/cancellation	V1.30
ESC &+[y]+[c1]+[c2]+[x]+[d1]..[dn]	Download character definition	V1.30
ESC 2	1/6-inch line pitch setting	ALL
ESC 3+[n]	Minimum-pitch-unit line pitch setting	ALL
ESC ?+[n]	External registration character deletion	V1.30
ESC ?+NUL	External registration character clearing	V1.30
ESC @	Printer resetting	ALL
ESC A+[n]	Line spacing setting	ALL
ESC C+[n]	Page length (number of lines) setting	ALL
ESC D+[d1]..[dn]+NUL	Horizontal tab position setting	ALL
ESC J+[n]	Forward paper feed	ALL
ESC K+[n]	Backward paper feed	ALL
ESC V+[n]+[m]	Text, bitmap and barcode rotation	ALL
ESC X +NUL+[m]	Setting the turning time of the motor excitation	ALL
ESC d+[n]	Printing forward n-line feed	ALL
ESC e+[n]	Printing backward n-line feed	ALL
ESC s+[n]	Printing speed setting	ALL
ESC {+[n]	Upside-down printing setting/cancellation	ALL
FS 9+[n]	Detection function enable/disable setting	ALL
FS E+[n]	Correction of impressed energy	ALL
GS &+[m]+[x]+[y1]+[y2]+[d1]..[dn]	Registration of image data	V1.30
GS &+NUL+NUL+NUL+NUL	Deletion of registered image data	V1.30
GS '+[m]+[n]	Print registered image data	V1.30
ESC [CD]+[02]+[88]+[n]+[m]	Set black mark size	ALL

Escape Sequence (HEX)	Description	Available from firmware
GS <	Mark detection execution	V3.00
GS E+[n]	Print quality setting	ALL
GS e+[n]+[m]	Bar code width setting	ALL
GS h+[n]	Bar code height setting	ALL
GS w+[n]	Bar code width magnification setting	ALL
GS k+[m]+[n]+[d1]..[dn]	Bar code printing	ALL
GS a+[n]	Setting and cancellation of status transmission.	ALL
FS r+[n]	Parameter transmission	ALL
ESC [CD]+[38]+[08]+[d1]..[d56]	Print raw uncompressed graphics	ALL
GS L+[n]+[m]	Left margin specification (V1.30)	V1.30
ESC [CD]+[02]+[E0]+[n]+[m]	Dot history pre-burn factor	V3.00
ESC [CD]+[02]+[E1]+[n]+[m]	Wide font printing	V3.00
ESC [CD]+[0C]+[E2]+[n]+[m1]..[m11]	Burn time correction specification	V3.00
ESC [CD]+[07]+[E3]+[n]+[m1]..[m7]	RS-232 Communication Parameter Specification	V3.00
ESC [CD]+[10]+[E4]+[m1]..[m16]	Customer-Specific Part Number Specification	V3.00
ESC [CD]+[10]+[E5]+[m1]..[m16]	Customer-Specific Serial Number Specification	V3.00
ESC [CD]+[N]+[07]+[d1]..[dN]	Print raw RLE8 compressed graphics	V3.00
ESC SP+[n]	Character spacing specification	V3.00
ESC 'u'+[n]	Character underlining specification	V3.00
ESC 'E'+[n]	Bold character enable/disable	V3.00
ESC [CD]+[02]+[E6]+[n]+[m]	Multi strobe burn factor	V3.00
ESC [CD]+[01]+[42]+[n]	Extended printing speed setting	V3.00
ESC [CD]+[00]+[E7] +[n]	Bar code plain text subtitle setting	V3.00
ESC [CD]+[01]+[E8]+[n]+[m]+[o1]..[o2]	Reserved cutter control command	FUTURE
ESC [CD]+[01]+[E9]+[n]+[m1]..[m4]	Reserved host control cutter command	FUTURE
ESC [CD]+[01]+[EA]+[n]	Flash write protect enable/disable	V3.00
ESC [CD]+[00]+[EB]	Position stamp setting	V3.00 CANCELLED
ESC [CD]+[02]+[EC]+[n]+[m]	Position stamp feed	V3.00 CANCELLED
ESC [CD]+[02]+[ED]+[n1]+[n2]	Customer flags setting	V3.00
ESC [CD]+[02]+[EE]+[n1]+[n2]	Jam detection setting	V3.01

4 Additional Information

4.1 Hex/Dec ASCII Table

ASCII		CHAR	ASCII		CHAR	ASCII		CHAR	ASCII		CHAR
HEX	DEC		HEX	DEC		HEX	DEC		HEX	DEC	
00	0	NUL	20	32	SP	40	64	@	60	96	`
01	1	SOH ^A	21	33	!	41	65	A	61	97	a
02	2	STX ^B	22	34	"	42	66	B	62	98	b
03	3	ETX ^C	23	35	#	43	67	C	63	99	c
04	4	EOT ^D	24	36	\$	44	68	D	64	100	d
05	5	ENQ ^E	25	37	%	45	69	E	65	101	e
06	6	ACK ^F	26	38	&	46	70	F	66	102	f
07	7	BEL ^G	27	39	'	47	71	G	67	103	g
08	8	BS ^H	28	40	(	48	72	H	68	104	h
09	9	TAB ^I	29	41	)	49	73	I	69	105	i
0A	10	LF ^J	2A	42	*	4A	74	J	6A	106	j
0B	11	VT ^K	2B	43	+	4B	75	K	6B	107	k
0C	12	FF ^L	2C	44	,	4C	76	L	6C	108	l
0D	13	CR ^M	2D	45	-	4D	77	M	6D	109	m
0E	14	SO ^N	2E	46	.	4E	78	N	6E	110	n
0F	15	SI ^O	2F	47	/	4F	79	O	6F	111	o
10	16	DLE ^P	30	48	0	50	80	P	70	112	p
11	17	DC1 ^Q	31	49	1	51	81	Q	71	113	q
12	18	DC2 ^R	32	50	2	52	82	R	72	114	r
13	19	DC3 ^S	33	51	3	53	83	S	73	115	s
14	20	DC4 ^T	34	52	4	54	84	T	74	116	t
15	21	NAK ^U	35	53	5	55	85	U	75	117	u
16	22	SYN ^V	36	54	6	56	86	V	76	118	v
17	23	ETB ^W	37	55	7	57	87	W	77	119	w
18	24	CAN ^X	38	56	8	58	88	X	78	120	x
19	25	EM ^Y	39	57	9	59	89	Y	79	121	y
1A	26	SUB ^Z	3A	58	:	5A	90	Z	7A	122	z
1B	27	Esc	3B	59	;	5B	91	[	7B	123	{
1C	28	FS	3C	60	<	5C	92	\	7C	124	|
1D	29	GS	3D	61	=	5D	93	]	7D	125	}
1E	30	RS	3E	62	>	5E	94	^	7E	126	~
1F	31	US	3F	63	?	5F	95	_	7F	127	DEL

4.2 Duration of data upload

Board Type	Firmware	Data Upload	Duration
USB	V3.00 or up	Upload of firmware (v3.00) using windows XP driver V1.08	< 10 sec
USB	V3.00 or up	Upload of 8x16 font (small font, 256 characters) using windows XP driver V1.08	< 01 sec
USB	V3.00 or up	Upload of 12x24 font (large font, 256 characters) using windows XP driver V1.08	< 02 sec
RS-232	V3.00 or up	Upload of firmware (v3.00) using windows XP driver V1.08	< 25 sec
RS-232	V3.00 or up	Upload of 8x16 font (small font, 256 characters) using windows XP driver V1.08	< 02 sec
RS-232	V3.00 or up	Upload of 12x24 font (large font, 256 characters) using windows XP driver V1.08	< 04 sec
RS-232	V3.00 or up	Upload of 24x24/20x20 font (wide font, 7280 characters) using windows XP driver V1.08	< 96 sec

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