TELSTAR ELECTRONICS CORP.

TCP176

2 Inch Thermal Printer Module

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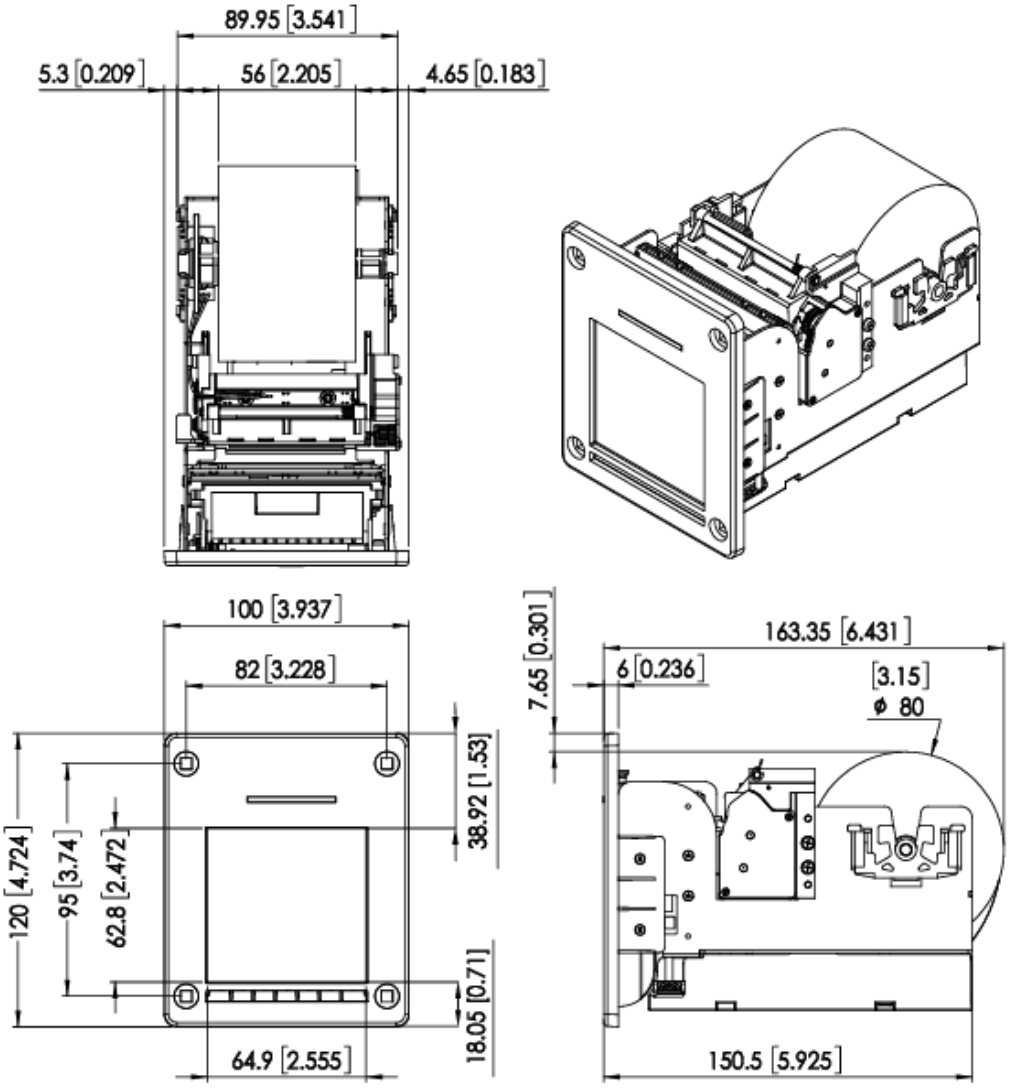
1. Specifications

General Specifications (Printer)

Item		Specifications	
Printer	Print method	Thermal line dot printing	
	Number of dots/line	448 dots	
	Print resolution	8 (dots/mm)	
	Printing width	56mm	
	Paper Width	Max. 56mm(2.2inch)	
	Printing thickness	0.06 to 0.12mm.	
	Printing speed	Max. 250mm/s*	
	Paper Roller diameter	Max. 80mm	
	TPH Life	Pulse Life: 1×10^8 pulses Abrasion Life: 150 km	
	Print color	Black	
Detection	Head temperature	Thermistor	
	Platen position	Photo Interrupter	
	Out of paper	Photo Interrupter	
	Cutter home position	Micro switch	
Power supply(V)	For head logic	Vdd	3.0 to 5.25 (DCV), 21mA (max.)
	For head heat element	Vp	12(DCV)
		Energy Consumption	0.12mJ/dot (Ton:0.29mS, 25℃)
		Power consumption	0.42 W/dot
	For motor	24 (DCV), 0.6A(Max.)	
	For cutter	24 (DCV)	
Cutter	Cutting method	Slide type	
	Cutting function	Full,Partial(Depend on customer)	
	Cutting width	63(Max)	
	Paper Type	Ordinary paper/Thermal paper	
	Cutting thickness	0.06-0.12mm	
	Paper density	60 g/m^2 to 120g/m^2	
	Allowable cutting frequency	Max.25 cuts/minute.(cutting 0.06mm paper)	
	Life	1,000,000 times (Ordinary paper thickness 0.06mm/60 g/m^2、Normal temperature)	
	Min. cut length	10mm	
Cutter Motor	Terminal Voltage	DC 24V, - 10%	
	Motor current (starting)	Approx. 1.2A (24V, 25°C)	
	Motor current (jam)	Approx. 1.8A (24V, 25°C)	
Cutter Micro Switch	Rated voltage	DC 5.5V	
	Rated current	2mA	
Operation Temperature (°C)		0 to +50 °C**	
Operation humidity		30 to 85% RH	
Storage Temperature (°C		-20 to 60°C (excluding paper)	
Outer dimensions		163.5(L) x 120(W) x 100(H)	

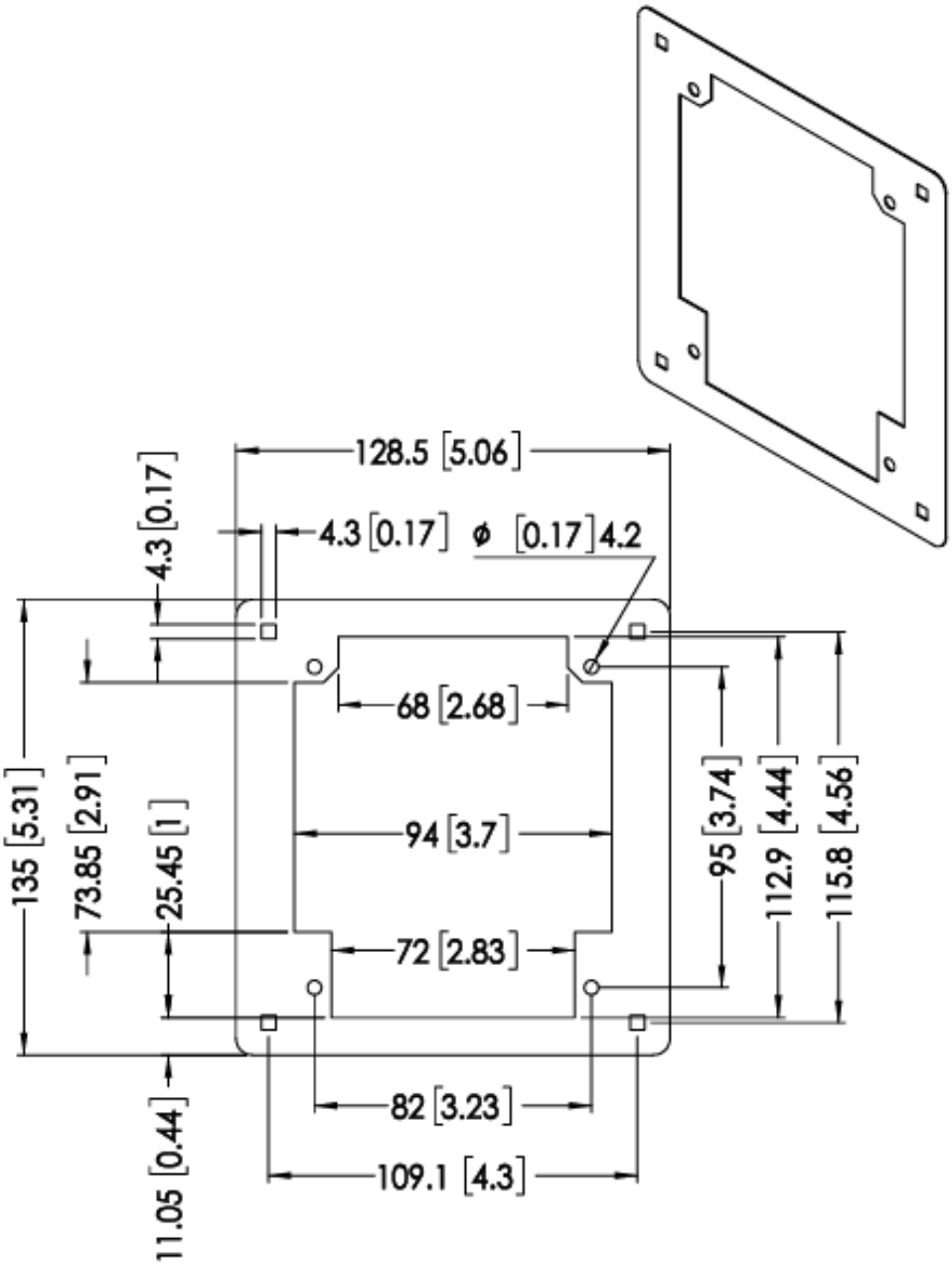
2.Dimension



Unit:mm[inch]

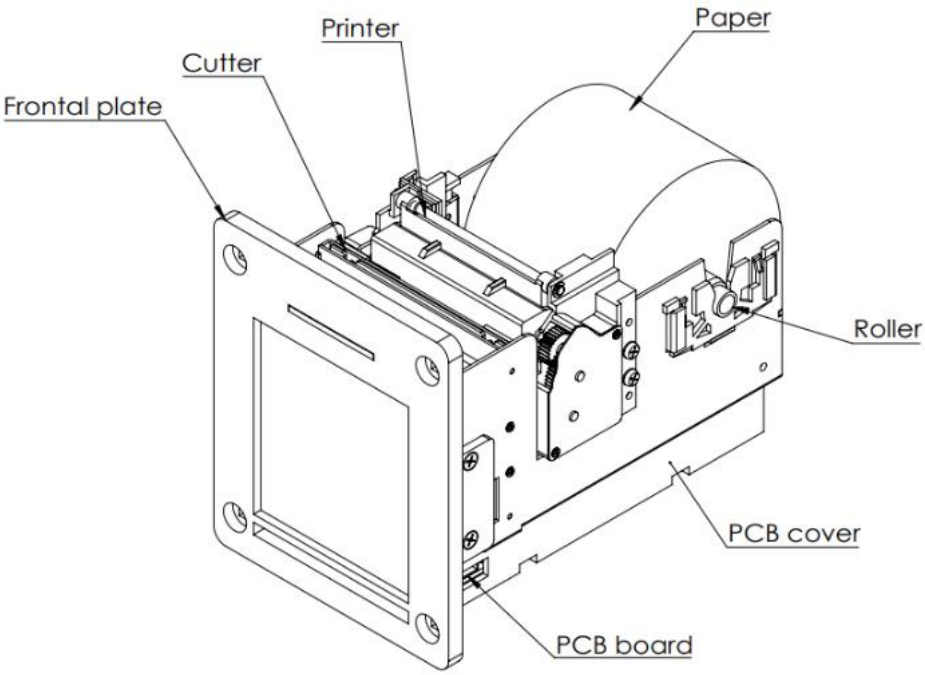
3. Metal Frame(Optional)

For VMC bezel which is larger than TCP176 bezel.

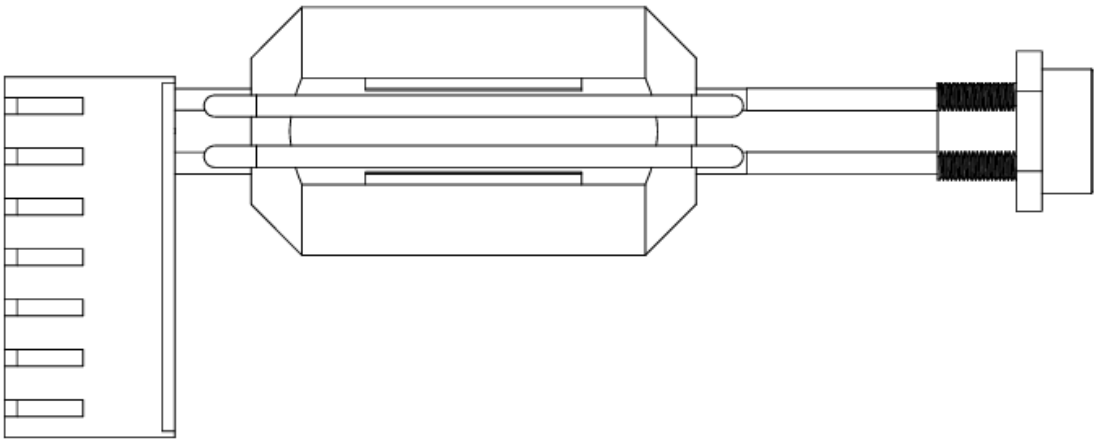


Unit:mm[inch]

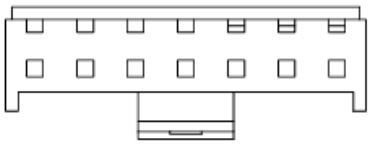
4.Component Names

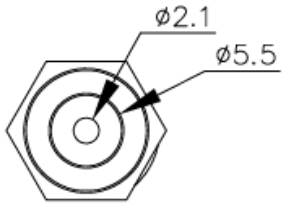


5.Power cord adapter



LHE A3963-H07 OR EQU





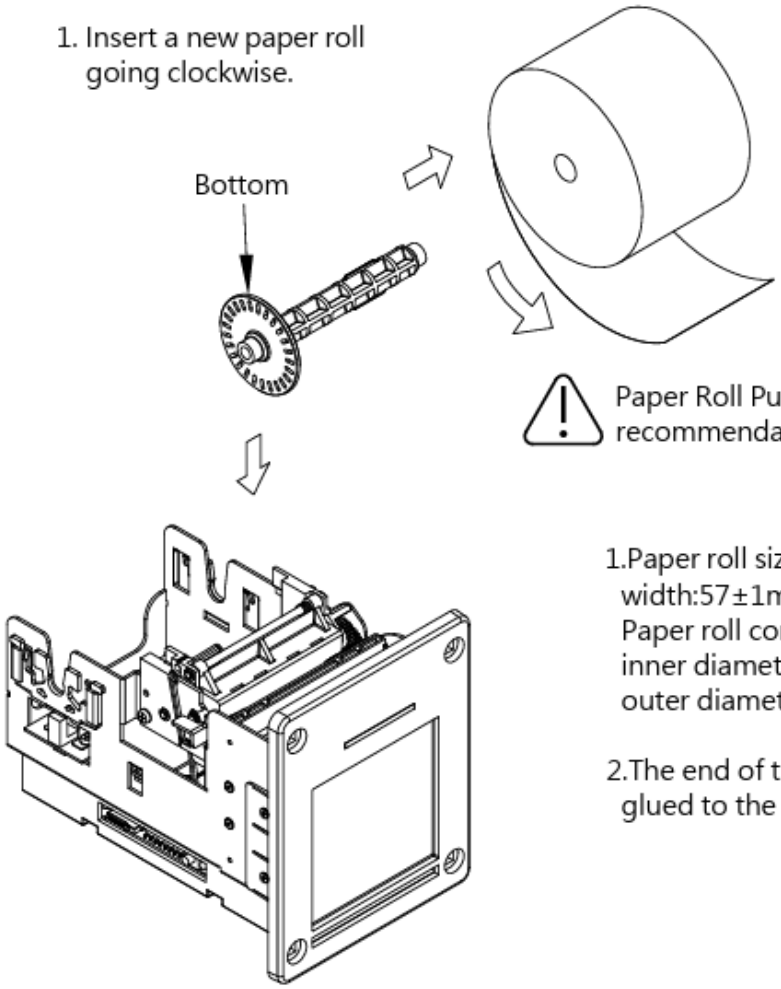
DC-Jack

Power connector**Connector CN1**: JST S15P-VH (7PIN , 3.963mm)

PIN NUMBER	SIGNAL NAME
1	DC12V
2	GND
3	
4	
5	
6	
7	

6.How to replace a new paper roll?

1. Insert a new paper roll going clockwise.



Paper Roll Purchase recommendation

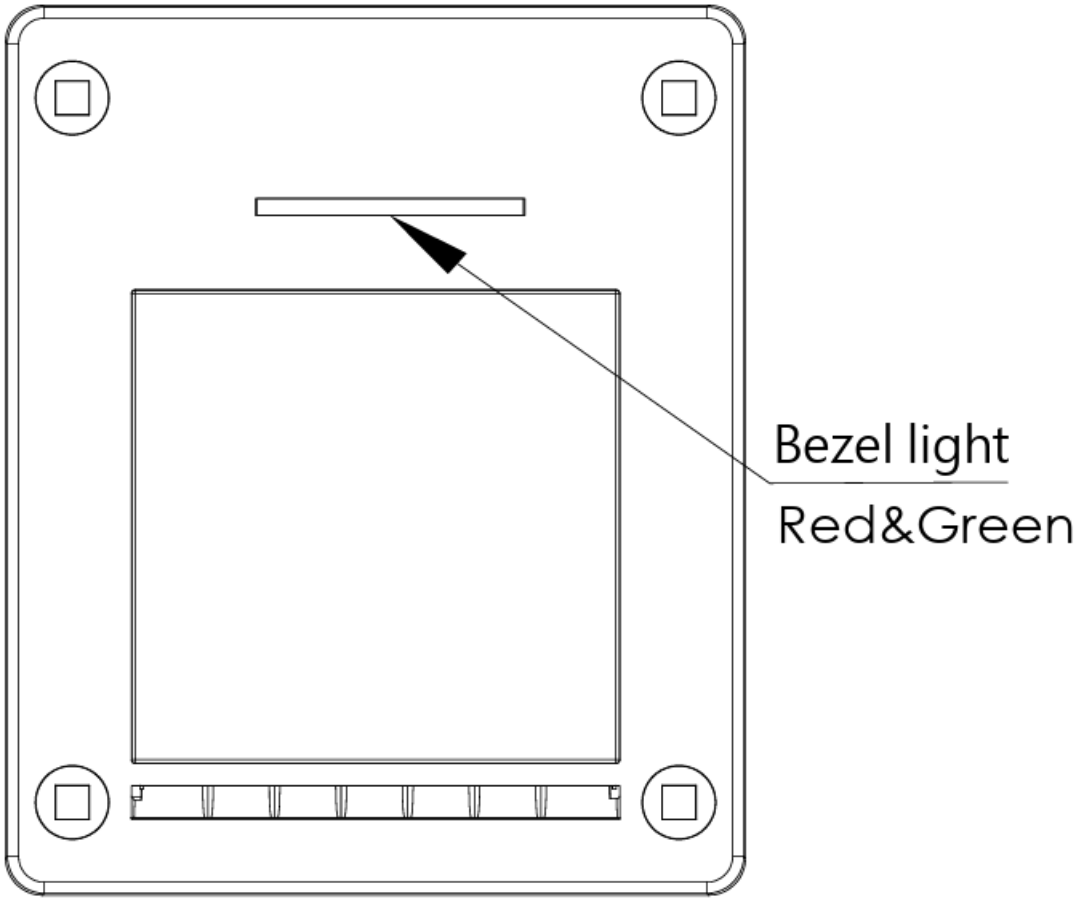
1.Paper roll size
width:57±1mm,diameter:80±2mm
Paper roll core
inner diameter:13±0.5mm
outer diameter:20±1mm

2.The end of the paper needs to be glued to the paper roll cover

Please push paper roll to the bottom while installing

7.Troubleshooting

LED has two colors: red and green

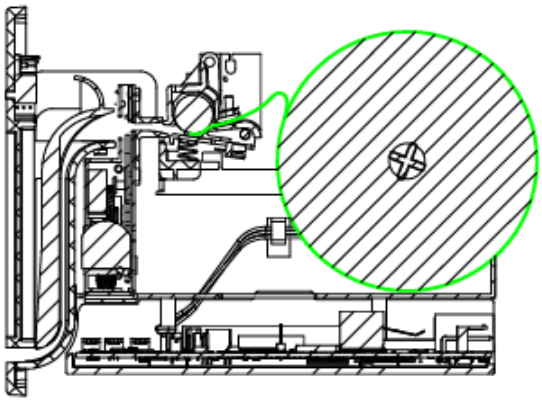


Switches and LED functions are defined in the following table:

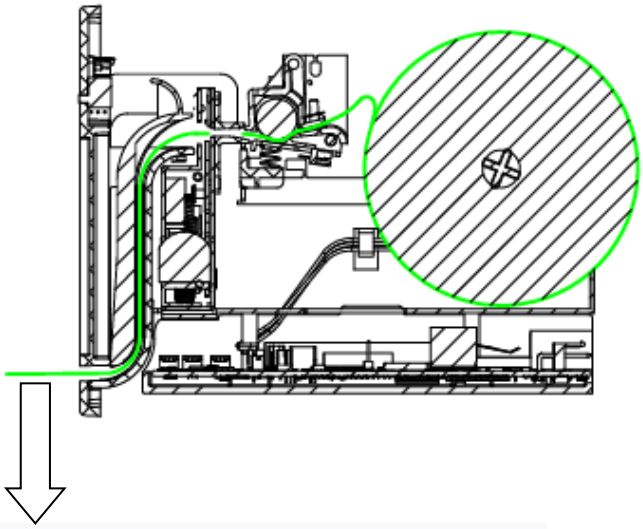
Flashing Code	Meaning of Flashing Code	Corrective Action
LED’ s always OFF	The printer has on power.	Check that power has been applied.
LED’ s always ON	NO error exists-printer is OK.	None.
1 Flashes	Printer paper is low.	The printer paper roll is low. Refill before it runs out.
2 Flashes	Paper Out	The printer has run out of paper. Replace the roll.
3 Flashes	Cutter error	The cutter is jammed or not runs Cutter home position
4 Flashes	Head Open	The “Platen” (front portion of the head) is not locked properly.
5 Flashes	Busy	The Printer is busy printing something or it is receiving a large amount of data from the host. Wait for the processes to finish or power cycle the printer.
6 Flashes	Programming error	An error occurred during the programming process (on The PC), try downloading the program again.
7 Flashes	Print-head temperature	Print-head temperature Too high or too low

8.Inserting paper will trigger the paper to be pulled in.

When the sensor automatically detects the paper, the paper has been successfully installed.



9.Paper output length

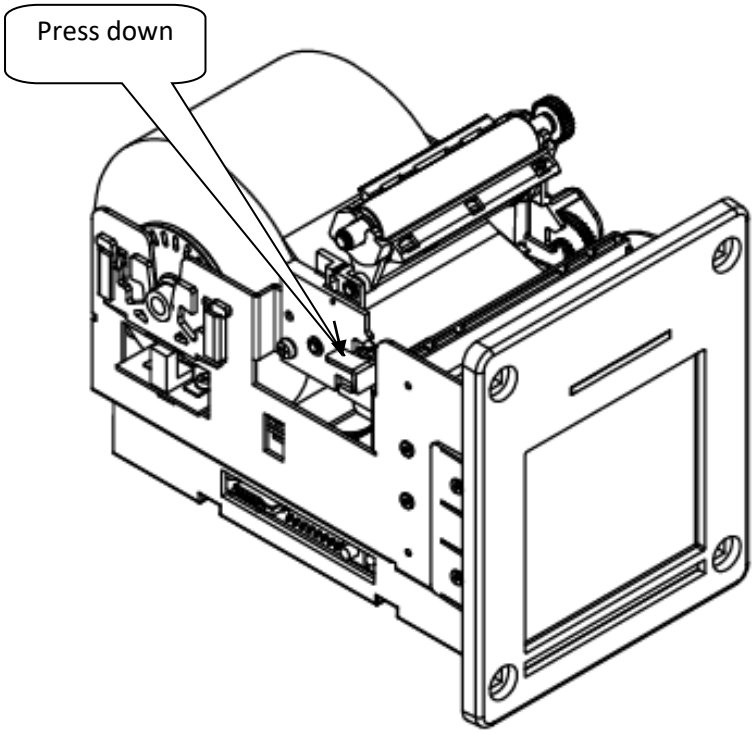


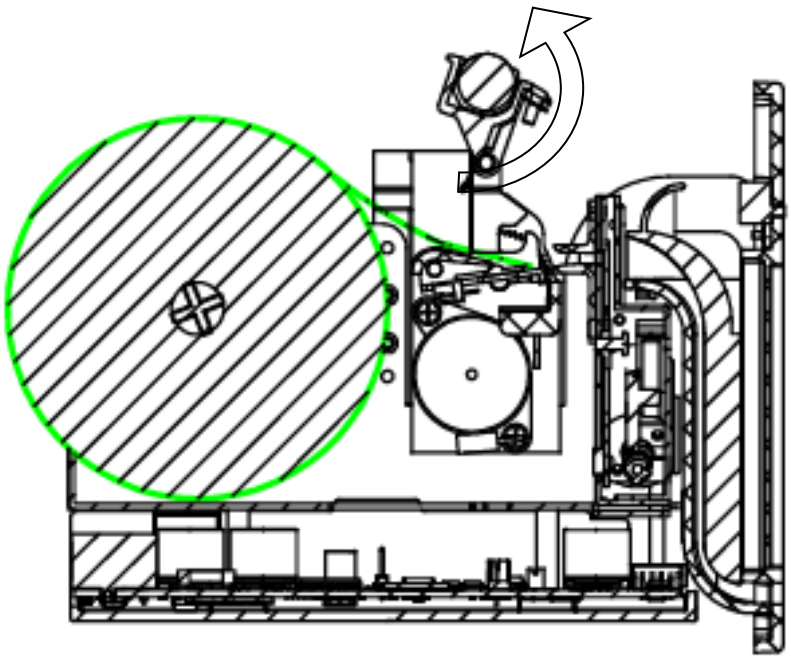
The shortest paper output length:100mm

"Paper output length over 100mm"

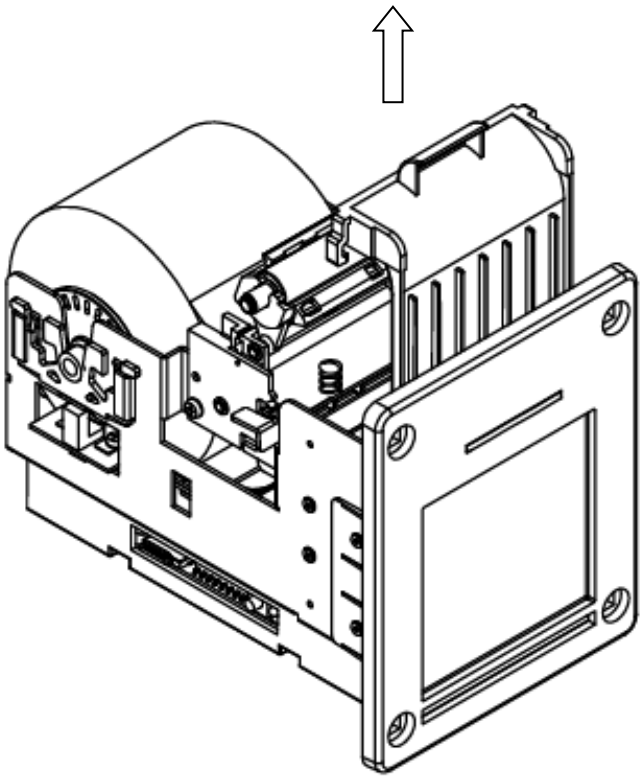
10.Eliminate paper jams

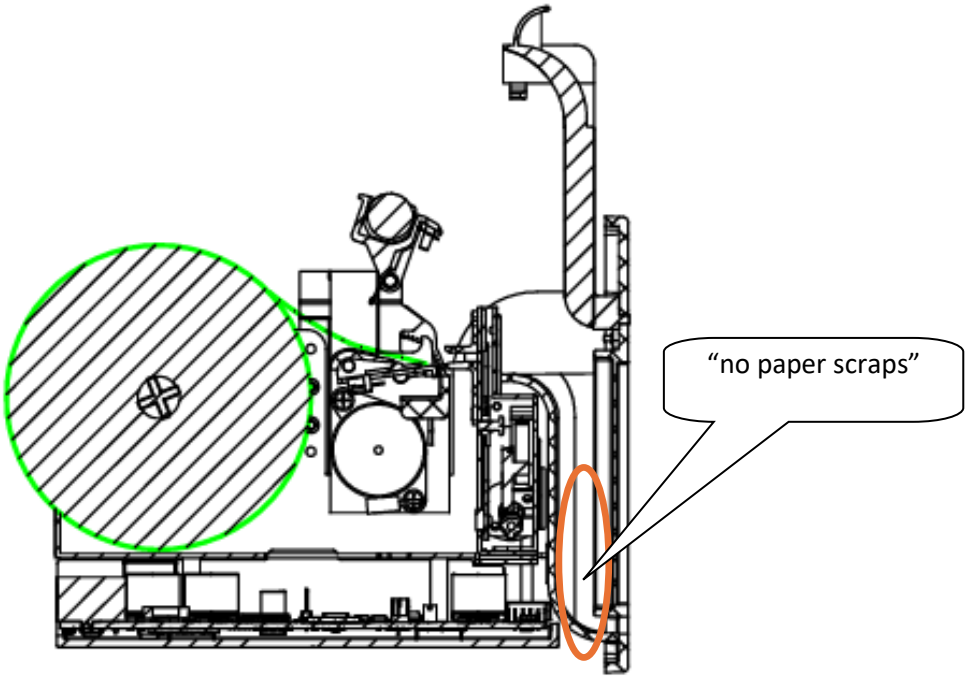
Press down on the rubber roller to clear the paper jam



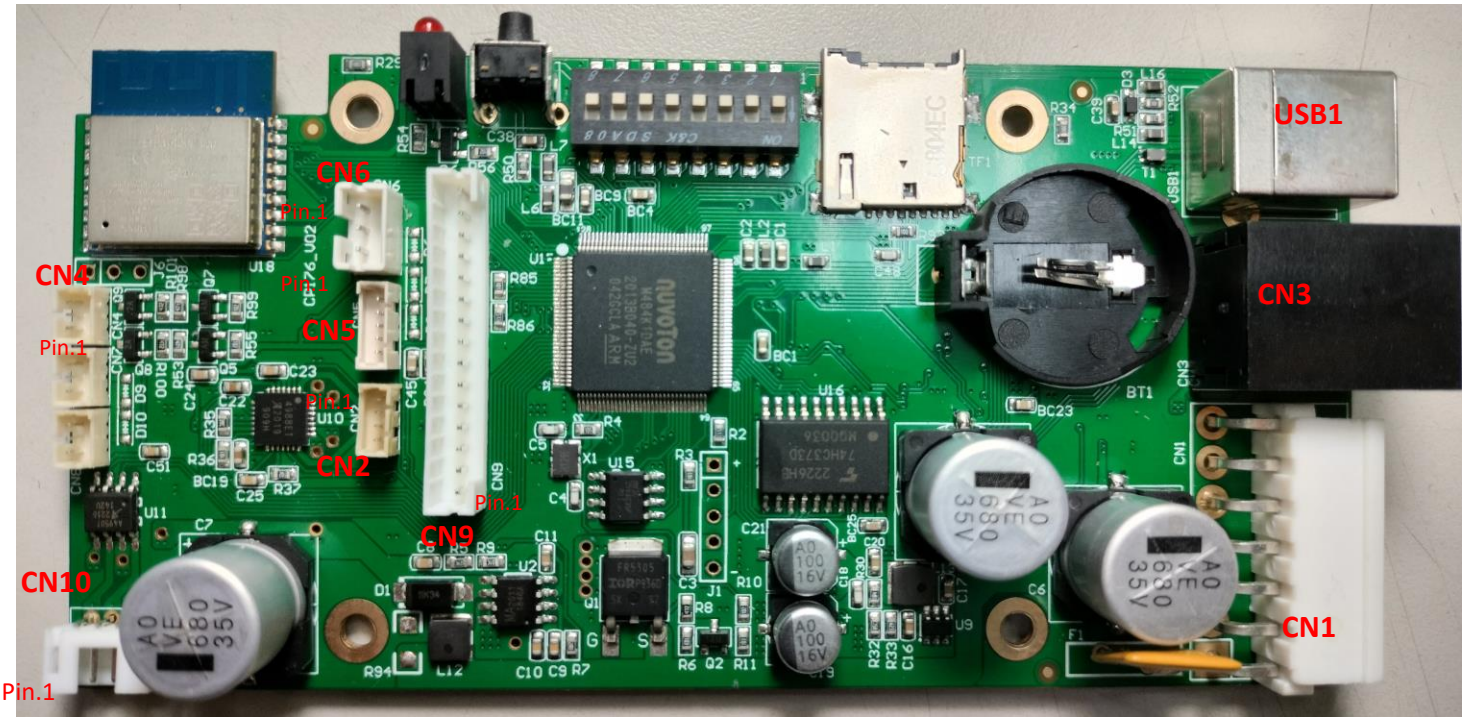


11.Pull out and check the paper scraps for cleaning





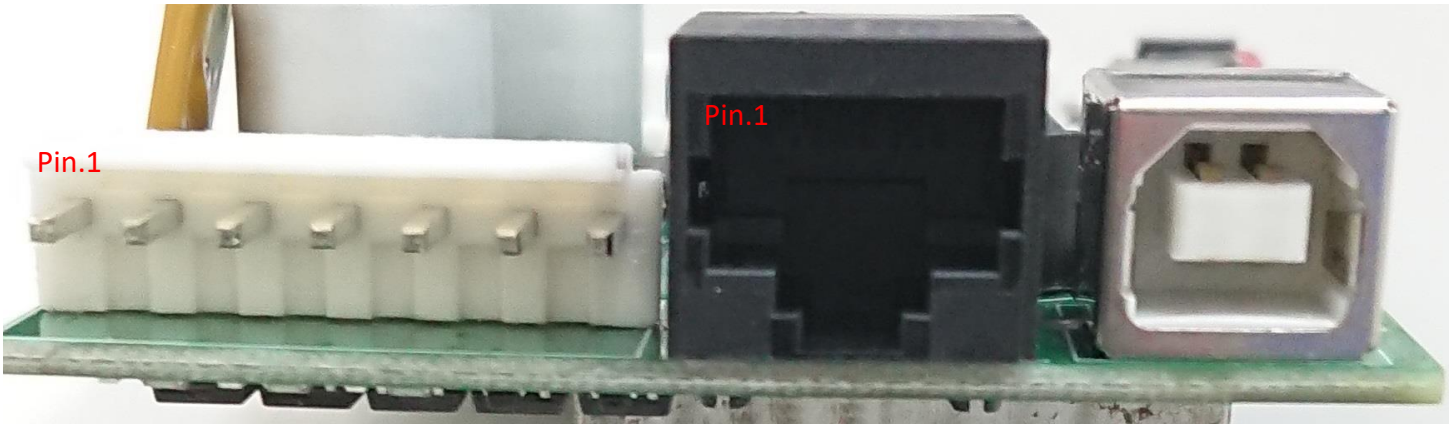
12 K305NA Control board Pin out assignment and usage reference



12.1 Power connector

Connector CN1: JST S15P-VH (7PIN , 3.96mm)

PIN NUMBER	SIGNAL NAME
1	DC12V
2	GND
3	Coin in Signal, Input, Opne Collect
4	Note in Signal, Input, Opne Collect
5	Payout Ttigger, Input, Opne Collect
6	Ticket Output, Output, Opne Collect
7	Error Output, Output, Opne Collect



12.2 Printer mechanism connector

Connector CN9: JST B15B-PH-K-S (15pin pitch 2.0mm)

Pin number	Input/output	Function	Active level
1	Vh	DC +12V	n/a
2	Vh	DC +12V	n/a
3	Vh	DC +12V	n/a
4	Vh	DC +12V	n/a
5	Gnd	Ground	n/a
6	Gnd	Ground	n/a
7	Gnd	Ground	n/a
8	Vdd	DC +3.3V	n/a
9	O	Print-head thermistor terminal	n/a
10	I	Strobe of print-head	Low
11	I	Strobe of print-head	Low
12	I	Strobe of print-head	Low
13	I	Serial clock of print-head	n/a
14	I	Data latch of print-head	Rising edge
15	I	Data-in of print-head	n/a

Switches and LED functions are defined in the following table:

Flashing Code	Meaning of Flashing Code	Corrective Action
LED' s always OFF	The printer has no power.	Check that power has been applied.
LED' s always ON	NO error exists-printer is OK.	None.
1 Flashes	Printer paper is low.	The printer paper roll is low. Refill before it runs out.
2 Flashes	Paper Out	The printer has run out of paper. Replace the roll.
3 Flashes	Cutter error	The cutter is jammed or not runs Cutter home position
4 Flashes	Head Open	The "Platen" (front portion of the head) is not locked properly.
5 Flashes	Busy	The Printer is busy printing something or it is receiving a large amount of data from the host. Wait until current processes finish or power cycle the printer.
6 Flashes	Programming error	An error occurred during the programming process (on the PC),try downloading the program again.
7 Flashes	Print-head temperature	Print-head temperature Too high or too low

12.3 RS232 communication connector

Connector CN3: Molex 0432028104 (RJ45 , 8Pin)

PIN NUMBER	SIGNAL NAME
1	NC
2	NC
3	NC
4	POG-RXD1,Input,RS232 Level
5	VCC(+5V DC)
6	VCC(+5V DC)
7	GND
8	POG-TXD1,Output,RS232 Level

12.4 USB communication connectors

Connector USB1: USB Type-B

PIN NUMBER	SIGNAL NAME
1	VCC(+5V DC)
2	D-
3	D+
4	GND

12.5 Paper-near-end sensor connector

Connector CN6: JST B3B-PH-K-S (3pin pitch 2.0mm)

PIN NUMBER	SIGNAL NAME
1	DC +5V
2	Status input (3.3V logic)
3	GND

12.6 Paper sensor connector

Connector CN5: Molex 0530470510 (5pin pitch 1.25mm)

PIN NUMBER	SIGNAL NAME
1	DC +5V
2	Status input (3.3V logic) (Paper Empty)
3	DC +5V
4	Status input (3.3V logic) (Black Mark)
5	GND

12.7 LED connector

Connector CN5: Molex 0530470310 (3pin pitch 1.25mm)

PIN NUMBER	SIGNAL NAME
1	DC +5V (LED1)
2	GND
3	DC +5V (LED2)

12.8 Stepper motor connector

Connector CN2: Molex 0530470410 (4pin pitch 1.25mm)

PIN NUMBER	SIGNAL NAME
1	Stepping motor second phase, second winding terminal
2	Stepping motor second phase, first winding terminal
3	Stepping motor first phase, first winding terminal
4	Stepping motor first phase, second winding terminal

12.9 Cutter DC motor connector

Connector CN10: JST S4B-PH-K-S (4pin pitch 2.0mm)

PIN NUMBER	SIGNAL NAME
1	Cutter motor first terminal
2	Cutter motor second terminal
3	Cutter home position sensor
4	GND

13 Printer device operations

13.1 Self-test

The procedure for entering the self-test mode is as follows:

1. Turn off the power.
2. Hold down the FEED button.
3. Turn on the power.
4. Release the FEED button after 2.5 seconds.

Another way to enter the self-test mode is to send command: 0x1F 0x10.

13.2 Hexadecimal Dump

Hexadecimal dump function

This function prints the data transmitted from the host computer as hexadecimal numbers.

The procedure for starting the Hexadecimal dump mode is as follows:

1. Turn off the power.
2. Hold down the FEED button.
3. Turn on the power.
4. Release the FEED button after 7 seconds.

To exit the Hexadecimal dump mode, turn off the power.

13.3 Paper loading

Paper loading can performed by two different methods:

- **Automatic paper loading**: When the print head cover is properly closed, insert the paper inside the printer, and then the roller will automatically feed the paper for about 40 mm (default value). When continuous paper feed mode is active and if printer has a cutter, this one will cut the paper after the loading step (if option enabled). When hole/black mark detection mode is active, the paper will move to the TOF position after the loading step (no cut). In every case, printer is then ready to print. This function can be performed only if power supply is valid.
- **Manual paper loading**: Open the print head cover, manually place the paper over the roller, close the print head cover, and now the printer is ready to print.

13.4 Text printing fonts

The controller board provides with two resident sets of characters: 9x17, and 12x24.
To use **Euro currency symbol**, set code page (n=16) "ESC t n" (Position 128, 80h).
12 characters are selectable from the international character set: refer to "ESC R n" control code for more information.

Code page : 1252 – Windows West European Latin 1 (n = 16)

- **12x24 characters set**: Alphanumeric characters area is *12 pixels* (10 "active dots" plus 2 characters spacing) *x 24 pixels* (22 "active" dots plus 2 lines spacing including underline). Horizontal character spacing and vertical line spacing are adjustable via software.

- **9x17 characters set**: Alphanumeric characters area is *9 pixels* (7 "active dots" plus 2 characters spacing) *x 17 pixels* (16 "active" dots plus 1 lines spacing including underline), Horizontal character spacing and vertical line spacing are adjustable via software.

13.5 Control codes

Control codes are non-printable characters or sequences of characters that control the operation of the printer. Within the following description, a control code causes the printer to interpret the following byte(s) as part of a command and not as a printable character.

13.5.1 Control codes cross reference

- *Setup and hardware control codes*

CONTROL CODE	DESCRIPTION
GS / n	Set maximum printing black dots (printing Electric current)
GS s n	Set maximum printing speed
GS D n	Set printing intensity
ESC @	Reset printer
ESC v	Send printer status
ESC I	Send printer identity
GS B n	Set serial communication settings
ESC s	Save in flash setup parameters
ESC d	Recover factory setup parameters
GS p n	Set paper loading pause
GS P n1 n2	Set paper loading length
GS M n	Set paper loading speed
ESC n s	Send "Near End of Paper" extension presence
GS F n	Set printer mode.
GS c n	Enable/disable historic heat.
ESC e	Get printer setup parameters.

- *Text and general control codes*

CONTROL CODE	DESCRIPTION
ESC % n	Select internal font
ESC R n	Select international character set
ESC 2 n	Set line pre-spacing
ESC 3 n	Set line spacing
ESC SP n	Set character spacing
ESC b n	Set normal/inverse video mode
ESC c n	Set maximum number of columns
ESC C n	Set text justification
ESC ! n	Set printing modes
ESC { n	Set normal/rotated text line
LF	Do a text line feed
CR	Do a carriage return
ESC J n	Feed paper forward (n dot lines)
ESC j n	Feed paper backward (n dot lines)
CAN	Cancel text line data buffer
ESC t n	Set code page

- *Graphic control codes*

CONTROL CODE	DESCRIPTION
ESC * n1 n2 n3 n4 n5 n6 <data>	Print graphic in full mode
ESC $ n1 n2	Set graphic offset in line mode
ESC V n1 n2 n3 <data>	Print graphic in line mode
Gs v 0 m xL xH yL yH <data>	Printing of raster bit image

- *Cutter control codes*

CONTROL CODE	DESCRIPTION
ESC m	Do a partial cut
ESC i	Do a full cut

* Some print mechanism is only full or partial cut.

- *Bar code control codes*

CONTROL CODE	DESCRIPTION
GS k n [Start] <data> [Stop]	Print bar code
GS h n	Set bar code height
GS w n	Set bar code magnification
GS H n	Set bar code text position
GS R n	Set normal/rotated bar code

- *Presenter control codes*

CONTROL CODE	DESCRIPTION
RS S n	Set Presenter speed
RS T n1 n2	Set the paper-retracted waiting time.
RS P n	Enable/disable the presenter Spit Out Papers mode

- *QR Code control codes*

CONTROL CODE	DESCRIPTION
GS Q n	Print QR Code
GS a n	Set QR Code Magnification factor
GS L n	Set QR Code error correction level

- *Hole and black mark detection control codes*

CONTROL CODE	DESCRIPTION
GS L n	Set mark length, switch continuous/mark mode
GS E	Move to "Top Of Form" (TOF) position
GS T n1 n2	Set "Mark" to TOF position length
GS Y n1 n2	Set "Optosensor" to "Head dot line" length
GS X n1 n2	Set "Mark" to "Cut" position length
GS x n1 n2	Set "Head dot line" to "Cut" position

	length

13.5.5 Setup and hardware control codes

GS / n

Description: Set maximum printing black dots (printing electric current) (impact on printing speed).
Format: <1Dh> <2Fh> <n>
Comments: n = 0: Allows printing of all black dots at the same time, ie 640 dots (maximum print speed, no current limit).
n = 1 to 76: software programmable consumption (dynamic division). The maximum number of black dots, which can simultaneously heated, is (n) x 8 + 24. So maximum printing speed may never reached because successive heats can take a lot of time.

Default: n=0
Example: n = 5 => maximum black dots simultaneously heated: (5)*8+24 = 64.
Notes: If n=1~76. Suggest maximum printing speed set 2ips.
If speed is greater than 2ips print quality may affected.

GS s n

Description: Set maximum printing speed.
Format: <1Dh> <73h> <n>
Comments: This control code may be used to setup printing speed.

n=0: speed is 1 ips.
n=1: speed is 2 ips.
n=2: speed is 3 ips.
n=3: speed is 4 ips.
...
n=11: speed is 11 ips.

n may vary from 0 to 11

Default: n=7 (8 ips)

GS D n

Description: Set printing density.
Format: <1Dh> <44h> <n>
Comments: n=0 to 7 : Set printing density.
n=0 : Lightest.
n=4 : nominal printing density (default value).
n=7 : Darkest.

ESC @

Description: Reset printer.
Format: <1Bh> <40h>
Comments: Reset printer device.

Notes: This is a real time request.

ESC v

Description: Send printer status.
Format: <1Bh> <76h>
Comments: Printer returns 2 byte that reflects its status in accordance with the following table
Return: < Byte1> < Byte2>

Byte 1:

Bit	Function	Bit = 0	Bit = 1
0	Head temperature	Normal	Too high or too low
1	Head-up	No	Yes
2	End of Paper	No	Yes
3	Hole and Black mark error	No	Yes
4	Printer in use	Ready	Action in progress
5	ON/OFF line	OFF line	ON line
6	-	-	-
7	Cutter error	No	Yes

Byte 2: Power supply Voltage . byte2 may vary from 0 to 255 .

Example : Byte2 = 12 ; Power supply Voltage is 12 volts.
Byte2 = 24 ; Power supply Voltage is 24 volts.

Notes: This is a real time request.

GS B n

Description: Set serial communication port settings.
Format: <1Dh> <42h> <n>
Comments: Sets serial communication speed and handshaking mode.
Bit 7: b7 = 0: No handshaking mode
b7 = 1: "RTS or DTR" handshaking mode (hardware control).
Bits 6, 5, 4, 3: Not used.
Bits 2, 1, 0: Baud-rate.

b2b1b0	Baud-rate
0	1200
1	2400
2	4800
3	9600
4	19200
5	38400
6	57600
7	115200

Default:n = 07h, no handshaking mode, 115200 bauds, 8 bits of data, none parity bit, 1 stop bit.

ESC I

Description: Send printer firmware version.
Format: <1Bh> <49h>
Comments: Printer returns an ASCII string ended by zero (00h) that reflects the printer firmware version. The string is formed by the concatenation of printer mechanism name and firmware revision, as below.

ESC s

Description: Save in flash setup parameters.
Format: <1Bh> <73h>
Comments: Printer parameters saved in the internal flash memory of controller. Therefore, they are not lost when power is removed or printer is reset, and are recovered at each power-on/reset.

Printer returns 1 byte representing the status of this request:
0x01: saving successful
0x00: saving fail.

Saving could take more or less time if a function or action is in progress. During saving, communication is not guaranteed because flashing operation cannot be performed simultaneously with normal operation function. It is advised for host to wait for printer return status with a sufficient timeout before resuming communication (100ms minimum, more if printing operation was in progress when request has been sent).

The following parameters saved by this command.

"Custom" parameters

- maximum printing black dots
- maximum printing speed
- intensity
- RS232 settings
- paper loading pause
- paper loading length
- paper loading speed
- active font
- active international character set
- pre-line spacing
- line spacing
- character spacing
- maximum number of columns
- text rotation
- inverse video
- text justification
- text mode (simple/double/quadruple width/height and underlining)
- printer mode
- historic heat management
- code page
- bar code height
- bar code magnification
- bar code "human readable interpretation" position
- bar code rotation

"QR code" parameters

- QR Code Magnification factor
- QR Code error correction level

"Hole / black mark" parameters

- "Mark" length
- "Mark" to "Top Of Form" position length
- "Mark" to "Cut" position length
- "Optosensor" to "Head dot line" length
- "Head dot line" to "Cut" position length

ESC d

Description: Recover factory setup parameters.

Format: <1Bh> <64h>

Comments: Revert all setup parameters (cf. above) to their factory default values. This updating is temporary, if printer is reset or power is cycled, setup parameters will be initialized with the last set saved in flash (with "ESC s"). If user wants to permanently set the parameters to their factory default values, the host must send an "ESC d" "ESC s" sequence. Combining the use of this command and the "Reset printer" one enables you to compare the effects of the new saved values with default ones without altering them.

Printer returns 0x01 when recovering done. It is advised for host to wait for this acknowledgement before resuming printing operations so as to be sure to work with coherent parameters.

Notes: Be careful regarding possible change of RS232 baud rate. Indeed, after sending this request, host should quickly update its baud rate too in order to be able to receive printer acknowledgement. It is advised to keep baud rate constant between default and new parameters values.

GS p n

Description: Set paper loading pause.

Format: <1Dh> <70h> <n>

Comments: Set time pause between the moment when printer detects the insertion of paper and the moment the roller starts turning. This allows accurate manual positioning of paper.
n is in 125 millisecond units (=> 0 to 32s).

Default: n=0 (instantaneous).

Example: n = 16 => printer will wait for 2 seconds before starting paper loading.

GS P n1 n2

Description: Set paper loading length.

Format: <1Dh> <50h> <n1> <n2>

Comments: Set length of paper to feed during the automatic paper loading.
Bytes n1 and n2 set the length L (in dot lines) of feeding: L = (256*n1) + n2.

Default: L = 40mm.

Example: (n1 = 3, n2= 32) => L = 800 dot lines => L = 800 / 8 = 100mm.
8-dot lines/mm is the line pitch.

GS M n

Description: Set paper loading speed.

Format: <1Dh> <4Dh> <n>

Comments: This control code used to adapt loading speed to various conditions.
n=0: speed is 1 ips
n=1: speed is 2 ips
n=2: speed is 3 ips
n=13: speed is 14 ips
n may vary from 0 to 13

Default: n=7 (8 ips)

ESC n s

Description: Send "Near End of Paper" status.

Format: <1Bh> <6Eh> <73h>

Comments: Printer returns a single byte representing the "Near End of Paper" status.

- 0x00 : OK, enough paper still present.
- 0x01 : "Near End of Paper" condition.

Note: Some models do not have this feature.

GS c n

Description: Enable/disable historic heat.

Format: <1Dh> <63h> <n>

Comments: Historic heat enabled can improve printing quality.

n = 0: historic heat is disable.

n = 1: historic heat is enable.

Default: n=0

ESC e

Description: Get printer setup parameters.
Format: <1Bh> <65h>
Comments: Get printer setup parameters.
Printer returns 36 byte:

Byte	Parameters
1	maximum printing black dots
2	maximum printing speed
3	intensity
4	RS232 settings
5	paper loading pause
6…7	paper loading length
8	paper loading speed
9	active font
10	active international character set
11	pre-line spacing
12	line spacing
13	character spacing
14	maximum number of columns
15	text rotation
16	inverse video
17	text justification
18	text mode (simple/double/quadruple width/height and underlining)
19	printer mode
20	historic heat management
21	code page
22	bar code height
23	bar code magnification
24	bar code “human readable interpretation” position
25	bar code rotation
26	QR Code Magnification factor
27	QR Code error correction level
28	Mark” length
29…30	Mark” to “Top Of Form” position length
31…32	Mark” to “Cut” position length
33…34	Optosensor” to “Head dot line” length
35…36	Head dot line” to “Cut” position length

Text and general control codes

ESC % n

Description: Select internal font.
Format: <1Bh> <25h> <n>
Comments: n = 0: **9x17** font is selected.
n = 1: **12x24** font is selected.

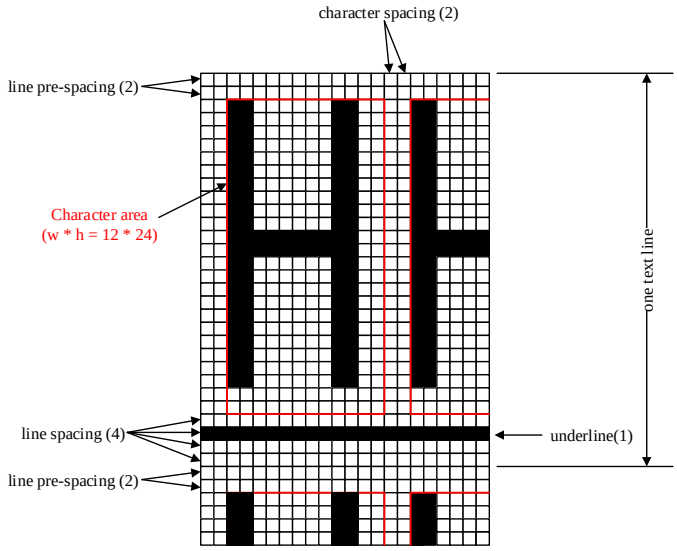
Default: n=1

ESC R n

Description: Select international characters set.
Format: <1Bh> <52h> <n>
Comments: 12 characters are defined as international characters. This control code enables which international characters set are selected.
n value selects one of the 13 available countries

n	Country	23h	24h	40h	5Bh	5Ch	5Dh	5Eh	60h	7Bh	7Ch	7Dh	7Eh
0	USA	#	$	@	[	\	]	^	‘	{	|	}	~
1	France	#	$	à	°	ç	§	^	‘	é	ù	è	″
2	Germany	#	$	§	Ä	Ö	Ü	^	‘	å	ö	ü	ß
3	UK	£	$	@	[	\	]	^	‘	{	|	}	~
4	Denmark 1	#	$	@	Æ	φ	Å	^	‘	æ	Φ	å	~
5	Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spain 1	Pt	$	@	¡	Ñ	¿	^	'	"	ñ	}	~
8	Japan	#	$	@	[	¥	]	^	‘	{	|	}	~
9	Norway	#	¤	É	Æ	φ	Å	Ü	é	æ	Φ	å	ü
10	Denmark 2	#	$	É	Æ	φ	Å	Ü	é	æ	Φ	å	ü
11	Spain 2	#	$	à	¡	Ñ	¿	é	'	í	ñ	ó	ú
12	Latin Amer.	#	$	à	¡	Ñ	¿	é	û	í	ñ	ó	ú

Default: n=0



ESC 2 n

Description: Set line pre-spacing.
Format: <1Bh> <32h> <n>
Comments: Set the number of dot lines to insert before starting character dot lines. This is very useful when printing in inverse video mode some characters which pixels start from first dot line.
n may vary from 0 to 15 dot lines. Line pre-spacing pitch is 1/8mm.

Default: n=0
CAUTION: Actual line pre-spacing is calculated from this user value n and updated proportionally in function of current height mode (simple (n*1), double (n*2), quadruple (n*4)).

ESC 3 n

Description: Set line spacing.
Format: <1Bh> <33h> <n>
Comments: Set the number of dot lines to insert just after last character dot line and before next one. n may vary from 0 to 15 dot lines. Line spacing pitch is 1/8mm.

Default: n=3
Note: Underline is managed only from line spacing of 3 and then it will be always the 2nd dot line of this set of dot lines.
CAUTION: Actual line spacing is calculated from this user value n and updated proportionally in function of current height mode (simple (n*1), double (n*2), quadruple (n*4)).

ESC SP n

Description: Set character spacing.
Format: <1Bh> <20h> <n>
Comments: Set the number of dots to insert just after last character dot and before next one. n may vary from 0 to 16 dots. Character spacing pitch is 1/8mm.

Default: n=2
Note: A last character can be possible provided it holds in the line even if next character spacing overlaps.
CAUTION: actual character spacing is calculated from this user value n and updated proportionally in function of current width mode (simple (n*1), double (n*2), quadruple (n*4)).

ESC b n

Description: Set normal/inverse video mode.
Format: <1Bh> <62h> <n>
Comments: n = 0: normal video mode.
n = 1: inverse video mode.

Default: n=0
Note: This setting is valid for the whole printing text line. Spaces at the beginning of a text line will be printed as a dark rectangle. In order to shift the black printing from the left margin, one can send TAB (ASCII 0x09) instead SP (ASCII 0x20). This enables an accurate control of white/black edges.

ESC c n

Description: Set maximum number of columns.
Format: <1Bh> <63h> <n>
Comments: Set the maximum number of printable characters that printer accepts in a same text line before automatically going to the next text line.
n may vary from 3 to 255.

Default: n=255

ESC C n

Description: Set text justification.
Format: <1Bh> <43h> <n>
Comments: Set how text will be justified
n = 0: text will be centered
n = 1: text will be right justified.
n = 2: text will be left justified.

Default: n=2

ESC ! n

Description: Set printing modes.
Format: <1Bh> <21h> <n>
Comments: Select various printing modes as described below

Bit of n	Function	Bit = 0	Bit = 1
0	n/a	n/a	n/a
1	Quadruple Height	Cancelled	Set
2	Quadruple Width	Cancelled	Set
3	n/a	n/a	n/a
4	Double Height	Cancelled	Set
5	Double Width	Cancelled	Set
6	Bold	Cancelled	Set
7	Underlined	Cancelled	Set

Default: n = 0
Note: Several printing widths can be mixed on the same text line, only one printing height is enabled per text line (change of height requests are ignored and lost), underline is actually managed only if enough line spacing (≥ 3).

ESC { n

Description: Set normal/rotated text line.
Format: <1Bh> <7Bh> <n>
Comments: n = 0 : printout is normal
n =1 : printout is rotated of 180°

LF

Description: Do a text line feed.
Format: <0Ah>
Comments: Move the print position to the beginning of the next text line.

Note: If LF follows a CR, printer will ignore LF. So, CR = LF = CR+LF.

CR

Description: Do a carriage return.
Format: <0Dh>
Comments: Move the print position to the beginning of the next text line.

Note: If CR follows a LF, printer will ignore LF. So, CR = LF = CR+LF.

ESC J n

Description: Feed paper forward (n dot lines).
Format: <1Bh> <4Ah> <n1> <n2>
Comments: Bytes n1 and n2 set the number of data bytes N to be feed paper
N = (256*n1) + n2
Paper is fed forward for n dot lines. Print position is reset to the beginning of the next dot line. N may vary from 1 to 65535. Dot line pitch is 1/8mm.

Note: N is 0 to stop the feed paper.

ESC j n

Description: Feed paper backward (n dot lines).
Format: <1Bh> <6Ah> <n1> <n2>
Comments: Bytes n1 and n2 set the number of data bytes N to be feed paper
N = (256*n1) + n2
Paper is fed backward for n dot lines. Print position is set to the beginning of the next dot line. N may vary from 1 to 65535. Dot line pitch is 1/8mm.

Note: N is 0 to stop the feed paper.

CAN

Description: Cancel text line data buffer.
Format: <18h>
Comments: Text line data buffer is cancelled and print position is set to the beginning of the next text line.

Note: Cancel operation is not applied on received data buffer (communication buffer) but only on text line data buffer (buffer used to stock all characters of the current text line).

ESC t n

Description: Set code page.
Format: <1Bh> <74> <n>
Comments:

n	Code page
0	437 – Original IBM PC hardware code page [USA]
1	Japanese
2	850 – Multilingual
3	860 – Portuguese
4	863 – Canadian French
5	865 – Nordic / Danish / Norwegian
6	West European
7	Greek
8	Hebrew
9	East European
10	Iran
16	1252 – Windows West European Latin 1
17	866 – Cyrillic
18	852 – Latin-2
19	858 – Multilingual / Latin-1 with euro symbol

Default: n=0

13.5.3 Graphic control codes

ESC * n1 n2 n3 n4 n5 n6 <data>

Description: Print graphic in full mode.

Format: <1Bh> <2Ah> <n1> <n2> <n3> <n4> <n5> <n6> <data>

Comments: Bytes n1, n2 and n3 set the number of data bytes N to be printed out
N = (65536*n3) + (256*n2) + n1
Byte n4 sets graphic operator on data bytes:
- n4 = 0 : data bytes are directly printed out (normal size, full printer resolution)
- n4 = 1 : double width (each pixel is repeated horizontally)
- n4 = 2 : double height (each pixel is repeated vertically)
- n4 = 3 : expanded (double width and height)

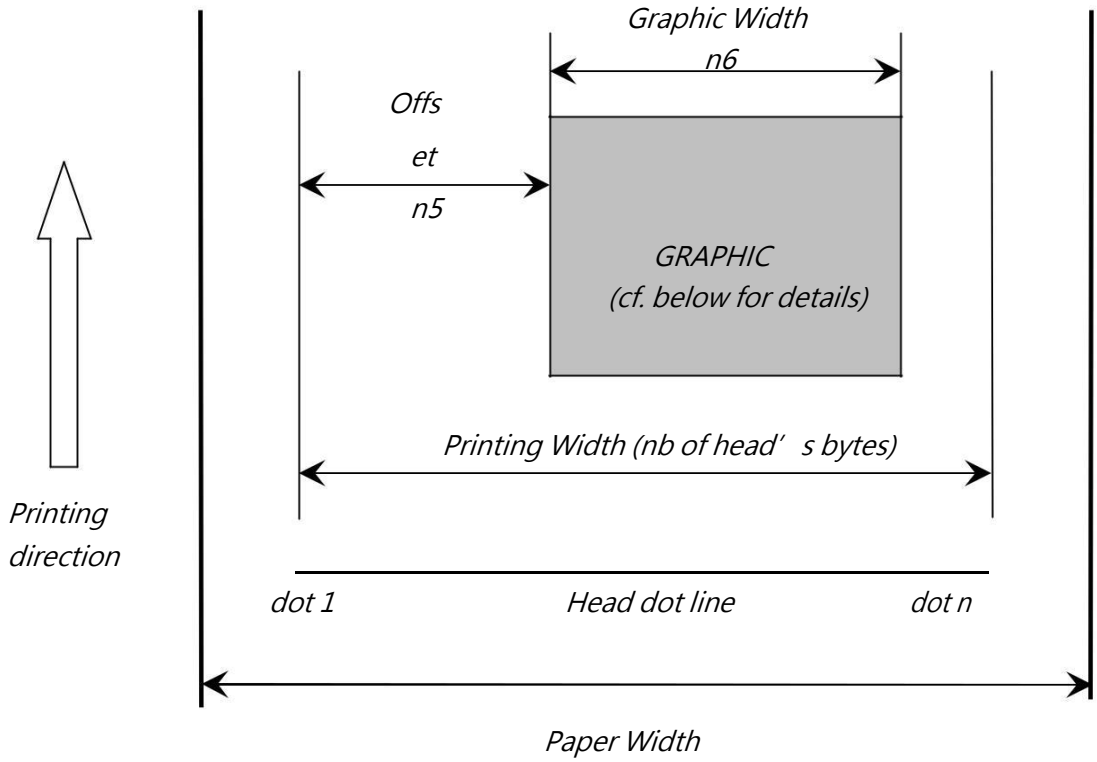
-

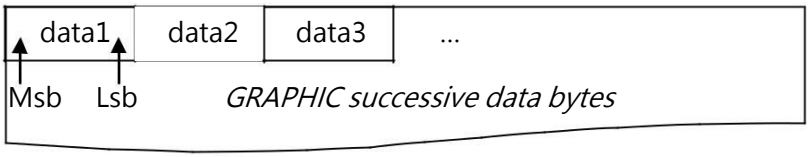
Byte n5 sets the number of dot bytes to be skipped (offset) before printing out the first graphic bit:
- n5 = 00h : first graphic bit to be printed out is dot 1 on the head
- n5 = 01h to FFh : 1 to 255 skipped dot bytes (< total number of head' s bytes)

-

Byte n6 sets the width of the graphic to be printed out:
n6 = 01h to FFh : width is 1 to 255 bytes (≤ total number of head' s bytes)

Data bytes: successive graphic dot bytes to be printed out. Host should send them with meeting order requirement drawn below. "1" bit value means black dots while "0" means white dot.





ESC $ n1 n2

Description: Set graphic offset in line mode.
Format: <1Bh> <24h> <n1> <n2>
Comments: This control code should use with "ESC V …" just before sending graphic data in line mode. Set the number N of bytes to be skipped before printing out first graphic bit of all next graphic lines (< total number of head' s bytes).
N = (256*n2) + n1. So n2 will be always 0.
The total number of dots divided by 8 gives total number of head' s bytes.

ESC V n1 n2 n3 <data>

Description: Print graphic in line mode.
Format: <1Bh> <56h> <n1> <n2> <n3> <data>
Comments: Byte n1 sets graphic operator on data bytes:
- n1= 0 : data bytes are directly printed (normal size, full printer resolution)
- n1= 1 : double width (each pixel is repeated horizontally)
- n1= 2 : double height (each pixel is repeated vertically)
- n1= 3 : expanded (double width and height)

Bytes n2 and n3 set the number of data bytes N to be printed out (≤ total number of head' s bytes)
N = (256*n3) + n2. So n3 will be always 0.

Data bytes: successive graphic dot bytes to be printed out. Host should send them with meeting the same order requirement as in full mode (cf. above). "1" bit value means black dots while "0" means white dot.
The total number of dots divided by 8 gives total number of head' s bytes.

IMPORTANT NOTES FOR GRAPHICS:

- It is advised when graphic printing is required with **RS232** line to set up communication speed at its maximum value (115200 bauds). Indeed, because there is a lot of data to transmit to printer, communication speed is then the main limitation factor on resulted printing speed. In addition, when user maximum printing speed is too high in comparison with RS232 communication speed and graphic features (width, zoom), it may cause some "stop-go" events which affects printing quality. To avoid this behavior, firmware automatically and temporarily maximum printing speed in function of all these previous parameters (=> lower but constant printing speed without "stop-go" event, better printing quality). However, this automatically setting is performed only in full mode. In line mode, user should set himself the right setting.

- It is advised when graphic printing is required with **USB** line to limit maximum printing speed. Indeed, because printer has a lot of data to process in a low period, when maximum printing speed is too high, it can cause also some "stop-go" which affects printing quality. Unlike RS232/full mode context, firmware does not limit automatically maximum printing speed. User should set himself the right setting.

- Please check that: "**n5 + n6 ≤ total number of head' s bytes**" (that is : *offset + width* ≤ *printing width*). If it is greater, graphic will be truncated, of course. Printer is robust but speed performance may be altered because useless data could be received and processed while it is not necessary. So it takes useless processing time which makes user set a lower maximum printing speed to get best printing quality.

For the moment, these previous advices are required to get the best performance as possible. Some enhancements are forecasted to make required settings automatically without user operation.

Gs v 0 m xL xH yL yH d1……dk

Description: Printing of raster bit image

Format: <1Dh> <76h><30h><m><xL><xH><yL><yH><d1>….. <dk>

Comments: Prints raster bit images in mode "m".

- xL, xH specify the number of data in horizontal direction of the bit image to (xL + xH x256) bytes.
- yL, yH specify the number of data in vertical direction of the bit image to (yL + yH x 256) bytes
- d1…dk specifies the bit image data (raster format).
- "d" denotes defined data. Dots to be printed are specified as "1", and those not to be printed as "0

m	Mode Name	Dot Density in Vertical Direction	Dot Density in Horizontal Direction
0,48	NORMAL MODE	203 DPI	203 DPI
1,49	DOUBLE WIDTH MODE	203 DPI	101 DPI
2,50	DOUBLE HEIGHT MODE	101 DPI	203 DPI
3,51	QUADRUPLE SIZE MODE	101 DPI	101 DPI

Parameter range: 0≤m≤3 ; 48≤m≤5

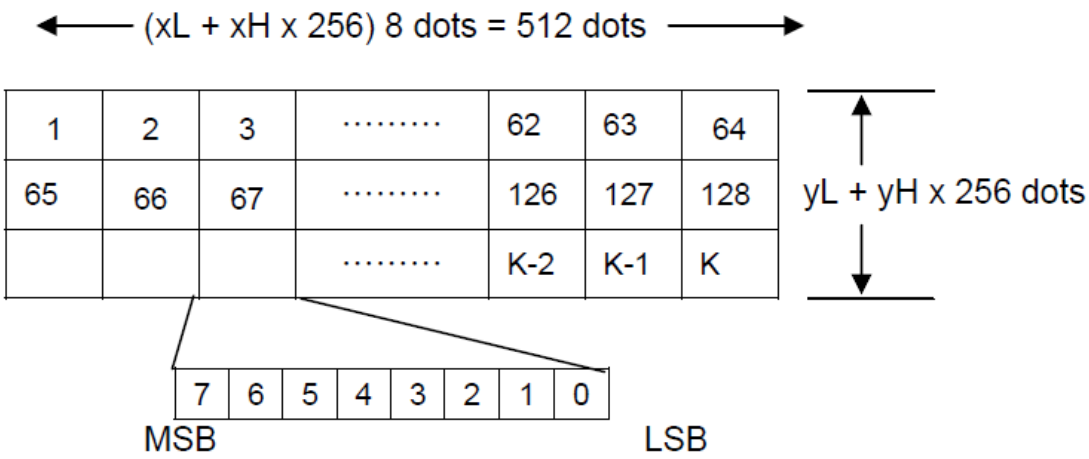
1≤xL+xH×256≤80

0≤yL≤255, 0≤yH≤255

0≤d≤255

k =(H1+Hh×256)×(yL+yH×256

Example: When xL + xH x 256 = 64



13.5.4 Cutter control codes

ESC m

Description: Do a partial cut.
Format: <1Bh> <6Dh>
Comments: If cutter is present, printer performs a partial cut.

ESC i

Description: Do a full cut.
Format: <1Bh> <69h>
Comments: If cutter is present, printer performs a full cut.

Cut position is function of current mode: - when continuous paper feed mode, partial cut is performed at the current paper position
when hole/black mark detection mode, first paper is fed forward until specific cut position (cf. "GS X ..." control code) and then partial cut is performed.

13.5.5 Bar code control codes

GS k n [Start] <data> [Stop]

Description: Print bar code.
Format: <1Dh> <6Bh> <n> [Start] <data> [Stop]
Comments: Byte n specifies bar code standard type as described in the following table.
[Start] is an optional byte only used with Code 128.

n	Start byte	Barcode type	Stop byte
0	n/a	UPC-A	00h
1	n/a	UPC-E	00h
2	n/a	EAN13	00h
3	n/a	EAN8	00h
4	n/a	Code 39	00h
5	n/a	Interleaved 2/5 (ITF)	00h
6	n/a	Codabar	00h
7	135d	Code 128 (start with subset A)	00h
	136d	Code 128 (start with subset B)	00h
	137d	Code 128 (start with subset C)	00h
	138d	Code 128 (automatic subset selection)	8Bh

Some checking are performed on <data> in function of bar code type: minimum number of data bytes, correct checksum byte, correct character type (only numerical characters for example), possible UPC-A compression. If data is wrong, bar code will not be printed out and next data bytes following to wrong data may be processed as other data. Therefore, some "unwanted" characters could be printed out instead of barcode if barcode data are not valid.

- When number of data bytes is higher than required number (required 'Stop' is not detected), even so bar code data are processed (checking step, ...).
- When checksum byte misses, printer will calculate it and add to <data> (except with Code 39). when UPC-E is selected, data to be transmitted can be either initial UPC-A data or directly corresponding compressed UPC-E data (checksum byte is then compulsory) .
- When Codabar is selected, "Start" and "Stop" bytes are compulsory to get a valid encoding (but their presence is not tested).
- When ITF is selected, last byte will be ignored if total number of bytes is odd. Furthermore, if total is null (or = 1), no bar code will be printed out.
- When Code 39 is selected, "Start" and "Stop" bytes are automatically added and so they should not be sent.
- When Code 128 is selected, automatic mode is advised because it enables direct encoding of data. However, to keep backward compatibility with old host MRS applications, "manual" mode is still available. For information, in this last mode, 0x00 cannot be encoded because used as "Stop" byte.

GS h n

Description: Set bar code height.
Format: <1Dh> <68h> <n>
Comments: Set bar code height as multiple of 1/8 mm. n should range from 1 to 255. When rotated bar code, printed height will be rounded up to mm.
(cf. example above; n=8 (i.e. 1mm) is advised).

Default: n=128 (16mm)

GS w n

Description: Set bar code magnification.
Format: <1Dh> <77h> <n>
Comments: Set bar code module width as multiple of 1/8mm. Module is the elementary bar/space on which bar code symbol is based. n should range from 2 to 6.

Default: n=3
Notes:

- **Bar code ratio** between thick and thin line is **2:1**.
- Bar code printing is always **centered**.
- When magnification is too large, bar code width may exceed printing width. Therefore, bar code will be printed out from left paper side and truncated.

GS H n

Description: Set bar code text position.
Format: <1Dh> <48h> <n>
Comments: Set position where HRI text (Human Readable Interpretation) of next barcodes to be printed out.

n	Text position
0	Not printed
1	Above bar code
2	Under bar code
3	Above and under bar code

Default: n = 0
Note: HRI is printed out with the latest text features (font, width, height ...) and always centered.

GS R n

Description: Set normal/rotated bar code.
Format: <1Dh> <52h> <n>
Comments: n = 0: bar code printing is normal (horizontally).
n = 1: bar code printing is rotated of 90° (vertically).

Default: n=0

13.6 QR code control codes

Gs O n

Description:	Print QR Code.
Format:	<1Dh> <51h> <Data...> [Stop]
Comments:	Print QR code, the [Stop] byte is 0x00 Note: Currently Only supports version 1 (21 x 21 modules) to version 10 (57 x 57 modules)

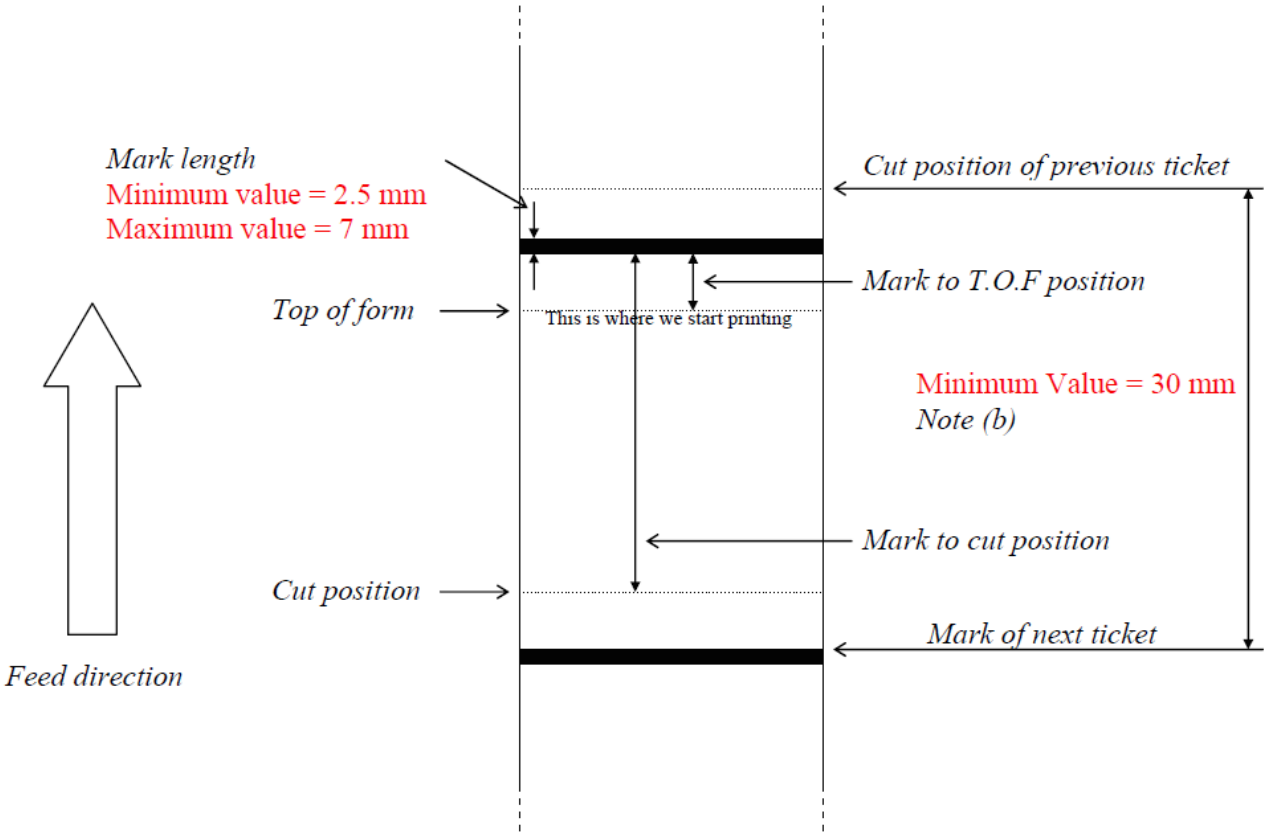
Gs a n

Description:	Set QR Code Magnification.
Format:	<1Dh> <61h> <n>
Comments:	n=2: Double n=3: Triple n=4: Quadruple n may vary from 1 to 10. Default: n=4

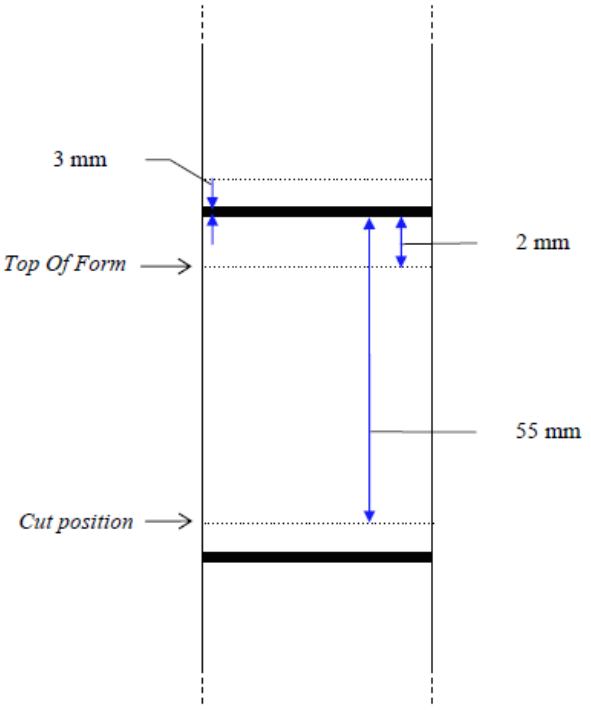
Gs l n

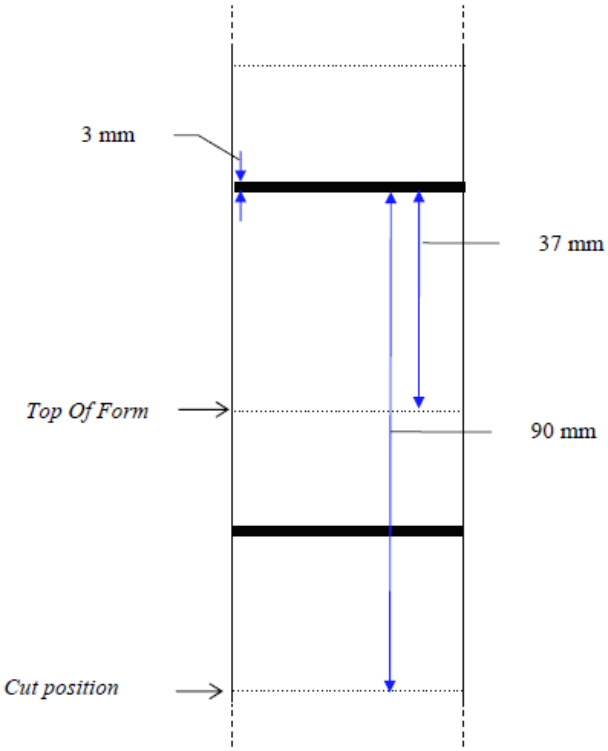
Description:	Set QR Code error correction level.
Format:	<1Dh> <6Ch> <n>
Comments:	n=0: Up to 7% of damaged code words can be recovered. n=1: Up to 15% of damaged code words can be recovered. n=2: Up to 25% of damaged code words can be recovered. n=3: Up to 30% of damaged code words can be recovered. Default: n=0

13.7 Hole / black mark detection control codes



EXAMPLES:





Gs L n

Description: Set mark length, switch continuous/mark mode.
Format: <1Dh> <4Ch> <n>
Comments: Set mark length and switch from continuous paper feed to mark detection mode.
n specifies mark length as multiple of 1/8 mm. n should range from 20 to 56 (=> mark length should range from 2.5 mm to 7 mm).

Default: 0 (continuous paper mode).

Example: If the mark length = 3 mm then the n = 24, and the printer immediately switches to the mark paper detection mode.

Notes: - n = 0 : printer switches into continuous paper mode.
- this command clears also the hole/black mark detection error bit of printer status.
-mark length is a parameter which can be saved in flash in order to recover directly the continuous/mark detection mode at each power on/reset.

Gs E

Description: Move to "Top Of Form" (TOF) position.
Format: <1Dh> <45h>
Comments: Paper is fed until next TOF position is under head dot line.

Note : hole/black mark detection error bit of printer status is set if no mark has been found during this operation after 20cm of paper feeding. Moving to TOF position is then stopped and printing operations are disabled. To remove this error and enable again printing operations, a "GS L n" command is required.

Gs T n1 n2

Description: Set "Mark to TOF" position length.
Format: <1Dh> <54h> <n1> <n2>
Comments: Set length L between end of mark and first printable line (TOF) as multiple of 1/8 mm.
L = (256*n1) + n2.

Default: n1 = 0 , n2 = 0 .

Note: negative length is allowed. Negative value is represented with the two' s complement of absolute value. For example, to set a "–5 mm" length :
L = - 40 = 65536 – 40 = 65496 => n1 = 255, n2 = 216.

Gs Y n1 n2

Description: Set "Optosensor to Head dot line" length.
Format: <1Dh> <59h> <n1> <n2>
Comments: Set paper path length L between optosensor position and head dot line as multiple of 1/8 mm. L = (256*n1) + n2. This data is required to be able to move with accuracy to TOF and cut positions from
end of mark detection.

Default: n1 = 0 , n2 = 100 , (12.5mm).

Notes: - this control code should be used only if optosensor position is different from default.
- no negative length is allowed; maximum value is 32767.

GS X n1 n2

Description: Set "Mark to Cut position" length.
Format: <1Dh> <58h> <n1> <n2>
Comments: Set length L between end of mark and cut position as multiple of 1/8 mm. L = (256*n1) + n2.

Default: n1 = 0 , n2 = 0 .

Note: no negative length is allowed; maximum value is 32767.

GS x n1 n2

Description: Set "Head dot line to Cut position" length.
Format: <1Dh> <78h> <n1> <n2>
Comments: Set paper path length L between head dot line and cut position as multiple of 1/8 mm. L = (256*n1) + n2. This data is required to be able to move with accuracy to cut position from end of mark detection.

Default: n1 = 0 , n2 = 76 , (9.5mm).

Notes: - this control code should be used only if cutter' s blade position is different from default.
- no negative length is allowed; maximum value is 32767.

13.8 RS232

Bytes are received one after one directly by UART of microcontroller. So they can be processed whatever printer state (printer error or full buffer). In the case of full buffer (handshaking was set OFF by printer with "RTS or DTR" or Xoff), host should disable its own handshaking control before sending its real time request. Otherwise this control will prevent request to be sent.

13.9 USB

Bytes are received directly in the form of a packet by the USB module of the microprocessor. The USB module handles 3 communication channels: DATA_IN, DATA_OUT and CONTROL_IN_OUT.

Host will use mainly "DATA_IN" channel to send its printing data and its control requests (printer control codes). However, this channel is not a real time channel unlike "CONTROL_IN_OUT". Therefore, when printer buffer is full, packets stay in the USB module which becomes full too. This module manages itself handshaking with host. So communication is "suspended" until enough memory space is free to stock new packet. So when printer is in error and buffer is full, the host may not able to send its real time request with using this "DATA_IN" channel. "CONTROL_IN_OUT" has to be used in place because this is a real time channel. However, allowable requests in this channel are regulated by USB standard (cf. "USB Device Class Definition for Printing Devices", version 1.1.). 3 kinds of requests are defined: "Standard Requests", "Class Specific Requests" and "Vendor Requests". The 2 first kinds are already defined by USB standard; only last kind is intended to specific user needs. Therefore, available status provided by "GET_PORT_STATUS Class Specific Request" is too limited. So, in order to retrieve extended printer status (the one returned with printer control code "ESC v"), a specific "Vendor Request" has been added to the set of standard USB printer requests: GET_PRINTER_STATUS.

Table below gathers all USB requests (standard and specific) and gives for each one their handling status:

REQUEST TYPE	LABEL	SUPPORTED	DETAILS
Standard	**GET_STATUS**	**Yes**	Cf. USB standard
	CLEAR_FEATURE	**Yes**	Cf. USB standard
	SET_FEATURE	No	
	SET_ADDRESS	**Yes**	Cf. USB standard
	GET_DESCRIPTOR	**Yes**	Cf. USB standard
	SET_DESCRIPTOR	No	
	GET_CONFIGURATION	**Yes**	Cf. USB standard
	SET_CONFIGURATION	**Yes**	Cf. USB standard
	GET_INTERFACE	No	
	SET_INTERFACE	No	
	SYNCH_FRAME	No	
Class Specific	**GET_DEVICE_ID**	**Yes**	Cf. USB standard
	GET_PORT_STATUS	**Yes**	Cf. USB standard
	SOFT_RESET	No	
Vendor	**GET_PRINTER_STATUS**	**Yes**	**Cf. below**

Table below specifies the 2 "Vendor Requests" available on our printers:

Label	bmRequestType	bRequest	wValue	wIndex	wLength	Data
GET_PRINTER_STATUS	11000001b (read dir|vendor req|i/f recipient)	0x01	0x0000	0x0000 (interface)	0x0001	1 byte received (see answer format below)

GET_PRINTER_STATUS:

Printer answers with a 1 byte data buffer containing below extended status information:

Bit	Function	Bit = 0	Bit = 1
0	Head temperature	Normal	Too high or too low
1	Head-up	No	Yes
2	End of Paper	No	Yes
3	Hole and Black mark error	No	Yes
4	Printer in use	Ready	Action in progress
5	ON/OFF line	OFF line	ON line
6	-	-	-
7	Cutter error	No	Yes

GET_DEVICE_ID:

VENDOR ID	0x0416
PRODUCT ID	0x5012

GET_PORT_STATUS:

Bit(s)	Field	Description
7 .. 6	Reserved	Reserved for future use; device shall return these bits reset to zero.
5	Paper Empty	1 = Paper Empty, 0 = Paper Not Empty
4	Select	1 = Selected, 0 = Not Selected
3	Not Error	1 = No Error, 0 = Error
2 .. 0	Reserved	Reserved for future use; device shall return these bits reset to zero.