IJ-7100 Ink-Jet Transaction Printer

Specification

Addmaster Corporation

Address: 225 East Huntington Drive
Monrovia, CA 91016

Web: www.addmaster.com
Phone: (626) 358-2395
FAX: (626) 358-2784

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1 Overview and General Description

This document provides the electrical, mechanical, and interface specifications of the IJ-7100 Ink-Jet Transaction Printer.

Figure 1.1 Addmaster IJ-7100

1.1 General Description

The IJ-7100 Printers are a series of Ink-Jet Transaction Printers for use in a wide variety of applications, including: Banking and Point-of-Sale. The IJ-7100 has several available options, including validation mechanisms, cutters, and interface emulations.

Special features include: plain-paper printing, validation, quiet operation, high resolution and high speed printing, and a choice of interfaces and power connections.

This printer utilizes the Hewlett-Packard C6602A ink-jet printhead. This printhead prints at 144 by 96 dpi using 12 nozzles.

1.2 User and Factory Configuration Options

The IJ-7100 can be configured with optional features for special applications. Some features can be configured by the user through utility programs. Other features are factory installed only. At this time, these options are shown below. Consult factory for current available options.

User Configurable Options

Items:	*Configurations Available*
Options:	Fonts: Defaults and Stylization Validation & Journal Mechanisms: Enabled/Disabled.

Factory Configurable Options

Items:	*Configurations Available*
Mechanisms:	Form Alignment Mechanism
Paper Roll Holder:	Enclosed or Open
Options:	Emulations of other printers.

2 Equipment Specification

Item	Specification
Power Requirements	
Voltage	24 Volts DC (+/- 10%) (Standard)
Power Consumption	
Operating	14 Watts Maximum
Standby	2 Watts
Operating Environment	
Temperature	10 -> 40 C
Humidity	10 -> 90% RH (non-condensing)
Printer Engine	
Type	Thermal Ink Jet
Ink Cartridge	Hewlett-Packard C6602A
Ink Detection	Ink drop usage counter.
Resolution	144 x 96 DPI (horizontal x vertical)
Modes	Standard and Ink-Saver (draft quality mode)
Speed	280 characters/sec. Max. (standard font)
Print Media / Paper	
Type	Roll, Plain Paper
Size	3 Inch Wide 3 Inch Diameter (Maximum) 5/8 Inch Core I.D. (Typical, but not req'd.)
Paper Detection	Paper-Out. Mechanical arm w/photo sensor. Form Inserted. Reflective photo sensor.
Paper-Usage	Electronic counter.
Paper Handling	
Loading	External loading with smart feed.
Communications	
Data Buffer	12K buffer
Interfaces	RS-232C and USB2.0
Physical Characteristics	
Dimensions	6.5" (W) by 3.25" (H) by 6.25" (D)
Weight	4.6 lb.
Noise Level	48 DBA at **t.b.d.** feet

3 Printer Features and Specifications

3.1 Printer Overview

Printer Features	
Logical Unit	
Processor	ARM7 Family
RAM	40K
Firmware Storage	256K Flash, with download procedure
Variables Storage	1K bit EEPROM
Characters & Fonts	
Character Height	0.070 to 0.125 inch (font dependent)
Character Set	Code page 850 (page 437 optional)
Fonts	7 Printer Fonts in Flash Memory -Standard -Standard Bold -Large -Large Bold -Times Roman -OCR -Tiny
Font Stylization	2 Styles available for Large and Large Bold for compatibility with IJ-6080. OCR font is newly created.
Font Pitch	Software adjustable.
Font Storage	Flash Memory: 128K Bytes for Fonts
Font Configurability	Downloadable procedure available.
Bar Codes	Code 39, 128, I2of5, UPC-A
Printing Modes:	4 Modes: non-exclusive -Double-strike / Single-strike -Double-wide / Single-wide -Uni-directional / Bi-directional -Upside-Down / Rightside-Up

Supplies: Features & Specifications

Printhead & Ink

Print Head	Hewlett-Packard C6602A
Ink Cartridge Life	112,000,000 dots typical
Ink Cartridge Life	5,000,000 characters, standard font
Print Contrast Ratio	Constant throughout life of cartridge.

Paper Media

Media Type	Roll Paper
Recommended Stock	Rittenhouse #7055SB
Roll Diameter	3.0 inches maximum
Roll Core I.D.	5/8 inches typical, (no special requirement)
Thickness	0.0015 to 0.03 inches
Width	3.00 inches (+0.1/-0.1)

Printer Capabilities and Capacities

Printer Speed

Print Speed	280 char/sec Max. (standard font)
Print Throughput	5 to 10 lps depending on text layout Logic seeking algorithm.
Paper Feed Speed	7 inches/sec.
"Typical" Receipt Throughput	t.b.d.

Printer Resolutions

Resolution (native)	144 x 96 dpi (horizontal x vertical)
Resolution (addressable)	144 x 96
Graphics	Print path optimized for graphics clarity.

Validation Capacity

Print Zone (Lines)	8 lines at 6 lines/inch
Print Zone	2.67 inches wide, by 1.54 inches tall see definitions for details

3.2 Printer Operating Modes Overview

Category	*Mode*	*Sub-Modes*	*Unit is:*
Operation	Operating		Operational -- may be utilized.
		On-Line	On-Line. Host may send data.
		Off-Line	Off-Line. Host should not send data.
	Download		Firmware download procedure underway.
	Self-Test		Self-test procedure underway.
Printing	Journal		Data printed to journal.
	Multi-LineValidation		Form validation procedure.
	Ink-Saver		Unit prints in draft quality conserving ink supply. <Not available>
	Regular Ink		Standard printing.

3.3 Printing

Printing Overview:

Printing is accomplished by sending print data to printer and commanding a vertical motion to the print-head. Printing occurs in other cases also, but these are the exception.

The printer includes various sensors to assure that printing occurs only on the media previously selected by the Host. For example, if Journal printing is selected, the printer will halt if a form is inserted erroneously. The printer will automatically restart when any blocking condition is cleared.

Printing will not take place if the unit is Off-Line or is out of paper. Both of these conditions are noted by operator indicators.

In absence of Host commands, the printer will use its default settings, which are:

Item	*Default Setting*
Font	Standard
	Right-side Up
Line Spacing	6 lines / inch
Ink-Saver	Not supported at this time.
Media	Journal Media
Method	Bi-directional printing

Font Overview:

The printer includes 7 internal fonts and 4 bar codes, which are given in the following table.

Name	*Pitch Char/Inch*	*Capacity Journal*	*Char/Line Validation*
Fonts:			
Standard	16	42	42
Standard Bold	16	42	42
Large	12	32	32
Large Bold	12	32	32
Tiny	18	54	54
Roman	Proportionally spaced	~30	~30
OCR		16	16

Fonts may be mixed within a print line. If so, then the available number of characters per line will depend upon the mixture of fonts. If the print line is longer than the available media width, the print line will be truncated (no wrap-around).

The pitch of the fonts may be adjusted as desired by user commands. For example, the Large Bold font pitch can be adjusted downwards from 12 to 8.

Fonts are downloadable into the printer non-volatile Flash memory by a procedure described in the document "*IJ-7100 Flash Programming Guide.*" Contact the factory if interested.

Ink-Saver Mode:

Not supported at this time.

Double-Strike Print Mode:

Double-Strike printing, when activated by software command, will print two dots in succession for every dot called for by the font. When double-strike is active, the print speed is reduced by up to one-half. Since more ink is used, the printing is darker, the contrast against the media is greater, and ink usage is double. Default is single-strike.

Bar Code Overview:

The printer includes 4 bar codes, which are given in the following table.

Name	*Pitch Char/Inch*	*Capacity Journal*	*Char/Line Validation*
Bar Codes:			
Code-39		12	12
Code-128		12	12
Inter. 2 of 5		12	12
UPC-A		12	12

Barcodes may not be mixed with fonts or other barcodes on the same line. Barcodes print automatically centered in the printfield and are 3/8 inches tall. Barcodes are printed uni-directionally at half-speed.

3.5 Validation Printing

Validation of Forms:

For the IJ-7100, there is only one method for validation. It is called *Multi-Line Validation Mode*. On other printer models, other methods (modes) of validation may be possible. We use the full term here to prepare for that case in future specifications.

The IJ-7100 validates by clamping the cut-form, moving the print-head horizontally during printing, and feeding the cut-form vertically to ready it for the next line of print.

Validation Mode is entered by sending a software command to the printer. Validation Mode remains in effect indefinitely and only exits by sending another software command. Consult Section 7 for the exact command syntax.

The Validation Mode pertains to 1 (one) document only. The printer follows these steps in validating forms. *Each* step must be undertaken for *each* document validated.

	Multi-Line Validation Procedure	*Via*	*Form LED*
1.	Printer enters Validation Mode.	Software cmd.	On
2.	Printer waits for Form to be inserted.		On
3.	Printer prints on Form.	Software cmd.	Off
4.	Printer replaces Form and waits for Form to be removed.	Software cmd. or excess data	Flashing
5.	Printer exits Validation Mode.	Software cmd.	Off

The following notes are important:

- If the capacity is exceeded (more than 8 lines sent), then any excess print data causes the following:
    - subsequent print data is ignored,
    - the form is returned to its original position and the clamp is opened,
    - operation will not continue until the Form is completely removed from the printer.
- *The printer remains in Validation mode until this mode is quit via a software command*.
- If the cut-form is removed during Multi-Line Validation, the printing mechanism will stop and abort the printing. It does this to prevent ink from being ejected into the printer.
- After Multi-Line Validation is completed, the cut-form is returned to its original position and the clamp is opened to allow for removal of the cut-form.
- The paper-feed button is operational during Multi-Line Validation.

Document Media and Validation Capacity Specification:

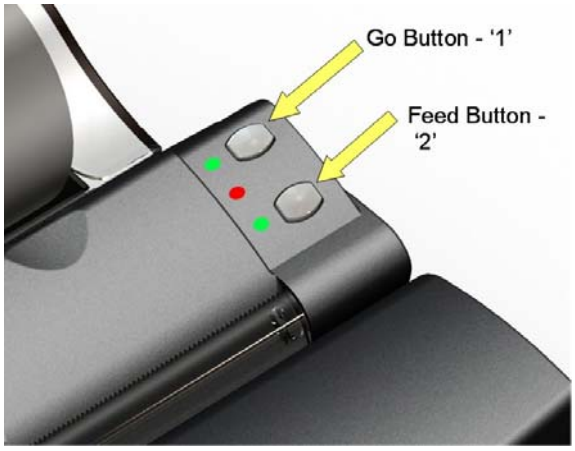
Category	*Item*	*Specification*
Document Media		
	Document Thickness	0.0015 to 0.0180 inches
	Document Capacity:	
	Loading	1 form, 0.018” max
	Catch Chute	none
	Document Width	
	Minimum	5.5 inches
	Maximum	unlimited
Validation Printing		
	Lines	8 max. at 6 lines/inch
	Print Zone: 1st Line	1.35 inches, baseline to form bottom
	Print Zone: Last Line	0.25 inches baseline to form bottom
	Print Zone: Width	2.67 inches

4 Operator Controls and Indicators

4.1 Operator Controls

The operator controls are clearly marked. Only three are present in this model, and there usage is given in the following table.

Item	*Usage*	
Power Switch.	Cuts power to the printer. ALWAYS USE THE POWER SWITCH TO REMOVE POWER.	
Paper-Feed Button. *'2'*	Feeds paper forwards.	
	Short depression:	Feeds last printed line past tear-bar (about 2 inches).
	Long depression:	Feeds paper continuously while button is depressed. Waits ½ second before beginning to feed.
Go Button. *'1'*	Causes action.	
	Short depression:	Services print head. Spits and wipes to clean and prepare print head if misoperating.
	Long depression:	Causes a Printer Status Message to be printed.



4.2 Operator Indicators

The operator indicators are LED lights which are located on the top front of the unit. Their usage is given in the following table.

Indicator	***State***	***Meaning***
Ready LED.	ON	Power is ON. Printer is On-Line and ready to operate.
	FLASH	Printer is Off-Line. Flashing is very low rate.
	OFF	Power is OFF.
Status LED.	ON	Error or Out-Of-Paper.
	OFF	No errors.
Form LED.	ON	Insert form for validation.
	FLASH	Remove form from printer.
	OFF	No form attention required.

4.3 Printer Self-Test & Verification

After the printer is set-up and its supplies are loaded, its operation can be tested by use of the printer's "Self-Test Routine." This self-test exercises most aspects of the machine's operation and provides visual indication that the unit is properly set-up and ready for operation. The following features are tested and verified:

- Identification: Model Number, Firmware & Revision Level, Installed Options
- Operation: Printing, Feeding, Validation Clamping & Ejecting,
- Printing: All fonts and print modes.

To initiate the Self-Test, follow these steps:

1. Turn off power.
2. Hold down GO button.
3. Turn on power.
4. Release button after printing starts.
5. A sample tape is printed.
6. Press GO button again (short depression) and next message will print. Continue at step 6 as desired.
7. Insert Form to test validation mechanism. Push FEED button. Repeat step 7 or continue at step 6.

IMPORTANT NOTE:

Unit exits self-test mode automatically after any communications.

5 Interfacing: Power, Communications, DIP Switches

5.1 Power Connections

Please use only the factory supplied power supply. If using another supply, please contact factory for proper power connections.

5.2 Serial Interface

Baud Rates:	9600 or 38400 (DIP switch selectable)
Data Bits:	8, w/1 stop bit
Parity:	None.
Handshaking:	Printer toggles RTS, which is connected by standard cables to IBM PC's CTS signal.
Interface Connector:	RJ-45 (phonejack type connector) RS232C interface levels.
Pin Configurations:	Standard PC compatible 9 pin. Mates directly to PC.
Cabling:	Addmaster P/N: **95078** Printer to PC compatible DB9 type serial port Cable is 8 wire RJ-45 to DB9 pin female.

5.3 USB2.0 Interface

Interface Connector:	USB (Type A socket).
Pin Configurations:	USB standard. No current draw on VCC.
Cabling:	Addmaster P/N: **95165**

5.4 Printer Communications Buffering

The printer has two type of buffers into which it places incoming characters:

Receive Buffer:

Stores incoming characters. The printer removes characters from the Receive Buffer when needed. The characters are then "processed."

The Receive Buffer, stores 12000 characters. In some models, this buffer may be larger or smaller.

Print-Line Buffer:

Stores characters (typically text characters) after processing, but before actual printing. This buffer is used to build up the complete "Print-Line" that will then be printed or validated.

In the standard IJ-7100, the Print-Line Buffer is approximately 200 characters. Therefore, you can not print a line with more than 200 characters (including any formatting commands).

5.5 Hardware Interface Handshaking

When the Receive Buffer is full or is otherwise unavailable, then the printer is unable to receive any characters. If any are sent, then they will be lost. This "un-availability" is signaled to the computer by "handshaking" lines on the interface.

For the Serial Interface:

The printer toggles its RTS line which is connected through the standard cables to the computer's line called "CTS". If the computer tests CTS high, then data can be sent, and if tested low, then do not send data. This testing is usually accomplished automatically via the computer's BIOS routines. CTS goes low when the Receive Buffer reaches 256 characters from full.

For DOS based computers, set the "mode" command as indicated below. The "p" parameter sets the appropriate retry on the CTS line when used with printers in general.

```
C:> mode com1:9600,n,8,1,p
```

For Windows NT/XP/Vista based computers, check the settings for the appropriated COM port. Assure that *Flow Control* is set to *Hardware*.

5.6 DIP Switch Settings

DIP Switches set functional features of the IJ-7100. The Switches are accessible from the bottom of the unit.

DIP Switch	*Setting*	*Usage*
1	ON	Firmware Download Mode
	OFF	Printing Mode
2	ON	Default Font: Standard Bold
	OFF	Default Font: Standard
3	ON	38400 Baud
	OFF	9600 Baud
4	ON	To be determined.
	OFF	

Notes:

- Recommended Baud setting is 38400. Unit is shipped in with Baud=9600 for compatibility with default setting for Windows. However, 9600 is usually too slow for printing graphics.
- Defaults are all OFF.
- Firmware Download Mode is described in another document.

6 Data Stream & Command Set

An overview of the supported interface commands is given below.

Type	*Sequence*	*Function*
RESETS		
	CAN	Reset. Hard power-on reset, at receive level.
	ESC @	Initialize. Soft, at process level.
	STX	Clear Print-Line Buffer.
OPTIONS		
	ESC > n	Set print mode options. n is bit-mapped.
	SOH	Set printer initialized bit. *PINIT.*
PRINTING		
	LF	Line Feed. Print and feed.
	CR	Carriage Return. Print and no-feed.
PRINT MEDIA SELECTION & CONTROL		
	ETB	Enter *Multi-Line Validation* Mode.
	FF	Exit *Multi-Line Validation* Mode and eject Form.
	ESC A	Enable form alignment, temporary.
	ESC a	Disable form alignment, temporary.
	ESC K	Enable form kickout, temporary.
	ESC k	Disable form kickout, temporary.
FONTS & PITCH		
	ESC 2 *n*	Set print font. *n* is bit-mapped. See table
	GS	Selects Large Font.
	FS	Selects Large Bold Font.
	RS	Selects Standard Font.
	US	Selects Standard Bold Font.
	SO	Selects Single-Wide pitch (cancels Double-Wide)
	SI	Selects Double-Wide pitch.
	ESC 7 n	Increase character spacing by *n* dots.
PRINT MODES		
	SUB	Set “Upside-Down Mode” printing.
	EM	Reset “Upside-Down Mode” printing.
	ESC U	Select Unidirectional Print.
	ESC u	Select Bidirectional Print.
	ESC D	Select Double-strike printing.
	ESC d	Select Single-strike printing.
LAYOUT CONTROL		
	ESC : n	Set line feed amount to *n*/96 inches.

Type	*Sequence*	*Function*
	VT	Paper Feed forwards past tear bar. (Prints buffer first).
	ESC 9n	Vertical feed *n* dots. (Prints buffer first).
	ESC 8n	Horizontal move *n* dots. (Cursor control).
GRAPHICS & IMAGES		
	ESC $ *mn data*	Print graphics bit image, 8 dots high.
	ESC 3 *n*	Print Logo #n
	ESC 5 *n*	Select barcode symbology
	ESC % ...	Print barcode
CONTROLS AND EXTENSIONS		
	SYN	Turn on FORM LED.
	ESC V	Enter Power Down state.
	ESC 1 *n*	Adjust Right/Left Alignment.
STATUS INDICATIONS		
	ENQ	Send printer status, immediate.
	ESC ? *n*	Send feature status. *n*=feature number
	ESC ACK	Send ACK after processing.
FEATURE CONFIGURATION		
	ESC = n	Set feature value to *n.*
	ESC (mn data	Set feature string/variable to *data.*
FACTORY DEBUGGING EXTENSIONS		
	ESC 0xe0 … ESC 0xff	Execute debugging routines. Do not use.
	ESC 0 n	Execute debugging routines. Do not use.
	ESC 6 n	Push *n* onto temporary variable stack.

Data Stream & Commands: Detail

Detail on each of the supported commands follows in this section. The commands are grouped according to function. A table listing the Hex and Decimal values of each of the codes is given in Section 9.

6.1 Resets

CAN	Reset. Hard reset, at receive level.

This command will clear out the Receive Buffer, reset any modes, fonts, and other settings to the default values, and re-initialize the interface.

This command basically emulates a Power-On Reset. It is acted upon as soon as it is received, even if the Receive Buffer contains unprocessed data. Use this command only when needed -- at Host driver power on, error condition clearing, etc.

This command also resets the Printer Initialized bit (PINIT).

See also the *ESC* @ command.

Syntax: 18H

ESC @	Initialize. Soft, at process level.

This command will clear out any partially formed print-line, reset any modes, fonts, and other settings to the default values.

This command basically emulates a Soft Reset. It is acted upon removed from the Receive Buffer (after all previous commands received have been processed).

Does not affect Receive Buffer! Does not affect *PINIT* bit.

This command is typically used ONCE at the start of each print-job to put the printer into a known state concerning fonts, print-modes, etc

Syntax: 1BH 40H

STX	Clear print line buffer and FORM LED.

Soft reset, at process level. This command will clear out any partially formed print-line. Also will turn off FORM LED.

Does not affect Receive Buffer!

Syntax: 02H

6.2 Options and Configuration

ESC > n	Set print mode options. n is bit mapped.

This command sets or clear various operational options. Each option is set or cleared depending on parameter *n* which is interpreted in a bit-mapped manner. Consult the following table.

Bit	*Setting*	*Usage*
0 (lsb)	0	Fonts reset after each printed line
	1	Fonts stay set until changed
1	0	Reserved
2	0	‘’
3	0	Disable Auto-LF on CR
	1	Enable Auto-LF on CR
4	0	Reserved
5	0	‘’
6	0	‘’
7	0	‘’

This option byte is defaulted to 01H. It is reset on Power-On, or by the *CAN* commands. See CR and LF commands for usage of Auto-LF on CR.

Always write 0’s to reserved bits to insure compatibility with future upgrades and features.

Syntax: 1BH 3EH *n*

SOH	Set printer initialized bit PINIT.

Sets *PINIT* to **1**. *PINIT* is reset to **0** by: Power On or *CAN* command.

Printer initialized bit *PINIT* can be read by the *ENQ* command. *PINIT* can be used by the host to determine whether the printer was reset by power failure or operator.

Syntax: 01H

6.3 Printing

LF	Line Feed. Print and line feed 1 line.

Any data previously received is printed. The paper is feed an amount specified by the current line spacing value.

Syntax: 0AH

CR	Carriage Return. Print and no line feed.

Any data previously received is printed. The paper is not fed in typical usage. If Auto-LF on *CR* mode is set by ESC >n command or by DIP switch, then the paper is fed 1 line.

Syntax: 0DH

6.4 Print Media Selection

ETB	Enter *Multi-Line Validation* mode.

Printer enters Multi-Line Validation Mode. Form LED is illuminated and printer awaits Form to be inserted before proceeding. If the printer is already in validation mode, the command is ignored.

Syntax: 17H

FF	Exit *Multi-Line Validation* mode and eject Form.

Any data previously received is first printed.

Subsequently, if the printer includes the validation mechanism AND the printer is currently in validation mode, then:

- The FORM is replaced into its original position,
- Printer waits until FORM is removed, and while so, Flashes the FORM LED,
- After FORM is removed, returns the printer to Journal printing mode.

Syntax: 0CH

ESC A	Align cut-form.
ESC a	Do not align cut-form.

Use these commands to temporarily enable or disable form alignment in *Multi-Line Validation Mode.* When set by this command the enable or disabled state will be used only for the next validation.

This feature is useful for situations where some forms should be aligned and others not. The default can be set and the ESC A, ESC a commands used for the exceptions.

Default is set by option. See Section TBD.

Syntax: 1BH 41H (alignment enabled)

1BH 61H (alignment disabled)

ESC K	Kickout cut-form after validation.
ESC k	Do not Kickout cut-form after validation.

Use these commands to temporarily enable or disable cut-form kickout after *Multi-Line Validation Mode*. When set by this command the enable or disabled state will be used only for the next validation.

This feature is useful for situations where some forms should be ejected and others not. The default can be set and the ESC A, ESC a commands used for the exceptions.

Default is set by option. See Section TBD.

Syntax: 1BH 4BH (Kickout enabled)

1BH 6BH (Kickout disabled)

6.5 Fonts & Pitch

ESC 2 n	Set print mode/fonts.

The Font and Pitch selected for printing is determined by the value of *n* as shown in the following table:

n	*Font / Mode Selected*
00H	Standard Font
01H	Standard Font
02H	Large Bold Font.
03H	Standard Bold Font
04H	Large Font.
05H	Tiny Font.
06H	
07H	Roman (Proportionally spaced.)
08H	
09H	OCR Font.
12H	Large Bold Font. (Alternate Style)
14H	Large Font. (Alternate Style)
40H	Single Wide Mode ON
41H	Double Wide Mode ON
50H	Ink-Saver Mode OFF (not implement yet)
51H	Ink-Saver Mode ON
others	Reserved.

Fonts may be changed in the middle of a line. Fonts will retain their values across lines depending upon the option setting.

Standard Font is the default.

Syntax: 1BH 32H *n*

GS	Selects Large Font.
FS	Selects Large Bold Font.
US	Selects Standard Bold Font.
RS	Selects Standard Font.

These command produce the same results as the *ESC 2 n* command.

Syntax: 1DH = (GS), 1CH = (FS), 1EH = (RS), 1FH = (US)

SO	Selects Single Wide pitch
SI	Selects Double Wide pitch.

Selects or De-selection double-wide printing. Double-wide printing will resets to single-side at the end of each line as specified by the *ESC >* command.

Syntax: 0EH (SO) 0FH (SI)

ESC 7 n	Increase horizontal spacing by *n* dots.

The horizontal spacing between characters is increased by *n* dots. This command may be used to increase the white space between characters.

The default is *n*=0.

Valid range for *n* is -1 to 32. *n* is a signed character. -1 is send as 0FFH.

Syntax: 1BH 38H *n*

6.6 Print Modes

SUB	Set “Upside Down Mode” printing.
EM	Reset “Upside Down Mode” printing.

These modes stay in effect until reset by this command or the *CAN* or *ESC @* commands.

The default is rightside up printing.

Syntax: 1AH (sub)

19H (em)

ESC U	Select Unidirectional Print.
ESC u	Reset Unidirectional Print. (Bidirectional).

Use these commands to select/reset unidirectional printing. Unidirectional printing enhances the line-to-line registration, however, print speed is reduced by half. Use this mode only if required.

Default is bi-directional printing.

Syntax: 1BH 55H (unidirectional)

1BH 75H (bi-directional)

ESC D	Select Double-strike Printing
ESC d	Reset Double-strike Printing. (Single-strike).

Use these commands to select/reset Double-strike printing. In Double-strike printing, dots in each character are printed twice in succession resulting in darker print. Print speed is reduced by approximately one-third. This command affects the entire print-line, regardless of when the command is sent.

Default is Single-strike printing.

Syntax: 1BH 44H (double-strike mode)

1BH 64H (single-strike mode)

6.7 Layout Control

ESC **:** *n*	Set line feed amount to n/96 inches.

Set line spacing to 96/n lines per inch.

The default is n=16 or 6 lines per inch.

Valid range for n is 1 to 255.

Note that the actual spacing will not be precisely as specified because the printer's feed increment is different from 1/96 inch.

Syntax: 1BH 3AH *n*

VT	Feed Paper Forwards to Tear-Bar.

Feeds last printline past cut position. After printing a receipt, use the *VT* command to feed the last line through cutter or tear-bar.

Alternately, you can insert approximately 12 lines of text at 6 LPI, to perform almost the same function.

Syntax: 0BH

ESC 9 *n*	Vertical feed n/96 inches.

Prints any text in buffer. Feeds vertically *n* dots at 96 dots/inch.

Valid range for *n* is 1 to 255.

Note that the actual spacing will not be precisely as specified because the printer's feed increment is different from 1/96 inch.

Syntax: 1BH 39H *n*

ESC 8 *n*	Horizontal move *n* dots.

Moves the cursor position on the current printline n/144 inches rightwards. Dots are printed at 144 dpi, so the move is also equal to *n* dots.

Valid range for *n* is 1 to 255.

Syntax: 1BH 38H *n*

6.8 Section Omitted

Omitted.

6.9 Graphics & Images

ESC $ mn data...	Print 8 dots high bit image, 144 x 96 DPI
ESC # mn data...	Not Implemented. Was 24 dot graphics in prior products.

Used to print a graphics on a bit-mapped basis, at the selected resolution.

Syntax: 1BH 23H *mn data* *(24 dot graphics)*

1BH 24H *mn data* *(8 dot graphics)*

m and *n* specify the number of data bytes, called COUNT, which follow.

m = LSB of COUNT

n = MSB of COUNT

data... represents a sequences of bytes, whose bits specify the bit-map to be printed. The printer prints a swath 8 (or 24) dots high across the paper on each pass of the print-head. Each vertical column of 8 (or 24) dots is called a slice. These slices are ordered from left to right across the print field.

The native resolution of the printer is 96 DPI vertical and 144 DPI horizontal, so each slice is 8/96 (24/96) inch tall, by 1/144 inch wide. Each dot on the print line may be specified by this command.

For the 24 dots high command, each vertical slice requires 2 bytes of information. At 8 dots high command, each slice vertical slice requires 1 byte.

Data is sent left-most slice to right-most slice. Within each slice, each byte represents 8 dots. Bytes are ordered top-most dots to bottom-most dots. Within each byte, bits are ordered top-most dot to bottom-most dot.

data... = slice1 slice2 ... sliceN

slice = Byte0 (for 8 dots high command)

slice = Byte0 Byte1 (for 24 dots high command)

For *ByteN*, the dots are specified by the bits as follows:

bit7 (msb) = top dot,
bit6 = 1 down from top dot,
etc..
bit0 = bottom dot

The line spacing should be 8/96 (or 24/96) inches to make graphics match up from line to line. Also select Unidirectional Print mode to get best line-up results.

ESC 5 *n* Select barcode symbology

Sets the type of barcode to be printed by subsequent barcode print commands. *n* specifies the barcode type. See table.

n	Barcode selected
00H	Code-128
01H	Interleaved 2 of 5 (I-2/5)
02H	UPC-A
03H	Code-39
others	Reserved.

Syntax: 1BH 35H *n*

ESC % *nm data* Print barcode

Prints a barcode using the currently selected barcode symbology. Data of barcode is supplied with the command.

Barcode is printed approximately in the middle of the print-field and text cannot be printed on the same line. The height of the barcode is approximately 1/3 inch.

The print density of barcodes is not affected by Ink-Saver Mode. Bar codes are always printed uni-directionally at ½ full print speed.

n, m specify the length in bytes of the following string of *data*. *n* is the least significant byte and *m* is the most significant byte. The format of *data* depends on the type of barcode printed. Examples are presented assuming symbology already selected with the *ESC 5* command:

Syntax: 1BH 25H *n m data*

Examples and Additional Information:

Code-128 Type C:

- Only Type C is fully supported. Type C encodes pairs of characters into one symbol.
- Consult Code-128 Specification for more information.

Example: Print “ABCD”, Required Start character is 69H for type-C

1BH 25H 05H 00H 69H 21H 22H 23H 24H

Interleaved 2 of 5:

- Number of data digits must be even.
- Start character is 64H and must be provided by the user.

Example: Print “81562153”

1BH 25H 09H 00H 64H 38H 31H 34H 36H 32H 31H 35H 33H

UPC-A:

- Number of digits must be exactly 11.
- The eleventh digit is a checksum. If provided incorrectly, the printer will correct and print the proper checksum.

Example: Print “07364002107”

1BH 25H 0BH 00H 30H 37H 33H 36H 34H 30H 30H 32H 31H 30H 37H

Code-39:

- Printer adds start/stop characters automatically

Example: Print “123456”,

1BH 25H 0BH 00H 31H 32H 33H 34H 35H 36H

ESC 3 *n*	Print Logo #n

Prints Logo #n which must be previously stored in printer. Logos are stored in non-volatile memory. By convention, Logo#1 is called the “Header” and Logo #2 is called the “Footer.”

Valid range for *n* is 1 to 8.

Syntax: 1BH 33H *n*

6.10 Controls and Extensions

SYN	Turn FORM LED ON.

The LED will remain ON until turned OFF by the *STX* command. The Form LED may toggle during printing. This may change in the future.

Syntax: 16H

ESC V	Enter Power down/Sleep Mode.

Print-head is docked and capped. All LED's (except power) are turned off, buttons and interface commands are ignored.

The printer stays in sleeps mode until: (1) power is turned off, or (2) the *CAN* command is received. The CAN command will emulate a hardware Power-On reset.

Syntax: 1BH 56H

ESC 1 n	Adjust Right/Left Alignment

The Right/Left Alignment adjustment value is changed to *n* dots for the currently selected print station. For example, if currently printing to the Journal, only Journal alignment is affected. To change Validation alignment, enter Validation mode first.

The default value is set by the factory. *n* is a signed character.

Syntax: 1BH 31H *n*

6.11 Status Indications

ENQ	Send Printer Status, immediate.

See following section for more details on this command and its responses.

The printer will respond to this command immediately after receiving it. Command is operational only for units with the serial interface.

Syntax: 05H

ESC ACK	Send ACK.

An *ACK* character (1 byte) is returned to the host after the sequence is processed. This can be used to determine when a print job is complete. To do so, send all print data and afterwards send the *ESC ACK* sequence. When the *ACK* is returned, then all data has been printed.

This command is operational only for units with the serial interface.

Syntax: 1BH 06H

ESC ? n	Send Feature Status.

Returns Feature specific information to the host.

n specifies the feature. See table.

n	Feature Status Requested
00H … 0FH	Send Mechanism Status
10H ... 2FH	Read Counter #0 (through #31).
30H … 3FH	Send Information strings
40H ... 6FH	Read Configuration Byte #0 (through #47). See Configuration Byte Table.
others	Reserved.

See following section for more details on this command and its responses.

The printer will respond to this command after the sequence is processed from the receive buffer. This command is operational only for units with the serial interface.

Syntax: 1BH 3FH *n*

6.13 Feature Configuration

ESC = n	Set feature value to *n.*

Features are selected by number and read-back by the *ESC ? n* command. The last *Feature Number* is saved. Subsequent to sending the *ESC ? n* command, the user can change the value for some of the features by sending the *ESC = n* command. For the *ESC = n* command, *n* will specify the new value to be stored for the previously selected Feature Number.

These commands are used to set various values and calibrations.

Syntax: 1BH 3DH *n*

ESC (mn data...	Set feature string/variable to *data.*

These commands are used to set various values and calibrations.

m and *n* specify the number of data bytes, called COUNT, which follow.

m = LSB of COUNT

n = MSB of COUNT

data... represents a sequences of bytes, containing the string/variable information.

6.14 Factory Debugging Extensions.

ESC 0 n *ESC 6 n* *ESC 0xe0* *…* *ESC 0xff*	Debugging Commands.

These commands are reserved for factory debugging usage. Do not use any of these commands as they are NOT SUPPORTED for any other purposes.

Syntax: 1BH 30H *n*

1BH 36H *n*

1BH F0H through 1BH FFH

7 Status Commands

This section gives more detail on the status commands are used to retrieve information from the printer. Three commands are available.

Command	*Usage*	*Response*
ENQ	Send printer status.	Immediate
ESC ? n	Send feature status.	Processed
ESC ACK	Send ACK after processing.	Processed

These commands generate responses of two types: Immediate and Processed.

- *Immediate* responses are sent to the host immediately after receiving the request. This response will occur regardless of the state of operation and any pending commands or data.

- *Processed* responses are sent to the host when the command is removed from the Receive Buffer. All prior and pending data and commands are processed before the response is sent.

Thus, there is an indeterminate delay between the Host sending Processed Response status requests and the Host receiving an answer back. Most often the delay will be a few milliseconds, but it can be seconds long. For example, a print job is sent and followed by the *ESC ACK* command. The printer will respond to the *ESC ACK* command after the print job is complete, which may take many seconds or even be delayed indefinitely if the printer is out of paper.

7.1 Send Printer Status, Immediate.

Host Sends: *ENQ* - 05H
Printer Response: 1 byte
Response Type: Immediate.

Usage Details:

The printer responds to this command immediately after receiving it. The printer will respond regardless of its current state of operation. The response to the *ENQ* command will is 1 byte in length.

Response Format Bit-map:

Bit	*Name*		*Usage & Meaning*
7	*PWRDWN*		Used to determine if printer is in power down state
		=1	• power down state
		=0	• operational state
6	*BEMP*		Used to determine if any data is waiting to be printed.
		=1	• if the Receive Buffer is empty and has processed all received data (processed data may not yet have been printed),
		=0	• if Receive Buffer has any unprocessed data.
5	*TREMP*		Undefined for this model
		=1	
		=0	• Fixed 0
4	*PINIT*		Used by the host to determine whether the printer was reset by power failure.
		=1	• if printer has received SOH command
		=0	• if printer has been: (1) powered off/on, (2) reset via the CAN command.
3	*ERROR*		
		=1	• error during validation
		=0	• no error detected or error condition cleared
2	*VMP*		Used to determine if machine is process of performing a mechanical task that may take an indeterminate amount of time
		=1	• if a valid message has been received and machine is performing an action or printing a line.
		=0	• otherwise.
1	*PRDY*		Used to determine if printer can print
		=1	• if printer is ready and no error conditions are sensed,
		=0	• if printer not ready because: (1) Form improperly inserted, (2) Paper-Out, (3) printhead in loading zone, (4) printhead jam.
0	*FORM*		Used to determine if Form is inserted into Validation Mechanism
		=1	• FORM is detected
		=0	• no FORM detected

7.2 Send Printer Status, Immediate (Variation)

--This status response is not implemented in the IJ-7100.--
-- Contact factory if this command is required. --

Host Sends: *ENQ* - 05H
Printer Response: 4 bytes.
Response Type: Immediate response.

Usage Details:

This command is a variation on the ENQ command given in the previous section in that the length of the response is different. The 4 byte response is called the Long Response. The user specifies the type of response in the following manner:

- At power-on, the unit defaults to Short Response. Remember that the *CAN* command emulates a power-on reset.
- The host can change the current setting by using the *ESC* > *n* command.

Long Response Format: 4 *(*four) bytes are returned to the host as follows:

Byte Number	*Contains*
1	00H
2	ENQ Short Response (see above)
3	Mechanism Status, byte #1
4	Mechanism Status, byte #2

7.3 Send ACK After Processing

Host Sends: *ESC ACK* - 1BH 06H
Printer Response: 1 bytes.
Response Type: Immediate response.
Response Format: *ACK* - 06H

Usage Details:

This command is typically used to by the host to keep track of a print job's progression.

A common use would be to send a complete print job, then send an *ESC ACK* command. The host can wait until an ACK is received back from the printer. When this occurs, the host knows that the previous print job is complete.

Another use would be on *Validation* mode. The host can send the ETB command to set the printer into validation mode, followed by the *ESC ACK.* When a Form is finally inserted, the printer will respond with an *ACK.* The host can use this information to properly pace the prompts given on a computer screen.

7.4 Send Feature Status.

Host Sends: *ESC ? n* - 1BH 3FH *n*
Printer Response: 1 Byte, 2 Bytes, 4 Bytes, or Multi-byte Sequence,.
Response Type: Processed.

Usage Details:

By specifying *n*, the host can obtain information on the following features:

n range	*Feature*
00H - 0FH	Printer Status Information
10H - 2FH	Printer Usage Information (Counters)
30H - 3FH	Printer Identification Information
41H - 6FH	Printer Features and Options
Others	Reserved

Printer Status: 00H < = *n* < = 0FH

Returns 2 bytes giving various information on the status of the printer.

n	*Status*	*Notes*
00H	Mechanism	See table below.
02H	Mechanism	See table below.
03H	Sensor	Factory use only.
04H	Microprocessor Pins 16-24	Factory use only.
05H	Microprocessor Pins 0-16	Factory use only.
Others	Reserved	

Feature: 00H or 02H = Mechanism Status.

Provides bit-mapped information on the current state of the printer mechanism. Two bytes of information are returned, Byte #1 first.

Byte #1: Print-head and Ink-Cartridge

Bit	*Function*	*Value* *0*	*1*
7 msb	0 - reserved		
6	0 - reserved		
5	0 - reserved		
4	Print-head jam	not jammed	jammed
3	Print-head docked	not docked	docked
2	Print-head at loading station	not loading sta.	at loading sta.
1	Ink-Cartridge empty	not empty	empty
0	Ink-Cartridge removed	installed	removed

Byte #2: Paper and Misc. Sensors

Bit	*Function*	*Value* *0*	*1*
7 msb	0 - reserved		
6	Paper loaded	paper out	loaded
5	Paper Top-of-Form Mark *(Reserved)*	not sensed	sensed
4	Paper in Presenter *(Reserved)*	not in presenter	in presenter
3	Paper feed fault	OK	fault
2	0 - reserved		
1	Door #2 Sensor *(Reserved)*	contact closed	contact open
0	Door #1 Sensor	contact closed	contact open

Printer Counters: 10H < = *n* < = 27H

These features and counters and are used to track printer usage. The available counters are shown below.

n	*Counter*	*Units*
10H	Resets	Times unit power cycled.
11H	Technician	Factory use only.
12H	Ink Cartridges	Number of Ink Cartridges used.
13H	Paper Rolls	Number of Paper Rolls used.
19H	Ink-Drops	Number of drops, current cartridge.
1AH	Paper Usage	Length of feeds (inches) ???
1BH	Validations	Number of forms validated.
1CH	Print-Head Dockings	Number of services of print-head.
1DH	Print Lines	Number of lines printed.
Others	Reserved	

Four bytes are returned. The least significant byte is send first. For example, if the counter for Ink-Drop holds 1,000,000, the bytes returned will be:

40H, 42H, 0FH, 00H

Printer Information Strings: 30H < = *n* < = 3FH

These features are used to identify the printer to the host. A string of information is returned in the format:

STX mn data ETX

STX	02H
m	LS Byte of COUNT
n	MS Byte of COUNT
data	data returned
ETX	03H

COUNT Number of bytes in data and ETX

The following information is available:

n	*Returns*	*Type*	*Type and Size (Max).*
30H	Model ID String	Alpha-Num	R 32
32H	Firmware Number and Revision	Alpha-Num	R 32
33H	Font File Name and Revision	Alpha-Num	R 32
34H	Boot Loader Name and Revision	Alpha-Num	R 32
35H	Setup Identification with Revision	Alpha-Num	R 32
36H	Manufacturer ID Number.	Numeric	R 3
37H	Manufacturer Name	Alpha-Num	R 32
38H	Factory ID Number.	Numeric	R 8
39H			
3AH	Temporary String #1	Alpha-Num	R/W 48
3BH			
3CH	User String #1	Alpha-Num	R/W 48
3DH	User String #2	Alpha-Num	R/W 48
3EH	Factory String	Alpha-Num	R/W 27
3FH			

Most strings are Read-Only and are indicated by an ‘R’ in the table above. Some strings are both Read and Write. The maximum size indicated does NOT include a string terminating NULL character. However, when writing strings, this NULL must be included. Numeric only strings must consist only of ascii numbers in the range ‘0’ to ‘9’ (30H to 39H).

For example, to request the Factory ID Number, send:

1BH 3FH 38H

and if the Factory ID is “12345678”, this is returned as:

20H 09H 00H 31H 32H 33H 34H 35H 36H 37H 38H 03H

Printer Configuration Bytes: 41H < = *n* < = 6FH

These features are used to configure various options. Most of the options are for factory use. One byte of information is returned.

n	*Item*	*Returns*
48H	Cfg #1	
49H	Cfg #2	
4AH	Cfg #3	
4BH	Cfg #4	
4CH	Cfg #5	Clamp delay time (units of 100ms). 0=disabled uses factory setting.
4DH	Cfg #6	
4EH	Cfg #7	
4FH	Cfg #8	
50H	Cfg #9	
51H	Cfg #10	
52H	Cfg #11	
53H	Cfg #12	
54H	Cfg #13	
55H	Cfg #14	
56H	Cfg #15	Setup Version
57H	Cfg #16	Setup Revision
58H	Opt #1	Printer Options
59H	Opt #2	
5AH	Opt #3	
5BH	Opt #4	
5CH	Opt #5	
5DH	Opt #6	
5EH	Opt #7	
5FH	Opt #8	
60H	Opt #9	Default Font, Journal.
61H	Opt #10	Default Font, Validation.
62H	Opt #11	Font Options
63H	Opt #12	Emulation Options
64H	Opt #13	MLValidation Options
65H	Opt #14	
66H	Opt #15	
67H	Opt #16	
68H	Cal #1	R2L Alignment, Current adjustment in dots for Journal Print. Signed value.
69H	Cal #2	R2L Alignment, Current adjustment in dots for Validation Print. Signed value.
6AH	Cal #3	
6BH	Cal #4	
6CH	Cal #5	
6DH	Cal $6	
6EH	Cal #7	
6FH	Cal #8	MLV Prefeed Calibration,. Current adjustment for prefeed steps in ML Validation. Signed value.

8 Interfacing Examples

To illustrate the various modes, this section presents examples. The following type-styles are used:

`Text`	- Text characters to be printed
ESC	- Control characters in symbol form, consult table for hex values
19H	- Control characters is hex form. Only 1 byte is send.
spaces	- Ignore spacing. Included for easy of reading only.
-Notes	- Notes

Example #1: Print 1 line

`This prints 1 line.` *CR*

`This prints 1 line and feeds 1 line.` *CR LF*

Example #2: Barcode Printing. Code-39

See the examples given in the specification of the ***ESC %*** command.

Example #3: Print, Cut, Eject Receipt.

`Receipt text, line #1.` *CR LF*	- print & feed
`Receipt text, line #2.` *CR LF*	- print & feed
`Receipt text, line #3.` *CR LF*	- print & feed
`Receipt text, line #4.` *CR LF*	- print & feed
VT	- feed into present & past cutter
ESC A	- full cut
ESC C	- eject receipt

Example #4: Multi-line Validation Print-job

ESC @	- soft initialize
ETB	- enter validation mode
`Validation text, line #1.` *CR LF*	- print & feed
`Validation text, line #2.` *CR LF*	- print & feed
`Validation text, line #3.` *CR LF*	- print & feed
`Validation text, line #4.` *CR LF*	- print & feed
FF	- eject form

Example #5: Inquiries

Host	*Printer*	*Meaning*
ENQ		
	62H	Printer Ready, No Form, Not awaiting Form
ENQ		
	63H	Printer Ready, Form Inserted, Not awaiting Form
ENQ		
	61H	Printer Not Ready, Form Inserted, Form needs removal or adjustment

Important Note: Printer responses are bit specific. Decode by bits, not values.

Example #6: Monitoring Cut-Form Validation

When validating Forms, it is often important for the applications program to monitor and control the flow at the printer. This is typically done to coordinate prompts on a computer terminal with the validation.

Method #1: Test for Form inserted before sending data.

Host	*Printer*	*Meaning*
ETB		
		Prompt Operator to insert cut-form Wait for cut-form insertion
ENQ		
	62H	Printer Ready, No Form
ENQ		
	63H	Printer Ready, Form Inserted
Send print data		
FF		Eject Form

Method #2: Send Validation command, wait for completion via *ESC ACK*

Host	*Printer*	*Meaning*
ETB		Prompt Operator to insert Form
ESC ACK		
		Wait for cut-form insertion
	ACK	ACK response after Form inserted.
Send print data		
FF		Eject Form

Method #3: Send print job, wait until completed.

Host	*Printer*	*Meaning*
ETB		Prompt Operator to insert Form
Send print data		
FF		Eject Form command
		Wait for print job to complete.
ENQ		
	23H	Buffer not empty, printing in progress...
- - -		Continue polling...
ENQ		
	62H	Buffer empty, printing complete...
		Print job complete.

Method #4: Send print job, wait until completed.

Host	*Printer*	*Meaning*
ETB		Prompt Operator to insert Form
Send print data		
FF		Eject Form command
		Wait for print job to complete.
ESC ACK		
		... Printing in progress ...
	ACK	Print job complete
		.

Method #5: Wait until printer idle, send new print-job.

Host	*Printer*	*Meaning*
		Wait for printer idle
ENQ		
	23H	Buffer not empty, command uncompleted...
- - -		Continue polling...
ENQ		
	62H	Buffer empty, prior printing complete.
ETB		Prompt Operator to insert Form
Send print data		
FF		Eject Form command

9 Control Codes and Character Set Tables

The following table lists potential control codes and their Hex values.

Control Code Table: 00H - 1FH

Code Symbol	*Ctrl Char*	*Hex Value*	*Code Symbol*	*Ctrl Char*	*Hex Value*
NUL	^@	00	*DLE*	^P	10
SOH	^A	01	*DC1*	^Q	11
STX	^B	02	*DC2*	^R	12
ETX	^C	03	*DC3*	^S	13
EOT	^D	04	*DC4*	^T	14
ENQ	^E	05	*NAK*	^U	15
ACK	^F	06	*SYN*	^V	16
BEL	^G	07	*ETB*	^W	17
BS	^H	08	*CAN*	^X	18
HT	^I	09	*EM*	^Y	19
LF	^J	0A	*SUB*	^Z	1A
VT	^K	0B	*ESC*	^[	1B
FF	^L	0C	*FS*	^\	1C
CR	^M	0D	*GS*	^]	1D
SO	^N	0E	*RS*	^^	1E
SI	^O	0F	*US*	^_	1F

ASCII Character Set: 20H - 7FH

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
20	sp	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
30	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
40	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
50	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
60	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
70	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	

Code Pages Supported:

- Code Page 850

10 Associated Features & Options

10.1 Cutter

The Cutter option is not presently available on this model.

10.2 Supplies Usage Counters

The printer uses counters to account for the supplies in use. Ink dots and paper use are tracked and current status is available via ESC ?n command.

When the usage or ink or paper approaches its expected life, it may be replaced on a preventative basis. If replaced, the host should clear the usage counter.

10.3 Cash Drawer Interface

A Cash Drawer Interface option is not presently available on this model.

11 Document Revision Information

Revision	*Date*	*Changes*
1	06-10-2008	Initial release.
2	08-20-2008	Corrections.
3	08-10-2009	Corrections to ESC >n command.