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## PROGRAMMER'S GUIDE

to the

**Ap1300**

**Thermal Printer**

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## **2 INTRODUCTION**

The Able Systems Ap1300 Battery Operated Thermal Printer shares a common controller IC (in which the main firmware resides), with several other Able Systems printers. This Programmer's Guide provides a full description of the software commands supported by this product when fitted with firmware Version 7.6.03. This firmware version is largely compatible with previous Ap800 series and Ap1200 series printers. Later versions will normally be 'backwards compatible' as far as possible. Refer to ASL for a comprehensive historical list of software changes, if required.

A User Guide, which contains connection data and details of operation, is available and should be read in conjunction with this document.

A wide range of software commands are supported, allowing control of printing format (e.g. width, height and spacing of text, underlining, text orientation etc.), as well as selection of modes of operation (e.g. support for the re-chargeable battery pack and sleep options, Serial Comms settings, Paper Out and Low indications and actions etc).

Many of the software commands are emulations of the EPSON TM-Series ESCPOS codes. Since the implementation of ESCPOS varies from one EPSON printer to another, there is no universal standard. The command set for the Ap1300 has primarily been based on that of the EPSON TM-T Series of thermal printers. Please refer to the acknowledgement and disclaimer.

### **2.1 NOTES ON PRINTER FIRMWARE REVISIONS (INCLUDING FLASH)**

Able Systems reserves the right to modify and improve the firmware in its printer products at any time. Whilst every effort is made to ensure backward compatibility, no guarantee in this respect is given or implied.

The Ap1300 includes a flash-reprogrammable microcontroller. This allows firmware upgrades under customer control. Refer to the factory for more information.

A proprietary Flash Programming Utility is available to aid the user in re-flashing printers. Also available is a Font Editor Utility, which allows the user to design and use bespoke fonts as required.

### **2.2 COPYRIGHT NOTICE AND DISCLAIMER**

Copyright subsists in all Able Systems intellectual property, including controller firmware (embedded software) and circuit diagrams, pin connection lists and application data. No warranty in respect of patent rights of Able Systems Limited or of third parties is given. Unauthorised reproduction or amendment of controller firmware may result in prosecution.

Design Registration of the Ap1300 printer has been applied for.

Fujitsu is a registered mark of its owner Fujitsu Limited. References to this or other owners' marks in this document are for illustrative purposes only.

Able Systems do not assume responsibility for interchangeable functionality of other parties' command sets.

### **3 MODES OF OPERATION**

Please refer to the User Guide for an overview of the modes of operation of the Ap1300, including waking, sleeping, idle mode and spool mode.

Some of the host-selectable features are retained during sleep mode by storage in non-volatile memory (FLASH), but the others are lost. This is clearly shown in the individual command descriptions below.

Operational status is indicated by factory-programmable colour combinations on the front-panel LED. These can indicate charger/battery status, buffer mode, paper status and so on. Refer to the User Guide for details.

#### **3.1 PAPER FEED BUTTON**

As the Ap1300 has no external power switch, additional functions have been assigned to the paper feed button.

- A single press and release of the button:
  - in idle or spooling mode, advances paper, also prints any partial line data from the buffer;
  - in sleep mode, wakes up the printer into idle mode.
- "Double-clicking" the button:
  - in idle mode, prints a demo/test message including the firmware version, encoded calibration data, and optionally the full character set and sample bar codes;
  - in spooling mode, prints any stored data and enters idle mode.

Double-clicking means pressing and releasing twice in quick succession, in a similar manner to a PC mouse.

Some functions of the paper feed button can be invoked or disabled by the host. The button is also disabled for 0.25 seconds after each data byte is received, to prevent the user from prematurely printing partial lines (Data from the host will generally be continuous).

### 3.2 PRINTING METHOD

The Fujitsu FHT printer mechanism in the Ap1300 has 384 horizontally-arranged elements, printing a single dot line across the full width of the paper at once. The paper is advanced past the print head by a rubber platen driven by a stepper motor. Typical print speed is 50 mm/s at a battery voltage of 6 Volts. Each printed dot is nominally 0.125 mm square. The paper may only be fed through the printer in the forward direction.

It is not possible to print partial lines in isolation: if such a line remains in the buffer, it will not be printed until flushed out by: a line terminator; some following data; a programmable timeout; or by the user pressing the paper feed button, if enabled. Once a partial line has been flushed out, it may not be extended. Any following data will be printed on the next line.

Character lines may be printed in single or double width, single or double height, and underlined. These three text mode attributes may be combined at will. If single and double height characters are mixed in a line, the bottom of the characters will be aligned.

### 3.3 BUILT-IN FONTS

The built-in font characters are formed according to the Font Mode:

Font Mode	Chars/Line	Character Height	Row Height
0	32	24 dots (3.00 mm)	30 dots (3.75 mm)
1	42	24 dots (3.00 mm)	30 dots (3.75 mm)
2	24	24 dots (3.00 mm)	30 dots (3.75 mm)
3	32	24 dots (3.00 mm)	24 dots (3.00 mm)

Font Mode 0 is the default factory setting. Character heights refer to the maximum spans of capital letters and descenders. Row heights refer to the interval from the top of one character row to the top of the next, including inter-row spacing. The row height may be adjusted if required.

In all the built-in Font Modes, the character set is the standard IBM® character set (also known as Code Page 437) which includes graphics box-drawing characters. These box-drawing characters are extended to link up in both axes where appropriate.

Certain special character substitutions are possible for particular applications (eg:- switching the '£' and '#' characters, or including the Nordic 'ø' & 'Ø' characters in place of the 'ç' & '¥' characters). See the section on SETTING INTERNAL CONFIGURATION INFORMATION for details.

The Font Mode is normally stored in non-volatile memory (FLASH). This means that the Ap1300 can be pre-configured to operate in 32, 42 or 24 Char/Line modes.

If required, Font Mode changes may be disabled. See the section on SETTING INTERNAL CONFIGURATION INFORMATION for details.

### 3.4 USER FONT

A single User Font may be programmed into the Ap1300 using the Flash Programming Utility. The format of the characters in the User Font is defined within the font itself.

When a User Font is present, the Built-In Fonts, and any character substitutions, are disabled. If the User Font is subsequently removed, then the Built-In Fonts are re-enabled automatically.

### 3.5 DOT ADDRESSABLE GRAPHICS

Several protocols for dot-addressable graphics data are supported:

- Eight (8) dot high graphics are aligned with the top of text characters. In these modes the dot patterns sent by the host may be doubled-up, tripled-up or quadrupled-up, both horizontally and vertically before printing. The dot size is nominally 0.25, 0.375 or 0.5 mm square.
- Twenty-four (24) dot high graphics are also aligned with the top of text characters, and are printed dot-for-bit as sent by the host. The nominal dot size is 0.125 mm square. Successive blocks can be vertically contiguous only if Font Mode 3 is selected.

Graphics may be combined with text printing as required. Large areas of solid dots are not recommended, as they may cause overheating and shorten the head life: try shading. Heavy graphics printing will also drain the battery more quickly.

### 3.6 SERIAL INTERFACE

The default serial interface format is 9,600 baud, 8 data bits, 1 or 2 stop bits, and no parity. Other formats can be programmed into the Ap1300 at the factory or in the field, from the host. A setup program, suitable for use with a PC, is available from Able Systems to simplify this process.

Serial data is expected on Rx in RS-232C format with -12V meaning 'mark' or logical '1', and +12V meaning 'space' or logical '0', with reference to the common ground. The serial data output line, Tx, transmits XON/XOFF and status information to the host at the same baud rate and format as the serial data input. The hardware busy line, Busy, is true (nominally -12V) when busy.

Some host equipment use a constant space condition (+12V) to indicate a reset condition or wait state. Some battery powered host equipment present the same output signal when they go to sleep. By default the Ap1300 will interpret this condition as a repetitive receive error, and will print multiple '?' characters to indicate the fault. If required, the printer may be set to ignore this condition.

### 3.7 DATA BUFFER AND FLOW CONTROL

The Ap1300 has a nominal 20k byte buffer which enables data to be received while previous lines are being printed. The state of the data buffer is transmitted to the host as follows:

XOFF	(13HEX)	sent when buffer fills to	3/4 full;
XON	(11HEX)	sent when buffer empties to	1/4 full; and also after a controller reset.

The hardware busy line is set when 256 bytes of space remains; and incoming data are no longer passed to the buffer (but may be processed) when 128 bytes remain. The hardware busy line goes ready again when 384 bytes become free. Note that the buffer can become filled with non-printable codes, in which case the controller will go busy.

It is not necessary to select hardware or software handshaking. Both are active at all times.

The printer always transmits an XON character when it has woken up and is ready to receive data. It always attempts to transmit an XOFF character to the host before going to sleep.

In the event of the battery becoming exhausted, the printer will automatically protect its own control circuitry by entering sleep mode if the instantaneous battery voltage drops below a threshold (e.g. during a particularly heavy section of print). In this event no XOFF character is transmitted.

### 3.8 IrDA AND BLUETOOTH WIRELESS INTERFACES (AP1300-IR AND AP1300-BT ONLY)

The wireless interfaces present in the Ap1300-IR and Ap1300-BT are virtually transparent emulations of a standard serial connection. In each case, complex link management protocols are employed to ensure the integrity of the data transport and handle link making and breaking. However, the 'payload' data required to control the printer is unaffected by the transport mechanism.

See the User Guide for more details on the protocols and profiles supported for each.

### 3.9 PAPER OUT AND HEAD UP SENSORS

A reflective optical Paper Out sensor within the mechanism detects an out-of-paper condition, and/or senses black marks to register with pre-printed forms. A mechanical Head Up sensor detects when the lid is open.

By default, the printer enters Spool mode automatically if either sensor becomes active. Spool mode is automatically exited, and any stored data printed, when new paper is loaded and the lid closed. This behaviour may be modified. See the section on SETTING INTERNAL CONFIGURATION INFORMATION for details.

The state of both sensors is reported in the STATUS BYTE. See the section on CODES TRANSMITTED BY THE Ap1300 for details.

## 4 CONTROL CODE TABLES

General Notes: All codes from 00 to 1F which are not listed below are ignored.

An ESC, GS etc code followed by an unrecognised command is ignored, but any following parameters are interpreted as normal characters. Any ESC, GS etc sequence which is described below but which has an illegal parameter is abandoned at that point. The controller will attempt to interpret subsequent characters as normal characters.

There is no need to follow ESC or GS control code strings with a line terminator. If one is added it will be interpreted as such.

Most control codes are executed when they fall through the data buffer at printing time. Some ("real time") codes are interpreted immediately on receipt, so that the printer can respond even if the buffer is full.

The settings defined in some commands, identified by N, may be stored in non-volatile memory [FLASH]. All settings are implemented as soon as they are interpreted, except for communication settings. Newly set values for the Baud rate, parity, data and stop bit parameters are not implemented until the printer has been cycled into sleep mode and back to waking mode.

### 4.1 COMMAND DESCRIPTION FORMAT

In the explanations that follow, commonly recognised labels have been used (eg LF, CR, FF, ESC); command parameters are given as equivalent ASCII characters (eg "J"); or as hexadecimal [hex] values (eg 4AH); or decimal numbers (eg 74 or n) which are single byte values. Dots (...) mean more parameters follow.

The command string descriptions are punctuated by commas [,] for clarity, though most versions of BASIC will use semi-colons [;]. However, these separators will not be transmitted by the host.

As an example, the command to select the underlined printing mode can be expressed in a number of ways, all of which are equivalent:

ESC, "!" ,n (as in the command description)  
27 , 33 ,128 (expressed as decimal character values)  
1BH,21H,80H (expressed as hex values)

n is a number, such that if expressed in binary, setting its most significant bit (bit 7) will select the underline mode.

This expression could be written into a BASIC program as:

```
10 PRINT#1,CHR$(27);"!Ç"; ...using ASCII characters, or as:  
10 PRINT#1,CHR$(27);CHR$(33);CHR$(128); ...using decimal values, or as:  
10 PRINT#1,CHR$(&H1B);CHR$(&H21);CHR$(&H80); ...which is equivalent, but using hex.
```

## 4.2 CODES RECEIVED BY THE Ap1300

The commands detailed below are listed in ascending ASCII code order.

To assist programmers in converting existing host software, a symbolic key to the compatibility of the codes interpreted by the Ap1300 has been adopted:

✓	Fully supported as in EPSON ESCPOS
✓+	Altered functionality compared with ESCPOS
@	ASL special code, no ESCPOS equivalent exists
N	Setting may be retained in non-volatile [FLASH] memory

<b>HTAB</b>	<b>09H</b>	<b>Horizontal Tab</b>	✓
Default positions: 8,16,24,32,40; 6 positions available; programmed using ESC,D command. Ignored if off the end of a line. The first HTAB does not move from a HTAB position to the next: e.g. <pre> 1234567890123456 123456 T          (1 Tab before "T") 1234567T         (1 Tab before "T") 1234567   T      (2 Tabs before "T") 12345678   T      (1 Tab before "T")           </pre>			

<b>LF</b>	<b>0AH</b>	<b>Line Feed</b>	✓
Works in an either/or way with CR: CR/LF pairs are treated as a single line terminator. Line terminators immediately following full lines are ignored.			

<b>FF</b>	<b>0CH</b>	<b>(Real time) Form Feed</b>	✓+
Exit spooling mode and print buffer contents. Ignored if the printer is not already in spooling mode or an error condition exists.			

<b>CR</b>	<b>0DH</b>	<b>Carriage Return</b>	@
Line terminator: works in an either/or way with LF. CR/LF pairs are treated as a single line terminator			

<b>CAN</b>	<b>18H</b>	<b>(Real time) Abort printing and initialise</b>	@
Same result as ESC,'@' but executed immediately when received. A line in progress is allowed to finish, but printing then continues from data received after the CAN code. Ignored if embedded in an ESC, GS or graphics sequence.			

<b>ESC," ",,..</b>	<b>1BH,20H,n</b>	<b>Set right-of-character spacing</b>	✓
n is the number of additional (note!) dot spaces placed to the right of each character printed. Default= 0; maximum value= 31. Setting is retained until cleared or the printer enters sleep mode.			

<b>ESC,"!",,..</b>	<b>1BH,21H,n</b>	<b>Select printing mode</b>	✓+N
The third byte n is interpreted as follows: bit 0 } Select Font Mode 0 to 3 bit 1 } (Mode 0 is factory setting) bit 4 Select(1)/Cancel(0) Double height mode bit 5 Select(1)/Cancel(0) Double width mode bit 7 Select(1)/Cancel(0) Underlined mode Bits 2, 3, and 6 are ignored. Each of these attributes remains in force until actively cancelled, or the printer enters sleep mode. The Font Mode only may be stored in non-volatile memory (FLASH) and retained through sleep mode. Some older host equipment may require the Font Mode Select bits to be disabled; See the ESC,"X",09H,n command for details of how to do this. Font Modes (0 to 3) cannot be mixed within a single print line: a new line results when the Font Mode is changed.			

<b>ESC,"\$",,..</b>	<b>1BH,24H,n1,n2</b>	<b>Set absolute print position</b>	✓+
Position = (n1 + 256*n2) dots from start of line. If printing is currently to the left of this position, blank space is inserted up to it. If it is to the right, then over-printing can occur, allowing special character combinations to be formed. Any overflow is cut off at end of line.			

<b>ESC,"*" ,..</b>	<b>1BH,2AH,m,n1,n2,d1...dk</b>	<b>Dot-Addressable (Bit) Graphics</b>	<b>✓+</b>
<p>Several modes of Dot Addressable Graphics are possible:  In all modes dot patterns are coded as 1= dot, 0= space, patterns are arranged in dot-columns, and the MSBit of each byte is printed at the top. The number of dot columns is given by <math>(n1 + 256 * n2)</math>.</p> <p>When the third byte, <math>m=0</math> or <math>2</math> (00H or 02H): <b>Doubled-up 8 dot graphics</b> [ <math>k = n1 + 256 * n2</math> ]  Each 8-dot vertical column is encoded as a single byte. Each dot is doubled in both axes to 0.25 mm square. Successive rows of 8-dot graphics cannot be printed contiguously in the vertical direction unless using a 16 dot high User Font.</p> <p>When the third byte, <math>m=3</math> (03H): <b>Tripled-up 8 dot graphics</b> [ <math>k = n1 + 256 * n2</math> ]  Each 8-dot vertical column is encoded as a single byte. Each dot is tripled in both axes to 0.375 mm square. Successive rows of 8-dot graphics can be printed contiguously in the vertical direction only in Font Mode 3 or a User Font which is 24 dots high.</p> <p>When the third byte, <math>m=4</math> (04H): <b>Quadrupled-up 8 dot graphics</b> [ <math>k = n1 + 256 * n2</math> ]  Each 8-dot vertical column is encoded as a single byte. Each dot is quadrupled in both axes to 0.5 mm square. Successive rows of 8-dot graphics can be printed contiguously in the vertical direction only in Font Modes 0, 1 or 2 or a User Font which is 32 dots high.</p> <p>When the third byte, <math>m=32</math> (20H): <b>Plain 24 dot graphics</b> [ <math>k = 3 \times (n1 + 256 * n2)</math> ]  Each 24-dot vertical column is encoded as three successive bytes. Bytes d1, d4, d7 etc are at the top of the 24-dot vertical columns. The printed graphic pattern is therefore represented by the byte numbers as follows:</p> <pre> d1 d4 d7 ... d(k-2) d2 d5 d8 ... d(k-1) d3 d6 d9 ... dk </pre> <p>Each dot is the mechanism dot size of 0.125 mm square. Significant features should be coded using at least 2 dots together. Successive rows of 24-dot graphics can be printed contiguously in the vertical direction only in Font Mode 3 or a User Font which is 24 dots high.</p> <p>If the print mechanism is allowed to stop between successive contiguous graphics patterns, slight discontinuities may occur due to mechanical hysteresis. Consider using spool mode to prevent this.</p> <p>Contact the factory for details of an alternative dot-line based graphics mode, if required.</p>			
<b>ESC,"-"..</b>	<b>1BH,2DH,n</b>	<b>Turn underline on/off</b>	<b>✓+</b>
If $n=0$ : Underlining is turned off; otherwise is turned on.			
<b>ESC,"2"</b>	<b>1BH,32H</b>	<b>Set default Row Height</b>	<b>✓</b>
Set default row height. I.e:-30 (0.125mm) dots in Font Mode 0,1 and 2; and 24 dots in Font Mode 3			
<b>ESC,"3",..</b>	<b>1BH,33H,n</b>	<b>Set Row Height</b>	<b>✓</b>
n is the row height. Allowed range: 20 to 100. Row height refers to the interval from the top of one character row to the top of the next, including inter-row spacing. This setting is retained until cleared, or the Font Mode is changed or the printer enters sleep mode			
<b>ESC,"@"</b>	<b>1BH,40H</b>	<b>Initialise printer</b>	<b>✓</b>
Clears print parameters to power-on default, ie normal width and height, no underline, no extra space, and default tabs. Does not affect the inverted mode. Not real-time, executed in data sequence (unlike CAN).			
<b>ESC,"D",..</b>	<b>1BH,44H,d1...dk,00</b>	<b>Set horizontal tab positions</b>	<b>✓+</b>
Up to 6 positions may be recorded, and replace the default settings. If more are given, the first 6 are accepted and normal processing resumes from that point. If less than 6 are given then the command should be terminated with a NUL(00H) character. Note that tab settings take variable character spacing into account. Setting is retained until cleared or the printer enters sleep mode.			
<b>ESC,"J",..</b>	<b>1BH,4AH,n</b>	<b>Print and feed extra paper</b>	<b>✓+</b>
n is the count of notional 1/20th print lines to be fed. This command terminates the current line; n is divided by 20 (remainder discarded) and the quotient used as a count of additional blank single-height character lines.			



### 4.3 BARCODE COMMANDS

<b>GS,"H",n</b>	<b>1DH,48H,n</b>	<b>Select automatic text in barcode</b>	✓												
<p>n is encoded so:</p> <table> <tr> <td>bit 0 cleared</td> <td>(0)</td> <td>No barcode text above barcode symbol (default)</td> </tr> <tr> <td>bit 0 set</td> <td>(1)</td> <td>Print barcode text above barcode symbol</td> </tr> <tr> <td>bit 1 cleared</td> <td>(0)</td> <td>No barcode text below barcode symbol (default)</td> </tr> <tr> <td>bit 1 set</td> <td>(1)</td> <td>Print barcode text below barcode symbol</td> </tr> </table> <p>This setting is retained and used for all subsequent barcodes, but is cleared to the default when the printer enters sleep mode</p>				bit 0 cleared	(0)	No barcode text above barcode symbol (default)	bit 0 set	(1)	Print barcode text above barcode symbol	bit 1 cleared	(0)	No barcode text below barcode symbol (default)	bit 1 set	(1)	Print barcode text below barcode symbol
bit 0 cleared	(0)	No barcode text above barcode symbol (default)													
bit 0 set	(1)	Print barcode text above barcode symbol													
bit 1 cleared	(0)	No barcode text below barcode symbol (default)													
bit 1 set	(1)	Print barcode text below barcode symbol													

<b>GS,"h",n</b>	<b>1DH,68H,n</b>	<b>Select height of barcode</b>	✓+
<p>Height of barcode = (n x 0.125mm) n is valid in the range 1 &lt;= n &lt;= 150.          Default value 100; a zero value is ignored; a value of 150 is used in place of values greater than 150. This setting is retained and used for all subsequent barcodes, but is cleared to the default when the printer enters sleep mode.</p>			

<b>GS,"k",...</b>	<b>1DH,6BH,m,d1..dk,0</b>	<b>Print barcode using data provided</b>	✓												
<p>N.B. This command must always be terminated with NUL.          The number and type of bytes of data varies with barcode type "m".          Valid m values:</p> <table> <tr> <td>0: UPC-A</td> <td>Numeric only ASCII data: supply 11 digits</td> </tr> <tr> <td>1: UPC-E</td> <td>Numeric only ASCII data: supply 6 digits</td> </tr> <tr> <td>2: EAN-13</td> <td>Numeric only ASCII data: supply 12 digits</td> </tr> <tr> <td>3: EAN-8</td> <td>Numeric only ASCII data: supply 7 digits</td> </tr> <tr> <td>4: Code 39</td> <td>Alphanumeric ASCII data: variable length (Maximum 22)</td> </tr> <tr> <td>5: Int2 of 5</td> <td>Numeric only ASCII data: variable length (Maximum 23)</td> </tr> </table> <p>Note that the user should verify that a given barcode will fit on the paper, especially when using the variable length barcodes. Barcodes may not be mixed with normal text.</p>				0: UPC-A	Numeric only ASCII data: supply 11 digits	1: UPC-E	Numeric only ASCII data: supply 6 digits	2: EAN-13	Numeric only ASCII data: supply 12 digits	3: EAN-8	Numeric only ASCII data: supply 7 digits	4: Code 39	Alphanumeric ASCII data: variable length (Maximum 22)	5: Int2 of 5	Numeric only ASCII data: variable length (Maximum 23)
0: UPC-A	Numeric only ASCII data: supply 11 digits														
1: UPC-E	Numeric only ASCII data: supply 6 digits														
2: EAN-13	Numeric only ASCII data: supply 12 digits														
3: EAN-8	Numeric only ASCII data: supply 7 digits														
4: Code 39	Alphanumeric ASCII data: variable length (Maximum 22)														
5: Int2 of 5	Numeric only ASCII data: variable length (Maximum 23)														

<b>GS,"w",n</b>	<b>1DH,77H,n</b>	<b>Select width of barcode</b>	✓
<p>Width of barcode element (narrow bar) = (n x 0.125mm)          n is valid in the range 2 &lt;= n &lt;= 4. Other values are ignored; Default value is 3.          This setting is retained and used for all subsequent barcodes, but is cleared to the default when the printer enters sleep mode. Note that the user should verify that a given barcode will fit on the paper, especially when using the variable length barcodes.</p>			

### 4.4 MARK SENSE OPERATION

Please refer to the factory for more detailed information before using the Mark Sense functions of the Ap1300.

### 4.5 RESERVED COMMANDS

In general, commands which are not implemented and described above should not be sent to the Ap1300, as the outcome may not be as expected. However, some additional EPSON ESCPOS commands are recognised, and an attempt is made to decode them, so that following commands will remain in synchronism and correctly interpreted. Please refer to Able Systems in case of difficulty.

#### 4.6 CODES TRANSMITTED BY THE Ap1300

The Ap1300 automatically transmits XON and XOFF bytes when the buffer status changes, as follows:

<b>XON</b>	<b>11H</b>	<b>Start transmission</b>	
Meaning: The buffer is ready to receive data. Transmitted after a reset, or when the data buffer empties to only 1/4 full.			

<b>XOFF</b>	<b>13H</b>	<b>Stop transmission</b>	
Meaning: The buffer is not ready to receive data. Transmitted when the data buffer becomes 3/4 full, or before a controlled entry into sleep mode.			

In addition the Ap1300 can transmit a special STATUS byte, either on request, or optionally when individual status conditions change state:

The commands ESC,"u",n and ESC,"v" request the STATUS byte be transmitted at the time that the command is interpreted. (N.B. The buffer is never reported as empty when these commands are used, as it contains at least this command at the time of transmission).

The command GS,ENQ requests the STATUS byte be transmitted immediately on receipt of the command, even if the buffer contains large amounts of data yet to be interpreted and/or printed.

The GS,"a",n command specifies individual bits of the STATUS byte which should be monitored, and result in the STATUS byte being automatically transmitted if a change of state is detected.

<b>[STATUS]</b>		<b>Status Report</b>	
The STATUS byte is encoded bitwise:			
bit 0 Head Up Sensor Active?		[0= head OK    1= head up    ]	
bit 1 Mechanism running		[0= stopped    1= running    ]	
bit 2 Data buffer completely empty?		[0= not empty    1= empty    ]	
bit 3 Paper Out Sensor Active?		[0= paper OK    1= paper out    ]	
bit 4 Reserved		[       Always 0       ]	
bit 5 Spooling mode?		[0= normal    1= spooling    ]	
bit 6 Error		[0= no error    1= error present]	
bit 7 Always Set		[       Always 1       ]	

The command GS,"l",n is also a request for information to be transmitted at the time that the command is interpreted (i.e. not in 'real-time'). For details of the valid values for n, and the resultant transmitted information see the QUERYING INTERNAL CONFIGURATION INFORMATION section below.

If an error condition exists, then the usual single STATUS byte is followed by a second error identification byte. This second byte is only sent if bit6 of the STATUS byte is set. The values of the error ID byte are as follows:

Value	Error type
80H	Mechanism Voltage (Vmech) above upper limit
7FH	Mechanism Voltage (Vmech) below lower limit
40H	Mechanism Head Temperature above upper limit

Other values are either not defined or represent internal controller hardware errors.

## 5 SETTINGS AND CONFIGURATION

The Ap1300 maintains a large number of internal settings and configuration information which is not derived from ESCPOS control codes, and is unique to ASL printers.

In general, the ESC,"X",m,... command is used to set these values, and the GS,"I",m command is used to query them. The following table details all valid combinations of these commands:

**(N.B. See the section SAVING CONFIGURATION INFORMATION).**

ESC,"X",m,...			GS,"I",m		
m			m		
4	eg "9600,N,8,2"	Set Baud	3	n1,n2	Report Firmware Version Number
9	n1	Set Internal Defaults	4	eg " 9600,N,8,2",CR	Report Baud Setting
11	n1,n2	Set Sleep Period	6	eg "SerialNo",CR	Report Unit Serial Number
15			9	n1,n2,n3	Report Internal Defaults
18	n1..n18	Set LED patterns	11	n1,n2	Report Sleep Period
19	n1	Set MT102FLAGS	15	n1,n2,n3	Report Voltage/Temp Data
20	n1,n2	Set MarkFeed / EjectFeed	18	n1..n18	Report LED patterns
23	n1	Set AUXFLAGS	19	n1	Report MT102FLAGS
33	n1	Set MaxDotsAtOnce	20	n1,n2	Report MarkFeed / EjectFeed
42	n1	Set EjectOffset	23	n1	Report AUXFLAGS
48	n1	Save all settings to Flash	33	n1	Report MaxDotsAtOnce
50	n1,n2	Set Spool Sleep Period	42	n1	Report EjectOffset
52	n1,n2	Set Auto-Save Period	50	n1,n2	Report Spool Sleep Period
			52	n1,n2	Set Auto-Save Period

### 5.1 SETTING CONFIGURATION INFORMATION

**N.B. This section contains details of how to modify some of the basic operating functions of the printer. Do NOT attempt to modify any parameter unless you fully understand the potential consequences.**

The command ESC,"X",m,... may be used to set various internal configuration values according to the value of m as defined below.

m=4 Select Baud rate, parity, word length and number of stop bits. (Default: "9600,N,8,1")

Command parameters must have format: e.g."19200,E,7,2", so:

4 or 5 number characters, [the required Baud rate]  
 1 comma character  
 1 "N/n/E/e/O/o" letter character, [the required Parity]  
 1 comma character  
 1 "7/8" number character, [the required Data bits]  
 1 comma character  
 1 "1/2" number character [the required Stop bits]

e.g. To select 19200,E,7,2 the following 14 byte command should be sent:

ESC,"X",04H,"19200,E,7,2"

or as hex codes: 1BH,58H,04H,31H,39H,32H,30H,30H,2CH,45H,2CH,37H,2CH,32H

Valid Baud rates are: 1200, 2400, 4800, 9600, 19200, 38400 and 57600.

Valid Parity settings are: None (N), Even (E) and Odd (O).

The number of Data Bits may be 7 or 8. The number of Stop Bits may be 1 or 2.

The setting must saved to non-volatile memory (FLASH), and does not come into effect until after the next sleep/waking mode transition.

m=9 Set Internal Default Values.

The command ESC,"X",09H,n sets the internal default values according to individual bits in the value of n. In each case, a bit set(1) means the following statement is true:

Bit 0 Default to inverted print mode  
 Bit 1 Disable FontMode bits (0&1) of ESC,"I",n command  
 Bit 2 Suppress "?" printing on RX error  
 Bit 3 [Unassigned]  
 Bit 4 Enable Split dots printing (See MaxDotAtOnce [m=33] for details)  
 Bit 5 [Unassigned]  
 Bit 6 Disable printing of partial data in buffer before going to sleep  
 Bit 7 [Unassigned]

Note: the setting of bit 0 does not come into effect until after the next sleep/waking mode transition.

m=11 Set auto-sleep timeout period. (or request sleep mode immediately).  
The command ESC,"X",0BH,n1,n2 sets the period of inactivity before the printer automatically enters sleep mode.  
The following two bytes define the period in seconds (n1+ 256\*n2). For example, the string 1BH,58H,0BH,84H,03H sets a period of 15 minutes [(132+ 256\*3) = 900 seconds].  
The printer will normally print any buffer contents before entering sleep mode, but this can be disabled. A value of 65535 (n1=n2=255) disables the auto-sleep feature; a value of zero (n1=n2=0) leaves the stored setting intact, but enters sleep mode immediately. The printer will never enter the sleep mode while a charger is connected. When in spooling mode, a different sleep period setting is used (See Spool Sleep Period [m=50] for details).

m=18 Set LED patterns.  
The standard pattern set displayed by the Ap1300 has been worked out with a great deal of care to provide the maximum useful information while remaining clear and unambiguous. However they may be modified if required. Please refer to ASL for details.

m=19 Set MT102FLAGS value.  
The command ESC,"X",13H,n sets the internal values according to individual bits in the value of n. In each case, a bit set(1) means the following statement is true:

- Bit 0 [Must be set to enable paper out optical sensor]
- Bit 1 Enable Mark Sense Operation
- Bit 2 Sense Mark at Black->White or White->Black Edge
- Bit 3 [Unassigned]
- Bit 4 [Unassigned]
- Bit 5 Led Pattern Dependent on Paper Out Sensor
- Bit 6 [Must be set to enable head up sensor]
- Bit 7 Led Pattern Dependent on Head Up Sensor

The standard setting for this value is: E1H for the Ap1300.

m=20 Set MarkFeed and EjectFeed values.  
The command ESC,"X",14H,n1,n2 sets the values of MarkFeed and EjectFeed. These parameters are used in Mark Sense operation. See MARK SENSE OPERATION section for details.

m=23 Set AUXFLAGS value.  
The command ESC,"X",17H,n sets the internal values according to individual bits in the value of n. In each case, a bit set(1) means the following statement is true:

- Bit 0 Select Short Demo Print
- Bit 1 Select swapping '#' (23H) and '£' (9CH) chars
- Bit 2 Select switching in Nordic 'ø' & 'Ø' chars in place of 'ç' (9BH) & '¥' (9DH)
- Bit 3 Select original CP437 character 'Ç' in place of new standard '€' (80H)
- Bit 4 Select Busy to go active when Paper Out condition seen
- Bit 5 [Unassigned]
- Bit 6 [Unassigned]
- Bit 7 [Unassigned]

m=33 Set MaxDotsAtOnce value.  
The command ESC,"X",21H,n sets the value of MaxDotsAtOnce. This value controls the operation of the printing process to limit the maximum instantaneous current that may be drawn from the battery (or power supply).  
Valid values are in the range 01H to 30H. This value equates to the number of dots that may be energised divided by eight. 01H represents the lowest current draw (i.e. only 8 dots may be energised at a time), and 30H represents maximum peak current draw (i.e. all dots are allowed to be energised simultaneously).  
The Ap1300 automatically slows the paper feeding to allow all the dots to be printed. Therefore, reducing the value of MaxDotsAtOnce also reduces the overall print speed.

The default value for the Ap1300 is 08H. Refer to the factory if more information is required. N.B. This value is disabled, and no splitting occurs, if bit4 of Internal Defaults (m=9) is clear.

m=42 Set EjectOffset value.  
The command ESC,"X",2AH,n sets the value of EjectOffset. This parameter is used in Mark Sense operation. See MARK SENSE OPERATION section for details.

**m=48** Save all settings to Flash.  
The command ESC,"X",30H,n forces an immediate save of all the configuration settings to flash. This takes less than a second, but the printer goes busy during the process.

m=50 Set auto-sleep timeout period for when Spooling mode is active.  
The command ESC,"X",32H,n1,n2 has the same format as the (m=11) command. By default the sleep period when in Spooling Mode is set to 300 seconds (5 minutes).

m=52 Set Auto-Save-to-Flash Period.  
The command ESC,"X",34H,n1,n2 has the same format as the (m=11) command. By default the Auto-Save-to-Flash function is disabled.

## 5.2 SAVING CONFIGURATION INFORMATION

All configuration information must be saved to Flash if it is to be non-volatile. Ideally, this should be performed manually by sending the command ESC,"X",30H (see above).

Before executing a controlled transition to sleep mode, the printer will save any new configuration information.

Alternatively, the printer maintains a special timer which will perform an automatic save of the configuration information after a pre-set period of inactivity. This period is normally disabled, but may be enabled by sending the ESC,"X",44H,n1,n2 command.

Note that during the saving procedure the printer effectively performs a full reset. Therefore, it is advised that the save command be issued in isolation (i.e. not embedded in a stream of printable data).

### 5.3 QUERYING CONFIGURATION INFORMATION

In general, for each ESC,"X",m,.. command, the corresponding GS,"I",m command may be used to query the current value. In some cases the information reported is different from the value(s) set.

m=3 Report Firmware Version.

In response to the command GS,"I",03H the Ap1300 transmits 2 packed BCD bytes. The first byte contains the major and minor version, and the second byte contains the revision number. eg:- 12H and 34H means Version 1.2.34

m=4 Report Baud rate, parity, word length and number of stop bits.

In response to the command GS,"I",04H the Ap1300 transmits a string of ASCII characters in the same format as used in the ESC,"X",04H,... command. eg:- "19200,E,7,2"

m=6 Report Unit Serial Number.

In response to the command GS,"I",06H the Ap1300 transmits a string of up to 10 ASCII characters terminated by a CR character. eg:- "123456",CR  
This is the Unit Serial Number as set by the factory during printer test/setup.

m=9 Report Internal Defaults.

In response to the command GS,"I",09H the Ap1300 transmits 3 bytes. The first byte contains the current values of the flags set using the ESC,"X",09H,n command. The following 2 bytes are for ASL diagnostics only.

m=11 Report Auto-Sleep Timeout Period.

In response to the command GS,"I",0BH the Ap1300 transmits 2 bytes which form a 16 bit value: (n1 + 256\*n2).

m=15 Report Real-Time Voltage and Temperature Values.

In response to the command GS,"I",0FH the Ap1300 transmits 3 bytes.

n1 = Battery Voltage x 10 [ eg:- 43H means 6.7V ]

n2 = Printhead temperature in °C [ eg:- 14H means 20°C ]

n3 is a coded byte: bit 0 Charger is present

bit 1 Reserved

bit 2 Battery voltage is low (normally indicated by Red LED)

m=18 Report LED patterns.

Please refer to ASL for details if required.

m=19 Report MT102FLAGS value.

m=20 Report MarkFeed and EjectFeed values.

m=23 Report AUXFLAGS value.

m=33 Report MaxDotsAtOnce value.

m=42 Report EjectOffset value

m=50 Report Spooling Mode Sleep Period value

m=52 Report Auto-Save Period value

In response to each of the above commands (in the form GS,"I",m), the Ap1300 transmits the current values of the parameters set using the corresponding ESC,"X",13H,m command.

## 6 COMMAND SUMMARIES

### 6.1 SUMMARY OF PRINT FORMAT COMMANDS AND VOLATILE SETTINGS

Function	Command
Clear Print Settings and Buffer (Select single width, single height, no underlining, no extra inter-character space, and default HTAB positions)	ESC,"@" CAN (real-time)
Font Mode, Double Height, Double Width, Underlining	ESC,"!",n
Underlining only	ESC,"-",n
Inverted Print Mode	ESC,"{",n
Print positioning	HTAB ESC,"\$",n1,n2 ESC,"\",n1,n2
Line termination (and Paper Feed)	LF CR ESC,"J",n ESC,"d",n
Dot Addressable (Bit) Graphics	ESC,"*",..
Entering and exiting Spooling Mode	ESC,"L" FF
Extra inter-character and inter-line spacing	ESC," ",n ESC,"2" ESC,"3",n
Set HTAB positions	ESC,"D",..
Request Printer STATUS BYTE	ESC,"u",n ESC,"v" GS,ENQ (real-time)
Select Barcode Size and Format	GS,"H",n GS,"h",n GS,"w",n
Print Barcode	GS,"k",..

### 6.2 SUMMARY OF REAL TIME STATUS INFORMATION

Information	How reported		
Mechanism Status	GS,ENQ	STATUS BYTE bit 1 (Set = Mech is Active)	+
Data Buffer Status	GS,ENQ	STATUS BYTE bit 2 (Set = Buffer is Empty)	+
Paper Out Status	GS,ENQ	STATUS BYTE bit 3 (Set = Paper is Out)	+
Spool Mode Status	GS,ENQ	STATUS BYTE bit 5 (Set = In Spool Mode)	+
Real Time Battery Voltage	GS,"I",15	Also In Self Test	+
Charger Status	GS,"I",15	Also In Self Test	+

### 6.3 SUMMARY OF NON-VOLATILE SETTINGS

Setting	How set	How reported		
Firmware Version No.		GS,"I",3	Also In Self Test	+
Unit Serial No.		GS,"I",6	Also In Self Test	+
Save all configuration to Flash	ESC,"X",48			+
Auto-Save config to Flash (Period)	ESC,"X",52..	GS,"I",52		
Baud Rate, Parity etc	ESC,"X",4..	GS,"I",4	Also In Self Test	+
LED patterns & Flash Period	ESC,"X",18..	GS,"I",18		+
Sleep Period	ESC,"X",11..	GS,"I",11	Also In Self Test	+
Sleep Period (In Spool Mode)	ESC,"X",50..	GS,"I",50	Also In Self Test	
Default to Inverted Print	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	+
Short Demo Message	ESC,"X",23..		Coded In Self Test	+
Suppress "?" on Rx Error	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	+
Split dots Printing (enable)	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	+
Split dots Printing (actual value)	ESC,"X",33..	GS,"I",33	Also Coded In Self Test	+
Sleep without Buffer Purge	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	+
Disable Feed Switch	ESC,"c5"..		Coded In Self Test	+
Disable Demo Mode	ESC,"c5"..		Coded In Self Test	+
Swap '#' (23H) <-> '£' (9CH) chars	ESC,"X",23,n	GS,"I",23		+
Use 'ø' & 'Ø' <-> 'ç' (9BH) & '¥' (9DH)	ESC,"X",23,n	GS,"I",23		+
Use 'Ç' <-> '€' (80H)	ESC,"X",23,n	GS,"I",23		+
Enable Black Mark Operation	ESC,"X",19..	GS,"I",19	Also Coded In Self Test	+
Black Mark parameters (detail)	ESC,"X",20..	GS,"I",20		
Black Mark parameters (more detail)	ESC,"X",42..	GS,"I",42		
Paper Out -> LED Pattern	ESC,"X",19..	GS,"I",19	Also Coded In Self Test	+
Head Up -> LED Pattern	ESC,"X",19..	GS,"I",19	Also Coded In Self Test	+
Select Busy on Paper Out condition	ESC,"X",23,n	GS,"I",23		
Font Mode	ESC,"I",n		Also Coded In Self Test	+
Disable FontMode changes	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	+
Disable FontMode->FLASH	ESC,"X",9..	GS,"I",9	Also Coded In Self Test	
AUTO_STATUS settings	GS,"a"..			

Note: + Indicates setting supported by the Ap8612 Setup Program

A setup program is available, in both QBasic source code format ("Ap8612.BAS") and executable format ("Ap8612.EXE"). This program is suitable for use on any IBM PC or compatible, and when connected to an Ap1300 with a suitable cable, gives easy access to the settings marked (+) in the tables above. The source code of this program may be freely copied, adapted or directly incorporated into host application system software if this eases implementation of the printer.

Please refer to Able Systems or visit our website at [www.able-systems.com](http://www.able-systems.com) for more information.

You are always welcome to contact Able Systems or your local supplier for specific assistance. We would also appreciate reports of any errors in our documentation, or suggested improvements.

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