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PROGRAMMERS GUIDE to the

Ap1300

Ap863-F

Ap1200

Thermal Printers

(Also covers the ATB102 and ATB1200 OEM controller PCBs)

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2 INTRODUCTION

This Programmers Guide provides a full description of the software commands supported by the:

- Ap1300 Battery Operated Portable Packaged Printer
- Ap863-F Packaged Printer with various power options,
- Ap1200 Panel Mounting Packaged Printer

It also contains some specific information relating to the:

- ATB102 OEM Printer interface for the EPSON M-T102 (& M-T102A)
- ATB1200 OEM Printer interface for the APS ELM205 mechanism

Each of these products shares a common controller IC (in which the firmware resides), although the specific firmware version may be different.

The firmware in all these products is largely compatible across the range, and also with earlier versions of printers (e.g.: Ap824, Ap842, Ap824-B, Ap842-B, Ap860-B, Ap862-B, Ap863).

A User Guide, which contains connection data and details of operation, is available for each product and should be read in conjunction with this document. Please see individual User Guides for more specific details of each product.

Throughout this Programmers Guide the term "Printer" should be taken to refer to all products where no distinction is necessary from the point of view of the system programmer.

If individual products differ in some important aspect, then this is noted.

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 re-chargeable battery packs and sleep options, Serial Comms settings, Paper Out, Paper Low and Head Up 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 these products 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 products at any time. Whilst every effort is made to ensure backward compatibility, no guarantee in this respect is given or implied.

These products include a flash-reprogrammable microcontroller (excluding the ATB102). This allows firmware upgrades under customer control. 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. User created or modified fonts may be flashed into the printer using the same Flash Programming Utility.

Refer to the factory for more information on these features.

Some host-selectable features may be retained during sleep mode by saving them to non-volatile memory (FLASH). The user must ensure that any changes to the printer's internal parameters are saved to flash memory, either manually or by timed auto-save. Refer to section 5.2 SAVING CONFIGURATION INFORMATION for more details.

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.

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, including waking, sleeping, idle mode and spool mode (where applicable).

Some of the host-selectable features may be 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. The user must ensure that any changes to the printers internal parameters are saved to non-volatile memory (FLASH), either manually or by timed auto-save.

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

No external power switch is fitted, so 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 (Ap1300 and Ap863-F only).
- "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

Each printer mechanism 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. This character set has been modified (except in the ATB102) to include the Euro symbol ('€') at position 80H (128 Decimal), in place of the usual capital C with cedilla ('Ç'). Also, 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 printer 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

N.B. The User Font facility is not available for the ATB102.

A single User Font may be programmed 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 printer 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 printer 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 printer 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.

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

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, PAPER LOW AND HEAD UP SENSORS

The sensors present in each product are shown below:

Product	Mechanism	Paper Out	Paper Low	Head Up	Auto-Spool
Ap1300	FTP-628MCL103	✓		✓	By default
Ap863-F	M-T102	✓	✓		Selectable
Ap1200	ELM205	✓			Selectable
ATB102	M-T102	✓		✓	Selectable
ATB1200	ELM205	✓			Selectable

In all the products 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. In the Ap863-F only, a mechanical switch with optical sensing Paper Low indication provides a 'near-end' paper alert. In the Ap1300 and the ATB102 only, a mechanical Head Up sensor detects when the lid is open.

The printer can be set to enter Spool mode automatically when the sensors become active. When selected, Spool mode can be automatically exited, when the problem is cleared. This behaviour may be modified. See the section on SETTING INTERNAL CONFIGURATION INFORMATION for details.

The state of the sensors is reported in the STATUS BYTE.

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

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 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

HTAB	09H	Horizontal Tab	✓
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. 1234567890123456 123456 T (1 Tab before "T") 1234567T (1 Tab before "T") 1234567 T (2 Tabs before "T") 12345678 T (1 Tab before "T")			

LF	0AH	Line Feed	✓
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.			

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

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

CAN	18H	(Real time) Abort printing and initialise	@
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.			

ESC," ",,..	1BH,20H,n	Set right-of-character spacing	✓
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.			

ESC,"!",,..	1BH,21H,n	Select printing mode	✓+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.			

ESC,"\$",,..	1BH,24H,n1,n2	Set absolute print position	✓+
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.			

4.3 BARCODE COMMANDS

GS,"H",n	1DH,48H,n	Select automatic text in barcode	✓												
<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													

GS,"h",n	1DH,68H,n	Select height of barcode	✓+
<p>Height of barcode = (n x 0.125mm) n is valid in the range 1 <= n <= 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>			

GS,"k",..	1DH,6BH,m,d1..dk,0	Print barcode using data provided	✓												
<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)														

GS,"w",n	1DH,77H,n	Select width of barcode	✓
<p>Width of barcode element (narrow bar) = (n x 0.125mm) n is valid in the range 2 <= n <= 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 CUTTER CONTROL COMMANDS (ATB102 DRIVING M-T102A ONLY)

The ATB102 has two additional commands for control of the cutter (when driving the M-T102A only):

ESC,"i"	1BH,69H	Execute a Full Cut	✓
Perform a full cut.			

ESC,"m"	1BH,6DH	Execute a Partial Cut	✓
Perform a partial cut.			

4.5 MARK SENSE OPERATION

Please refer to the factory for more detailed information before using the Mark Sense feature.

4.6 RESERVED COMMANDS

In general, commands which are not implemented and described above should not be sent to the printer, 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.

4.7 CODES TRANSMITTED

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

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

XOFF	13H	Stop transmission	
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 printer 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.

[STATUS]		Status Report	
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		[]	
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
07H	Cutter Blade stuck out - probably jammed (ATB102 only)
06H	Cutter Blade stuck in or no cutter found (ATB102 only)

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

N.B. The ATB102 (only) differs in the use of bits 0 and 3 of the STATUS byte. It reports the "Paper Out" status via bit 0. It also provides for an additional "Head Up" input which is reported via bit 3.

5 SETTINGS AND CONFIGURATION

The printer 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	Report 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 MaxDotsAtOnce [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).
The direct powered products (Ap1200, ATB102 and ATB1200) cannot enter sleep mode, but this timeout period can be used to initiate an auto-purge of the buffer if required.

m=18 Set LED patterns.
The standard pattern set displayed by the printer 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 'ø' (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 printer 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 (See below for more details).

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 automatically saves any changes to the 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 automatic timed save 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 system 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 printer 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 printer 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 printer 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 printer 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 printer transmits 2 bytes which form a 16 bit timeout value in seconds: $(n1 + 256*n2)$.

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

In response to the command GS,"I",0FH the printer 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 printer transmits the current values of the parameters set using the corresponding ESC,"X",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",..
Cutter Control (ATB102 with M-T102A only)	ESC,"i" ESC,"m"

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 & LED 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 (MaxDotsAtOnce)	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' <-> 'ø' (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	+
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 a printer 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 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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