

Able Systems Limited Northwich, Cheshire, England www.able-systems.com

USER GUIDE

to the

ABLE SYSTEMS ATB1200

and the

APS ELM205-ST

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1 INTRODUCTION

This document is a User Guide, written for the person connecting and using the Able Systems ATB1200 printer controller PCB. Please read this Guide carefully before making any connection.

The ATB1200 is designed for use with the APS ELM205-ST Easy Load Fixed Head Thermal (FHT) printer mechanism, which delivers low noise, high speed and high quality print as well as an integral paper-out/head-open sensor. While this document should provide enough information for most system integrators, a separate Technical Reference document for the mechanism is available if more in-depth information is required.

The microcontroller at the heart of the ATB1200 is the same one as found in the Ap1200 Panel Mounted printer and Ap863 Hand Held printer. The host programming control codes are virtually identical for these products, and are detailed in a separate Programmers Guide which covers all of these products.

1.1 FIRMWARE VERSIONS, COMPATIBILITY AND UPGRADES

The ATB1200 is currently supplied with V7.2.02 firmware fitted. Able Systems reserves the right to continually improve and refine the firmware and to supply units with amended firmware in future. Whilst every effort is made to assure compatibility and inter-operability, both forwards and backwards within a product range, as well as across Able Systems' range of printer products, no guarantee is given or implied in this respect.

The controller in the ATB1200 is flash based, and the firmware may be upgraded without replacing hardware. Currently PCBs must be returned to the factory for firmware changes, but field upgrades will be introduced in due course.

1.2 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.

APS is a registered mark of its owner Advanced Printing Systems LTD. 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.

2 PHYSICAL DIMENSIONS AND MOUNTING

2.1 ATB1200 DIMENSIONS

The ATB1200 PCB is nominally 93 x 47.6 mm, with two \emptyset 4.5 mm mounting holes, each with \emptyset 7.6 mm clearance from any components or electrical tracks on the PCB.



Figure 1 - ATB1200 Dimensional Diagram

N.B. Components shown in Figure 1 are for illustrative purposes only. For a full layout diagram please see "*Appendix 1 - ATB1200 Layout Diagram*" on page 14.

2.2 ATB1200 & ELM205-ST RELATIVE LOCATIONS

The ATB1200 is designed to be mounted directly below the ELM205-ST and to connect directly to the mechanism FPC (Flexi Printed Circuit) as shown in Figure 2 below. See "Section 3.7 - J3 Pinouts (ELM205-ST Connector)" on page 7 for information on the pinout.



Figure 2 - ATB1200 and ELM205-ST Configuration Diagram

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2.3 ELM205-ST HOUSING DESIGN

Reproduced below is an extract from the APS ELM205 Technical Reference (the drawing referred to is included in this user guide as "*Appendix 1 - ELM205-ST Dimension Drawing*" on page 15):

Designing the Door

The function of the door is to bring the rubber roller to the chassis' window entrance and to make it follow the external path of the chassis' window.

Given the shape of the chassis and the example in the mechanical drawing section (See attached drawing), the cover is fairly easy to design.

In order to keep a good alignment, it is strongly advised to keep the rubber roller fully floating inside the cover to compensate any tolerance problem inside the cover.

Moreover this play must be present in order to allow the rubber roller to follow the shape of the chassis.

The Easy Door Opening System

Because the rubber roller is only referenced to the chassis and has no dependence on the cover, the mechanism is very reliable. To achieve this reliability, the rubber roller must be strongly locked inside the chassis.

To avoid any twist, and mechanical stress on the cover and more generally on the customer plastic, so increasing the reliability and quality, APS developed a unique and patented feature to ease the opening of the door, that makes the mechanism very easy to open, and does not require any access to the cover's sides, giving more flexibility and ergonomics to the customer design.

This is achieved by clipping an internal lever inside the cover, that pushes symmetrically on both sides of the mechanism. So the mechanism's shape has been optimized to concentrate the effort locally and always refer this effort to the chassis.

Doing so there is no need to have access to the cover side, giving more freedom to design the cover, and allowing to reduce the width of the unit.

Please contact APS to obtain the *application notes* and for any assistance in designing the lever.

For assistance in designing the enclosure, the door, or the opening lever for use with the ELM205-ST, please contact Able Systems first. If necessary we will gladly refer any particularly complex requirement through to APS.

3 EXTERNAL CONNECTIONS

The ATB1200 has three external connectors for Power Input (J1), Host Communication (J2) and for connecting to the ELM205-ST mechanism (J3).

IMPORTANT NOTE:

A fourth connector (J4) is present on the PCB; see "*Appendix 1 - ATB1200 Layout Diagram*" on page 14. **NO CONNECTION SHOULD BE MADE TO J4 AT ANY TIME.** J4 is used during factory programming of the firmware for the main controller IC. If connection is made to J4 during normal use, the factory-fitted resident firmware may be corrupted or erased. In this case the ATB1200 must be returned to ASL for re-programming. A charge will be made for this service.

N.B. An additional connector providing User Front Panel Connections to a Paper Feed Input and an LED output will be provided. However, that this facility is not available on the Revision 8 ATB1200 PCB. See "Section 6 - User Feed Switch and LED" on page 11 for more details.

3.1 CONNECTOR DETAILS AND SUGGESTED MATING PART NUMBERS

Reference	Connector Fitted	Suggested Mating Part
J1	2-Way Power Input	09-91-0200 (Molex Housing)
	Molex Part No: 26-60-4020	08-52-0072 (Molex Crimp)
J2	6-Way Data Input	22-01-2065 (Molex Housing)
	Molex Part No: 22-27-2061	08-50-0032 (Molex Crimp)
J3	27-Way Mechanism Connection Molex Part No: 52806-2710	FPC fitted on ELM205-ST
J4	2-Way Jumper Pins	Do Not Make Any Connection to J4

See "Figure 1 - ATB1200 Dimensional Diagram" on page 3, or "Appendix 1 - ATB1200 Layout Diagram" on page 14, for orientation details.

3.2 J1 PINOUTS (POWER INPUT CONNECTOR)

The 2-way power connector has the following pinouts:

Pin	Assignment	
Pin 1	Power Ground	
Pin 2	Vmech (DC Power In)	

3.3 POWER SUPPLY REQUIREMENT

The DC power should be supplied between +4.75V DC and +8.5V DC. For best printing use between + 5V DC and +7.5V DC. Never supply more than +8.5V DC.

Avoid voltage drops by taking care over wiring and connections. Do not interrupt, reverse or reduce the voltage or damage will occur.

Average current during normal printing is normally around 2A. Peak current may be up to 10A. We recommend a 3A power supply, although a higher specification may be necessary for some applications.

See "Section 5.5 - Feeding and Printing Performance" on page 10 for more information on the tradeoffs that can be made between PSU voltage, PSU current capacity and printing performance.

3.4 J2 PINOUTS (RS-232 HOST COMMUNICATION CONNECTOR)

Pin	Name	Function
Pin 1	SGND	Signal Ground (Common with Power Ground)
Pin 2	RXD	Receive (RS 232)
Pin 3	BUSY	Busy (RS 232)
Pin 4	TXD	Transmit (RS 232)
Pin 5	N/C	Reserved for +5 V Logic Input (Do Not Connect)
Pin 6	RESET	Reset Input

The 6-way data connector has the following pinouts:

Pin 5: The standard ATB1200 derives its internal controller logic supply from the Vmech DC Power In (on J1) via an on-board low dropout regulator. As an option the ATB1200 may be provided without this component fitted. In this case the +5V +/- 5% supply for the controller logic should be supplied to pin 5 of J2. Please contact the factory for more details on this option.

Pin 6: An external reset input is provided. This should be left unconnected or linked directly to SGND if it not used. To reset the printer, this signal should be taken to between +2V and +25V.

3.5 HOST COMMUNICATION DATA FORMAT

The default serial interface format is RS-232, 9,600 baud, 8 data bits, 1 or 2 stop bits, and no parity. Other formats can be programmed into the ATB1200 at the factory or by the host.

Serial data is expected on RxD 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, TxD, transmits XON/XOFF 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 ATB1200 will not ignore this condition. It will print a series of question-mark characters ('?') to indicate a data problem. This behaviour can be modified so that the printer ignores the condition. See the Programmers Guide for details.

As an option, the ATB1200 may be supplied with TTL interface. Please contact the factory for details.

3.6 SUGGESTED CONNECTIONS TO A PC

To operate from a PC the ATB1200 should be connected to a serial COM port on the PC. Suggested connections to a 9-Pin COM port are shown below:

ATB1200 J2 Pin	ATB1200 Signal	PC D-9 Pin	PC Signal Name	Function (refers to PC)
2	RXD	3	TXD	Transmit Output (RS 232)
4	TXD	2	RXD	Receive Input (RS 232)
1	SGND	5	SGND	Signal Ground
3	BUSY	6 & 8	DSR & CTS	Busy Input (RS 232)
Other pins are unconnected				

It is strongly recommended that a screened data cable be used, with its braided screen connected to the system ground.

3.7 J3 PINOUTS (ELM205-ST CONNECTOR)

The 27-way mechanism connector is suitable for connecting directly to the ELM205-ST mechanism FPC.

Pin Number	Signal name	Function	
1	CO	Collector of photo-transistor	
2	VF	Anode of photo-sensor	
3	L_GND	Gnd for logic	
4	VH	Dotline voltage	
5	VH	Dotline voltage	
6	DI	Data input	
7	STB6	Sixth strobe	
8	STB5	Fifth strobe	
9	STB4	Fourth strobe	
10	P_GND	Gnd for dotline	
11	P_GND	Gnd for dotline	
12	P_GND	Gnd for dotline	
13	P_GND	Gnd for dotline	
14	TM	Thermistor first terminal (second in Gnd)	
15	STB3	Third strobe	
16	STB2	Second strobe	
17	STB1	First strobe	
18	Vdd	Logic voltage	
19	CLK	Serial clock	
20	\LAT	Latch	
21	DO	Data output	
22	VH	Dotline voltage	
23	VH	Dotline voltage	
24	SM4	Fourth phase of stepper motor	
25	SM3	Third phase of stepper motor	
26	SM2	Second phase of stepper motor	
27	SM1	First phase of stepper motor	

Table 1 - ELM205-ST FPC Connection Details

Please ensure that the FPC from the mechanism is inserted into the socket on the ATB1200 (J3), with the metal contact nearer the edge of the PCB.

If more detailed information is required about the connections of the ELM205-ST, please refer to Able Systems.

4 EMC CONSIDERATIONS

4.1 EMC DISCLAIMER (DIRECTIVE 89/336/EC)

The ATB1200 is designed to be used as a component in another finished good, and is not intended to be placed on the market or brought into service independently. The system integrator using this item must assume responsibility for Electro-Magnetic Compatibility (EMC) between this item and its environment, both for emissions and immunity/susceptibility.

Particular attention should be paid to the wiring connections between the ATB1200 and the power supply, data source and other parts of the user's system in case special shielding and/or cable layout is required to meet applicable EMC criteria.

To assist OEM customers, Able Systems has carried out traceable pre-compliance EMC tests on our popular Ap1200 printer, which uses a variant of the ATB1200 PCB and the ELM205-ST mechanism. The results of these tests indicate that the printer mechanism and controller electronics are unlikely to prevent EMC compliance of the customer's equipment, as follows:

- Since the ATB1200 is DC powered and will only be electrically connected within an OEM equipment, conducted emissions and immunity are not relevant, and we consider that the ATB1200 falls outside the scope of the Regulations in these regards.
- When fitted in an earthed steel case and connected to an internal data source and power supply, the ATB1200 may be expected to comply with the requirements of the EMC Directive in respect of radiated emissions and immunity;
- See "Section 4.2 Earthing Arrangements for ESD" below for special information about ESD.

4.2 EARTHING ARRANGEMENTS FOR ESD

The standard ELM205-ST has no provision for an earth connection to the metal parts of the printer mechanism. In order to satisfy EMC criteria when using this mechanism, the system integrator must ensure that the end user cannot discharge themselves to any of the metal parts of the mechanism. This could be achieved, for example, by preventing the user from gaining access to those parts, or by ensuring the user is discharged to earth before gaining access to them.

A variant of the ELM205-ST mechanism is available (order number: ELM205-ST-VRF), in which the metalwork of the printer is internally connected to the system power ground. In this case, the system integrator must ensure that sufficient power supply voltage filtering is in place to cope with possible ESD strikes.

Please refer to Able Systems if more information is required on this.

4.3 EMC ADVICE

While system EMC compliance remains the responsibility of the system designer, Able Systems has many years experience of implementing mini-printer solutions. In particular, it is recommended that screened cables are used, that all cables are kept as short and low-impedance as possible, and that all user accessible parts are adequately earthed.

Further advice is available from Able Systems on request.

5 OPERATING MODES

The APS ELM205-ST printer mechanism has a fixed (parallel) print head with 384 horizontallyarranged thermal elements. The paper is advanced by a stepper motor, and printing takes place in a single dot row for each step of the paper. Each printed dot is approximately 1/8 mm square. The printing speed and dot density are controlled according to the voltage and the head temperature.

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 or some following data. Any following data will be printed on the next line. The paper may only be fed through the printer in the forward direction.

Alternative printing modes, including graphics, are invoked by 'Escape' sequences. Control codes and status report protocols are described in detail in the Programmers Guide, available as a separate document.

5.1 DATA BUFFER

The ATB1200 has a nominal 20k byte buffer to optimise throughput: this enables data to be received into the buffer while previous lines are being printed.

The buffer may be cleared by data command or by a hardware reset. A partially full line will be printed on receipt of an appropriate control code, or after a programmable timeout delay.

5.2 SPOOLING MODE

In spooling mode data is received and stored, but not printed. This is useful when printing needs to be suppressed during data transfer (for example in mobile radio systems); or when the paper needs to be changed, or a jam cleared, and the buffer contains data.

If selected, the buffer will automatically enter spooling mode on a paper out condition; it can also enter spooling mode by a command from the host.

The spooling mode is exited by a command from the host, or the paper feed button being doubleclicked. Any stored data will then be printed out.

5.3 CHARACTER PRINTING

Several character fonts are supported, the default 32-column character set being formed from a 24x10 dot matrix. The standard 224 IBM® character set (Code Page 437) includes graphics characters, which are extended to link up in both axes where appropriate. The character set has been modified to include the Euro symbol ('€) at position 80H (128 Decimal), in place of the usual capital C with cedilla ('Ç').

Text can be printed in various combinations of single or double width, single or double height, inverted, underlined, and with other attributes. Text and dot- addressable graphics can be mixed within a line.

5.4 GRAPHICS PRINTING

Various dot-addressable graphics modes are supported, at up to 384 dots per line. Refer to the Programmers Guide for full details.

5.5 FEEDING AND PRINTING PERFORMANCE

PSU Voltage (V)	Feed and Print Speed (mm/s)	Duty Cycle (%)
5.0	56	60
5.5	59	50
6.0	62	40
6.5	68	35
7.0	72	30
7.5	80	25

Feeding speed is dependent on supplied PSU voltage as shown:

Table 2 - Feed Speed vs PSU Voltage

APS recommend that the ELM205-ST should not feed or print continuously for more than 30 seconds without a pause, in order to avoid the stepper motor overheating.

In addition, after feeding or printing, the printer should be allowed to rest for a period as defined in Table 2above. For example, if operating from a 5.0V power supply, a feeding period of 30 seconds should be followed by a rest period of 20 seconds, yielding an active duty cycle of 60% (30s = 60% of 30+20s).

The maximum possible print speed at a given PSU voltage is the same as the feed speed for that voltage. However, the actual print speed may reduce if heavy printing is required. Also, the ATB1200 may be configured to limit the peak current requirement of the PSU. In this case, the ATB1200 slows the print process automatically so that the peak current drawn from the PSU never exceeds a pre-set limit. Please see the Programmers Guide or contact the factory for more information.

6 USER FEED SWITCH AND LED

6.1 FRONT PANEL CONNECTION DETAILS

The ATB1200 has provision for fitting an external Paper Feed Button and LED. These two functions are combined into a single connection. The circuit for this connection may be represented as follows:



N.B. The signals represented as A and B in this diagram are not easily accessible on the Revision 8 PCB. The signals exist on the PCB, but are not brought to a convenient connector. The system integrator may, if required, wire directly on to signal A, and use an external connection to SGND. Signal A may be found on the Revision 8 PCB at the location where pin 30 of the mechanism connector J3 would be if a 30-way connector were fitted. No connection is normally made to this point on the PCB. Please refer to the factory for more information if required.

6.2 PAPER FEED SWITCH

(N.B. This function is not easily accessible on the Revision 8 PCB. See above)

Pressing the paper feed switch when the printer is idle advances paper at up to 50 mm per second, depending on the voltage supplied. However, the feed switch has several additional functions:

- A single press and release of the switch:
- \Rightarrow in idle or spooling mode, advances paper (in steps of 1/16 mm);
- "Double-clicking*" the switch:
 - ⇒ in idle mode, prints a demo/test message including the firmware version, encoded calibration data, and the full character set;
 - ⇒ in spooling mode, or having been out of paper, prints any stored data and enters idle mode.
 - * Double-clicking means pressing and releasing twice in quick succession like a PC mouse button.

Some of the functions of the paper feed switch can be invoked or disabled under control of the host. The LED is extinguished while the Paper Feed switch is being pressed.

6.3 LED INDICATIONS

(N.B. This function is not easily accessible on the Revision 8 PCB. See above)

The LED indicates the following printer conditions:

- Steady illumination means that all is normal.
 - Flashing on and off indicates either:
 - ⇒ the printer is out of paper
 - \Rightarrow the mechanism is not closed
 - \Rightarrow or a combination of the two
 - Very rapid flashing indicates the power supply voltage is too low.
 - No light indicates that the unit has no power.

The LED is extinguished while the Paper Feed button is being pressed.

Other LED patterns may be programmed into the ATB1200 on request or by the system designer. Please refer to the Programmers Guide for details of how to set up these functions.

7 PAPER

The ELM205-ST is designed to operate using paper rolls which are 57.5 ± 0.5 mm wide and have the thermally sensitive coating on the outside. The maximum diameter of the roll will depend largely on the design of the housing.

Suitable rolls are available as ASL Product Code: 04-A05846TPR1 Thermal Paper Roll (46 mm dia, 25 m long approx)

Please ensure that quality paper is used. Extra dust and printer head wear may result from nonapproved paper rolls.

Always discard the first few turns of paper in case they have been damaged or have glue on.

7.1 PAPER OUT SENSOR

The ELM205-ST includes a Paper-Out sensor. The signal from this sensor may be used to provide a visual indication that the paper is out (by flashing an LED), or to notify the host. The ATB1200 may also be configured to automatically enter Spool Mode when the paper is out, to prevent data loss.

The standard paper rolls normally supplied by Able Systems have a red marking towards the end of the roll, providing a further indication that the roll is nearly exhausted.

The paper out sensor may also be used to detect pre-printed marks on the paper roll. The ATB1200 should be configured correctly to achieve this. Please contact Able Systems for more information.

8 GETTING STARTED

You may find that you can connect up the printer to your Personal Computer (PC), and everything works perfectly first time. However, there are many variables, and the following information may help if you find you need some assistance. These are only suggestions, and may not work with all PC's.

CONNECTING TO A PC – A CHECKLIST 8.1

First, you need to GET THE PRINTER GOING

Check that the ATB1200 functions when power is applied. It should feed paper when the paper feed button is pressed, and produce a Self Test print when double-clicked.

Next, you need to make some HARDWARE CONNECTIONS

The back panel of a PC normally includes three D-type (keystone-shaped) connectors, typically as follows:

D-9 Plug (male): COM1: Serial port for mouse, serial printer, etc

COM2: Serial port for modem, serial printer, etc

D-25 Plug (male): D-25 Socket (female): LPT: Parallel ('Centronics') port for parallel printer, etc

You can use either of the two serial ports for the ATB1200, whichever is free. COM2: is assumed in what follows, as most likely to be available.

You can make up a cable using the information in 'Section 3.6 - Suggested Connections to a PC'.

Now you will need to SET UP YOUR COMPUTER'S SERIAL PORT to match the printer Your proposed application program may have a way of doing this, or you can get to the DOS prompt [eq C:>] and type the following command line (assuming you have connected the printer to COM2:): MODE COM2:9600,N,8,2 [RETURN]

This will set up the port (COM2:) to 9600 baud, No parity, 8 data bits, and 2 stop bits which is the default setting for the ATB1200.

Now, SEND SOME DATA TO THE PRINTER from your computer

An easy way to do this from the DOS prompt is to type:

DIR >COM2: [RETURN]

This should send a directory listing to the printer. The lines will probably overflow, but it will at least show that the communication between the computer and the printer is working. You can also send data from **QBASIC**, for example:

OPEN "COM2:9600,N,8,2" FOR RANDOM AS #1

PRINT#1, "Hello"

Alternatively, in Windows, use the **TERMINAL** program to send some text to the printer.

WINDOWS[™] PRINTER DRIVERS 8.2

At present, no Windows driver specifically written for the ATB1200 is available. However, the built-in Windows "Generic/Text-Only" printer driver should work in a limited manner.

8.3 YOUR APPLICATION PROGRAM

Once communications between your computer and the printer have been established, you can try driving the printer from your application program.

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Able Systems' web site "http://www.able-systems.com" includes application data updates, product announcements, and e-mail facilities for customer support.

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.



