



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

USERS' GUIDE
to the
ABLE SYSTEMS A104B
Printer Controller Board

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1 Introduction

This document is a Users' Guide, written for the person designing-in, connecting and using the Able Systems A104B printer controller board for the EPSON M-160 series of 4-needle mini-printer mechanisms. Please read it carefully before making any connection. The A104B is an enhanced replacement for the A160B series of controller boards, and shares many features of the range. Every effort has been made to simplify the transition for existing customers, but of necessity some of the connections are slightly different.

Throughout this document, the designation A160B can generally be taken to represent the A150B, A160B, A163B, A164B, and national variants of these products.

2 On-Line Information

Able Systems maintains a site on the World Wide Web. This includes application data updates, product announcements, and e-mail facilities for customer support.

The **URL** of our **web site** is: <http://www.able-systems.com>
Our **e-mail address** is: contact@able-systems.com

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Note: EPSON is a registered mark of its owner Seiko Epson Corporation. References to this or other owners' marks in this document are for illustrative purposes only.

3 Pin Connections

The A104B has three external connectors or connection areas, for data and power, auxiliary power, and the printer mechanism. The locations of these connectors, and the overall PCB outline and fixing positions, are designed to be identical to those of the A160B. There are also some onboard jumpers. Please refer to the layout diagram for connector locations and pin orientation.

3.1 Data/Power Connector J3

	Function	J3 Pin no		Function
(S/P Select)	Data Input D7	1	2	Busy output (high when busy)
(Baud Select)	Data Input D6	3	4	Inverted Mode Select Input (low for inverted)
(Baud Select)	Data Input D5	5	6	Ground (0V)
	Data Input D4	7	8	Ground (0V)
	Data Input D3	9	10	Power for mechanism (+5V)
	Data Input D2	11	12	Power for logic (+5V)
	Data Input D1	13	14	Reset Input (low to reset)
	Data Input D0	15	16	Serial Data / Parallel Data Strobe Input

3.2 Auxiliary Power Connector J4

These connections are in parallel with those on J3, and are provided for cases in which the user prefers to separate the data and power connectors, as we would recommend.

J4 Pin no	Function
1	Power for logic (+5V)
2	Power for mechanism (+5V)
3	Ground (0V)

3.3 Paper Take-up Motor Connector J5 (only fitted to customer order)

J5 Pin no	Function
1	Ground (0V)
2	Paper Take-up Motor +ve

The output from Pin 2 is in parallel with the mechanism motor drive, with a protective series resistance of about 16 Ohms. Please consult the factory before making any connection.

3.4 Mechanism Connector J2

The A104B is normally supplied without a connector fitted, or with a flat 0.1" pitch jumper cable.

J2 Pin no	Function
1	Reed switch input
2	Reed switch return (0V)
3	Motor return (0V)
4	Motor drive output
5	Solenoid common return (0V)
6	Solenoid D output
7	Solenoid C output
8	Solenoid B output
9	Solenoid A output
10	Tacho bias
11	Tacho input

4 Installation

4.1 Power Supply

A clean DC power supply of 5V \pm 5% 3A is required to power the A104B. The rise time of the supply must be short enough to give a valid reset signal to the controller chip. It is recommended that the power supply for the controller circuits is separate from the supply to the mechanism motor and solenoid circuits, to minimise interference. In the event that the power supply is not adequate to power the A104B, on board circuitry will hold the printer in reset and avoid any damage which may occur to the printer mechanism.

4.2 Parallel and Serial Interface Selection

Serial and parallel data modes are selected using D7 (pin 1 on J3):

Parallel mode is selected if D7 is held low (connected to 0V) for a period of 100 μ s after the printer is reset.

Serial mode is selected if D7 is held high or left unconnected (internal pull-up to +5V) for a period of 100 μ s after the printer is reset.

In "classic" mode, the parallel interface is selected by having D7 low (logic "0") at power up. In some parallel applications the port driving this pin may be indeterminate at power up and so an alternative parallel select is provided (jumpers S5 / S6). If either of the two serial/parallel select pins are held to ground on start up, then parallel mode is selected. Both pins must be left high to select serial data. In order to change from serial to parallel, or from parallel to serial, the printer must be reset. Serial data Baud rates are selected on D5 and D6 when the printer is in serial mode.

Serial data Baud rates:

Baud	300	1,200	2,400	9,600
D5	1	0	1	0
D6	0	1	1	0

Note that the combination for 9600 Baud was used to select 110 Baud in the A160B family of controller boards.

In order to implement the baud rate the printer must be reset.

4.3 Jumpers

There are three jumpers on the A104B (refer to layout for position). Closing these jumpers will select the following:

S1 / S2	Self test
S3 / S4	Inverted printing
S5 / S6	Alternative parallel (Classic/New Mode) select.

4.4 EMC Compliance

As a component, the A104B is outside the scope of the EMC Directive and the user must take responsibility for the compliance of the complete equipment or installation. Please refer to the EMC disclaimer in the Appendix.

5 Operation and Programming

5.1 Mechanism selection

All the four-needle EPSON mini-printer mechanisms (M150, M160, M163, M164 and M170) are now supported by a single A104B device. The A104B exercises the mechanism on the first power-up, and its type is sensed by counting tacho pulses per head cycle. The result is stored in the EEPROM, and on

subsequent power-ups the mechanism identity is read from there. If the EEPROM is not fitted, the chip will carry out the mechanism selection test at every power-up.

N.B. If the mechanism is changed, the ESC,<125> command can be used to force re-detection.

5.2 Parallel Data Mode

D7 to D0 are the data connections for parallel mode 8 bit data. If using one of the backwards compatible 7 bit character sets (A160C family) D6 to D0 are the data connections. Positive true ASCII codes are accepted at TTL or 5V CMOS levels. The data inputs are not latched and must be static during the handshake sequence. The Data Strobe input times the incoming data transfer. When the printer is not busy (the busy signal is low) the data must be held static on the data pins and the strobe signal taken low until the busy signal goes high to acknowledge the data transfer. The data strobe must then be taken high ready to transmit the next byte. Figure 5.1 shows typical connections to a PC parallel port.

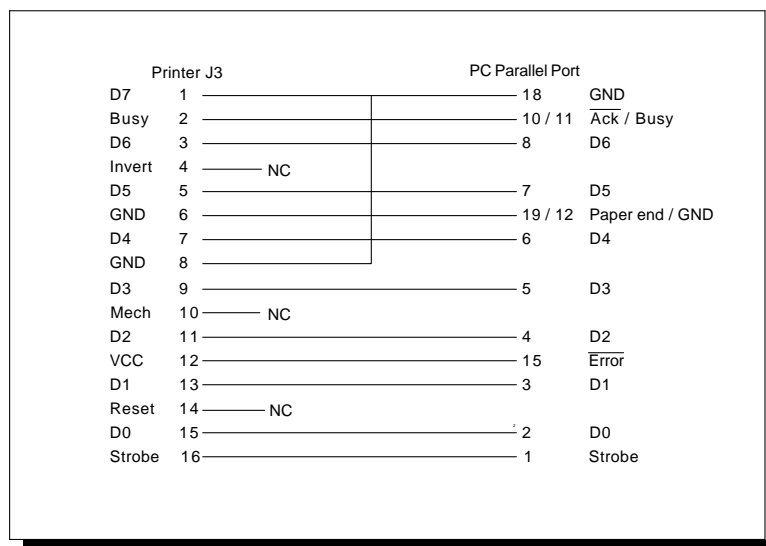


Fig. 5.1 Parallel Connection to a PC

5.3 Serial Data Mode

The serial data input accepts a TTL or 5V CMOS positive true signal. The busy signal will be low when the printer is ready to accept data. The A104B is not suitable for direct connection to a PC RS232 COM: port. (Please refer to ASL for a converter board, or alternatively Able Systems produce an Ap25S which is the serial RS232 version of the Ap25 and is suitable for direct connection to a PC.) Figure 5.2 shows typical connections to a PC serial COM: port for the Ap25.

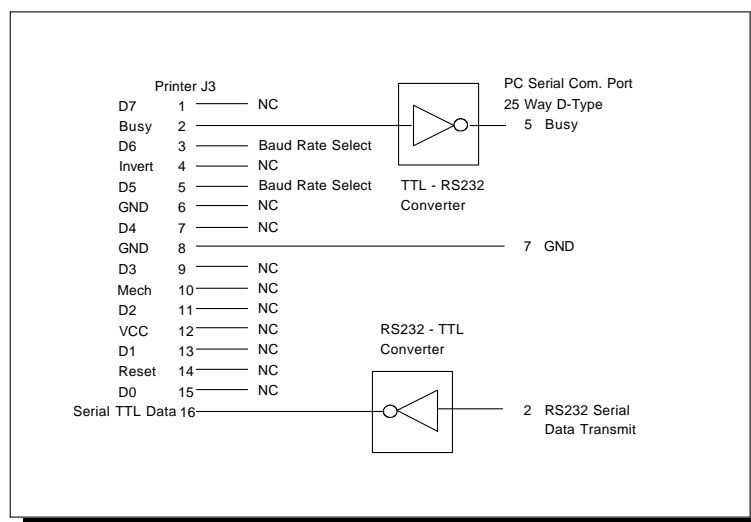


Fig. 5.2 Serial Connection to a PC

5.4 Busy Output Signal

The controller asserts the Busy output when the input buffer is one character away from being full. The following character will, however, be loaded into the input buffer. This avoids any data being lost due to the host not responding to the busy signal immediately (such as with a double-buffered UART in a PC).

5.5 Printing modes and data buffer

Character printing modes include graphics, inverted, double height and double width. Graphics mode is cancelled at the end of every dot line, whereas the combinations of double height and width remain in force until cancelled by a new command.

The A104B will print data before the ESCape code and then implement the new mode selection. The data buffer accommodates 48 bytes, which can extend over many physical print lines, depending on the mechanism in use and the data format; and new data can be entering the buffer as previous data are being printed.

5.6 Character Printing

The A104B prints the characters from left to right. The characters fit into a 6 wide \times 10 high matrix. The standard letter is 5 wide \times 7 high, this provides for a one dot space between each character, a dot line for descenders and a dot line above and below each character line. The number of characters required to fill a dot line varies according to the printer mechanism.

Mech.	Characters per line	Character lines per second	Vertical dot pitch	Horizontal dot pitch	Paper width
M-150	16 characters per line	1 line/second	0.35mm	0.35mm	44.5mm
M-160	24 characters per line	0.7 lines/second	0.33mm	0.33mm	57.5mm
M-163	32 characters per line	0.5 lines/second	0.33mm	0.25mm	57.5mm
M-164	40 characters per line	0.4 lines/second	0.33mm	0.20mm	57.5mm
M-170	40 characters per line	0.4 lines/second	0.33mm	0.25mm	69.5mm

The ASCII characters 32 to 255 (32 to 127 if using a backwards compatible 7 bit character set) are in the printable range. Any character below character 32 is ignored unless it is one of the control codes (section 5.8).

5.7 Graphics Printing

The product is programmed to take advantage of the graphics printing capability of the mechanisms. Graphics are received as the least significant 6 bits of each byte. The same number of graphics bytes are required to terminate a line as the number of characters required to print a complete line. The graphics mode is reset at the end of every dot line and hence the graphics command, <ESC><02>, must be entered at the start of every dot line. Graphics patterns are built up as a succession of dot lines across the paper. Large areas of solid dots are not recommended as they may cause over heating and shorten the ribbon life. Heavy graphics printing may also require a higher current power supply. A typical graphics line for the A104B would be:

Control code Data (24 bytes for the M-160 printer mechanism)
<ESC><02> <00><00><01><02><03><04><05> etc.

5.8 Control Codes

9 character sets which may be selected for backwards compatibility. The default character set is the 8 bit IBM 224-character set.

Previous versions of the A160B family have been supplied programmed with 7 bit character sets, UK, French, German, "Scandinavian", Danish/Norwegian, Swedish, Japanese and Spanish character variations (often to special order). The A104B contains all these variants, which may be software selected for backwards compatibility. 8 bit data is selected when using the 8 bit IBM character set, otherwise the 8th data bit is ignored.

The structure of the command is as follows:

<ESC><127><n> where **n** is a byte of the form [X,X,X,X,B3,B2,B1,B0] (X = don't care)

Country selection:

Character set	B3	B2	B1	B0
Full 8 bit IBM (default)	0	0	0	0
UK	0	0	0	1
French	0	0	1	0
German	0	0	1	1
Scandinavian	0	1	0	0
Danish	0	1	0	1
Swedish	0	1	1	0
Japanese	0	1	1	1
Spanish	1	0	0	0

ESC><n> (If buffer is not empty, print buffer contents and) Set print mode.

Note: **n** is a byte of the form [0,0,0,0,B3,B2,B1,B0] (all except the lower 4 bits must be zero, to avoid conflict with other ESCape codes).

Mode selection:

Print Mode	B3	B2	B1	B0
Default	0	0	0	0
Inverted (reversed)	X	X	X	1
Graphics mode	X	X	1	X
Double width mode	X	1	X	X
Double height mode	1	X	X	X

Any combination of modes is permissible.

The command <ESC><126> stores the current character set and print mode (double height, etc.) in the EEPROM and these will be the default setting the next time the printer is powered on or reset. If this code is not received the A104B reverts to previous default values on the next power up.

<ESC><ESC> (Print any buffer contents, and) Print Self test message.

<ESC><127><n> (Print any buffer contents, and) Select country character set.

<ESC><126> (Print any buffer contents, and) Store country character set and print mode in EEPROM.

<ESC><125> (Print any buffer contents, and) Clear the EEPROM.

<CR> Print any buffer contents (line terminator). Treat as <CR><LF>.

<LF> Print any buffer contents (line terminator). Treat as <CR><LF>.

<CR><LF> Print any buffer contents (line terminator). Treat as single <CR><LF>.

<LF><CR> Print any buffer contents (line terminator). Treat as single <CR><LF>.

A character line is automatically terminated and printed if it reaches the full line width for a given mechanism and print mode setting. Note that if any of the above 4 line terminator codes is received immediately after a character which completes a printable line, it will be ignored.

This treatment differs from the A160B family but will generally be an improvement.

<VTAB> Print any buffer contents, and feed 30 dot lines.

If the print quality deteriorates due to dot lines being displaced, the EEPROM can be cleared and the chip forced to repeat the first-time initialisation by sending the code <ESC><125>.

Appendices

Following page:	EMC Directive 89/336/EC Disclaimer
Next page:	A104B PCB Component Layout (Drawing Number: L4984203-3)
Final page:	A104B PCB Schematic Diagram (Drawing Number: S3990301-4)

EMC Directive 89/336/EC (Disclaimer)

Please note that the item to which the enclosed application data refer 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 item 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.

A104B Series Printer Controller Boards

- To assist OEM customers, we have carried out traceable pre-compliance tests on our most popular Ap24 printer, which indicate that the printer itself is unlikely to prevent EMC compliance of the customer's equipment, as follows:
- Since the A104B 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 A104B 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 A104B may be expected to comply with the requirements of the EMC Directive in respect of radiated emissions and immunity;
- When fitted with an earthing wire to the mechanism, the A104B may also be expected to comply with the requirements in respect of electrostatic discharge (ESD).

