

#### DATAC 160SB INTERFACE BOARD

The 160SB is a single printed circuit board interface to the Epson M-160 printer mechanism. The M-160 is a very compact 24 column alphanumeric impact printer, using four solenoids and needles in a moving shuttle to build up characters as a raster of dots, 144 per horizontal line. A d.c. drive motor provides head motion and paper feed; timing is by a reed switch and tacho generator. The motor and solenoids operate from a 5V d.c. supply, and draw about 1A during printing.

The 160SB provides an exceptionally small and cost-effective interface to the M160. The interface consists of an 8048 single-chip micro-computer, with 1K of program ROM and 64 bytes of RAM; data input is directly into the power transistors, with an active driver/brake for the motor to give fast stopping in the graphics mode.

The parallel data interface is similar to Centronics practice, with a 7-bit parallel input, controlled by a strobe line, and a busy line to indicate processor status. A single line buffer accommodates up to 24 characters. In the graphics mode (entered by software command) the data input is interpreted as 6-bit binary information for the dots to be printed and is accepted one raster line at a time (24 bytes for 144 dots).

## SPECIFICATIONS:

**Designation:** 160SB Interface board  
**Dimensions:** 73x55x15mm overall.

**Power supply:** +5V dc  $\pm$  5% at 100mA (quiescent), up to 1A typical printing (the power supply should be capable of meeting peak demands of up to 3A to ensure correct initialisation and printing performance).

**Data Interface:** (1) Parallel TTL: 7 bits + strobe + busy (Centronics type)  
(2) Bit Serial TTL: 1 bit input + busy (RS232 protocol)  
Note: These interface options are pin-selectable on the board connector.

**Format:** 24 characters per line as 7 (high) x 5 (wide) dot matrix. Graphics as 144 dot raster lines under software control.  
Various character and graphics operating modes also under software control:  
\* Text mode (normal orientation, last line lowest)  
\* Data mode (for panel mounting application, last line height)  
\* Double width  
\* Double height  
Any combination of the various operating modes can be used in graphics or characters, e.g. Text mode, double height and double width.

**Character set:** 64 characters ASCII, upper case only.  
Lower case codes interpreted as upper case.  
Special character sets available to order.

**Printing speed:** As M160 mechanism, 0.7 lines per second (typical).

**Consumables:** IRC160 Ink Ribbon Cartridge (purple)  
OP58 58mm wide x 13m long. 45mm OD; 16mm ID; white wood free; red warning stripe at end.

## PRINT SAMPLES:

```
(3)SELF TEST:  
@ABCDEFGHIJKLMN0PQRSTUW  
XYZI\J _ " ! $ % & ' ( ) * + , - . :  
0123456789; <=> ?  
@ABCDEFGHIJK  
@ABCDEFGHIJKLMN0PQRSTUW  
@ABCDEFGHIJK  
MNUISR@ABCDEFGHIJKLMN0PQRSTUW  
@ABCDEFGHIJKLMN0PQRSTUW  
XYZI\J _ " ! $ % & ' ( ) * + , - . :  
0123456789; <=> ?  
@ABCDEFGHIJK  
@ABCDEFGHIJKLMN0PQRSTUW  
@ABCDEFGHIJK
```



```
ABCDEFGHI; <=> ?@ABCDEFGHI  
; <=> ?@ABCDEFGHIJ <=> ?@ABC  
DEFGHIJK = ?@ABCDEFGHIJKL  
< ?@ABCDEFGHIJ LM ?@ABCDEF  
GHIJKLMN@ABCDEFGHIJKLMNO  
4BCDEFGHIJKLMN0PBCDEFGHI  
JKLMN0PQ0CDEFGHIJKLMN0PQR  
DEFGHIJKLMN0PQRSEFGHIJKL  
MN0PQRSTFGHIJKLMN0PQRSTU  
GHIJKLMN0PQRSTUWHIJKLMNO  
PQRSTUWVIJKLMN0PQRSTUWX  
JKLMN0PQRSTUWXYJKLMN0PQR  
STUWXYZLMN0PQRSTUWXYZI  
MN0PQRSTUWXYZI\NOPQRSTU  
UVWXYZE\JOPQRSTUWXYZI ^  
PQRSTUWXYZI ^ _
```

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TUDOR ROAD  
BROADHEATH  
ALTRINCHAM  
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W14 5TH  
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## MODEL-160 / MODEL-161 MICRO DOT PRINTER

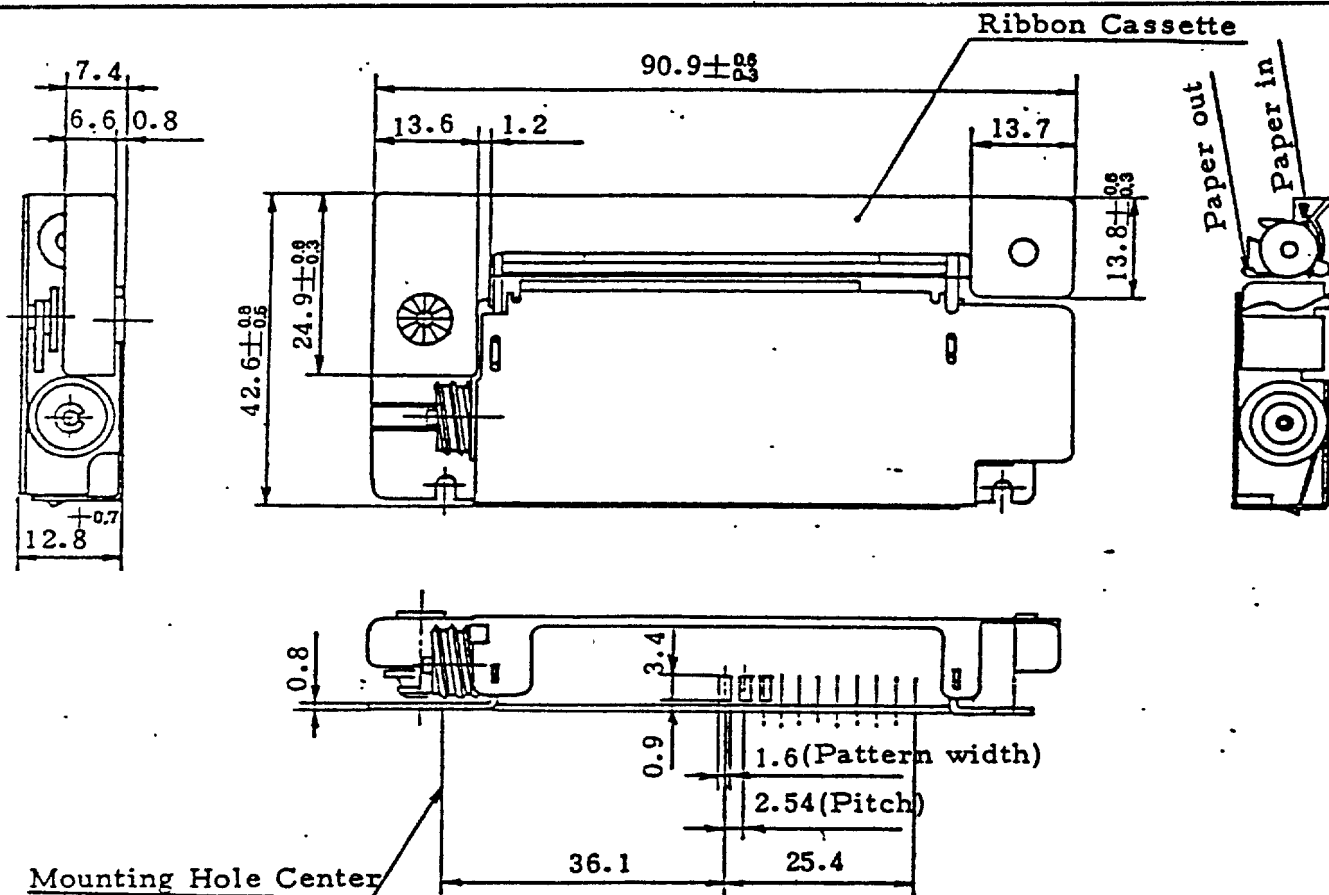
### FEATURES

- \* World's smallest Micro Dot Printer
- \* Super thin (12.8mm), compact, light weight
- \* Column Capacity : Max. 24 columns (Model-160)
- \* Uses 58mm width regular paper
- \* Clear printing and High reliability
- \* Operates with batteries designed to save electricity (4 Ni-cd batteries)

### SPECIFICATIONS

	Model-160	Model-161
Print Method	Impact Dot Matrix	Impact Dot Matrix
Print Format (Number of Total Dot) (Number of Column)	Max. 144 dots/line Max. 24 columns (5 x 7)	Max. 96 dots/line max. 16 column (5 x 7)
Print Speed	Approx 0.7 l/s	Approx. 1 l/s
Character Size (Dot Space) (5 x 7 Dot Matrix)	Horizontal 0.33mm Vertical 0.33mm 1.7(W) x 2.4 (H) mm	Horizontal 0.35 mm Vertical 0.35 mm 1.8(W) x 2.5(H) mm
Paper	58(W)mm Woodfree Paper	58(W)mm Woodfree Paper
Inked Ribbon	Ribbon Cassette ERC-07 (Purple or Black)	Ribbon Cassette ERC-07 (Purple or Black)
Motor	Terminal Voltage 4.5 ± 0.5 VDC Mean Current Approx. 0.2A	Terminal Voltage 4.5 ± 0.5 VDC Mean Current Approx. 0.2A
Print Solenoid	Terminal Voltage 4 ± 0.5 VDC	Terminal Voltage 4 ± 0.5 VDC
Ambient Temperature Operating	0°C to 50°C	0°C to 50°C
Reliability	MCBF 5 x 10 <sup>5</sup> lines	MCBF 5 x 10 <sup>5</sup> lines
Overall Dimensions	91(W)x42.6(D)x12.8(H)mm	91(W)x42.6(D)x12.8(H)mm
Weight	Approx. 75G (0.15 lb)	Approx. 70g (0.15 lb)

## Overall Dimension



## Print Sample (Model-160)

<α-N print>

```

00000000000000000000000000000
11111111111111111111111111111
22222222222222222222222222222
33333333333333333333333333333
44444444444444444444444444444
55555555555555555555555555555
66666666666666666666666666666
77777777777777777777777777777
88888888888888888888888888888
99999999999999999999999999999
: : : : : : : : : : : : : : : : :
: : : : : : : : : : : : : : : : :
<<<<<<<<<<<<<<<<<<<<<<<<<<<
=====
>>>>>>>>>>>>>>>>>>>>>>>
? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
A A A A A A A A A A A A A A A A A
B B B B B B B B B B B B B B B B B
C C C C C C C C C C C C C C C C C
D D D D D D D D D D D D D D D D D
E E E E E E E E E E E E E E E E E
F F F F F F F F F F F F F F F F F
G G G G G G G G G G G G G G G G G
H H H H H H H H H H H H H H H H H
I I I I I I I I I I I I I I I I I
J J J J J J J J J J J J J J J J J
K K K K K K K K K K K K K K K K K
L L L L L L L L L L L L L L L L L
    
```

<Graphic print>



JANUARY

SU	MO	TU	WE	TH	FR	ST
*	*	*	*	*	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	*	*	*	*	*	*

DATAc 150/160SB PRINTER COTROLLER BOARD

USER MANUAL

Document: DS8015

Author : S. Wilks

Date : 6th April 1987

Revision: 1.1

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## INTRODUCTION

The 150SB/160SB is a controller board to drive the M150 or M160 mini printer mechanism. The board and printer operate from a single 5V, 1.5A power supply. The unit incorporates the 1601 single-chip microprocessor and provides a serial and parallel data interface at TTL levels plus full 96-code UK ASCII character generation.

As well as upper and lower case text printing, a variety of modes of operation can be selected by sending control codes:

TEXT	or	DATA mode
CHARACTER	or	GRAPHICS mode
SINGLE WIDTH	or	DOUBLE WIDTH
SINGLE HEIGHT	or	DOUBLE HEIGHT
SINGLE LINE BUFFER	or	72 BYTE BUFFER

All 32 mode combinations can be selected by sending the appropriate control code.

The following facilities are also provided:

- M150 (16 char/line) M160 (24 char/line) select input.
- PARALLEL/SERIAL data select input
- BUSY output when printer operating and for data acknowledge
- PAPER ADVANCE input
- TEST input - for integral self test
- PAPER TAKE-UP output to drive paper take up unit

## CHARACTER SET & CONTROL CODES

The character set is 96-code UK ASCII; (hex) codes 20 to 7F inclusive. Codes from 00 to 1F are ignored with the following exceptions:

(HEX)	(CODE)	
0A	(LF):	Line feed - used in character modes causes print out of line buffer contents and advances the paper one line.
0D	(CR):	Carriage return - same action as LF. NOTE: that a data line terminated by CR LF will cause printing plus an extra line feed.
1B	(ESC):	Escape - used to change mode of operation, next character "mode code" defines action.
04	(EOT):	End of test - used to terminate data string in 72 byte buffer mode.

#### Mode Codes:

After an ESC code bits 0 to 4 of the next code ("mode code") determine the new print mode:

BIT 0 (l.s.b.)	: 0 for TEXT mode	1 for DATA mode
BIT 1	: 0 for CHARACTER mode	1 for GRAPHICS mode
BIT 2	: 0 for SINGLE WIDTH	1 for DOUBLE WIDTH
BIT 3	: 0 for SINGLE HEIGHT	1 for DOUBLE HEIGHT
BIT 4	: 0 for SINGLE LINE BUFFER	1 for 72 BYTE BUFFER

All 32 mode combinations are acceptable, e.g.

ESC - 1E (hex) = 72 byte buffer, double width, double height, graphics, text mode. Mode zero is assumed on reset and power up which is also the ESC,00 sequence. BITS 5 & 6 of the "mode code" are not read and can therefore be 1 or 0, thus any ASCII code with bits 0 to 4 in the correct combination for the desired mode code can be used.

ESC - ESC is the software self test command and causes print out of test routine, all eight character modes are printed followed by a graphics pattern.

#### NOTE:

ESC = 1B (hex) therefore "mode code" 1B (hex) cannot be used; if this is required codes 3B, 5B or 7B (hex) can be used instead which will not be interpreted as ESC codes, but are valid "mode codes".

#### CHARACTER PRINTING

Characters are formed from a 5-wide by 8-high dot matrix, with one dot space between characters. The eighth dot row is used for descenders.

16 characters per line are printed on the M150 and 24 characters per line are printed on the M160. Printing is initiated automatically when a complete line has been sent. Shorter lines must be terminated by CR or LF code. The BUSY signal is activated during printing and momentarily after each character sent to acknowledge the data.

In the TEXT mode characters are printed from left to right like a typewriter; DATA mode prints inverted and from right to left for panel mounting applications.

#### GRAPHICS PRINTING

Graphics codes are received as 6-bit groups; input data is assumed to be graphics information following the receipt of an ESC sequence in which the "mode code" has BIT 1 set to 1. A complete line of graphics must be received following which the dot line is printed. The BUSY signal is activated during printing and momentarily after each code to acknowledge the data. The graphics mode is automatically cleared after each dot line. It is therefore necessary to transmit the graphics ESC sequence before every dot line.

The graphics pattern is built up as a succession of horizontal dot lines, 96 dots per line (16 x 6) on the M150 or 144 dots per line (24 x 6) on the M160. In each 6 bit graphics code a 1 is "dot on" and a 0 is "dot off", the most significant bit of each code being printed left most of each 6 bit group. Only the 6 least significant bits of each code are printed, so codes in the range 40 to 7F (hex) will be treated as 00 to 3F (hex). The printer will stop after each dot line for more data to be sent.

All eight graphics modes are feasible; double height and/or double width may be used to economise on data coding if only a coarse pattern is required.

Printing large areas of solid dot patterns is not recommended as it may lead to premature wear. If the graphics mode is to be used extensively, the power supply rating should be studied carefully as the voltage must never fall below 4.3V or the printer will be reset.

### 72 Byte Buffer Mode

Up to 72 bytes of data may be sent before printing is initiated. The buffer mode is entered by sending an ESC sequence in which the "Mode code" has BIT 4 set to 1. The following data which can include CR, LF and ESC sequence codes is then entered directly into the buffer as it is sent. The BUSY signal is activated momentarily to acknowledge each code in the normal way. Printing begins automatically after 72 bytes have been received and BUSY is activated until the complete buffer contents have been printed. If less than 72 bytes are to be sent then printing can be initiated by sending an EOT code (04 hex) to signal the end of text.

All 16 modes of operation, i.e. combinations of double width, double height, graphics, etc., are possible within a buffer mode and ESC sequences can be embedded within the data sent to the buffer. ESC sequences are acted upon, the buffer is emptied and data is printed out. The system will remain in the mode indicated by the last ESC sequence acted upon as the buffer was emptied. If BIT 4 of the "mode code" was set to 1 then the buffer mode will continue and the next byte of data sent will begin filling up the buffer again. If BIT 4 was set to 0 then the buffer mode is terminated.

The buffer mode is very useful where long strings of data are to be sent especially where data has to be formatted with a large number of line feeds in between lines of print, or there are only a few columns of print on each line. Effective use of the buffer facility can greatly improve the efficiency of data transfer.

When formatting data for the Buffer mode the following notes may be useful:

Every valid byte of data received by the buffer is counted as one of the 72 including CR,LF,ESC and "mode codes".

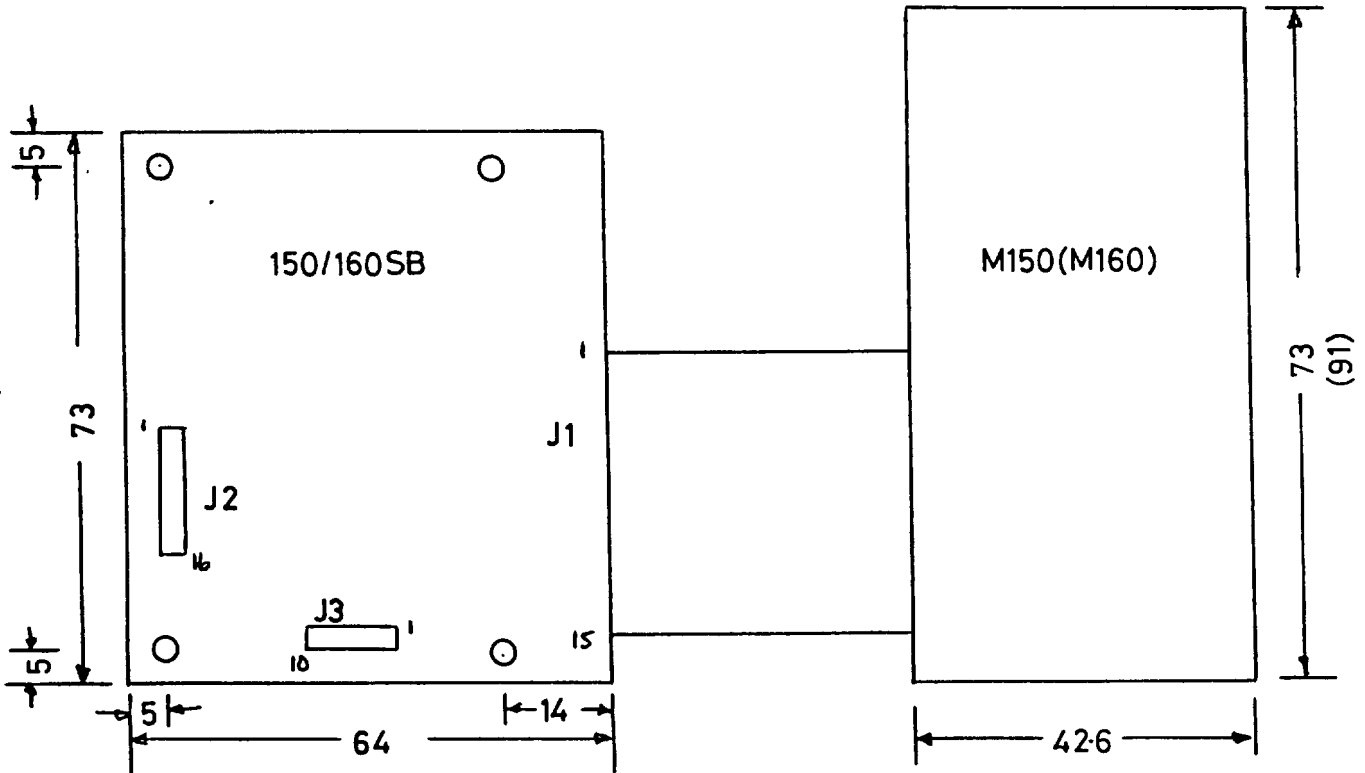


If the buffer is filled the complete 72 bytes of data are automatically printed out, even if the last line was not complete, and paper is advanced to the next line. In most cases it will be better to initiate printing with an EOT code at the end of a line of data, otherwise part lines may be printed at the beginning and end of each buffer printout.

When using an ESC sequence embedded within the buffer contents it will be better to use "mode codes" in which Bit 4 is set to 1 to prevent inadvertent termination of the buffer mode.

BOARD\_LAYOUT

(Dimensions in mm)



The printer mechanism should be wired directly via ribbon cable to J1.

CONNECTION DATA (see board layout diagram)

All input signals to J2 and J3 are TTL compatible.

\* DENOTES ACTIVE LOW SIGNAL

J2: Data input to 16-way connector.

	NOTE		NOTE
1. *STR/SDATA	(1)	2. Data input D0	(6)
3. *RESET	(2)	4. Data input D1	
5. +5V	(3)	6. Data input D2	
7. +5V		8. Data input D3	
9. GROUND		10. Data input D4	
11. GROUND		12. Data input D5/BR1	
13. *PAPER FEED	(4)	14. Data input D6/BR2	
15. BUSY	(5)	16. *PAR/SER	(7)

J3: 10-way connector (use if required)

	NOTE	
1. N/C		2. +5V
3. N/C		4. +5V
5. N/C		6. GROUND
7. PTU	(8)	8. GROUND
9. *TST	(9)	10. N/C

LINK: M150/M160 SELECT - link is inserted if driving M160 printer, removed if driving M150 printer.

J1: 11-way Ribbon cable to printer mechanism..

1. R. DETECTOR		7. SOLENOID C
2. R. DETECTOR (OV)		8. SOLENOID B
3. MOTOR -		9. SOLENOID A
4. MOTOR +		10. T. DETECTOR (OV)
5. SOLENOID COMMON (+5V)		11. T. DETECTOR
6. SOLENOID D		

NOTES:

1. During parallel operation, Data Strobe (STR) can be taken low when BUSY is low and input data is on D0-D6. BUSY will pulse high to acknowledge that data has been read in. In the serial mode pin 1 is the Serial Data (SDATA) input, positive true.

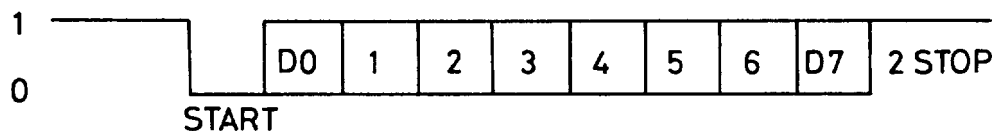
2. RESET may be taken low to initialise the controller or to clear a fault condition. An automatic reset is performed on power-up.
3. +5V supply (tolerance +/- 10%) must be capable of 1.5A continuous.
4. Paper Feed input provides continuous paper feed when switched low.
5. The BUSY output (max. 1 TTL Load) is active high whilst printer is running and is pulsed high momentarily after each character sent, to acknowledge data input. Any data sent when BUSY is high will be ignored.
6. Data inputs D0 (least significant) to D6 (most significant) are the ASCII code inputs for parallel operation. In the serial mode D5 and D6 are used as Baud rate select inputs (BR1 & BR2) as follows:

D6	0	0	1	1
D5	0	1	0	1
Baud Rate	110	300	1200	2400

All data inputs must be terminated high or low in ALL modes.

7. Parallel/Serial select input (PAR/SER) must be held low for parallel data input or high for serial operation.
8. PTU is driven high for approx. 40mS after each printed dot line. This can be used to drive a paper take-up unit if required (current source up to 1A).
9. TST is a hardware self test input. When taken low a print out of the self test pattern will be initiated.

#### SERIAL DATA TIMING



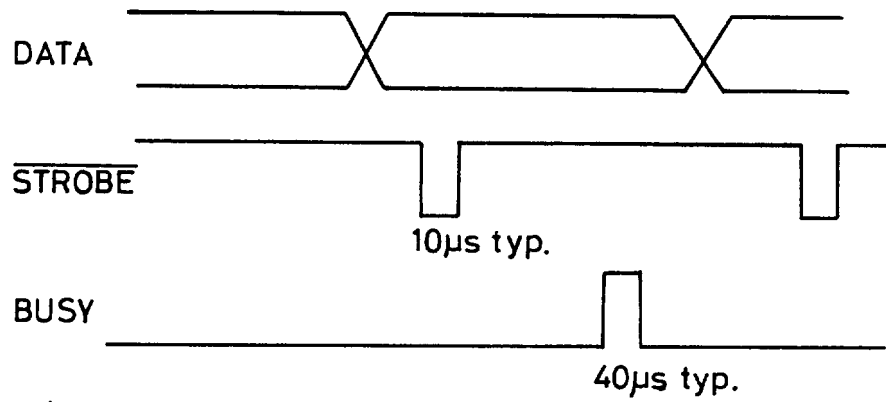
i.e. One start bit (always a zero), 8 data bits (D7 ignored), one or more stop bits.

Baud Rates	110	300	1200	2400	Baud
Bit Times	9091	3333	833	417	uS

The BUSY signal will go true momentarily after each serial character is received, and will stay true during print cycle.

Data must not be sent whilst BUSY is true.

PARALLEL DATA TIMING



The data inputs are sampled when STR is low. STR must be removed when or before BUSY goes low again to prevent multiple inputs of the same character.