USER MANUAL

DATAC 1641

SINGLE-CHIP PRINTER CONTROLLER

CONNECTION DATA

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DATAC 1641 SINGLE-CHIP PRINTER CONTROLLER

The 1641 is a single-chip microcomputer mask programmed to control the M163, M164 or M170 mini printer mechanisms. The chip and mechanisms operate from a single +5V power supply and, combined with a few external components the chip provides a serial or parallel data interface and 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

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

The following facilities are also provided:-

M163 (32 characters/line) M164/M170 (40 characters/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.

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

ALL 32 mode combinations are acceptable e.g:
ESC, OE (hex) = 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
text. 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.

32 characters per line are printed on the M163 and 40 on the M164 and
M170. 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
received 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 graphic 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. 192 dots per line (32 x 6) on the M163 printer and 240 (40 x 6) on the M164 and M170. 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 course 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 improper operation and consequential damage may result.

PIN CONFIGURATION (TOP VIEW)

RES DET	1	40	VCC (+5v)
XTAL 1	2	39	TACHO
XTAL 2	3	38	MSS
RESET	4	37	MDS
SS	5	36	BUSY
STR/SDATA	6	35	FLAG
EA	7 DATAC	34	SOL D2
RD	8	33	SOL D1
PSEN	9	32	SOL C2
WR	10	31	SOL C1
ALE	11 1641	30	SOL B2
DO	12	29	SOL B1
D1	13	28	SOL A2
D2	14	27	SOL A1
D3	15	26	VDD (+5v)
D4	16	25	PROG
D5/BR1	17	24	TST
D6 BR2	18	23	PA
PAR/SER	19	22	PTU
GND	20	21	M163/M164,M170

PIN_DESCRIPTION

PIN	NAME	FUNCTION	NOTE
1	RES DET	Reset detector input from printer.	(1)
2,3	XTAL 1,2	6MHz Crystal input	
4	RESET	Reset input: used to initialise processor. ACTIVE LOW	(2)
5	SS	Connect to Vcc for proper operation.	
6	STR/SDATA	Parallel data strobe/Serial input data	(3)
7	EA	Connect to GND for proper operation.	
8	RD	NC	
9	PSEN	NC	
10	WR	NC	
11	ALE	NC	
12-16	D0-D4	Parallel data inputs bits 0 to 4	(4)
17	D5/BR1	Parallel data input bit 5/Baud rate select.	(4)
18	D6/BR2	Parallel data input bit 6/Baud rate select.	(4)
19	PAR/SER	Parallel or Serial select: connect to GND for parallel or +5V via 10K resistor for serial operation.	
20	GND	Ground (0v)	
21	M163/M164	M163 or M164/M170 select input: connect to GND for M164/M170 operation.	
22	PTU	Paper take-up output	(5)
23	PA	Paper advance input: active low - provides continuous paper feed.	
24	TST	Self test input: active low - provides printout of self test pattern.	
25	PROG	NC	
26	VDD	+5V supply	
27-34	SOL A1-SOL D2	Solenoid driver outputs	(6)
35	FLAG	Flag output to indicate processor internal timing.	(7)
36	BUSY	Busy output: high level indicates busy condition	(8)
37	MDS	Motor Drive Signal: low level to turn Motor On	
38	MSS	Motor Stop Signal: low level to provide dynamic braking when motor turned off	(9)
39	TACHO	Dot timing input from printer	
40	Vcc	+5V supply	

NOTES:

1) A 6MHz crystal must be used for proper timing. It may be necessary to decouple pins 2 and 3 with capacitors of approx 20pF to ensure reliable operation.

2) A reset on power up must be provided. A 1uF capacitor to GND on pin 4 will fulfill this requirement, but supply level protection should be included. See recommended circuit page 9.

3) During parallel operation, data strobe (STR) can be taken low when busy is low and input data are on D0-D6. Busy will pulse high to acknowledge that data has been read in. In the serial mode pin 6 is the serial data (SDATA) input, positive true.

4) Data inputs D0 (least significant) to D6 (most significant) are the ASCII code inputs for parallel operation. In the serial mode D5 & 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.

5) PTU output goes on for approx. 40mS after each printed dot line. The signal can be used to switch appropriate drive circuitry for a paper take-up unit if required.

6) Two processor outputs are provided for each printer solenoid A, B, C, & D. It is recommended, however that only one output be used for each solenoid. The outputs should be taken via ordinary TTL buffers to provide good switching characteristics for solenoid driver circuits. The two outputs are only provided to maintain compatibility with earlier circuits where each pair was commoned to provide drive current directly into the solenoid drivers.

7) The FLAG output can be used for testing purposes. It is pulsed low momentarily to indicate timing; during serial input at data sample point and during printing at the start of each dot.

8) The BUSY output is active (high) whilst the 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.

9) Motor brake signal is taken low immediately after the motor is turned off and this signal should be used to switch on a dynamic braking circuit to stop the motor during the print head return stroke.

ELECTRICAL SPECIFICATION (ABRIDGED)

Absolute maximum ratings:

Temperature range, operating 0 deg C to 70 deg C
                   storage -65 deg C to +150 deg C

Voltage on any pin with respect to ground -0.5v to +7v.
Power dissipation 1.5W

DC Operating characteristics:

Referred to 0-70 deg C range, Vcc = Vdd = +5v ± 10%

Input low voltage   -0.5 to +0.8v
Input high voltage   2.0 to Vcc
Output low voltage   0.45v max at 1.6mA sink
Output high voltage   2.4v min at 40uA source
Power supply current   40mA typ. 80mA max @ 25 deg C - 25 deg C
Solenoid output pulse width 0.6mS typ.

APPLICATION NOTES (refer to Circuit diagram)

a)   BD678 PNP & BD677 NPN Darlington transistors: any high gain (750
      @ 1A) Darlingtons or transistors capable of 1A, continuous will
      be suitable e.g. BD675,TIP 110 & BD675,TIP 115.

b)   Good on board decoupling is required to minimise noise on the 5v
      supply.   The 1000uF electrolytic capacitor should be mounted as
      close as possible to the "solenoid common" and the 0v return.

c)   A reset circuit is shown which monitors the +5V supply and will
      reset the printer if the supply falls below approximately 4.3V.

d)   Circuitry associated with the TACHO and REED SWITCH should
      closely follow the diagram if consistent results are to be
      obtained.

e)   If controller inputs are likely to be shorted or subjected to
      over-voltage then it is recommended that they are buffered.

      Additional circuitry can be added to provide a Centronics type
      parallel input, using a data input latch, activated by the
      STROBE, and generating an acknowledge signal from the falling
      edge of the BUSY. Line receivers and drivers can be incorporated
      to provide an RS232C, V24 type serial interface if required.

f)   This manual relates to software revision 017C as indicated on the
      self test printout.   If no heading is printed on the self test
      then it is an old revision of software and parts of this manual
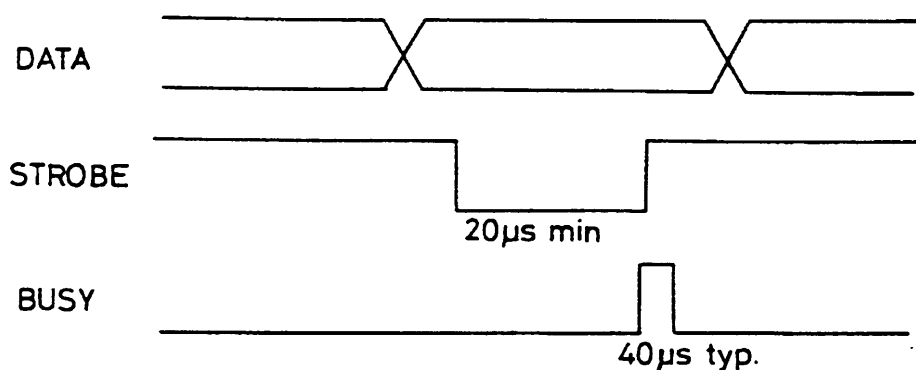   will not apply.

SERIAL_DATA_TIMING

```
1 ─────────┐     ┌────┬───┬───┬───┬───┬───┬───┬────┬──────
           │ DO  │ 1 │ 2 │ 3 │ 4 │ 5 │ 6 │ D7 │ 2 STOP
0          └─────┘
        START
```
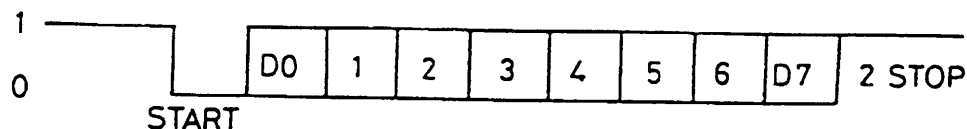
i.e One start bit (always a zero), 8 data bits (D7 ignored), one or
more stop bits.

| 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

```
DATA   ────────────<         ><                ><───────

STROBE ───────────────────┐           ┌─────────────────
                          └───────────┘
                            20µs min

BUSY   ────────────────────────────┐   ┌────────────────
                                    └───┘
                                       40µs typ.
```

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.

J1

+5V
+5V

SOL. A
SOL. B
SOL. C
SOL. D

MOTOR −
R-DET.
MOTOR +
0V

7V5 D2

D5

D3

D4

BD677

1R2
1R3
1R4
1R5

F11 2K2
1R9
BC183L
R10 10K

1R7 BD676
1R6 BD677
R4 2K2
R5 2K2

R2 2K2
R3 1K
R9 2K2

BC676
1R8
PTU

10
5
3
1

R6 2K2
D1 3V9
R7 2K2
1R1 BC183L
R8 1K
1R10 R13
BC183L
C6 1µF
R1 10K

74LS366
IC2

DATAC
1601
IC1

6MHz
C5 22pF
C4
150 1
160 1

8
6
4
2

0V
0V
TEST

J3

+5V
4
2

F1 2A

+5V 5
7
0V 9
11
RESET 3

STROBE/SER DATA 1
D0 2
D1 4
D2 6
D3 8
D4 10
ERR/DS 12
ERR2/D6 14
PTR/SER 16
PAPERFEED 13
BUSY 15

J2

C2
1000µF
C1 1000/10V
C3 0.01µ

TITLE
1605B MARK II

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NUMBER
CJ/375
SHEET No. 1 OF 1