B I T S & P.C.s COMPUTER PRODUCTS LTD.
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PROGRAMMABLE CHARACTER GENERATOR (C) COPYRIGHT BITS & P.C.s

Design B.S.WINGFIELD

Documentation B.S.WINGFIELD

Software I.S.CHAMBERLAIN

Take care in the assembly of your P.C.G. and it will work first time. Before you begin construction read this documentation very carefully.

If you develop any software,games,educational or whatever we would very much like to hear from you as we intend to build up a software library for use with the P.C.G.

KIT CONTENTS

Carefully check the contents of your kit with the list below please report any shortages .

1) Double sided through plated P.C.B. ref:BSW 170
2) 2 24 pin dil to 26 pin strip line connectors on length of ribbon cable
3) 4 10n ceramic capacitors
4) 1 length connecting wire
5) 2 24 pin i/c sockets
6) 2 20 pin i/c sockets
7) 5 16 pin i/c sockets
8) 3 14 pin i/c sockets
9) 2 26 pin strip line plugs
10)1 7400 i/c
11)1 74LS14 i/c
12)1 74LS32 i/c
13)1 81LS97 i/c
14)1 DP8304 i/c
15)5 74LS157i/c
16)1 4118 i/c
17)2 solder posts
18)3 pieces double sided sticky tape
19)3 self adhesive rubber feet
20)1 cassette of demo software and editor

ASSEMBLY

Before inserting any components into the P.C.B. hold the P.C.B. in front of a strong light and check for any obvious track breaks or etch faults.These can occur in the best of boards.A precautionary examination at this stage can save a lot of trouble later.

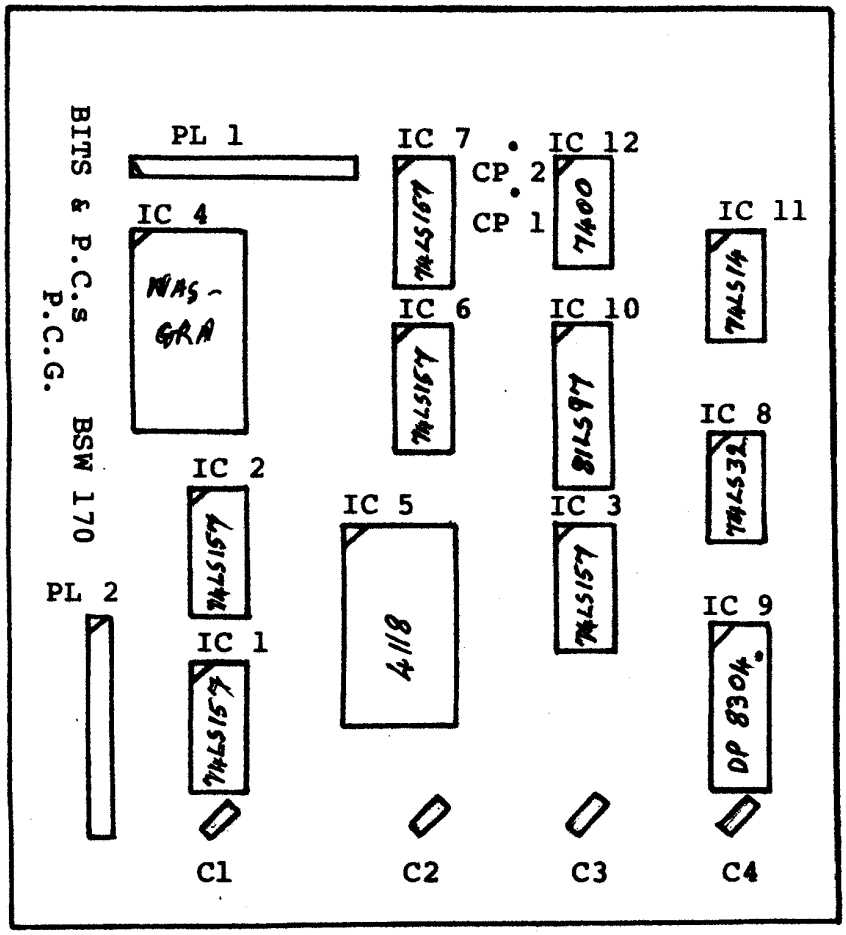
Observe MOS handling precautions with the 4118 ram i/c.

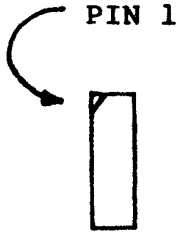
Insert the components in the following order with reference to the overlay drawing.The component side of the P.C.B. is the one with our name and reference on.

Solder posts
All i/c sockets
capacitors
PL1 & PL2
the following i/c's

IC1,2,3,6,7	74LS157
IC8	74LS32
IC9	DP8304
IC10	81LS97
IC11	74LS14
IC12	7400
IC5	4118 ram

IC4 ** optional graphics rom not part of kit


BITS & P.C.s
P.C.G.
BSW 170
PL 1
PL 2
IC 4
MAS-
GRA
IC 2
74S174
IC 1
74S174
IC 7
74S157
IC 6
74S157
IC 5
4118
IC 12
7400
CP 2
CP 1
IC 10
81LS97
IC 3
74LS157
IC 11
74LS14
IC 8
74LS32
IC 9
DP 8304
C1
C2
C3
C4


PIN 1

P.C.B. OVERLAY

VIDEO MODIFICATION TO NASCOM 2

This modification is not essential but improves the video of a NASCOM 2 and makes the resolution greater.It also makes the writing of P.C.G. software much simpler.

We recommend that at this stage a decision is made to implement this modification and that this is done now and tested before connecting and testing the P.C.G.

All our P.C.G. software will assume that this has been done.

Remove the following i/cs and replace with the legs indicated bent at right angles to the i/c body such that they do not connect with the socket and are ready to have wires soldered to them.

IC53 legs 1 and 11 ✓

IC56 legs 5 and 6 ✓

IC68 legs 1 and 10 ✓

Now link the following points with the wire provided

IC68 pin 1 to 8 ✓

IC68 pin 10 to 16 ✓

IC53 pin 11 to IC68 pin 5 to IC56 pin 5

IC56 pin 6 to IC44 pin 11 ✓

IC53 pin 1 to IC68 pin 11 ✓

Now test your NASCOM 2 you may find that the picture is now a little higher on the screen, the tv or monitor will have to be adjusted to compensate for this.Now try your existing graphics you will find for example that the little man graph/5 has now got legs.When this stage is complete continue with the section on P.C.G. instalation.

P.C.G. INSTALLATION DETAILS

The first decision to make before proceeding with this section is to decide which one of the 8 ram sockets (i/c 35 to 42) is to be used and at which address it is to be located. Assuming i/c 42 and address C000 hex are spare then use i/c 42 at C000.

To achieve this strap LKS1 3 to 4 to 11 and strap LKB1 for RAM.At first sight our connections for LKS1 may appear incorrect but in fact the NASCOM manual shows blocks A & B reversed on LKS1.

If you decide to fit the P.C.G. in any other location then study this manual in conjunction with the NASCOM 2 manual

Make sure that the relevant LKB linkblock is strapped for RAM.

If it is neccessary to mix RAM and ROM in the same block simply strap LKS1 as if that block were all RAM.

Check over the now completed P.C.B. very carefully for dry joints and solder splashes.When satisfied stick the three self adhesive rubber feet to the underside of the P.C.B. as indicated in fig.1 .Make sure that they line up with the i/c tops to which they will be stuck .

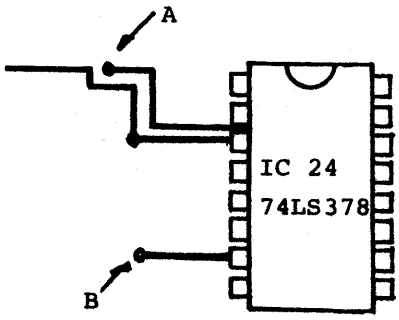
It is recommended that the P.C.G. is tested before final mounting and connection of the mode control wires.

The ribbon connectors are supplied ready terminated with a 26 pin strip line on one end and a 24 pin dil header on the other.These are terminated on 24 way ribbon cable to the correct length.Plug the shorter length on to PL 1 and the other to PL 2 refer to fig.1 for actual positions.Note that the ribbon cables are of sufficient length to allow flexibility in the choice of RAM socket i.e. i/c,s 35 to 42 Plug the 24 pin dil header from PL1 into the graphics rom socket on the NASCOM 2.Plug the 24 pin dil header from PL2 into the chosen RAM socket.

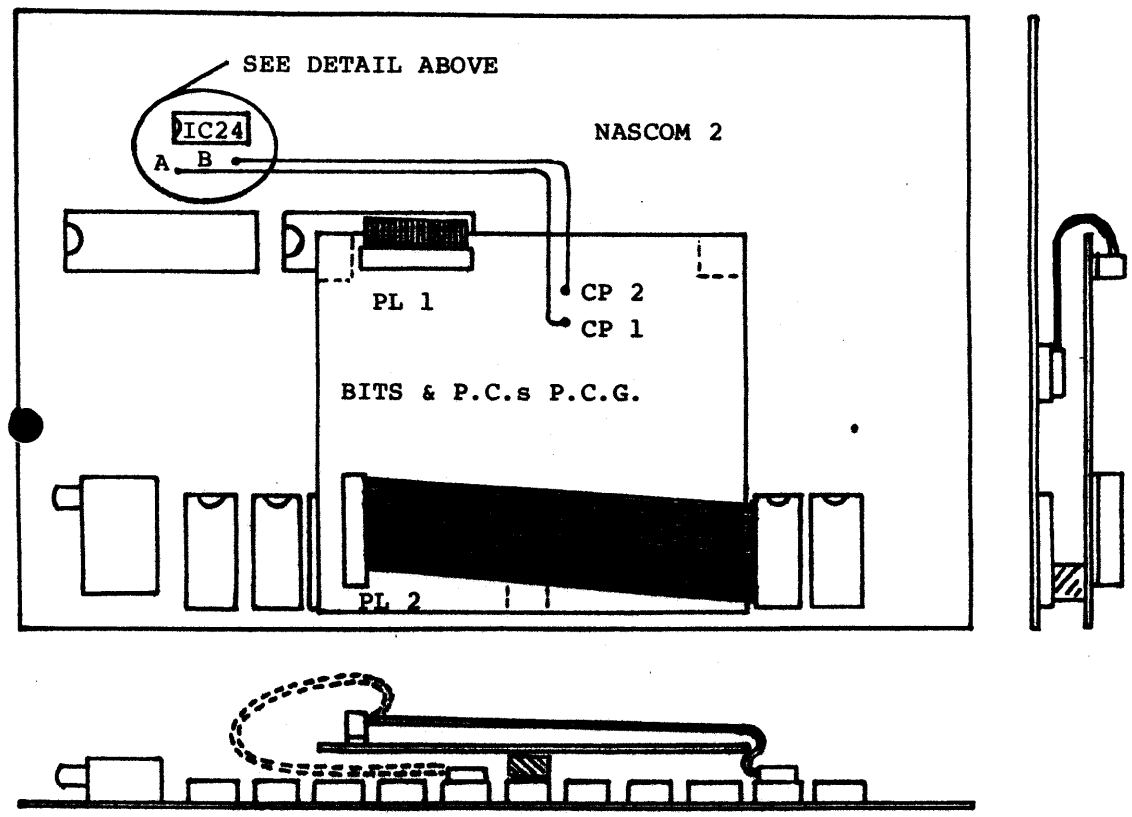
Check carefully making sure that all the above instructions have been carried out correctly.

Make sure that the P.C.G. is not touching any part of the NASCOM main board. Now we are ready for the preliminary test.

fig. 1



DETAIL SHOWING THROUGH PLATED HOLES A & B (see text)



VIEWS OF P.C.G. INSTALLED ON NASCOM 2 SHOWING CONNECTIONS AND MOUNTING BLOCKS

PRELIMINARY TEST AND FINAL INSTALLATION

Switch on your NASCOM and ensure that it operates normally i.e clears screen and gives the monitor prompt.

Make sure that the graphics switch LSW2/9 is up i.e. set for graphics.

Now using the modify command check that P.C.G. RAM exists at the selected address.e.g. If the RAM is at C000 hex using the M command modify C000 to 00.

Now use the copy command as follows C C000 C001 400 this will copy 00 to all P.C.G. locations.

Now tabulate C000 C400 and check that the contents of each byte are all 00.

Now modify location 0BCA (the first video location) to 80 hex this will place the first graphics character into this location.A graphics character may or may not appear depending upon the state of the hardware switch on the P.C.G.Carefully ground CP1 and CP2 alternately this will cause a graphics character to flash.Finaly leave the P.C.G. in the mode where the character is not visible.

The reason for the character not being visible is that we are now in the programmable graphics mode and in the previous test all P.C.G. bits were set to 0.

Now modify the first P.C.G. ram location (possibly C000) to e.g. 10 and a single dot should appear.At this stage your P.C.G. is operational and requires finally fixing to the top of the NASCOM 2 main board using the double sided sticky tape between the rubber feet and the i/c tops.

If your P.C.G. fails at any stage please check your soldering and connections carefully.

All that remains now is to connect the two wires that control the software switch.With reference to fig.1 identify points A and B on your NASCOM 2 and connect them to the P.C.G. as shown.

CONTROL OF THE SOFTWARE SWITCH

There are two methods of controlling the switching of the P.C.G. the first is a toggle system where the subroutine can be called and will change the present state of the graphics i.e. Normal graphics or Programmable.

The second method consists of two subroutines the first one will always give programmable graphics and the second will always give normal graphics.

METHOD 1

```
21 00 0C    LD HL 0C00 PORT0
7E          LD A (HL)
EE 04       XOR
77          LD (HL) A
DF 5E       FFLP  Flip bits of port 0
DF 5B       MRET  return to monitor
```

METHOD 2

To switch P.C.G. ON:

```
21 00 0C    LD HL 0C00 (PORT0)
7E          LD A (HL)
CB 97       RESA bit 2
CB EF       SETA bit 5
77          LD (HL) A
DF 5E       FFLP
DF 5B       MRET
```

To switch P.C.G. OFF

```
21 00 0C    LD HL 0C00
7E          LD A (HL)
CB D7       SETA bit 2
CB AF       RESA bit 5
77          LD (HL) A
DF 5E       FFLP
DF 5B       MRET
```

The above routines can be called in a program .It is only neccessary to change the monitor restart to a return (C9).

To call them from BASIC it is neccessary to :

1)Replace DF 5B with C9

2)Put the address of your subroutine in USRLOC(4100)

3)Execute X=USR(0)

THE EDITOR

The editor package simplifies the programming of special characters and is very simple to use. The editor is written in BASIC and is provided on cassette recorded at 1200 baud.The editor assumes that your P.C.G. ram resides at C000H if your location is different then this will require a simple modification to the program.Examine the first three lines of the program in line 3 variable MP=-16385 this is the variable to alter,its value is the start of your P.C.G. ram.When you have done this type RUN.

The first thing the editor will do is to ensure that the computer is in a programmable graphics mode by actuating the software switch.

On the screen you will now have ,to the left the entire contents of the P.C.G. ram displayed and a large white rectangular view window to the right.

The editor will now be requesting the entry of a main program command either TYPE:

1(enter) Which will enter edit mode on character currently on view

2(enter) Which will return to BASIC

3(enter) Which will clear the P.C.G. ram to all blank characters

To view a character enter its decimal value i.e. 128 to 191.The character will then appear scaled up in the view window, and normal size below .

To edit this character type 1 (enter) you are now in the edit mode a flashing cursor will now be seen,this can be moved arround the view window using the cursor control keys.Pressing S or R will SET or RESET the dot currently under the cursor.A will abort the character and return to the main command mode,W will write the current character to the P.C.G. ram.

To the right of the view window a small square (pixel) will be seen if the dot curently under the flashing cursor is set.
On the lower part of your screen you will see the decimal value of each byte of the character currently under edit.These values are valid only on initial display of the character in the view window and will not change unless the character is written under W to the P.C.G. ram.

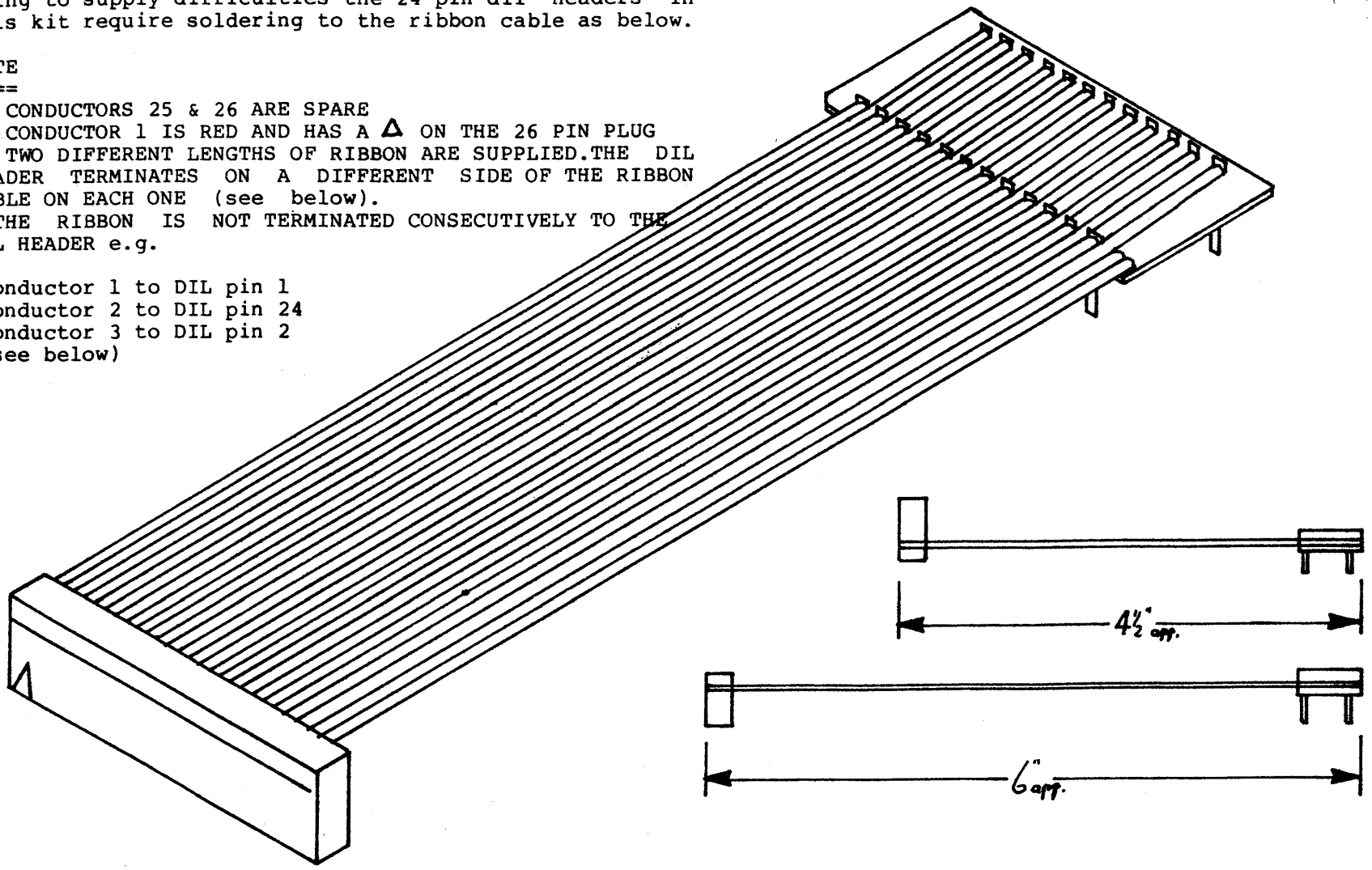
P.C.G. ERRATA RIBBON TERMINATIONS

Owing to supply difficulties the 24 pin dil headers in this kit require soldering to the ribbon cable as below.

NOTE

1) CONDUCTORS 25 & 26 ARE SPARE
2) CONDUCTOR 1 IS RED AND HAS A Δ ON THE 26 PIN PLUG
3) TWO DIFFERENT LENGTHS OF RIBBON ARE SUPPLIED.THE DIL HEADER TERMINATES ON A DIFFERENT SIDE OF THE RIBBON CABLE ON EACH ONE (see below).
4)THE RIBBON IS NOT TERMINATED CONSECUTIVELY TO THE DIL HEADER e.g.

conductor 1 to DIL pin 1
conductor 2 to DIL pin 24
conductor 3 to DIL pin 2
(see below)



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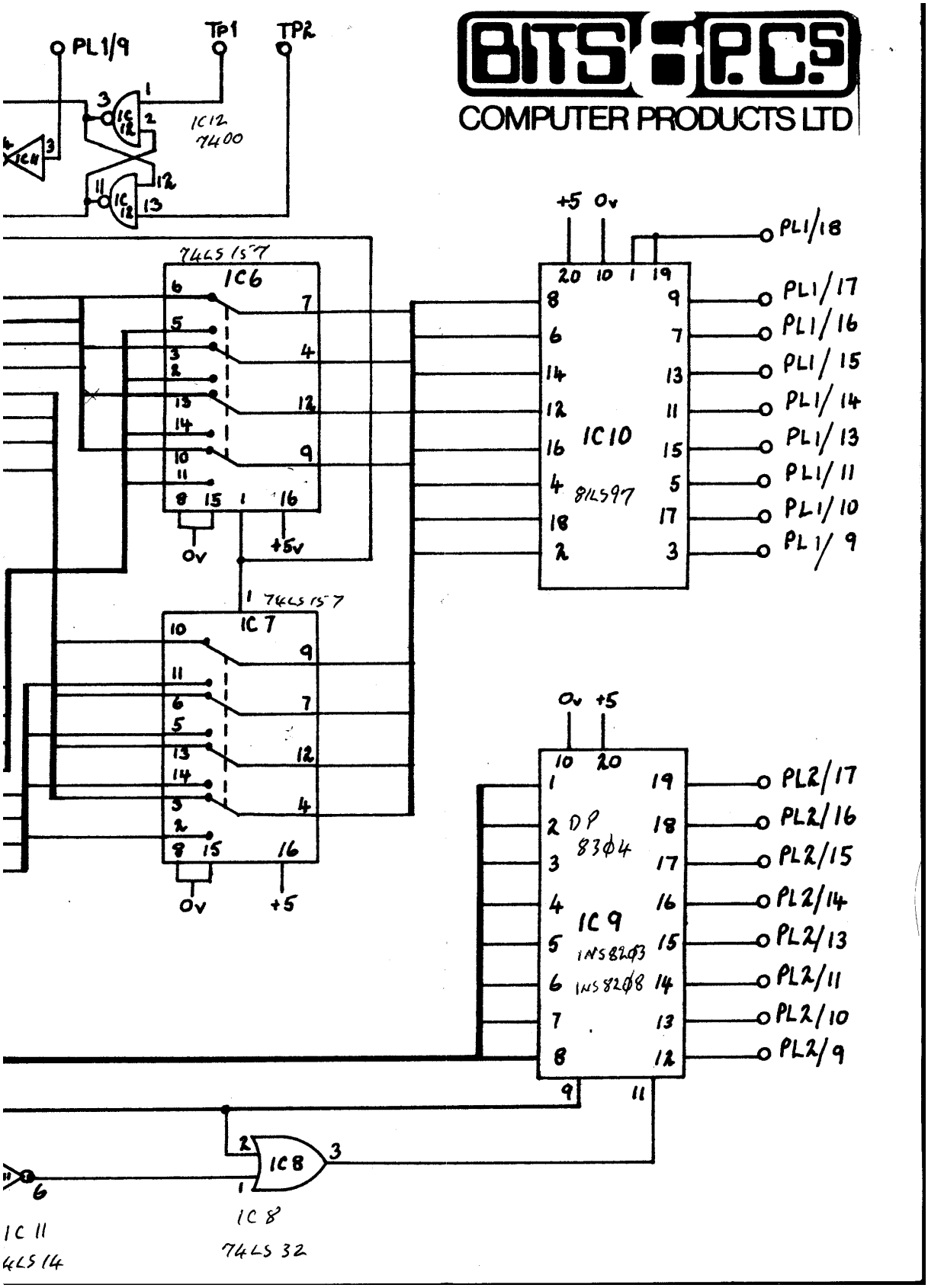

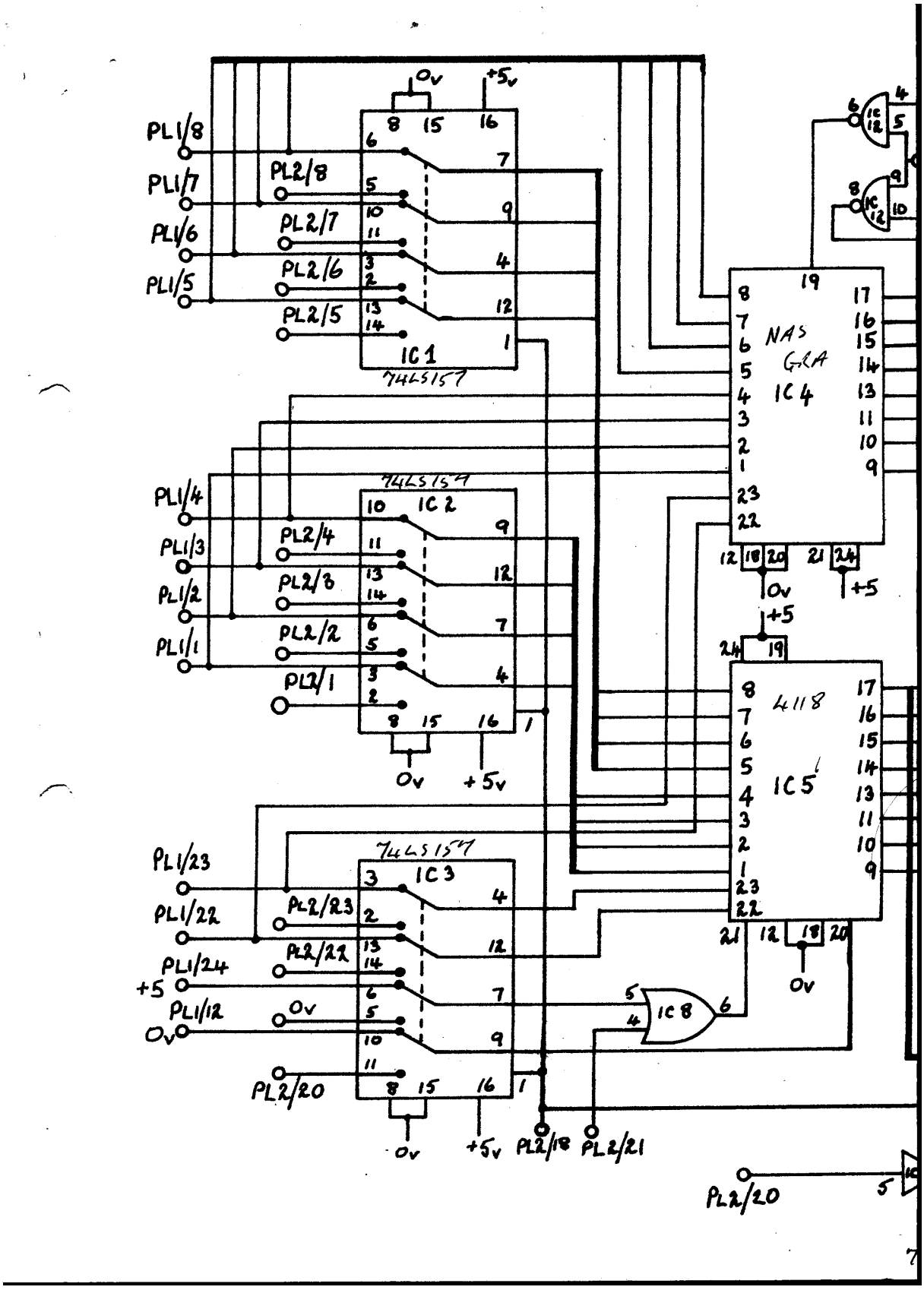
PL1/8
PL1/7
PL1/6
PL1/5
PL2/8
PL2/7
PL2/6
PL2/5
IC 1
74LS157
PL1/4
PL1/3
PL1/2
PL1/1
PL2/4
PL2/3
PL2/2
PL2/1
IC 2
74LS157
PL1/23
PL1/22
PL1/24
+5
PL1/12
0v
PL2/20
PL2/23
PL2/22
IC 3
74LS157
IC 4
NAS
GRA
IC 5
4118
IC 8
PL2/18
PL2/21
PL2/20
0v
+5v

SOCKET CONNECTIONS.

4118 Socket	MAIN BOARD.
1 – A7	24 – 5v
2 – A6	23 – A8
3 – A5	22 – A9
4 – A4	21 – LKB – WRD
5 – A3	20 – LKB – RDB
6 – A2	19 – LKB – 5v
7 – A1	18 – LKB – CS (--è)
8 – A0	17 – D7
9 – D0	16 – D6
10 – D1	15 – D5
11 – D2	14 – D4
12 – (--è)	13 – D3

PL2 Long Lead

BASIC ROM Socket	MAIN BOARD
1 – A7	24 - +5v
2 – A6	23 – A8
3 – A5	22 – A9
4 – A4	21 – A12
5 – A3	20 – BROM (-è)
6 – A2	19 – A10
7 – A1	18 – A11
8 – A0	17 – D7
9 – D0	16 – D6
10 – D1	15 – D5
11 – D2	14 – D4
12 (--è)	13 – D3

PL1 Short Lead

N.B. (--è) denotes ground connection. double check with circuit diagram and instructions.