microbee engineering note book

Ideas, additions, improvements and service checklist for your microbee

An invaluble aid for every microbee computer owner. Notes and drawings by Max Maughan
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MICROBEE ENGINEERING NOTEBOOK

This booklet contains ideas, additions, improvements and changes that can be made to your MicroBee. Many improvements are already in the latest MicroBees.

This is not the Technical Manual and does not replace it. Most of its ideas have been compiled by Max Maughan, Engineering Manager, Applied Technology.

These ideas and additions are for your interest and can be added to your MicroBee by you or someone with hardware knowledge. The only things that will be added by Applied Technology are the modifications required with upgrade. These will only be done with the upgrade and not under any other circumstances.

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FIELD CHECK LIST

Please note: This list is written for people with some electrical knowledge. You must know how to use a multimeter and a low-wattage soldering iron. In many cases a working MicroBee would be handy to be able to swap parts; when swapping parts put the suspect part into the working unit. For example, swap the 6545 from the dead unit to the working unit; this way if there is anything in the dead unit causing the chip to fail it won't damage the good one.

DISCONNECT BATTERY WHEN CHECKING UNIT

FAULT	CHECK	REMEDY
No power on or picture dead unit	Try another plug pack unit; if machine OK check wiring and voltages — should be no load 14-16 volts	Replace or repair plug pack
Ditto	Still dead, plug pack OK — remove cover, check input voltages at D14, check D14 for open circuit and D15 for short circuit	Replace D14; remove D15; don't replace D15
Ditto	Still dead — check all tag tantalum capacitors for burnt tops; with suspicious ones, remove one leg from board and power up	Replace capacitor
Ditto	Still dead — if input volts OK, check the three 5 volts: 1. pin 16 IC2, main board; 2. pin 16 IC3, main board; 3. pin 24 IC30, core board	Any 5 volts missing, check and replace 7805 reg.
Ditto	Still dead, all 5 volts OK — try another core board	Change ROMs, service core board
Ditto	Still dead, core board OK — change IC25 Z80CPU	Replace Z80
Ditto	Still dead, CPU OK — remove IC9 6545, leave out, and try for power-on beep	Replace 6545 if beep heard
Ditto	Still dead, 6545 out — change IC1 PIO, try for power-on beep	Replace IC1 PIO
Ditto	Still dead, all above OK — time for an experienced technician with test equipment	Take unit to MicroBee Service Centre
Power-on beep but no picture	Check leads from DIN plug to monitor for open circuits	Repair connections
Ditto	Still no video, leads OK — try running a BASIC program using play; test control 'G'	If no go then replace 6545
Ditto	Still no video, core board and 6545 OK — time for Service Centre	Service Centre
Picture but no beep	Check wiring to speaker and speaker for open circuit	Repair wiring
Ditto	Change IC1 PIO and check TR3 under keyboard	Replace PIO or TR3
Loss of picture after a couple of minutes	Check regulators under keyboard for loose screws stopping heatsinking	Tighten nuts or use pop rivets
Ditto	Regulators heatsinking OK — change IC9 6545	Replace 6545
Ditto	IC9 OK — try another plug pack	Replace or repair plug pack
Breaking out of programs back to ready	Change plug pack — bridge rectifier breaking down in plug pack	Replace bridge rectifier in plug pack
Only cursor on screen after 5 to 10 minutes	Change plug pack - same as above	Replace bridge rectifier in plug pack
Black bands moving up screen	Check DIN plug — move to see if bands change; if no change, try another plug pack	Replace plug pack
Keys not working	Resolder contacts while pressing hard on keytop; if still no go, remove and replace (use a solder sucker to remove solder from contacts and PC holes)	Resolder or replace
No keyboard input, incorrect video	Change IC9 6545	Replace IC9 6545

Know Your Limits When Attempting Repairs

The faults and remedies listed are the most common faults and easy to fix. Other less common faults are harder to locate. These faults involve removal of soldered-in ICs. Experience is required to locate correct ICs, and boards damaged by removal of chips will not be replaced. Normal *labour* costs will be charged to repair the damage. If in doubt use your nearest **MicroBee Service Centre.**

A good example of what can happen when you try to do something you don't know enough about happened in June 1983. An electronic magazine published an article on upgrading your MicroBee from 16K to 32K yourself at a fraction of the cost. Applied Technology's price for this upgrade was $125.00. A customer reading this article decided to do it himself.

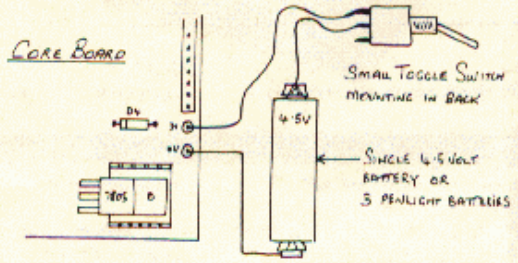
However, after his attempt to do the upgrade, the MicroBee didn't work any more, so Applied Technology's service department received the unit to restore it to working condition. Somehow this customer had managed to destroy all the RAM chips on the core board. To restore his MicroBee to a 16K unit cost him $130.00; five dollars less and he could have had a 32K instead of his original 16K.

Unless you have plenty of money to waste, know your limits when attempting repairs or connecting things to your MicroBee. If you're not sure how to do it, ask for advice from someone with the required knowledge.

BATTERY BACK-UP

To get longer life from your battery, switch it off when it is not needed. Even though battery back-up is great, it is still not as good and reliable as a good copy on tape. You never know when the battery will go flat.

If you must have battery back-up 24 hours a day, seven days a week, then install a rechargeable battery. By switching the battery off when it is not required I have had the same battery for over twelve months.



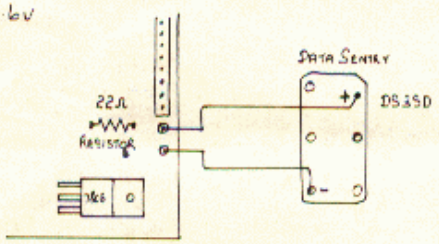
RECHARGEABLE

NICKEL - CADMIUM BATTERIES

GENERAL ELECTRIC DATA SENTRY

MODEL NO DS3SD

VOLTAGE 3·6V



NOTE: These batteries are not stocked or sold by Applied Technology.

Facts About Plug Packs

These units have been tested and approved by their manufacturers to run the MicroBee. We have no control over the quality of parts used in these units.

It is normal for them to get warm after a period of time running under full load. The MicroBee uses between 900 ma and 1 amp and the plug packs are designed to supply 1 amp.

In the plug pack there are three components: 1. Transformer, 2. Bridge rectifier, 3. 2000 uf capacitor. The part that usually fails is the bridge rectifier. It is not the continuous supplying of 1 amp of current that causes this to fail, but the power-on surge current, which can be as high as 30 amps.

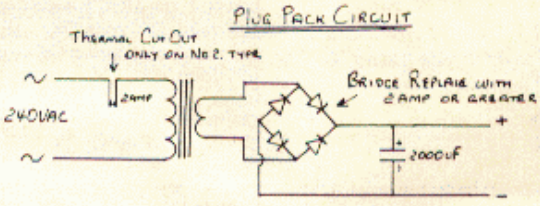
Under warranty the whole plug pack is replaced free of charge; this does not include the leads. Outside warranty customers are up for the cost of a new plug pack, but in most cases the plug pack can be repaired.

Repairing A Plug Pack

There are two types of plug packs: 1. The Arlec that plugs into the power point; 2. The MicroBee one, fitted on a lead. To repair no. 1, lay pack on its side on a hard surface and hit with a hammer along the joint, then pull apart. For no.2 type, unscrew four screws, then tap around the joint to get apart. Replace the bridge rectifier with another bridge or four diodes, then re-glue or screw back the cases.

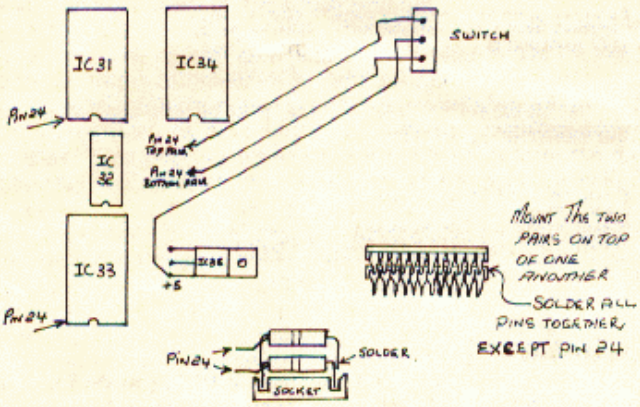
Just as a point of interest, MicroBees don't mind being left switched on. For example, on August 24 1982 at the Gosford factory we wanted to find out the MTBF on the MicroBee. A MicroBee was switched on with a program running in a continuous loop, and was left on for 24 hours a day, 7 days a week. On July 14 1983 when this was written, that MicroBee was still running, and not one component had failed. So when you're not using your MicroBee, put it to work; for example, use it as a burglar alarm.

No failures in eleven months = 325 days = 7800 hours. This would be equivalent to using your MicroBee for three hours a day, 7 pm to 10 pm, seven days a week for 2600 days – which amounts to 7.12 years.

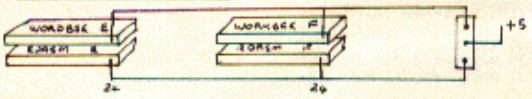


WORDBEE AND EDITOR ASSEMBLER IN THE SAME MICROBEE

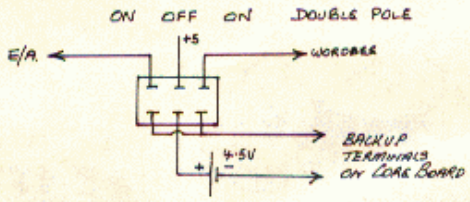
M.S. ARMIGNAN
APPLIED TECHNOLOGY.



JOIN THE TWO PIN 24 TOGETHER OF EACH SET



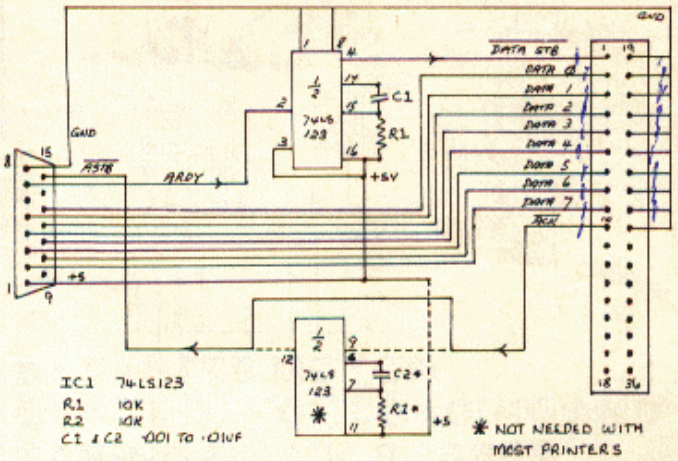
USING ONE SWITCH FOR ROM AND BATTERY BACK-UP



MICROBEE PRINTER INTERFACES

PARALLEL PRINTER

DRAWN : M.S.M.
22/6/83



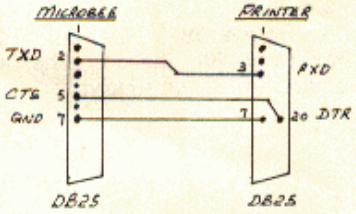
IC1 74LS123
R1 10K
R2 10R
C1 & C2 .001 TO .01MF

DB15 CONNECTIONS

1 — +5V	6 —	11 — DA4
2 — DA7	7 — ARDY	12 — DA2
3 — DA5	8 — GND	13 — DA0
4 — DA3	9 —	14 —
5 — DA1	10 — DA6	15 — ASTB

NOTE READY MADE CABLES SOLD BY APPLIED TECHNOLOGY.

SERIAL PRINTER RS232

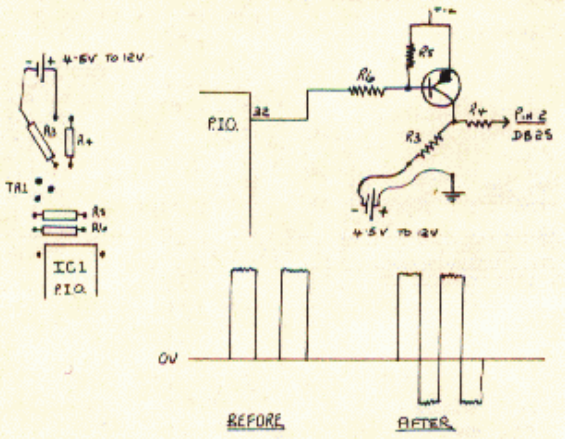


PROTOCOL

300 BAUD
OR
1200 BAUD
8 DATA BITS
NO PARITY
TWO STOP BITS
CR & LF TRANS.

IMPROVING RS232 OUTPUT ON THE MICROBEE

BY MAX MAUGHAN
APPLIED TECHNOLOGY.



The RS232 output from the MicroBee will not drive all RS232 receiving devices because it has no negative drive signal. If your receiver is a 1489 IC receiver you will have no problems. If the receiver has an input resistor you will probably have problems.

If you know the receiver circuit works because it worked on another machine with an RS232 transmitter circuit, OK. Then you need to try the above circuit modifications in your MicroBee. For a quick and easy test use a battery between 4 and 12 volts. Current drain from the battery is low so it could become permanent. Disconnect RS232 plug when not in use to save battery life.

Another suggestion is if your printer has a –12 volt supply, connect it to a spare pin on the DB25 plug, feed it back to the MicroBee and connect it to R3. The only other way – a rather untidy way – is a separate 12 volt supply.

REMOVING THE LINEFEED CHARACTER FROM THE LIST OUTPUT STREAM

Some printers, usually parallel interface models, perform both a carriage return and line-feed when they receive the ODH character (return). Since the MicroBee sends an OAH (line-feed) code in the listing as well as a return, double spacing results, wasting paper.

To remove this problem, a special routine can be placed into the spare RAM which intercepts the LF code before it gets to the output routine.

The assembly code to accomplish this is as follows:

```
0148    FE0A        cp      1F      ;is it a linefeed
014A    C8          ret     z       ;if it is,dont print it
014B    C3xxxx      jp      routine ;print the character
```

The address "xxxx" depends upon which stream is being used for the printer.

```
Parallel printer    address B5F8    xxxx = F8B5
300 Baud RS232      address A87A    xxxx = 7AA8
1200 Baud RS232     address A87F    xxxx = 7FA8
```

The 16-bit printer vector must also be changed to print to the intercepting routine:

```
Store 48H, 01H at addresses
00B4H, 00B5H for parallel printer (device 1)
00BAH, 00BBH for 300 baud RS232 (devise 4)
00BCH, 00BDH for 1200 baud RS232 (device 5)
```

In BASIC

To make the above changes from BASIC, run the following program after the MicroBee has been **cold started**

```
Parallel printer (device 1)
00100 DATA 254,10,200,195,248,181
00110 RESTORE 100
00120 FOR I=328 TO 333: READ A : POKEI,A: NEXT I
00130 POKE 180,72: POKE 181,1

300 Baud Serial Printer (device 4)
00100 DATA 254,10,200,195,122,168
00110 RESTORE 100
00120 FOR I=328 TO 333: READ A : POKEI,A: NEXT I
00130 POKE 186,72: POKE 187,1

1200 Baud Serial Printer (device 5)
00100 DATA 254,10,200,195,127,168
00110 RESTORE 100
00120 FOR I=328 TO 333: READ A : POKEI,A: NEXT I
00130 POKE 188,72: POKE 189,1
```

IMPROVING KEYSWITCH RELIABILITY

To improve the reliability of the keyswitches on the MicroBee, a resistor network, RN1, has to be changed.

This resistor network is in front of IC4 under the keyboard frame. It is used as a pull-up resistor on the input lines of IC4 and does not appear on the circuit diagram.

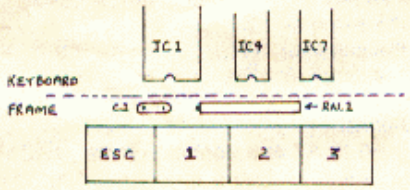
The resistance value of this network is 3k3 or 4k7, which is too low. The resistance has to be increased to 33k (or near to this value); a 33k network or eight 33k resistors will do.

To remove the old network, pull out keyswitches nos. 1 and 2; remove them as described in the notes on repairing keyswitches. With switches removed, suck out solder from the resistor network connections. Remove resistor through keyswitch holes.

Fit new resistor pack, then refit keyswitches. If you have to use resistors they may not fit under the keyboard frame. If you cannot fit them, solder them on the bottom; there is plenty of room underneath between the base and the case.

If you have a machine with faulty keyswitches it is advisable to change the resistor network first. Most if not all of your faulty keys will disappear.

This repair can be done by the service department, but the normal repair charges will apply if the machine is out of warranty. It is not necessary in most cases to change this resistor if key operation is okay.



REPAIRING KEYSWITCHES ON THE MICROBEE

Tools required: 1. soldering iron; 2. solder sucker; 3. long-nose pliers; 4. small screwdriver; 5. ink rubber.

If you have any keyswitches that are hard to use on your MicroBee and you can't afford the down-time to send it in for repairs, then you or someone you know who can use a soldering iron should be able to fix that troublesome keyswitch.

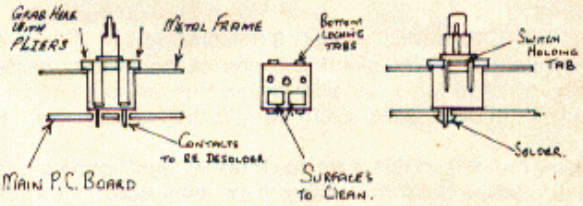
The keyswitch has to be removed and the contacts inside cleaned with an ink rubber or very fine emery paper.

To remove a keyswitch the MicroBee has to be completely removed from its covers. Remove the keytop of the faulty key – just pull it straight off. Then, with your soldering iron and solder sucker, remove the solder from the holes holding the keyswitch in the main board. **Caution:** do not use too much heat on the switch contacts or you may melt the plastic switch case.

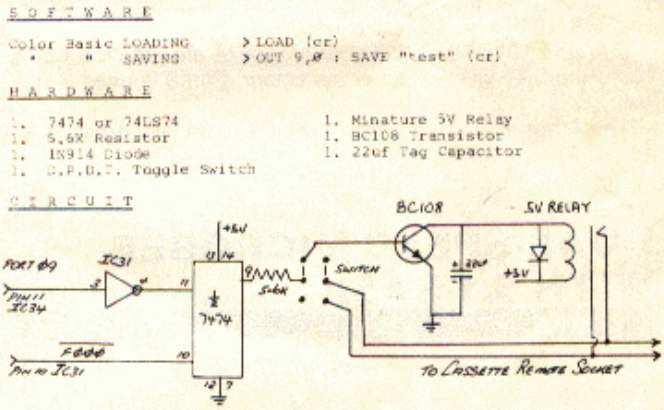
With the solder removed, from the keyboard side grab the keyswitch body with a pair of long-nose pliers near the frame on the right and left sides. Then pull up; if all the solder has been removed it should pull out easily.

Then with a very small screwdriver remove the bottom of the switch (**watch out for the spring**). With the switch apart clean the two gold contacts. Re-assemble the switch and install back into the Bee.

The whole job will take around 15 minutes. **Note:** only attempt this on machines out of warranty. Keyswitches are completely replaced on warranty machines or any machine serviced by Applied Technology.



CASSETTE MOTOR CONTROL FOR LOADING AND SAVING ON MICROBEES WITH COLOUR 5.22e BASIC



On the IC MicroBee the 7474 can be placed in IC32 position (cut tracks first), connect pin 1 IC30 to 0V. The relay can be mounted in the spare socket.

Operation

Out 9,0 set the 7474; this latches the relay when the contacts close, starting the motor. When anything is written to the screen F000, the 7474 is reset, stopping the motor. During loads and saves nothing is written to the screen except the "*". The capacitor stops the relay from changing during this write to the screen. Load and Save out 9,0, then write and set the 7474 again. PLAY, LLIST, LPRINT also out 9,0, so the switch has been added to stop the relay clicking during play. This allows you to rewind your tapes without disconnecting any plugs. Test control "G" then space.

CASSETTE MOTOR CONTROL FOR LOADING AND SAVING ON MICROBEES WITH STANDARD 5.1 BASIC

Note: With 5.1 BASIC you can use the same circuit as the Colour BASIC but you cannot use the $\overline{F000}$ signal and you have to enter a bit more software.

Software

5.1 BASIC LOADING > OUT 9,0 : LOAD (cr)

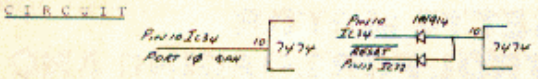
When the tape is loaded use one of the two suggestions in the operation.

5.1 BASIC SAVING> OUT 9,0 : SAVE "test" : OUT 10,0 (cr)

Or> OUT 9,0 : FOR X=1 to 3: SAVE "test" :next x : OUT 10,0 (cr) saves "test" three times then stops motor.

Hardware

Same as used with Colour BASIC version.



The 7474 can be mounted in the spare socket but the relay will have to be mounted where it fits best. Stick it on the back or side near the spare socket.

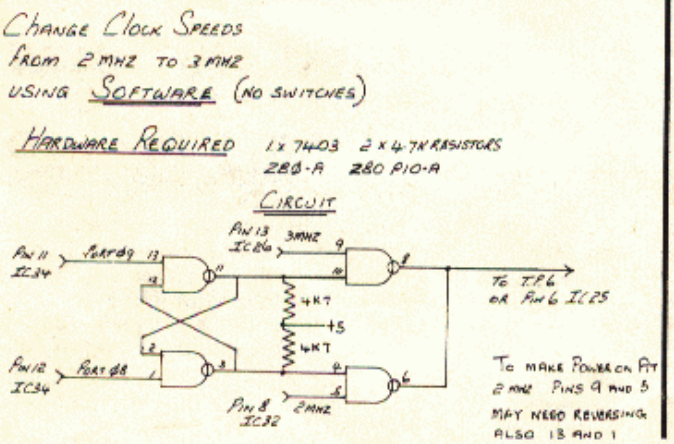
Operation

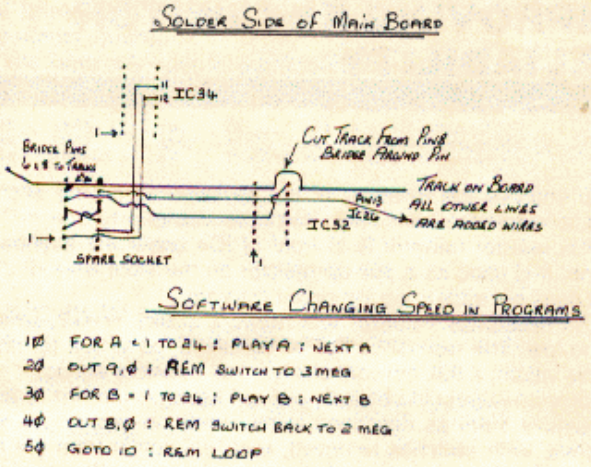
To have the motor stop automatically after loading, save your programs with Auto start; the first line of the program could be 100 OUT 10,0 REM stop Motor on Cassette.

Use port 10 not port 8; if your programs are run on a Colour MicroBee they will not upset the colour. Port 8 is used for colour.

The other way to stop the tape is to manually press Reset or type in ›OUT10,0.

DUAL-SPEED MICROBEE WITH 5.1 BASIC





SOFTWARE CHANGING SPEED IN PROGRAMS

```
10  FOR A = 1 TO 24 : PLAY A : NEXT A
20  OUT 9,0 : REM SWITCH TO 3 MEG
30  FOR B = 1 TO 24 : PLAY B : NEXT B
40  OUT 8,0 : REM SWITCH BACK TO 2 MEG
50  GOTO 10 : REM LOOP
```

DECODING EXTRA INPUT/OUTPUT PORTS

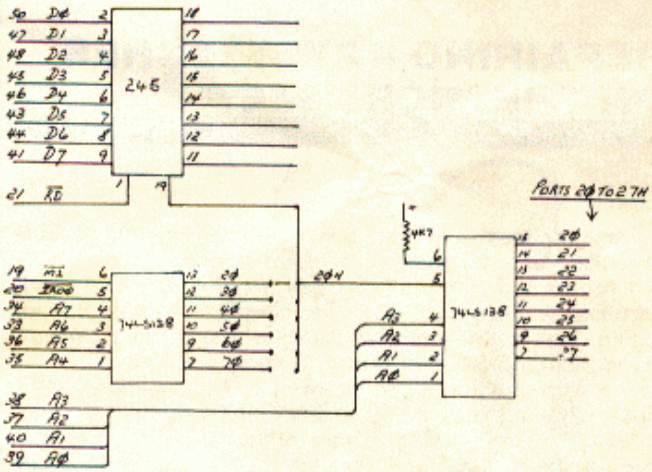
Ports 20 Hex to 27 Hex or 2F hex
Selectable from 20 Hex to 70Hex in 10H steps

Note:

Ports 00 to 20 hex are decoded in the MicroBee
Port 00 is the same as 10H
Port 08 is the same as 18H
Port 0F is the same as 1FH

Address line A4 is not decoded, causing the double up. Not to worry, 223 ports left.

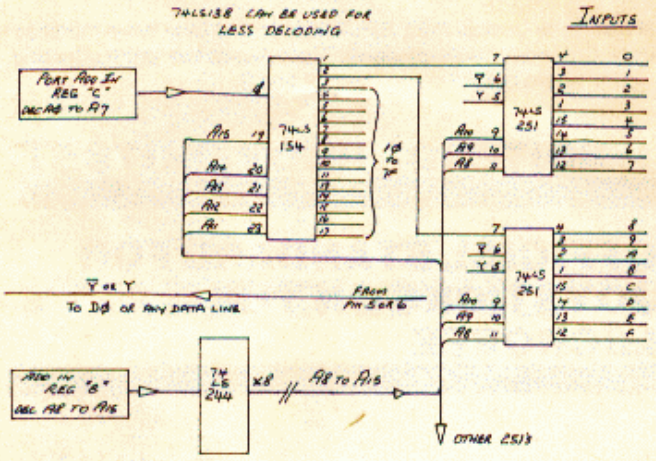
Address lines A0 to A7 and control signals $\overline{IORQ}$, $\overline{M1}$ and $\overline{RD}$ need not be buffered if they are only used to drive one gate each. Data lines must be buffered.



Note: By replacing the 74LS138 with 74LS154 you can decode twice as many ports. See data books for pin connections.

SCANNING UP TO 255 SEPARATE INPUTS ON ONE PORT

Using Machine code to check for on/off, zero or one.




```
ADDR   CODE    LINE   LABEL  MNEM   OPERAND

3000           00100         ORG    3000H
3000 2A0040    00110         LD     HL,(4000H);Address to store results
3003 01200F    00120         LD     BC,0F20H  ;Port20 C  start B at 0F
3006 EDA2      00130         INI              ;input with increment
3008 C9        00140         RET
0000           00150         END
00000 Total errors
```

For output use the same decoding circuits, but the output chips will be different. 74LS154 or 74LS138 if no latching is required. If latching is required use 9334, 74LS259 or NE5090.

There are plenty of output instructions to use using Reg 'B' as a counter of A8 to A15.

64K ROM PACK

This pack will work on any 16K or 32K MicroBee with 5.1 BASIC or 5.22e Colour BASIC. All that needs fitting to the MicroBee is a 50-way expansion plug to the core board; no modifications are needed.

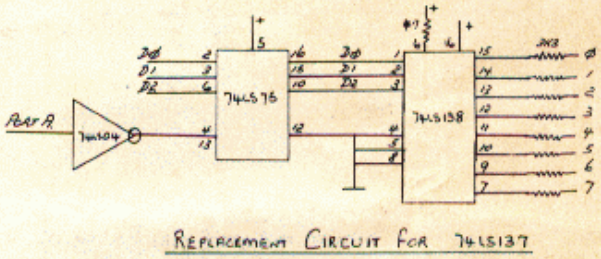
ROMs or the ROM at COOO and DOOO in the MicroBee must be removed and fitted in the pack. These ROMs cannot be disabled under software without modifications.

To use the pack with 5.1 BASIC, enter under BASIC 10, (n), where n is any number from 0 to 7. Then enter >EDASM, and ROM at location (n) will be executed.

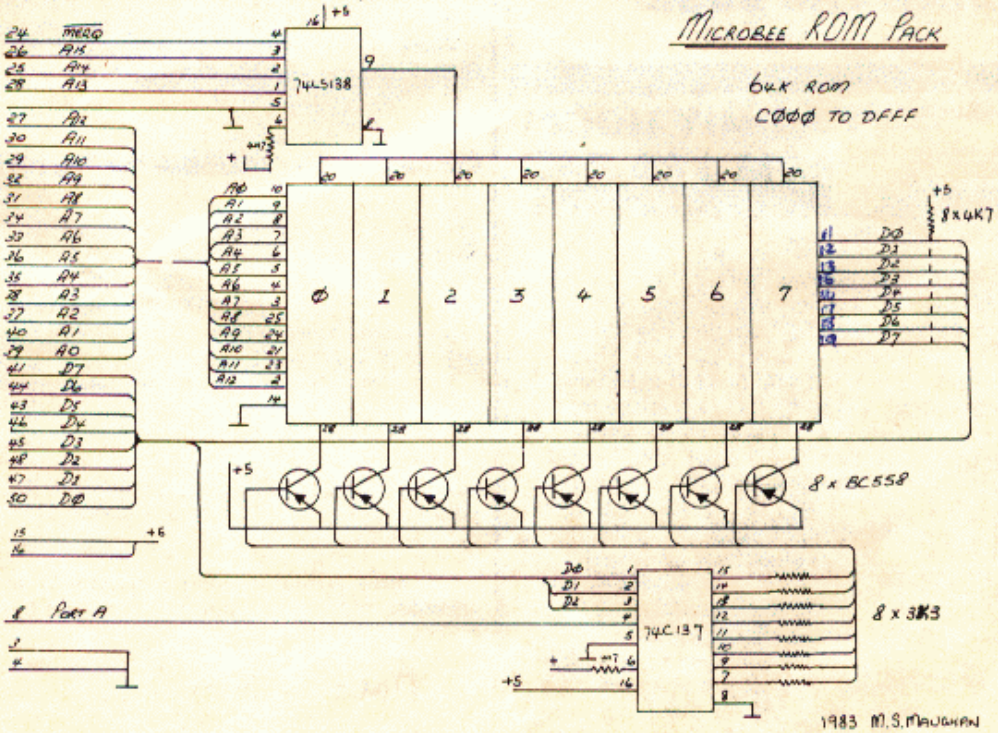
With the IC MicroBee enter under BASIC >PAK (n) where n is any number from 1 to 7. (ROM 0 is in the Bee and has to be removed or the core board modified.) The ROM at location (n) will auto execute. To use ROM 0 use ›OUT 10,0 then PAK.

The eighth set of 8K ROMs are all wired in parallel except for the power supply pin to +5 volts. The five volts is only applied to the selected ROM and is latched there until a new ROM is selected. You can only have one ROM powered up at any one time. There is no need for extra power supply to run this board; it uses the +5 V from the core board.

If you cannot get a 74C137 IC then the following circuits will do the same job.



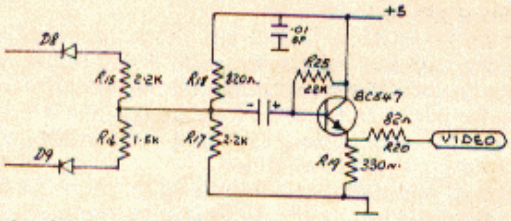
REPLACEMENT CIRCUIT FOR 74LS137



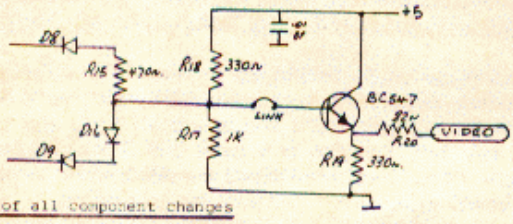
1983 M.S.MAUGHAN

CIRCUIT CHANGES (ONLY FOR EARLY MICROBEES)

Orginal Video Circuit.



Updated and current Video Circuit.

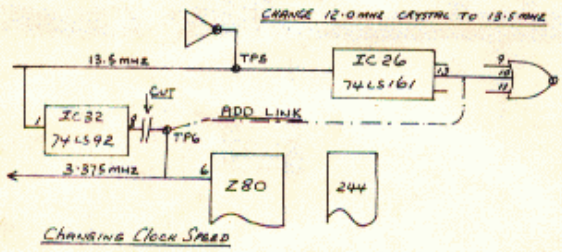


List of all component changes

	WAS	NOW
R1	3.3K	10K (CTS)
R15	2.2K	270 ohms
R16	1.5K	IN914 now D16
R17	2.2K	1K
R18	820 ohms	330 ohms
R19	330 ohms	330 ohms no change
R20	82 ohms	82 ohms no change
R21	4.7K	82 ohms (tape circuit)
R25	22K	NOT USED
C20	22 uF	NOT USED
D5	IN914	18K ¼ watt in parallel with DIODE)

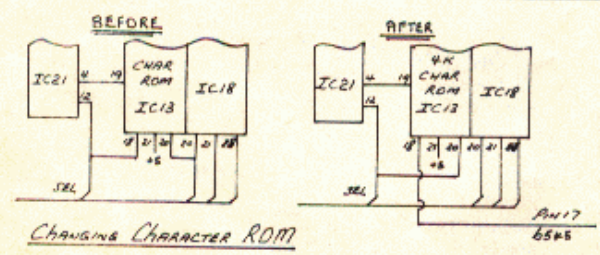
UPGRADING THE BASE BOARD

①



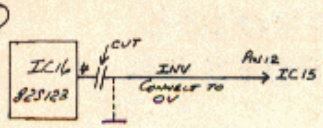
Changing Clock Speed

②

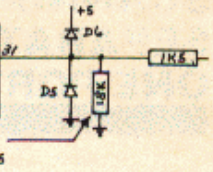


Changing Character ROM

③



④



Note: Base boards from REVISION H and later have modifications (2) and (3) already done. The artwork has been changed. Check board before doing mods 2 and 3.

OFFICIAL STANDARD FOR JOYSTICKS ON THE MICROBEE

DB15 port and joystick connections.

Connections for the Spectravideo 'Quick Shot' joystick. This unit normally has a DB9 plug fitted and for the MicroBee you need a DB15.

Connections for the DB9:

1. UP
2. DOWN
3. RIGHT
4. LEFT
5. Not Used
6. FIRE
7. Not Used
8. Switch common
9. Not Used

Colour code of wiring:

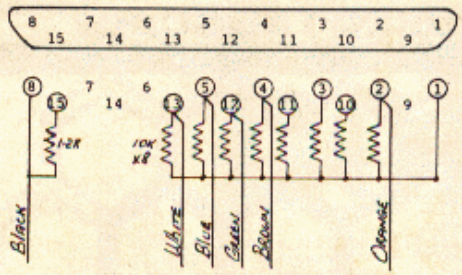
White = UP, Blue = DOWN, Brown = LEFT, Green = RIGHT, Orange = FIRE, Black common return for all switches.

Connections For MicroBee Via The DB15

Pin	Status	Usage	DB15 connections All 10k Resistors
1	Supply +5	Common for Resistors	Orange + 10k
2	Data 7	FIRE button	+ 10k *
3	Data 5	Select player 2	Brown + 10k
4	Data 3	LEFT	Blue + 10k
5	Data 1	DOWN	N.C.
6	Not used		N.C.
7	A ready	Do not connect	Black
8	Earth 0v	Return for Switches	N.C.
9	Not used		+ 10k *
10	Data 6	Not allocated	+ 10k *
11	Data 4	Select player 1	Green + 10k
12	Data 2	RIGHT	White + 10k
13	Data 0	UP	N.C.
14	Not used		1k2 resistor to pin8
15	A strobe	Pull low (to pin 8)	

The three pull-up resistors marked with an asterisk are not essential, but help to give reliable input from the port. N.C. means Not Connected.

▶



Pinout of the DB15 connector viewed from the solder side.

TESTING YOUR JOYSTICK

When you have modified or constructed your joystick, you will need to test it and check it is functioning correctly.

```
00100 REM joystick test program for Microbee
00110 OUT 1,255                 :REM initialise the port
00120 A = IN(0)                 :REM read joystick on port zero
00130 A = 143 - (A AND 143)     :REM converts to positive logic
00140 B = -(A AND 1)    :IF B THEN PRINT "up",
00150 B = -(A AND 2)    :IF B THEN PRINT "down",
00160 B = -(A AND 4)    :IF B THEN PRINT "left",
00170 B = -(A AND 8)    :IF B THEN PRINT "right",
00180 B = -(A AND 128)  :IF B THEN PRINT "fire",
00190 IF A=0 THEN PRINT "nothing",A ELSE PRINT A
00200 FOR T = 1 TO 100 : NEXT T : REM short delay
00210 GOTO 120
```

If the program is RUN without a joystick connected, the display:

up down left right fire 143

should print continuously up the screen (provided all inputs of your PIO float LOW with no input connected). When the joystick is plugged in, the display should change to:

nothing 0

repeating continuously. If you now push the joystick forward the display should change to:

up 1

Now press one of the fire buttons while still holding the stick forward; this should show:

up fire 129

Move it slightly left and you should see:

up left fire 133

Continue until all combinations have functioned correctly. Once you are satisfied that all is functioning correctly you can start writing your own joystick software, or modifying your existing programs to make use of the joysticks.

Don't forget if you develop any good programs please take them to your local MicroBee distributor for forwarding to 'Honeysoft', or send them directly to:

Honeysoft Pty Ltd
82a Jubilee Tce
Bardon 4065 Qld

We may be able to sell them on your behalf, or at least include them in users' group material for distribution to other MicroBee owners.

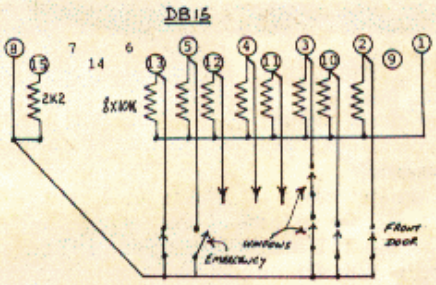
SIMPLE INTRUDER ALARM

One way to use your MicroBee for a simple alarm system is to use the parallel port. Wire it up in a similar way to the joysticks, only instead of wiring up to the joystick switches wire up the reed switches and contacts on your windows and doors.

The program will have to look for open circuit and not closed circuits, but this shouldn't cause any problems. Exit and entry delays can also be programmed. The alarm can be the internal speaker or use a spare port – 9 or 10. If you have the cassette load control relay fitted, use this to drive an external alarm (with its own circuit and power supply). The length of time the alarm is to ring can also be programmed, as can self-testing.

This is one way of getting your MicroBee to work for you when you're not using it. Switch your screen off; it's not needed when you're not looking at it. Just switch it on to check the status of the doors and windows when the program is run.

Leaving your MicroBee on 24 hours a day won't hurt it; there is very little to wear out.



With eight inputs you can have a good selection; window switches can be wired in series on one bit. You can also program to look for closed circuits such as emergency switches.

MODIFYING A TV SET FOR USE AS A MONITOR

To achieve the best results from your MicroBee with its 64 characters per line you need a special monitor. If you can't afford one of these the next best thing is a modified television set.

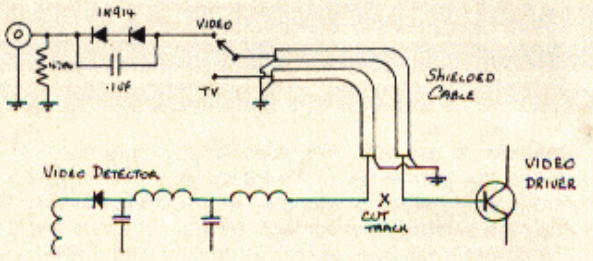
If you have a small B/W portable or large old B/W set, then in most cases it is possible to use them as a switch-selectable TV/monitor.

Note: There are some TV sets you cannot convert, so a circuit diagram of your set is needed first.

Parts Required

1 x RCA socket to connect the video from the MicroBee
1 x 470 ohm 1/4 watt resistor
2 x 1N914 diodes
1 x 0.1 uf monolithic capacitor
1 x spdt switch (if you still need a TV set)
2 x 600 mm shielded cable

All these can be mounted in the set near the aerial input. ▶



Note: You cannot expect to get the same quality picture from a converted TV as you get with a professional monitor. If you want to do a lot of computing a good monitor is the best investment.

INTERFACING THE HALF-INTENSITY COLOUR SIGNALS

With three colour signals, R G B, it is only possible to get eight foreground and eight background colours. Black is counted as a colour.

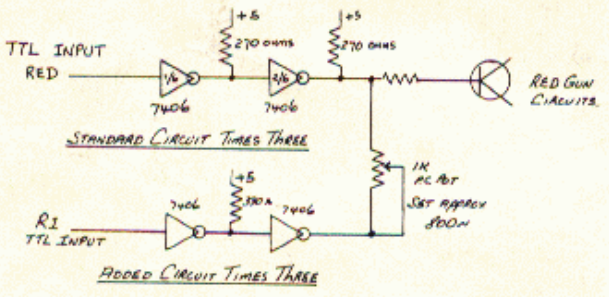
To get a greater range of colours the MicroBee has three extra signals, R1, G1, B1; these are the half-intensity signals. All six signals are TTL level signals (you can't have half-level TTL). Mixing R with R1 has to be done in analogue and is best done in your monitor.

Most colour monitors accept TTL level R G B signals, then convert them to analogue to drive the colour guns. The half-intensity signals have to be interfaced between the TTL output (in the monitor) and the analogue input.

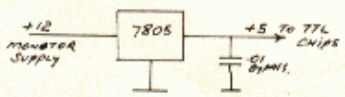
The following circuits show one possible way to do this mixing; note: it may not be possible with all monitors.

MICROBEE DB15 PIN CONNECTIONS

1. C.SYNC +	2. C.SYNC −	3. B2	4. G2	5. R2	6. Blue
7. Green	8. Red	9. 5 volts	10 to 15	0volt GND



5 VOLT POWER CIRCUIT MAY NEED CHANGING TO POWER EXTRA IC



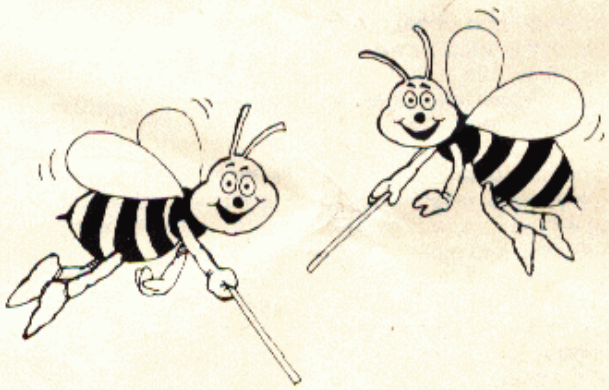
WORDBEE TAB SCALE

```
00100 CLS REM  M.S.Maughan 7th July 1983
00110 IF PEEK (2225)= 1 THEN 190
00120 UNDERLINE
00130 CURS207 :PRINT"W o r d b e e   T a b   S c a l e"
00140 NORMAL
00150 POKE220,20 :POKE140,0 :POKE216,17
00160 POKE162,30 :POKE163,128 :POKE2225,1
00170 CURS340 :PRINT "Press Reset to Continue"
00180 GOTO180
00190 FOR X=62464 TO 62527 :POKE X,46 :NEXT X
00200 Y=49
00210 FOR X=62464 TO 62527 STEP 8
00220 POKE X,Y : Y=Y+1 :NEXT X
00240 EDASM
00250 END
```

HEX-DECIMAL CONVERSION TABLE

COL. 3		COL. 2		COL. 1		COL. 0	
HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
0	0	0	0	0	0	0	0
1	4,096	1	256	1	16	1	1
2	8,192	2	512	2	32	2	2
3	12,288	3	768	3	48	3	3
4	16,384	4	1,024	4	64	4	4
5	20,480	5	1,280	5	80	5	5
6	24,576	6	1,536	6	96	6	6
7	28,672	7	1,792	7	112	7	7
8	32,768	8	2,048	8	128	8	8
9	36,864	9	2,304	9	144	9	9
A	40,960	A	2,560	A	160	A	10
B	45,056	B	2,816	B	176	B	11
C	49,152	C	3,072	C	192	C	12
D	53,248	D	3,328	D	208	D	13
E	57,344	E	3,584	E	224	E	14
F	61,440	F	3,840	F	240	F	15

```
TO  convert  8517 Hex to Decimal
        col. 3    8 =  32,768
        col. 2    5 =   1,280
        col. 1    1 =      16
        col. 0    7 =       7
                  ------------
                  34,071  or 34071 decimal
```



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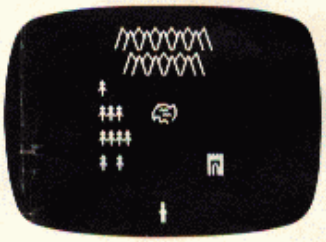

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PROGRAM AID VARIABLES USED

VARIABLES USED IN PROGRAMMING.....PROGRAM

A	B	C	D	E	F	G	H	I
J	K	L	M	N	O	P	Q	R
S	T	U	V	W	X	Y	Z	

A0	A1	A2	A3	A4	A5	A6	A7
B0	B1	B2	B3	B4	B5	B6	B7
C0	C1	C2	C3	C4	C5	C6	C7
D0	D1	D2	D3	D4	D5	D6	D7
E0	E1	E2	E3	E4	E5	E6	E7
F0	F1	F2	F3	F4	F5	F6	F7
G0	G1	G2	G3	G4	G5	G6	G7
H0	H1	H2	H3	H4	H5	H6	H7
I0	I1	I2	I3	I4	I5	I6	I7
J0	J1	J2	J3	J4	J5	J6	J7
K0	K1	K2	K3	K4	K5	K6	K7
L0	L1	L2	L3	L4	L5	L6	L7
M0	M1	M2	M3	M4	M5	M6	M7
N0	N1	N2	N3	N4	N5	N6	N7
O0	O1	O2	O3	O4	O5	O6	O7
P0	P1	P2	P3	P4	P5	P6	P7
Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7
R0	R1	R2	R3	R4	R5	R6	R7
S0	S1	S2	S3	S4	S5	S6	S7
T0	T1	T2	T3	T4	T5	T6	T7
U0	U1	U2	U3	U4	U5	U6	U7
V0	V1	V2	V3	V4	V5	V6	V7
W0	W1	W2	W3	W4	W5	W6	W7
X0	X1	X2	X3	X4	X5	X6	X7
Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Z0	Z1	Z2	Z3	Z4	Z5	Z6	Z7

50-WAY EXPANSION PORT CONNECTIONS

PIN	Z80 NAME	DESCRIPTION
1,2	+12 v Input/output	Power connection for Microbee
3,4	0v	system ground
5	Port-09 * (O)	goes low when port is accessed
6	Port-08 * (O)	goes low when port is accessed
7	WAIT * (I)	used to slow down the CPU
8	Port-0A * (O)	goes low when port is accessed
9	INT * (I)	interrupt input
10	HALT * (O)	indicates CPU is halted
11	NMI * (I)	generate non maskable interrupt
12	CPU clock (O)	3.375 mhz or 2 mhz (N1)
13	BUSAK * (O)	Acknowledge bus request
14	BUSRQ * (I)	request use of bus
15,16	+5 regulated from CORE BOARD	
17	RFSH * (O)	for refresh on dynamics RAM
18	RESET * (I/O)	O/C input/output
19	M1 * (O)	indicates instruction fetch
20	IORQ * (O)	indicates port access
21	RD * (O)	read strobe
22	XWR * (O)	deglitched write strobe
23	SEE NOTE N2	see note (N2)
24	MREQ * (O)	indicates memory access
25	A14	
26	A15	Most significant address BIT
27	A12	
28	A13	
29	A10	
30	A11	
31	A8	
32	A9	
33	A6	
34	A7	
35	A4	
36	A5	
37	A2	
38	A3	
39	A0	
40	A1	
41	D7	128 data line
42	0V	system ground
43	D5	32 data line
44	D6	64 data line
45	D3	8 data line
46	D4	16 data line
47	D1	2 data line
48	D2	4 data line
49	0V	system ground
50	D0	1 data line

Notes:

* means active low signal

(O) means output from MicroBee

(I) means input to MicroBee

(N1) Standard MicroBees = 2 MHz. Early 64K = 2.25 MHz. IC models = 3.375 MHz

(N2) Core boards, old style 8000 series – this is (O) ROM SELECT * ; new style core boards and 56K board – this is PHANTOM (I) *

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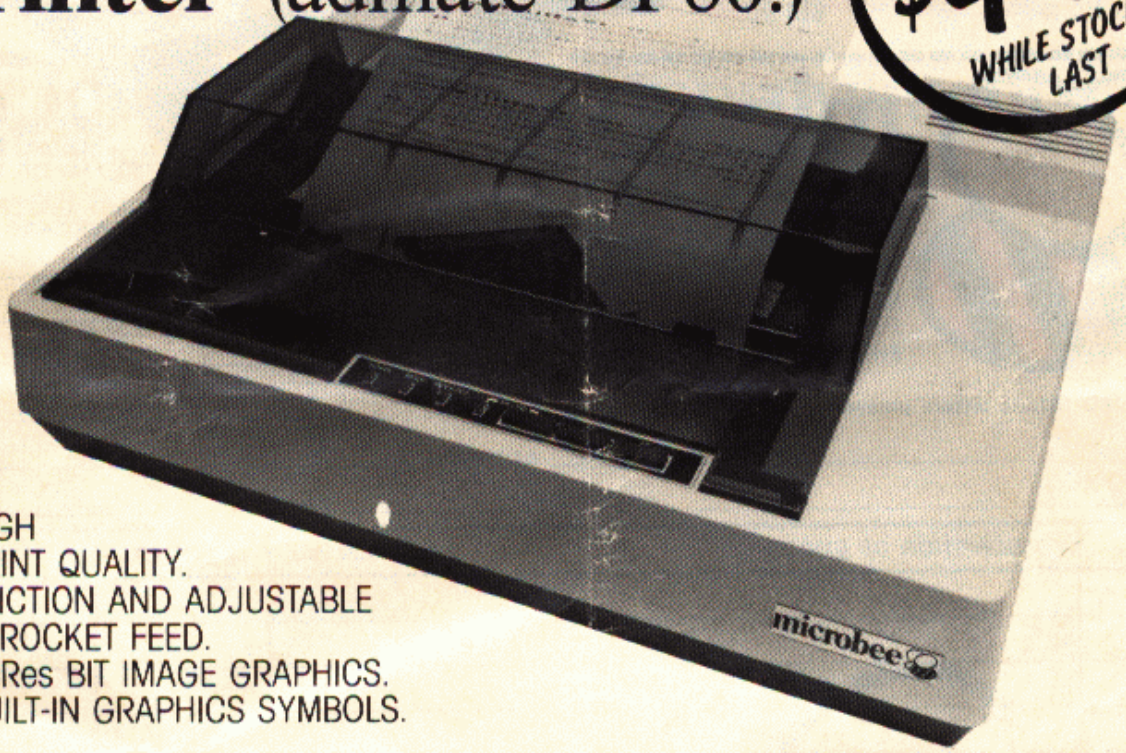

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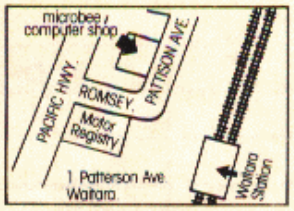

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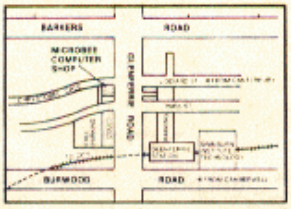

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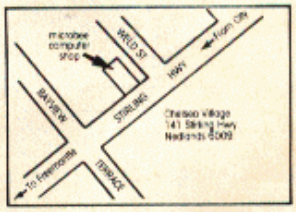

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