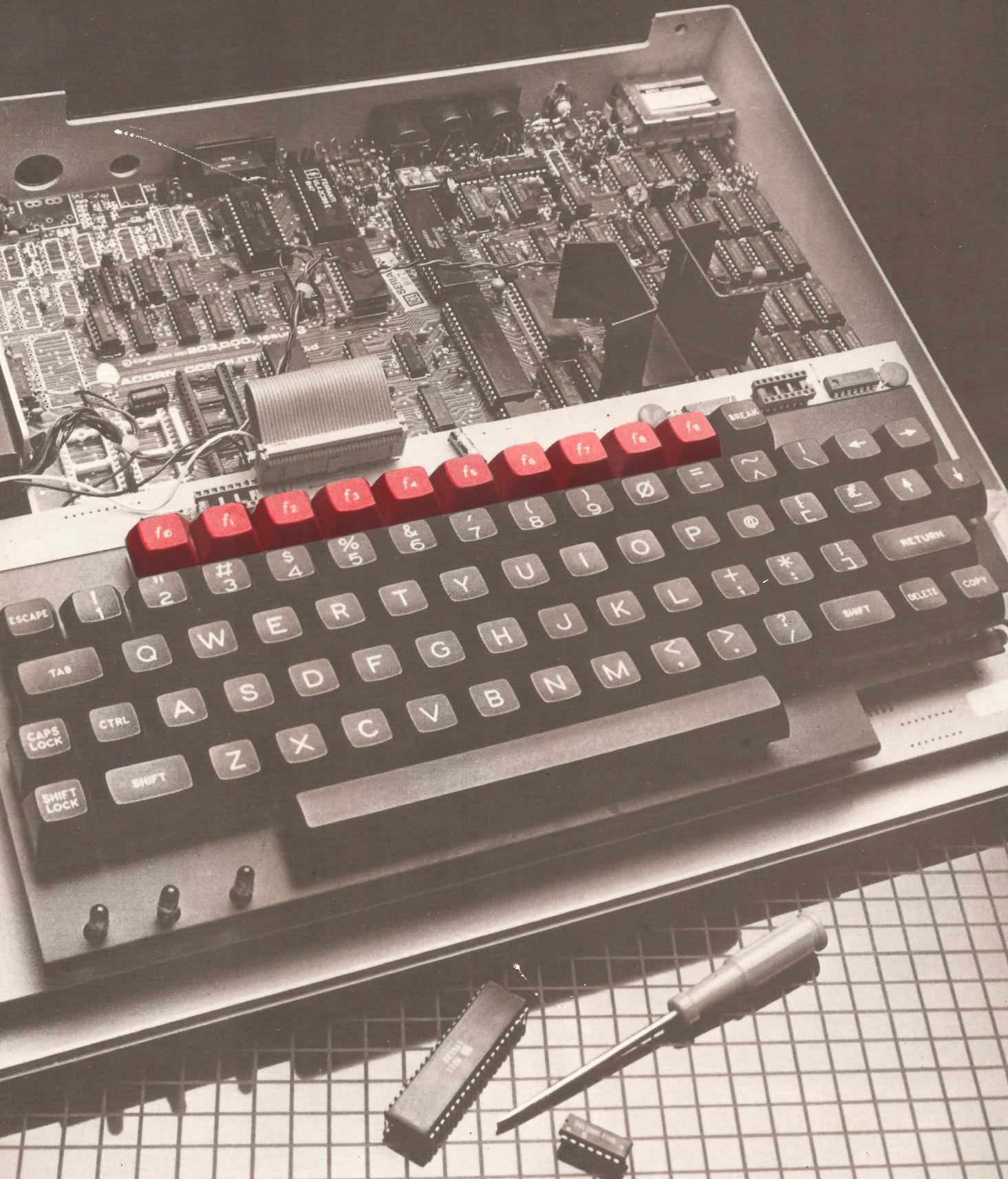
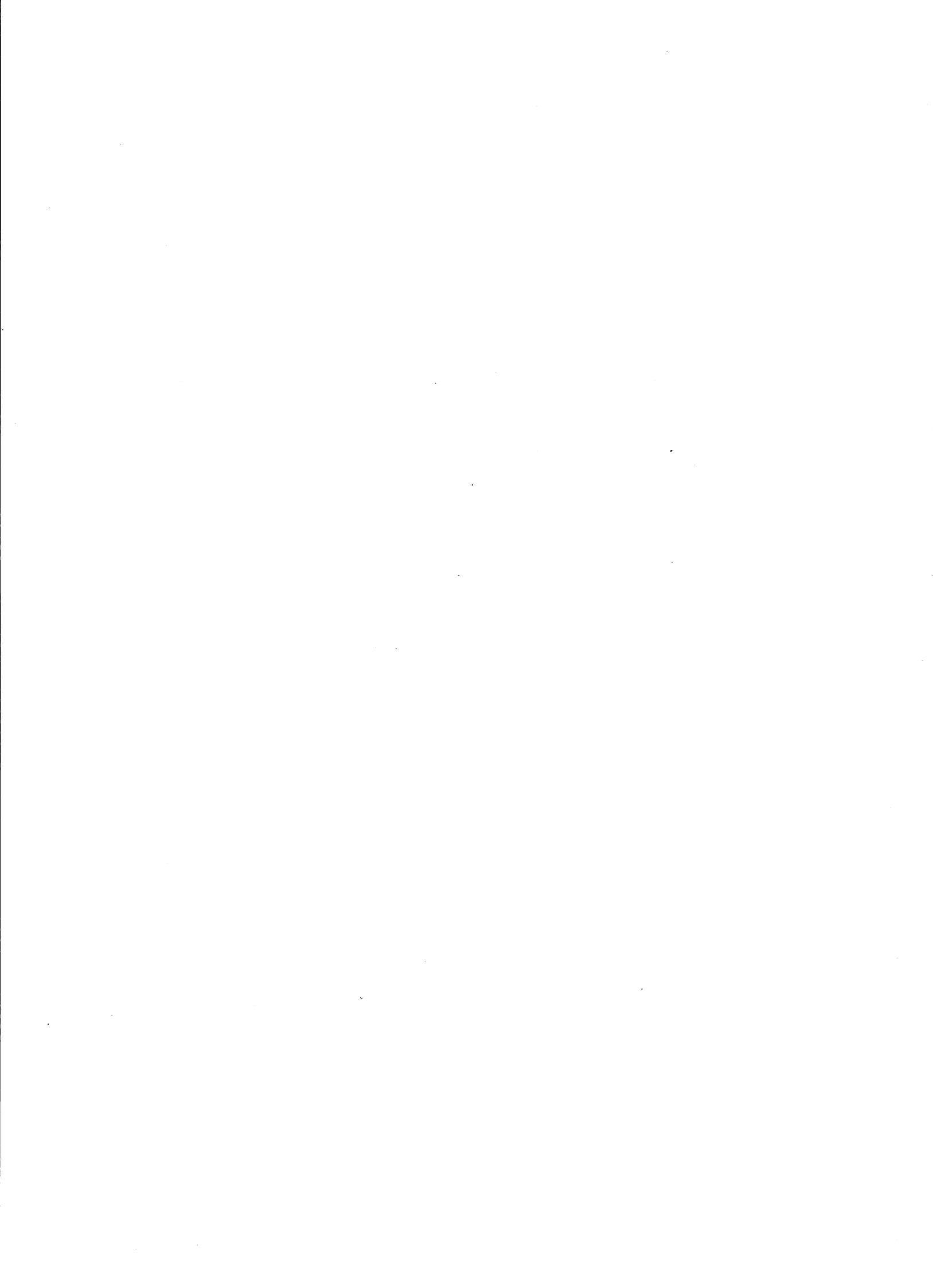


Troubleshooting The BBC Micro

MODEL A & MODEL B





TROUBLESHOOTING THE BBC MICRO

Model A and Model B

THE OPEN TECH UNIT

MICROELECTRONICS EDUCATIONAL DEVELOPMENT CENTRE

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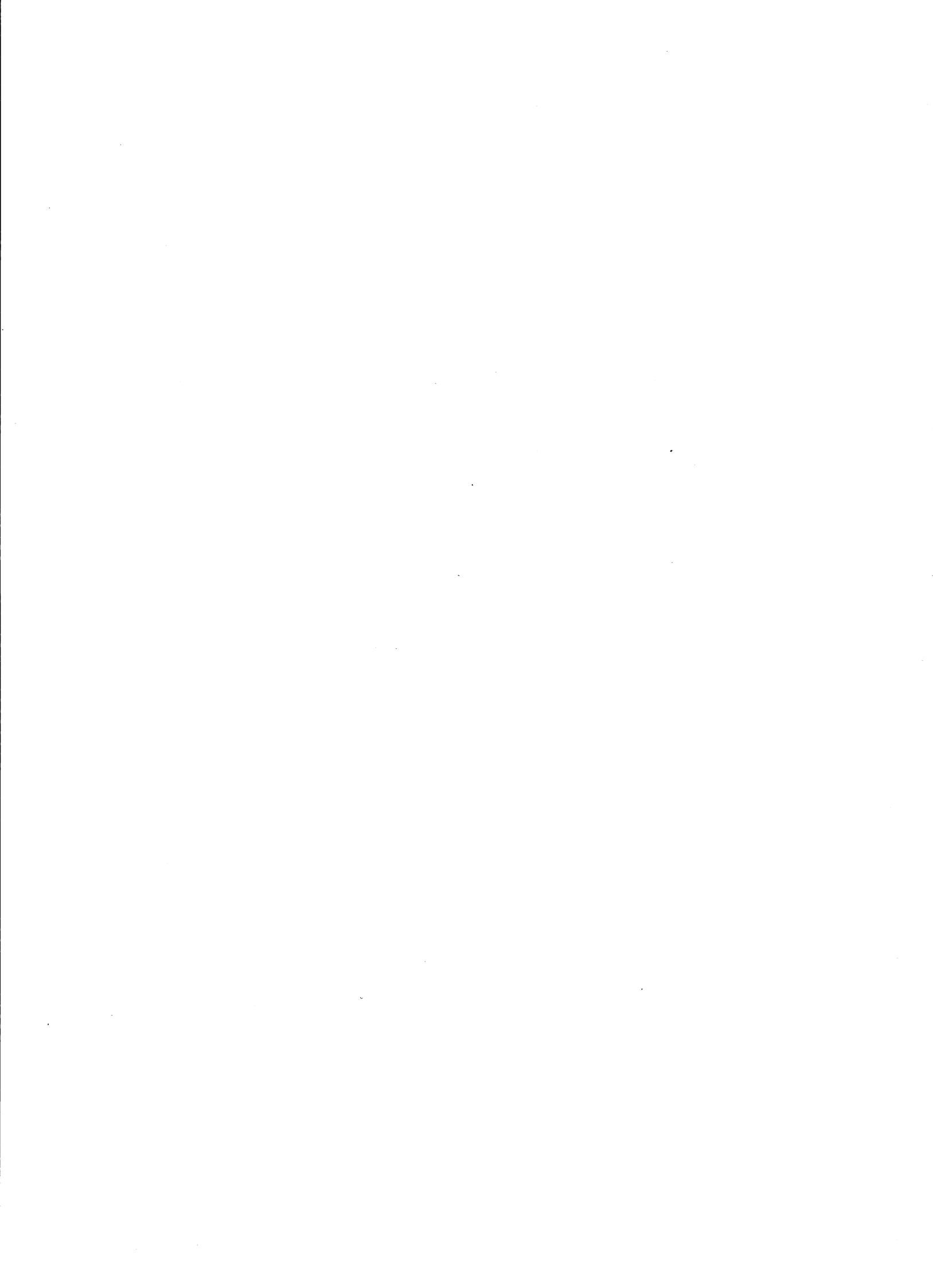
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First Published 1987

ACKNOWLEDGEMENT

This book is based on the experience and investigations of a team of technicians at MEDC. The main contributors were: Jack Davidson, Frank McCabe and John Kerr. They used their knowledge of the BBC Model B Micro to catalogue a pattern of observable fault symptoms for this machine. They describe appropriate diagnostic and remedial measures that can be implemented to rectify the causes of such faults. It is to their skill and hard work that this book owes its present form.



PREFACE

This book could be described as 'by technicians, for technicians'. At MEDC our technician staff have to cope with many different kinds of microcomputer, all of which are heavily used on courses throughout Scotland. This usage brings out the weak points in the various machines and trains the technicians' eyes to spot the links between faults and symptoms.

With well equipped laboratories they can just keep up with the demands on their skills, but there have been many occasions in the field where their resources are no more than those available to the non-specialist, or technicians in schools and small companies without the budget for servicing equipment.

To meet the needs of such staff who have to keep equipment working at all costs or none, we decided to take perhaps the most commonly used microcomputer in education and training establishments in the UK, the BBC micro, as the subject for this book.

The result is a collection of procedures, hints and tips on how to trace likely causes of faults from visible and audible symptoms. No specialist equipment is needed beyond a simple multimeter and hand tools. The techniques are mainly those of identifying and replacing potentially faulty chips, and of tracing problem areas on the board and in the external connections. No one can predict exactly which fault matches a given symptom. A chip might contain thousands of gates capable of contributing to the observable pattern. What we can say is that the collective knowledge of a group of experienced technicians have found certain common symptoms on the BBC micro and have cured the problem by taking certain action. What worked for them should be a good starting point for your investigation.

What would we recommend to anyone setting up a servicing department for such micros? Of course it would include oscilloscopes, signature analysers, logic analysers, digital multimeters and the whole paraphernalia of high tech industry. If the institution has the funds,

it can be a good investment in terms of time saved. Having lived through all the constraints of education and training departments for more years than we collectively care to remember, we know that such a counsel of perfection is more dream than reality.

We hope that this book will give users the confidence to tackle those servicing tasks that can be done with minimum resources, and the knowledge of when the equipment needs more specialist skills. That way, the micros can be kept running longer to satisfy the customer, servicing bills can be reduced, and each technician can build up a valuable log of experience that should be transferable to new microcomputers.

We would caution against over confidence. There is a stress on safety in the book; don't take chances just to effect a speedy cure. There may come a point in any servicing procedure where the simple tests suggested have not found the answer. This is not surprising nor is it an admission of defeat. We shall have to send equipment back to the manufacturers or to service agents when appropriate. What we hope to have shown is that we don't have to stop short when the dreaded words "it doesn't work" are uttered. There is a long way to go beyond that before we have to seek outside help.

The book was written based on faults found in models A and B of the BBC micro. The basic procedures are directly applicable to the B+, and the principles will remain valid for any related machines, including the Master series.

Dr Peter Williams BSc PhD MInstP CEng MIEE, Director MEDC

CONTENTS

	Page
I N T R O D U C T I O N	
READ THIS FIRST	1
Purpose of This Guide	1
Scope of Usage	1
Equipment Required	2
Servicing Approach	2
Storing ICs	2
Straightening IC Pins	2
Final Inspection	2
Handling Floppy Discs	3
Cleaning Your Disc Drive	3
Precautionary Reminders	4
SAFETY	5
Mains Power Supply	5
Safety in Schools	6
D I S A S S E M B L Y	7
REMOVING THE COVER	7
REMOVING THE KEYBOARD	8
REMOVING THE POWER UNIT	9
REMOVING AN INTEGRATED CIRCUIT	10
The Identification of Pin 1	10
F A U L T D I A G N O S I S	11
GENERAL	11
SYMPTOMS/CAUSE AND REMEDY MATRIX	12
MAIN SYSTEM FAULTS	13
PERIPHERAL FAULTS	32
Testing for Output to the Printer Port	32
Testing for Output to the User Port	34
Testing for Input to the Analogue In Port	35
The Cassette Port	38
The RS423 Port	40

	Page
D I S C I N T E R F A C E	43
GENERAL	43
BOARD LINKAGES	44
DISC INTERFACE FUNCTIONAL REQUIREMENTS	45
COMMON FAULTS WITH THE DISC INTERFACE	45
SYSTEM FAULTS CAUSED BY A DEFECTIVE DISC DRIVE	46
Faults Encountered When Accessing The Drive	47
I C F O C U S	51

A P P E N D I X A

Printed Circuit Board Layout

A P P E N D I X B

Replacement Stock

A P P E N D I X C

Suppliers of Integrated Circuits

G L O S S A R Y

INTRODUCTION

READ THIS FIRST

Servicing your computer is USUALLY a task best entrusted to a reputable dealer who is equipped with the necessary diagnostic equipment. There are many faults, however, that can be remedied by the user which do not incur the cost, nor the delays, involved in having the dealer brought in.

Purpose Of This Guide

This guide to servicing the Acorn BBC Microcomputer is intended for its owner, an inexperienced technician, or an enthusiast with limited servicing experience. It should also prove a useful reference for the more proficient technician.

It has been our experience with the BBC Micro that a high percentage of faults can be traced to components which are easily replaced. We have decided therefore to concentrate on faults which can be remedied by simply changing a bad component for a good one, thus avoiding the necessity to de-solder.

All the fault symptoms discussed have been met with in practice. You may find some variation in the symptoms, but it is worth comparing the symptoms that you find with the ones we have documented in our defect table. If what you are experiencing is similar, then it would be worth trying the solutions that worked for us.

Scope of Usage

This guide only concerns itself with components that can be easily replaced. In some cases, however, it is likely that further action may be required after the remedial action suggested in this guide has been taken. Comments, for example, which refer to possible faults with the printed circuit board are a clear indication that you should return the computer to your dealer for repair.

Equipment Required

The minimum requirement for instrumentation and tools to carry out the tasks outlined in this guide are:

- Multimeter
- Screwdrivers - medium and small size blade and cross-slot
- Thin long nose pliers

Special tools for integrated circuit removal are expensive to buy. Provided care is taken, these components can nevertheless be removed with long nose pliers or a small screwdriver.

Servicing Approach

Make a systematic and orderly approach to servicing your computer. Plan ahead to minimise errors. Keep your workplace tidy by removing any unnecessary objects. Allow yourself plenty of room in which to work and ensure that the work area is adequately lit.

Storing IC's

When you remove IC's do not leave them lying around the workbench; place them in conductive foam or anti-static tubing for safe keeping until required for re-use. Follow this practice for all integrated circuits.

Straightening IC Pins

Straighten the pins of IC's that are bent with a thin long nosed pliers. Take your time and try not to overbend since these pins are quite fragile and will break if you are not careful.

Final Inspection

After completing a task, inspect all areas of the printed circuit board for any small pieces of wire that may have accidentally fallen onto the printed circuit board.

IMPORTANT

A visual inspection is recommended every time the cover is removed or before it is replaced. Pay particular attention to the heat sink on IC6, as this could cause problems if the adhesive bond has been broken. Also check that none of the resistors or capacitors in the area of IC6 are bent over or shorted.

Handling Floppy Discs

Where disc drives are in use ensure that your floppy discs are handled with care:

- (1) Never write on a label which is already on a disc.
Write the label before attaching it to the disc.
- (2) Do not bend or touch the exposed area of the disc.
- (3) Always return discs to their protective sleeve when not in use.
- (4) Never leave them lying out in direct sunlight or in close proximity to a magnetic field.
- (5) Do not attempt to clean the surface of the disc.
- (6) Keep the discs away from sources of high temperature. For example, do not leave your discs lying on the BBC cover (power supply heat).

Cleaning Your Disc Drive

All disc drive heads pick up oxide particles from discs. As this contamination builds up, so do read/write errors. Regular cleaning with a proprietary cleaning kit, ideally once a week, will remove any residue that may interfere with magnetic information on your applications software discs. Cleaning kits are available for single sided and double sided disc drives. The instructions on the proprietary cleaning kit must be followed, but the cleaning method usually involves the following:-

Spray Isopropyl Alcohol (solvent) on the "Head Cleaning Disc" supplied with the cleaning kit. Insert the disc into the disc drive and spin the drive by calling up the Catalogue (*CAT). This will result in a disc fault message appearing on the screen, since the cleaning disc is not formatted.

Repeat the * CAT request 2 or 3 times to ensure that the heads are thoroughly cleaned.

Precautionary Reminders

The preliminary instructions which precede the tests suggested are simple and are carried out repeatedly as the possible faults are worked through. We could have issued general instructions at the beginning to avoid repetition and run the risk of a user dipping into the manual for a quick guide, thereby missing the precautionary reminders.

Alternatively, we could have repeated the detailed procedures on every occasion, boring and irritating the more experienced technicians.

It seemed best to provide something between these extremes. Reminder boxes such as the following are scattered throughout the manual and we have occasionally included the reminders within the text.

REMINDER

- *Keep the cover on between tests to avoid accidental damage to the board.*
- *Switch off mains power when removing or replacing IC's. Take care not to damage these devices.*
- *Follow the instructions given for straightening damaged IC pins and for storing these devices when not in use.*

SAFETY

Mains Power Supply

It has now become standard practice for manufacturers of electrical equipment to provide the user with a 3 core power lead for connection to the mains supply. It is not usual, however, for them to provide the standard 13 amp plug to complete the connection. It is left to you to make such provision, to ensure that the plug is correctly fitted and that the recommended fuse rating is adhered to.

If you are not familiar with the way a power lead is connected to a standard 13 amp plug, then the following explanation, read in conjunction with Figure 1.1 will enable you to do so.

WARNING

YOUR COMPUTER MUST BE EARTHED

The colours used to identify the wires in the manufacture of your mains lead may not necessarily correspond with the colour markings used to identify the terminals of your plug, so note the following.

- The GREEN & YELLOW insulated wire must be connected to the plug terminal identified by the letter E (earth), or alternatively by the earth symbol or otherwise indicated GREEN.
- The BLUE insulated wire must be connected to the plug terminal identified by the letter N (neutral), or otherwise indicated BLACK.
- The BROWN insulated wire must be connected to the plug terminal identified by the letter L (live), or otherwise indicated RED.
- Fit a 3 amp fuse to BS1362.

If the socket outlets available to you are unsuitable for use with the standard plug, then it may be possible to use an adapter. Failing that, use a plug of suitable type and wire as above. If a fuse blows in the course of using your BBC Micro, find the cause and clear the fault before replacing the fuse.

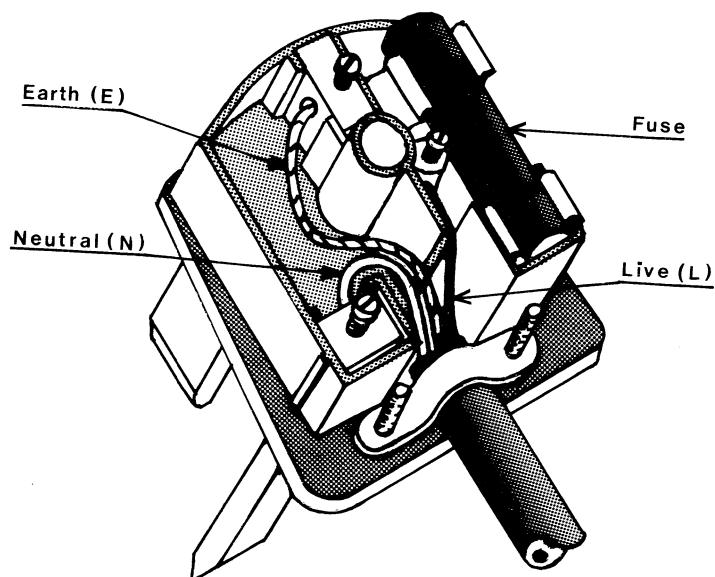


FIG. 1.1 MAINS PLUG CONNECTIONS

Safety in Schools

Technicians in schools should read and become familiar with the safety information circulated by their establishment in consideration of:

- Working alone
- Safe working arrangements
- Live working
- Competent persons

The recommendations given are written with your safety in mind. You should therefore at all times comply with such recommendations.

DISASSEMBLY

REMOVING THE COVER

Disconnect the computer from the mains supply before removing the cover.

The cover is secured to the case by cross slotted fixing screws at 4 points as shown in Figure 2.1. Two screws fix the cover to the back panel and the other two have been inserted from underneath.

Remove the screws at the rear, then raise the case to unfasten the bottom fixings. Place the 4 screws in a container for safe keeping. Carefully lift the cover clear of the case and set aside.

Removal of the cover gives access to a large area of the main pcb. To gain full access to the main pcb, it will be necessary to remove the keyboard.

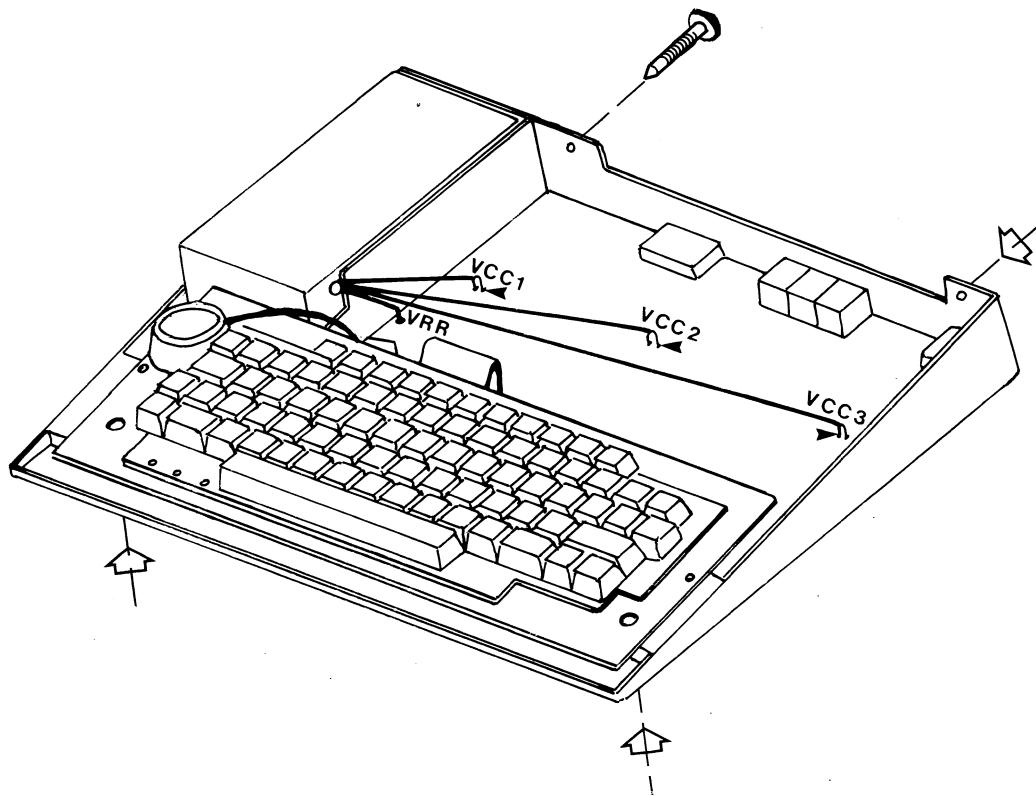


FIG. 2.1 REMOVING THE COVER

REMOVING THE KEYBOARD

The keyboard is fastened to the case by two sets of nuts, bolts, shakeproof washers and plain washers positioned either side of the keyboard (some earlier models are fixed at 3 points).

With the power cable disconnected, slacken the nuts and remove the fixings, see Figure 2.2 for locations. Carefully detach the keyboard cable and speaker cable from connectors PL13 and PL15 on the pcb respectively. Remove the KEYBOARD.

If a keyboard fault is suspected, it would be very useful to have access to another BBC Micro for the purpose of making a keyboard exchange. This is a quick way of telling if your suspicions are correct or not.

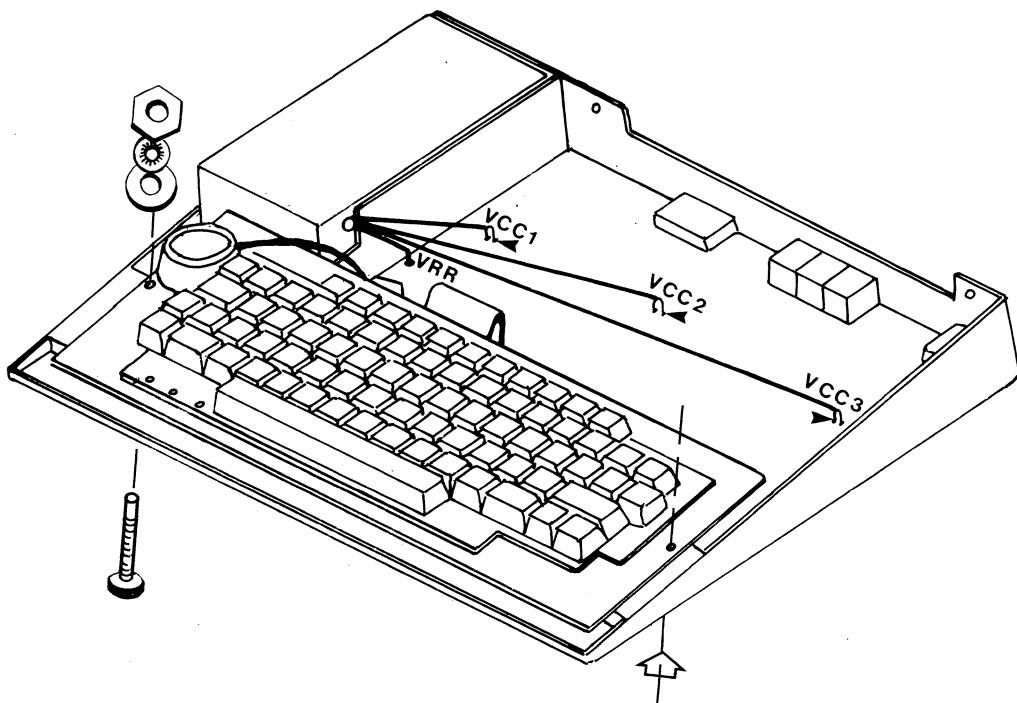


FIG. 2.2. REMOVING THE KEYBOARD

REMOVING THE POWER UNIT

Before you begin to suspect that a fault has developed with the power unit, remove the fuse from the mains plug and check it for continuity. Fit a new 3A fuse as necessary. Should you find the fuse in good condition, then proceed with the removal of the power unit for investigation by your dealer.

With the mains supply disconnected, remove the voltage cables from terminals Vcc1, Vcc2 and Vcc3 on the main pcb. Remove the purple cable from terminal VRR. Unfasten the three fixing screws from the underside of the case. Carefully remove the power unit. Do not attempt to service the unit yourself.

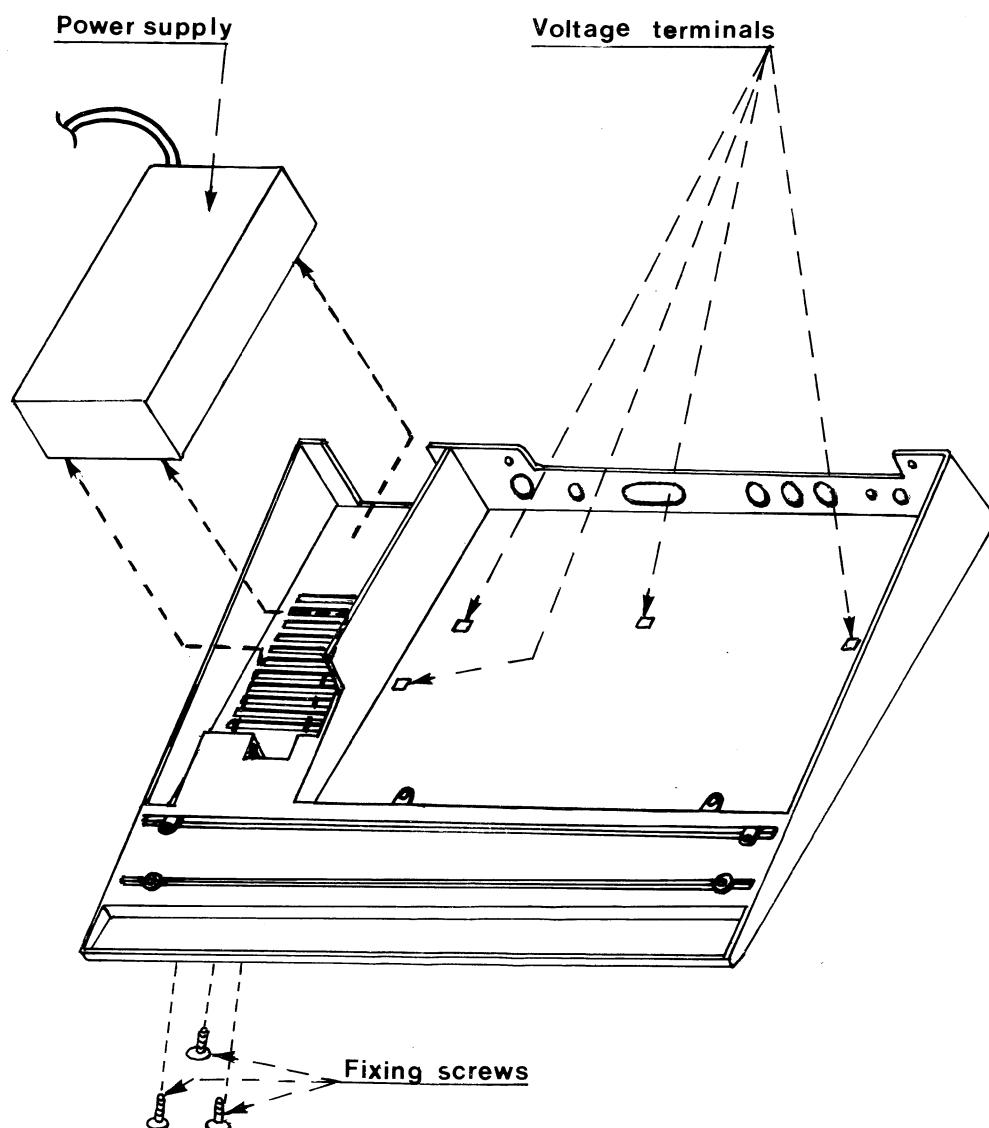


FIG. 2.3 REMOVING THE POWER UNIT

REMOVING AN INTEGRATED CIRCUIT

IC's may be removed from their sockets by using an extraction tool specially designed for the purpose. These tools are, however, fairly expensive for occasional use. If care is taken, a small screwdriver or thin nose pliers can be used as a suitable alternative and we shall proceed with the assumption that this will be the method employed.

With the computer plug removed from the mains, place the blade of a small screwdriver or thin nose pliers between the IC and its socket. Carefully raise the IC from its seating by gently levering one end and then the other. Raise evenly to prevent pin damage. Lift the IC clear and store it in a safe place.

When you come to replace an IC, first of all ensure that it is the correct type for the socket you intend to put it in and second, that pin 1 is properly located. Do not use excessive force or you will more than likely cause catastrophic damage to the pins.

The Identification of Pin 1

In the BBC Microcomputer the integrated circuits on the printed circuit board are all oriented with pin 1 toward the rear of the case as illustrated in Figure 2.4. The top surface of the IC is slotted at one end, and pin 1 is always the first pin to the left of this slot. Pin 1 may also be identified by a dot placed in close proximity to it. In the manufacture of the IC, either the slot or the dot are used for identifying pin 1.

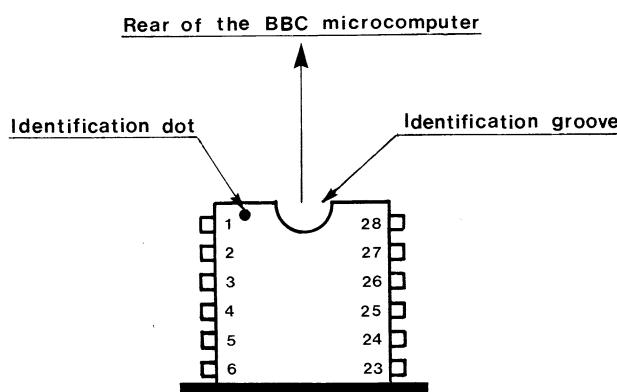


FIG. 2.4 IDENTIFYING PIN 1 ON AN IC PACKAGE

FAULT DIAGNOSIS

GENERAL

It is obviously not possible to predict what faults are likely to occur with a particular microcomputer system. What we can do, however, is to separate the peripherals from the main system and treat each in isolation for the purpose of fault diagnosis.

- **MAIN SYSTEM FAULTS** - are faults which prevent the computer from being used. For example, the screen displays the BOOT-UP message (see under) as normal but the keyboard fails to respond.

BBC Computer 32K

Acorn DFS

BASIC

- **PERIPHERAL FAULTS** - are faults which allow the computer to operate as a processing unit but affect the operation of a peripheral. For example, on switching on, the BOOT-UP message appears on the screen and the keyboard response is normal. The disc-drive, however, doesn't operate.

Locating the cause of some faults can be difficult, especially when they affect different parts of the system. Certain faults are easier to detect, but the most irritating fault is one which leads one to presume that the system is dead. With the BBC Micro there are a number of "life" signals you must look for before deciding on a course of action:

- are any of the LED's lit on the keyboard?
- is there any sound (beep) coming from the speaker?
- is there anything on the screen?

These signs which should give you a pointer to the likely cause of a fault. In the following pages we have documented particular symptoms which we have encountered. With these symptoms, we can guide you to the likely causes of the fault and suggest appropriate remedies.

SYMPTOMS	PAGE No. FOR CAUSE OF FAULT & REMEDY								
	13	15	16	17	18	23	24	26	29
No boot-up message	●								
Boot-up message normal				●			●		
Variation with boot-up message									●
Boot-up message corrupted								●	
Blank screen		●	●		●	●			
No sound from speaker	●	●	●			●			
Weak sound from speaker				●					
Continuous tone from speaker					●		●		●
No response from keyboard					●	●	●		●
Keyboard functions correctly					●				
Keyed input corrupted								●	
No LED's lit on keyboard	●								
All LED's lit on keyboard		●							
Caps Lock LED is lit			●	●	●	●	●		
LED's respond erratically on break								●	
Random coloured background or text.									●

SYMPTOMS/CAUSE & REMEDY MATRIX

MAIN SYSTEM FAULTS

SYMPTOMS

- No sound from speaker
- No boot-up message
- No LED lit on keyboard

These symptoms suggest that there is no power available to drive the system. Check the fuse and connections in the mains plug.

If you can't find anything wrong with the power lead, then leave the plug disconnected and remove the cover from the micro to determine whether or not the 5 volts supply from the power unit is reaching the various Vcc distribution points as identified in Figure 3.1.

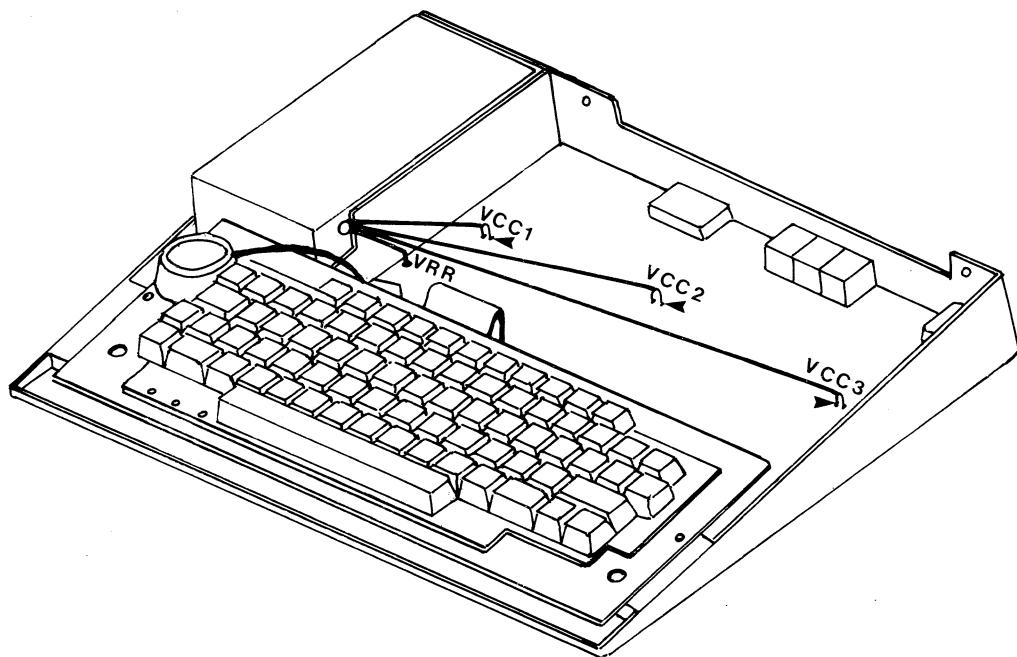


FIG. 3.1 VOLTAGE TERMINALS

Switch on and check that there is 5 volts at each of the three Vcc terminal points (Vcc1, Vcc2 and Vcc3) and also that the following voltages are available at IC32, IC36 and IC77.

	IC32	IC36	IC77
Pin 7		0V	
8	0V		0V
14		5V	5V
16	5V		

NOTE: On Issue 7 of the board the Vcc lines are connected together, as are the OV (GND) lines, although you will not readily detect this. This means that all Vcc and GND leads on the Issue 7 board would have to be loose or disconnected to show the symptoms. On boards before Issue 7 a loose Vcc1 connection would cause these symptoms

If 5 volts is not found at any of these Vcc points then remove all the power distribution leads from the board and check the voltage readings again between each Vcc push-on connector and its respective ground.

If you obtain a reading with the Vcc leads disconnected then tighten the push-on connector on each lead. Carefully push the leads back onto the spade terminals ensuring that they are all pushed fully home. Switch on the system and check the voltage levels again at the IC pins tabulated above. If the voltage readings do not correspond with those tabulated, then it is likely that an open or short circuit has developed with your board. Return the computer to your dealer for repair.

Should you not get a reading at all between a Vcc connector and its respective ground, then remove the power unit and return it to your dealer.

SYMPTOMS

- Blank Screen
- No sound from speaker
- All LED's lit on keyboard

Remove the cover, switch on and check that Vcc2 is supplying 5 volts to the board by verifying that IC32 is receiving 5 volts on pin 16 and that 0 volts is observed on pin 8.

If you can't detect 5 volts on pin 16 then switch off and remove the Vcc2 lead from the board. Switch the power on and check the Vcc2 push-on connector for 5 volts by making a connection from it to its respective ground pin.

If Vcc2 does not respond in this way, then the power unit is probably faulty. Take it to your dealer for repair.

If 5 volts is detected when the Vcc2 lead is free, however, then squeeze the female connector to tighten its contact with the board.

With Vcc2 connector in place make a further check at IC32 for 5 volts on pin 16. Failure to detect 5 volts is indicative of an open or short circuit on your board. Take the computer back to your dealer for further investigation.

SYMPTOMS

- Blank Screen
- No sound from speaker
- Caps Lock LED is lit

These symptoms are similar to those described for the previous case.

The investigative procedure is therefore similar, but the difference observed is that LED activity moves the focus away from IC32 to IC36.

Work through the procedure as before but this time concentrate on Vcc3 which is the source for 5 volts on pin 14 of IC36.

REMINDER

- *Keep the cover on between tests to avoid accidental damage to the board.*
- *Switch off mains power when removing or replacing IC's. Take care not to damage these devices.*
- *Follow the instructions given for straightening damaged IC pins and for storing these devices when not in use.*

SYMPTOMS

- Weak sound from speaker
- Boot-up message normal
- Caps Lock LED is lit
- Keyboard functions correctly

Start off by pressing CTRL G followed by CTRL BREAK and finish by pressing the COPY key. Each operation should cause the speaker to emit the usual bleep.

If you can't get any sound from the speaker, switch off and remove the cover. Switch on and check for -5 volts between the connector VRR and the ground lead of Vcc1. Squeeze to tighten the female connectors as necessary.

The presence of a voltage indicates that the fault lies within the speaker circuit, otherwise it is more than likely that the power unit is defective.

SYMPTOMS

- Blank Screen
- Continuous tone from speaker
- Caps Lock LED is lit
- No response from keyboard

These symptoms could be caused by any one of a collection of IC's as follows:

IC1; IC2; IC3; IC4; IC7

IC51; IC52

IC69

IC73; IC78

IC81; IC86; IC88

IC100; IC101

Before we examine these IC's, however, it would be advisable in the first instance to check the connectors PL11 and PL12 (1MHz bus and TUBE respectively) for bent pins or short circuits. Remedy any defects found, then check to see if the fault symptoms have cleared.

If the connectors are not at fault, then make sure that all the IC's arranged above are properly seated in their sockets. Keep checking the symptoms to see if the faults clear as you proceed.

If the faults persist, examine the following groups of IC's in turn:

- sideways ROM's
- peripheral IC's
- main system IC's

SIDEWAYS ROM's (IC88; IC100; IC101)

Remove each IC from its socket in turn. After each withdrawal, switch the system on again to see if the symptoms clear. Straighten any bent pins or change the ROM as necessary. **IMPORTANT:** Do not disturb IC51 or IC52 until advised to do so.

If the faults persist after having changed all the ROM's, then keep them out of the system and proceed with the examination of the peripheral IC's.

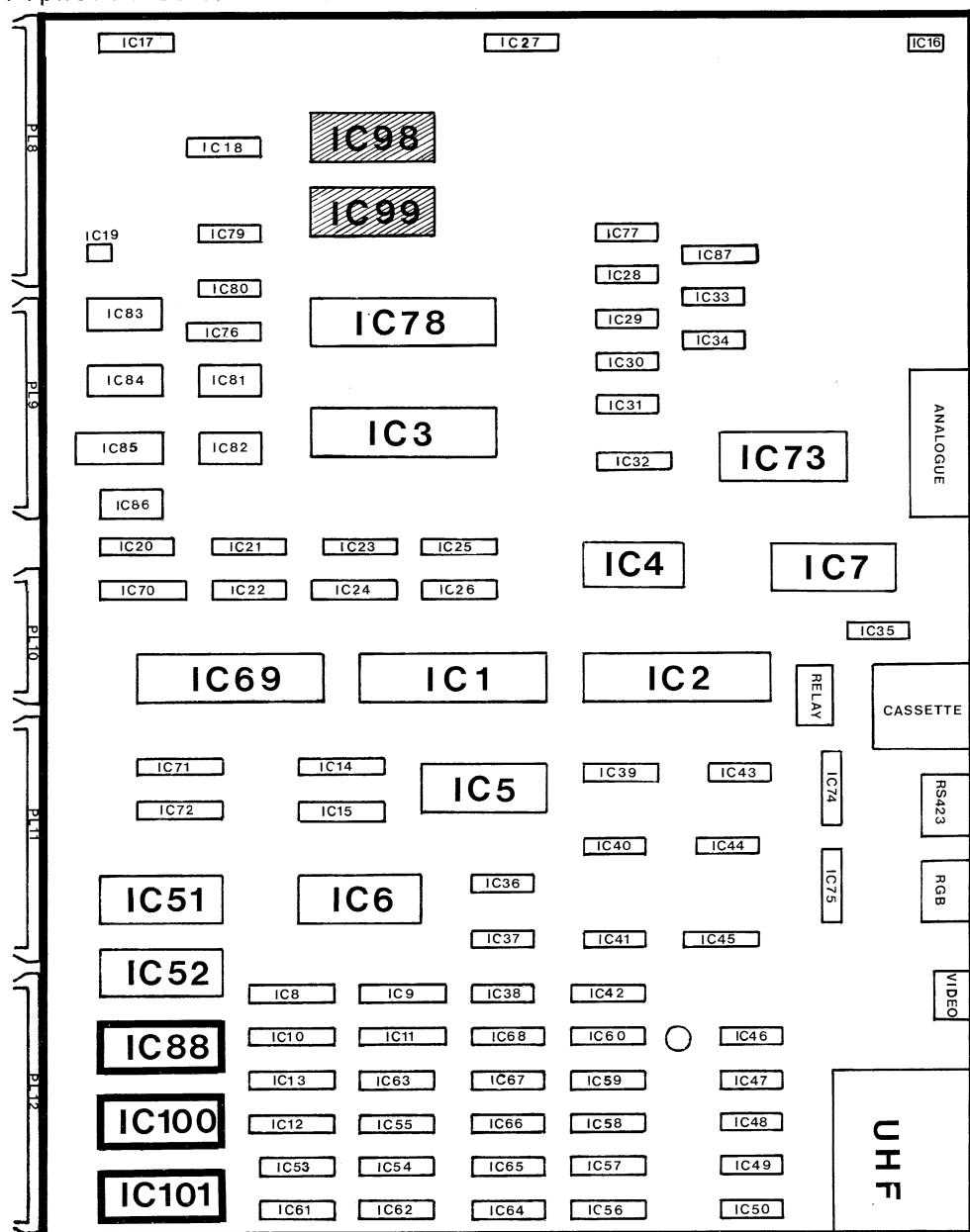


FIG. 3.2 BOARD POSITIONS OF IC88; IC100; IC101

PERIPHERAL IC's (IC4; IC7; IC69; IC73; IC78; IC81; IC86)

Remove each IC in turn and check each time to see if the symptoms clear. Keep a close watch for bent or missing pins as you proceed.

In the absence of any apparent damage, change each IC in turn for a known good one. If you still can't clear the faults after having made these replacements, then remove the IC's from the board and investigate the main system IC's.

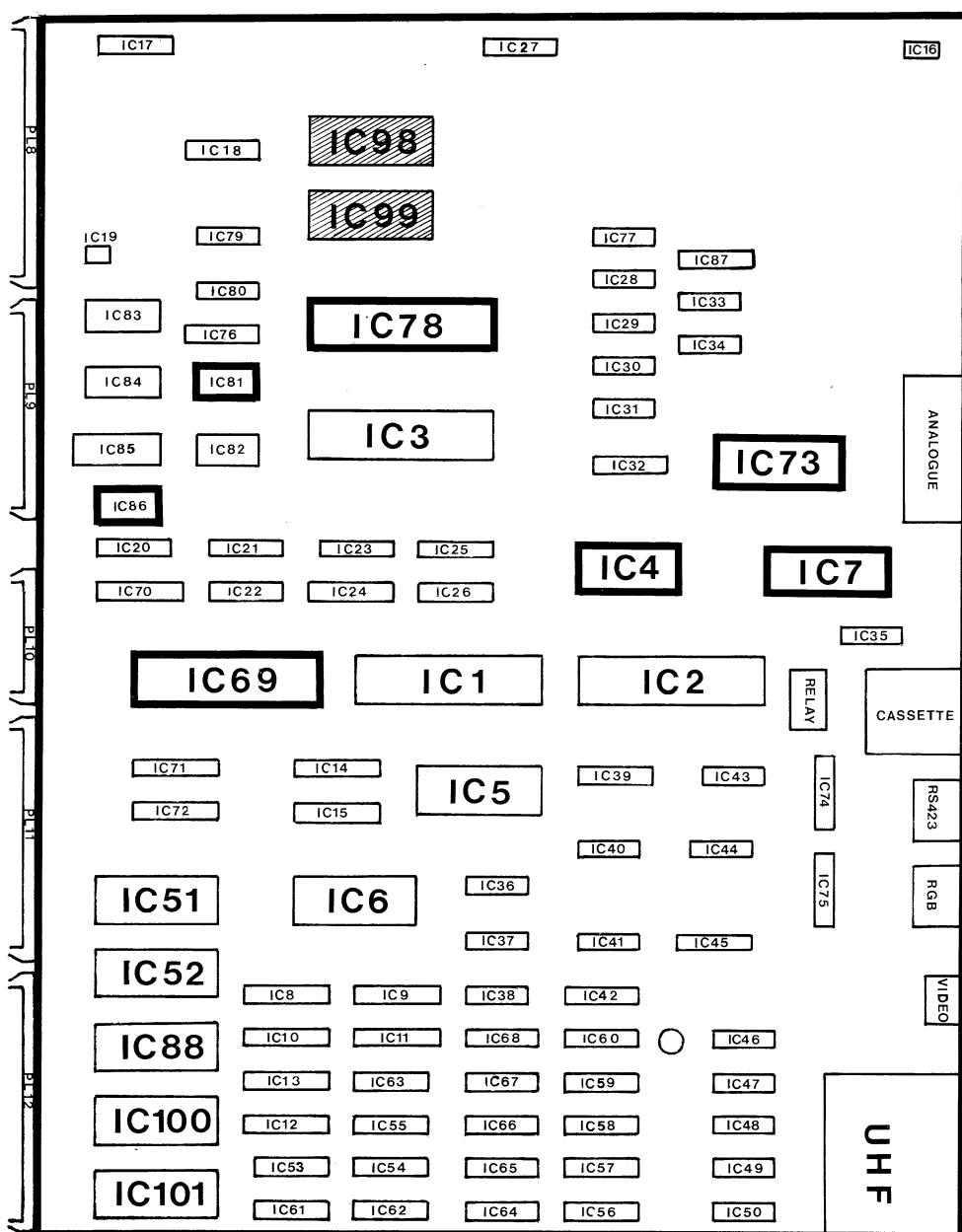


FIG. 3.3 BOARD POSITIONS OF IC4; IC7; IC69; IC73; IC78; IC81; IC86

MAIN SYSTEM IC's (IC1; IC2; IC3; IC51; IC52)

Remove these IC's from the board in the order prescribed above. Carry out the visual inspection as before, but this time, replace the IC's before continuing to the next page to learn the particular effects these IC's have on system performance. **IMPORTANT** Following inspection, Main system IC'S must be re-inserted in their sockets.

IC52: If IC52 is faulty, the boot-up message will still appear on the screen but a question mark will be displayed against the language. Check the IC pins once more, and if necessary change the IC for a known good one.

IC2: If IC2 is faulty, no boot-up message will appear on the screen. Look for signs of a top and bottom border with intervening white screen. Alternatively, the whole screen may turn white depending upon the fault with IC2.

Pressing CTRL G at this point should cause the speaker to emit its usual bleep.

IC3: If IC3 is faulty, the normal boot-up message will appear on the screen but a constant tone should be heard from the speaker. The keyboard, however, will not respond.

IC1 and IC51: If the system has not recovered at this stage, remove IC1 and IC51 and check for pin damage. If on replacing these IC's you find that the symptoms still persist, then change each ROM in turn for a known good one.

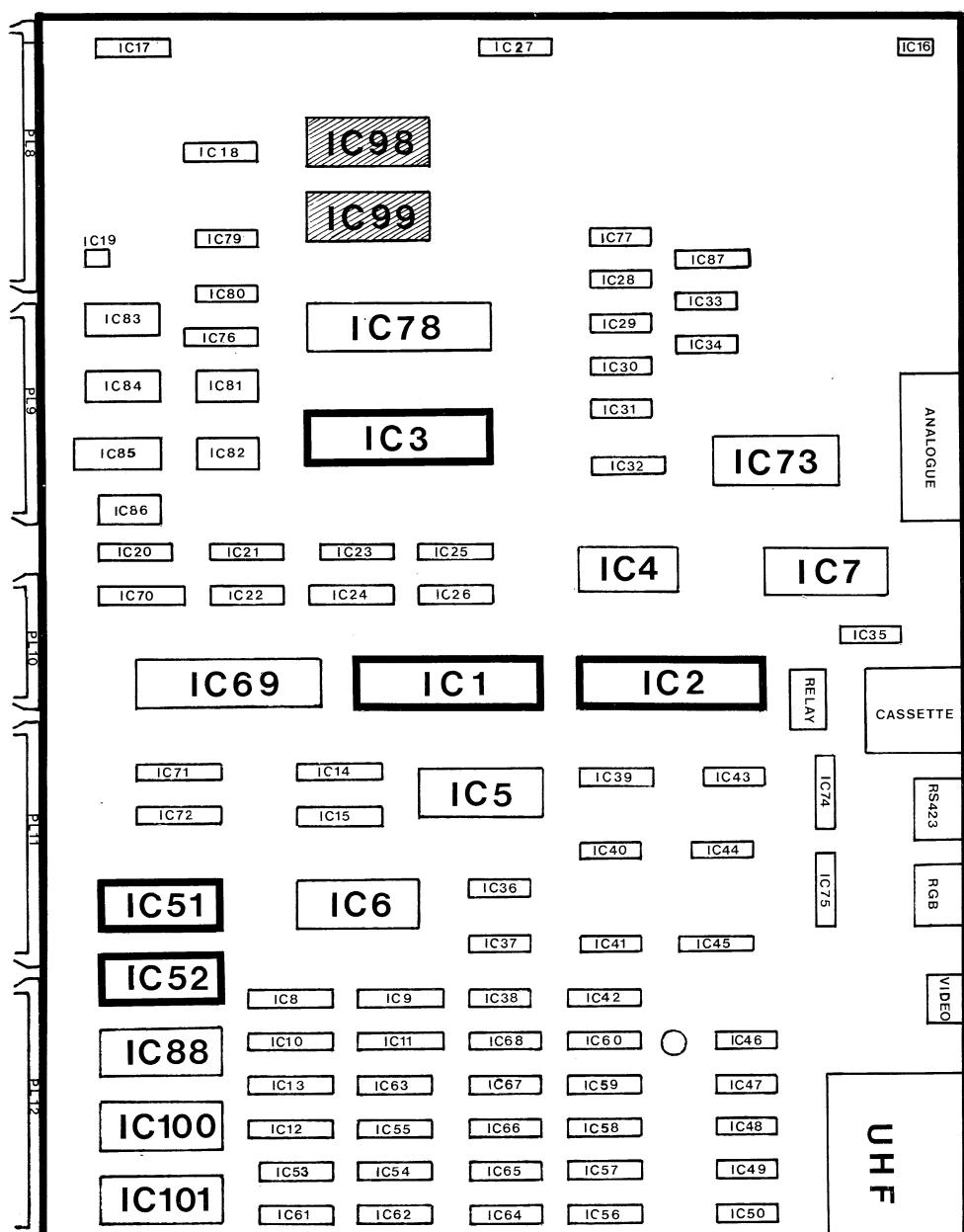


FIG. 3.4 BOARD POSITIONS OF IC1; IC2; IC3; IC51; IC52

SYMPTOMS

- **Blank Screen**
- **No sound from speaker**
- **No Response from keyboard**
- **Caps lock LED is lit**

Check that IC6 is seated correctly in its socket and that the heat sink is firmly in place. Check for pin damage and as a last resort change the IC for a known good one.

SYMPTOMS

- Boot-up Message normal
- Continuous tone from speaker
- Caps Lock LED is lit
- LED's respond erratically on break
- No response from keyboard

Check the terminations at each end of the cable that connects the speaker to the main board (PL13), see Figure 3.5. Make sure that the connectors are seated correctly and that they are not displaced from true alignment, (left or right of centre).

If the cable connections are not responsible for the symptoms, then remove the cable and check for continuity.

If the cable is satisfactory, check to see if IC3 is seated correctly in its socket and that no pin damage has occurred. If the problems persist, change IC3 for a known good one. IC69 can be used as a suitable replacement provided that you have no immediate use of a printer (PL9) or some other peripheral attached to the user port (PL10).

Change the keyboard if the investigations above have failed to identify the fault. If a keyboard exchange doesn't help, then take the computer to your dealer.

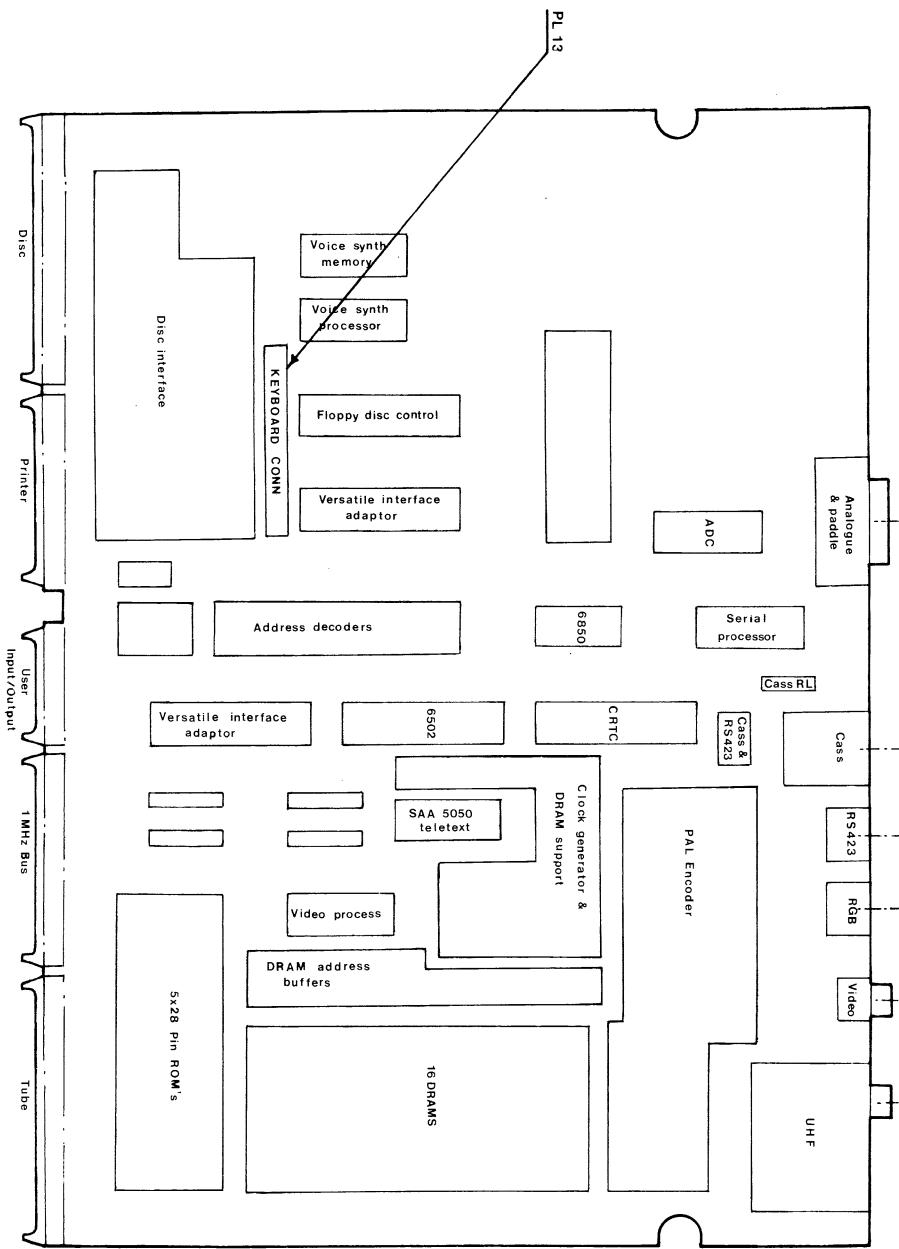


FIG. 3.5 BOARD POSITION OF KEYBOARD CONNECTOR PL13

SYMPTOMS

- Random coloured background or text
- Boot-up message corrupted
- Keyed input corrupted

The IC's that influence screen display, background and text colours are: IC2, IC5 and IC6. A fault with an RGB connector can also result in similar symptoms.

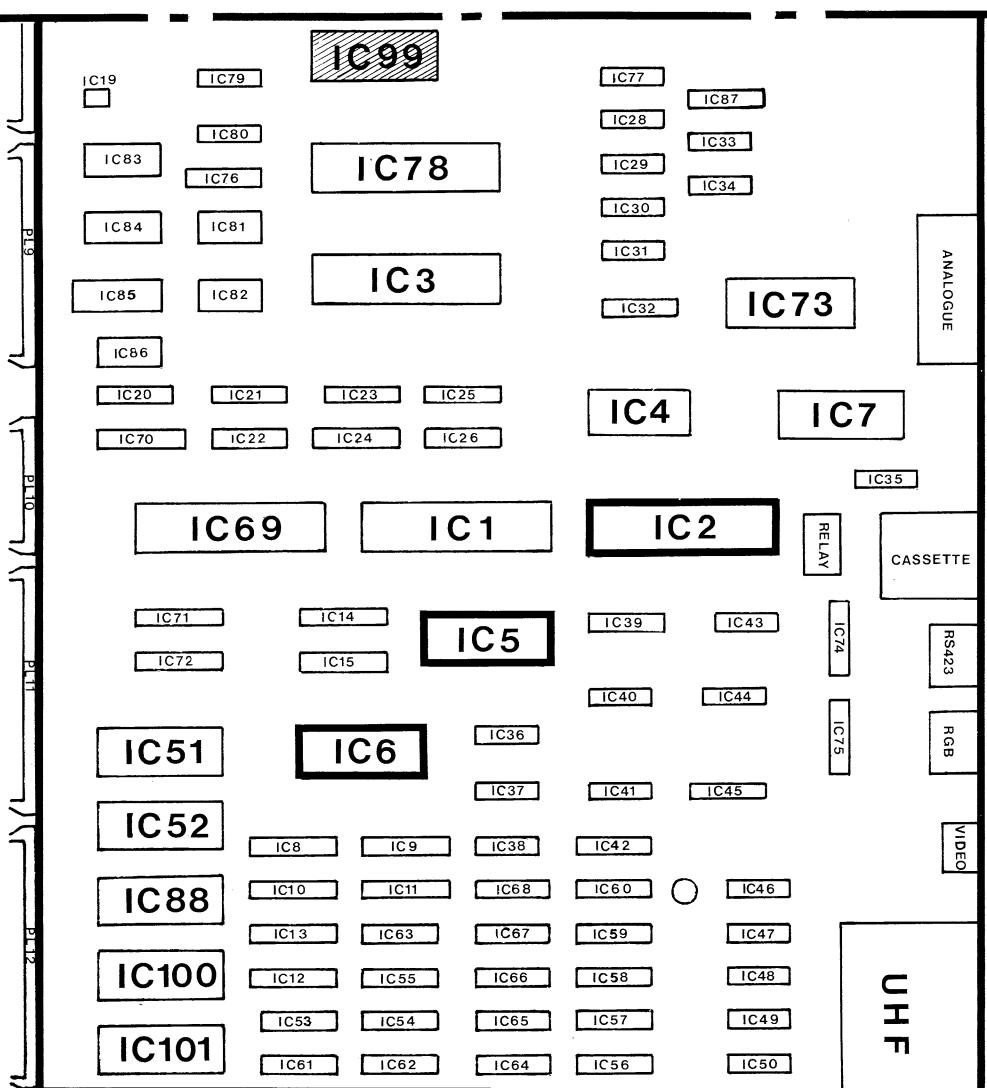


FIG. 3.6 BOARD POSITION OF IC2; IC5; IC6

In particular cases where background colours or text are corrupted, or there is no display at all, the first candidate for inspection should be the RGB cable. Check the cable for continuity and short circuits between pins, see Figure 3.7

If you have problems with the screen display when using a UHF or MONO cable, then these should also be checked.

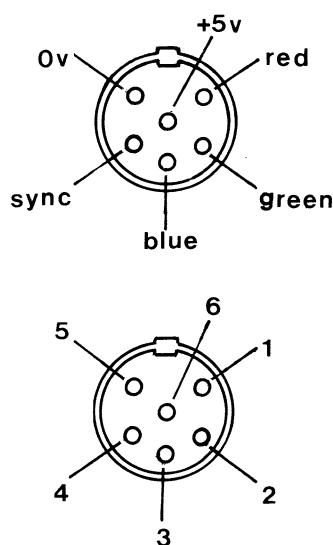


FIG. 3.7 RGB CONNECTOR - AS VIEWED FROM REAR OF BBC CASE

If your cables are in good order, switch off and ensure that IC2, IC5 and IC6 are correctly seated in their sockets. The IC6 heat sink, if fitted, must be securely in place. Switch on and check the symptoms.

If the symptoms show a reduced screen height with a white background, or a corrupted boot-up message, or multiple characters appearing on the screen in response to keyboard input, then look to IC2 as the cause.

If changing IC2 for a known good one doesn't cure the problem, then the board itself is probably at fault.

With other screen effects, the problem will usually lie with IC5 or IC6.

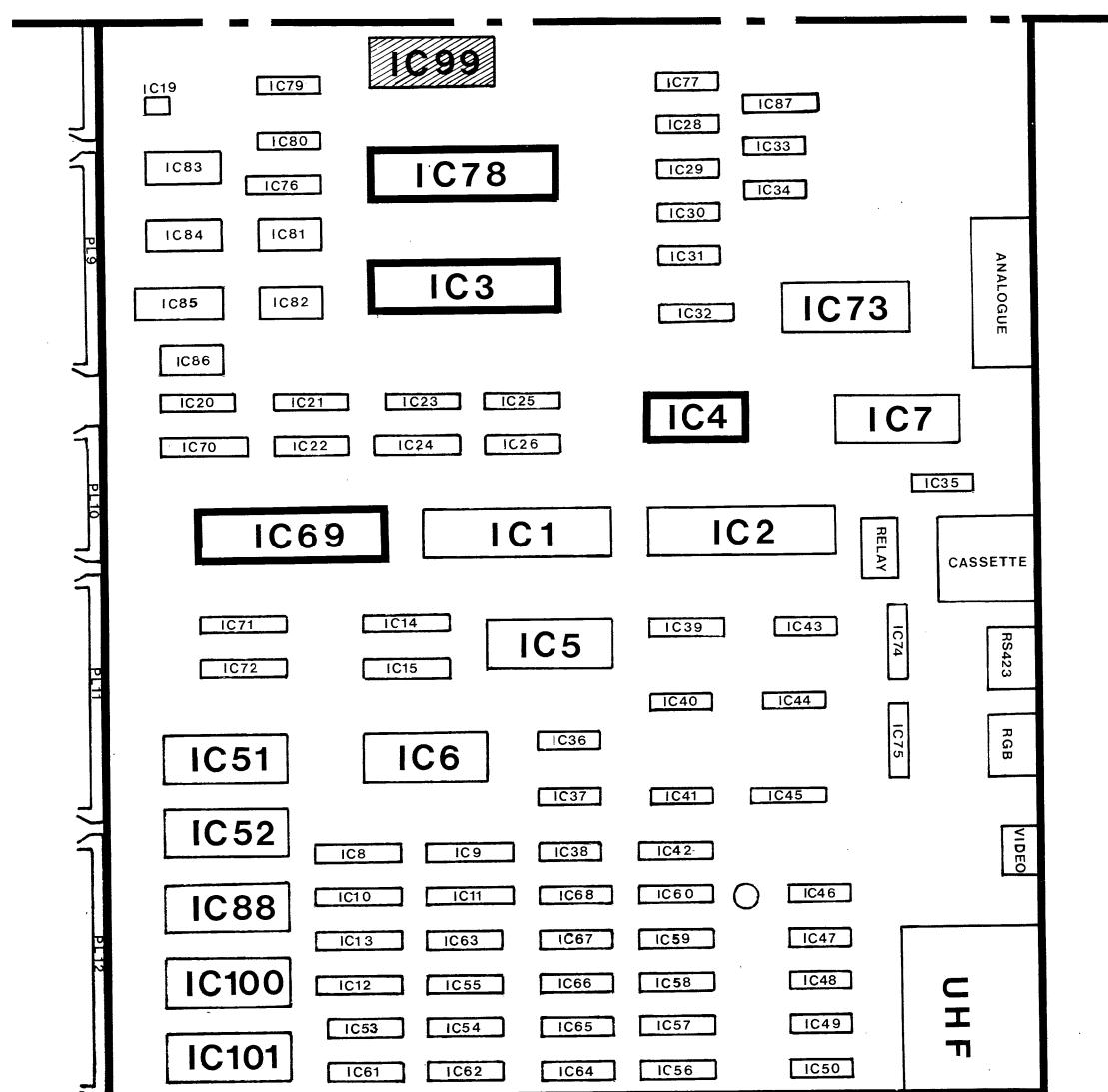
If the system boots up with a white screen and a flashing cursor, selecting Mode 1 should return the screen to normal. When the screen is white, obviously no characters will appear in response to keyboard entries. By changing the mode, the keyboard input should appear. If these symptoms are experienced with IC5 removed, this indicates that IC5 is at fault. Visually inspect IC5 and change for a known good one as necessary. If the problem persists, then it is likely that the printed circuit board is at fault.

If the symptoms are different from those associated with IC5 above, switch off and examine IC6 for damage. Replace with a known good one as necessary and if the symptoms persist, take the computer to your dealer.

SYMPTOMS

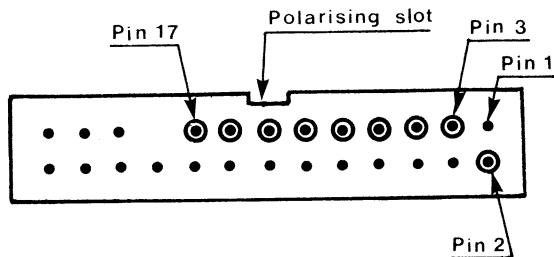
- Variation with boot-up message
- No response from keyboard
- Continuous tone from speaker

These symptoms can be caused by a damaged chip select pin on the following IC's: IC3, IC4, IC69, and IC78.

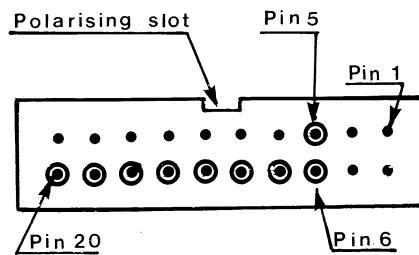


Damage to this pin can initiate an interrupt before the system has completed its boot-up routine. It is also reasonable to assume that an IC in this group which is not correctly seated could be responsible for these symptoms being present.

A short circuit across the 1MHz bus (PL11) or the Acorn tube (PL12) may also result in similar symptoms being generated. Switch off and check pins 6 and 8 of the 1MHz bus connector PL11, and pin 6 of the Acorn tube connector PL12 for short circuits. Figure 3.9 identifies where these pins are within the connectors.



Connector PL11: 1Mhz Bus



Connector PL12: Acorn Tube

FIG 3.9 PIN LAYOUT OF CONNECTORS PL11 AND PL12
(Frontal View - Case Raised)

Switch off and remove the cover. Ensure that IC3, IC4, IC69 and IC78 are properly seated in their sockets.

If the symptoms persist, switch off, remove the IC's and check for damage to the pins.

It is known that similar symptoms can appear if the read only memories in sockets 51, 52 and the sideways ROMs are not properly seated. Remove the sideways ROMs individually and check for bent or broken pins: similarly check the ROMs in sockets 51 and 52. If the symptoms still persist there is probably something wrong in that region of the circuit board.

REMINDER

- *Keep the cover on between tests to avoid accidental damage to the board.*
- *Switch off mains power when removing or replacing IC's. Take care not to damage these devices.*
- *Follow the instructions given for straightening damaged IC pins and for storing these devices when not in use.*

PERIPHERAL FAULTS

Testing for output to the PRINTER PORT

Disconnect the printer from the connector PL9 to determine whether or not the external VIA (IC69) is sending data out to the printer port.

The following program when run should exercise the printer port repeatedly so that you can detect the presence of the two logic levels on each data pin.

```
50 REM THIS PROGRAM TESTS
60 REM THE PRINTER PORT
70 ?&FE63=&FF
80 X=&55
90 Y=&AA
100 ?&FE61=X:FOR N = 1 TO 10000:NEXT
110 ?&FE61=Y:FOR N = 1 TO 10000:NEXT
120 GOTO 100
```

Figure 3.10 represents an underside front view of the twenty-six pin printer port. Pin 1 is located at the right hand side of the top row nearest the polarizing slot. The pins in the top row are numbered: 1, 3, 5, 7 etc as viewed from right to left.

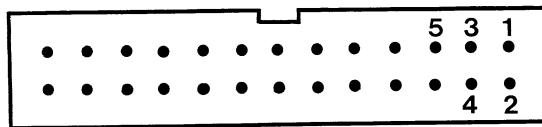


FIG. 3.10 PIN LAYOUT OF PRINTER PORT
(as viewed from front of computer)

The data pins in the printer port are assigned as follows:

DATA PIN	PIN NUMBER
D0	3
D1	5
D2	7
D3	9
D4	11
D5	13
D6	15
D7	17

Connect the negative lead of a multimeter to pin 2 of the printer port and the other lead to the data pins in turn. What you should observe is that the signal level on each data pin will cycle between logic 0 and logic 1 (approximately 4.5 volts on average) every 5 seconds or so.

Should any of the data pins fail to register the results expected, then IC69 should be examined for damage and replaced if necessary. If a component replacement fails to remedy any problems you may have with the printer port, then take the computer to your dealer for repair.

Testing for output to the USER PORT

Disconnect any peripheral from the connector PL10 to determine whether or not the external VIA (IC69) is sending data out to the user port.

The following program when run should exercise the user port repeatedly so that you can detect the presence of the two logic levels on each data pin.

```
50 REM THIS PROGRAM TESTS
60 REM THE USER PORT
70 ?&FE62=&FF
80 X=&55
90 Y=&AA
100 ?&FE60=X:FOR N = 1 TO 10000:NEXT
110 ?&FE60=Y:FOR N = 1 TO 10000:NEXT
120 GOTO 100
```

Figure 3.11 represents an underside front view of the twenty pin user port. Pin 1 is located at the right hand side of the top row nearest the polarizing slot. The pins in the top row are numbered: 1, 3, 5, 7 etc as viewed from right to left.

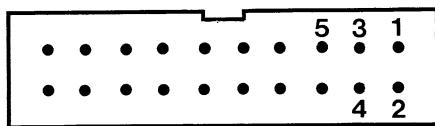


FIG. 3.11 PIN LAYOUT OF USER PORT
(as viewed from front of computer)

The data pins in the user port are assigned as follows:

DATA PIN	PIN NUMBER
D0	6
D1	8
D2	10
D3	12
D4	14
D5	16
D6	18
D7	20

Connect the negative lead of a multimeter to pin 5 of the user port and the other lead to the data pins in turn. What you should observe is that the signal level on each data pin will cycle between logic 0 and logic 1 (approximately 4.5 volts on average) every 5 seconds or so. Check all pins 6, 8, 10, 12, 14, 16, 18 and 20 in the same way. If the readings are correct in all cases then the system is transmitting the data bits correctly.

Should any of the data pins fail to register the results expected, then IC69 should be examined for damage and replaced if necessary. If a chip replacement fails to remedy the problem, then take the computer to your dealer for repair.

Testing for Input to the Analogue in Port

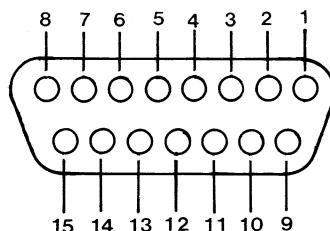
The analogue in test will be different to those previously prescribed for the printer and user ports. The analogue in test is designed to read a voltage from a selected channel and to display its converted value (decimal) on the screen.

With reference to figure 3.12 use a multimeter to carry out continuity checks between pins 2, 3, 5, 6 and 8. Switch on the power and bring the negative lead of the multimeter into contact with pin 2 and the positive lead into contact with pin 1. You should get a reading of approximately +5 volts on the meter.

Keep the power on and connect the negative lead of the multimeter to pin 2 and the positive lead to pin 11. The multimeter should display a reading of approximately +1.85 volts. If either of these two voltage checks fail, then take your computer to your dealer for repair.

NOTE

To make connections to the analogue in port pins, we suggest you use a 15 pin male type D connector (uncovered) to improve accessibility



1.+5V	9.LPSTB
2.0V	10.PB1
3.0V	11.VREF
4.CH3(Channel 4)	12.CH2(Channel 3)
5.Analog Gnd.	13.PBO
6.0V	14.VREF
7.CH1(Channel 2)	15.CHO(Channel 1)
8.Analog Gnd.	

FIG. 3.12 PIN LAYOUT OF ANALOGUE IN PORT
(As viewed from rear of case)

Save the following program on your disc:

```
5 REM PROGRAM TO TEST ANALOGUE IN
10 REM CHANNELS 1 TO 4
20 PRINT"SELECT CHANNEL 1, 2, 3 OR 4"
30 FOR T=1 TO 2000:NEXT
40 INPUT Y:IF Y<1 OR Y>4 THEN 40
50 X=ADVAL(Y)
60 PRINT X
70 FOR T=1 TO 2000:NEXT
80 GOTO 50
```

Now make the following connections identified in the table below and run the program above for both conditions prescribed for each channel. Compare your findings with those values given.

PIN INTER- CONNECTION	CHANNEL SELECTED BY PROGRAM	OUTPUT VALUE ON SCREEN
8(GND) -15	1	BETWEEN 600 & 950
11(VREF)-15	1	APPROX. 65000
8 -7	2	BETWEEN 600 & 950
11 -7	2	APPROX. 65000
8 -12	3	BETWEEN 600 & 950
11 -12	3	APPROX. 65000
8 -4	4	BETWEEN 600 & 950
11 -4	4	APPROX. 65000

If your values do not correspond with those given in the table then power down, remove the cover and replace IC73 with a known good one. If a chip replacement doesn't improve your results then take your computer to a dealer for repair.

The Cassette Port

The cassette port is located at the rear of the main board and is therefore accessible to the user from the rear of the case. The pin assignments of the cassette port are identified in Figure 3.13 below.

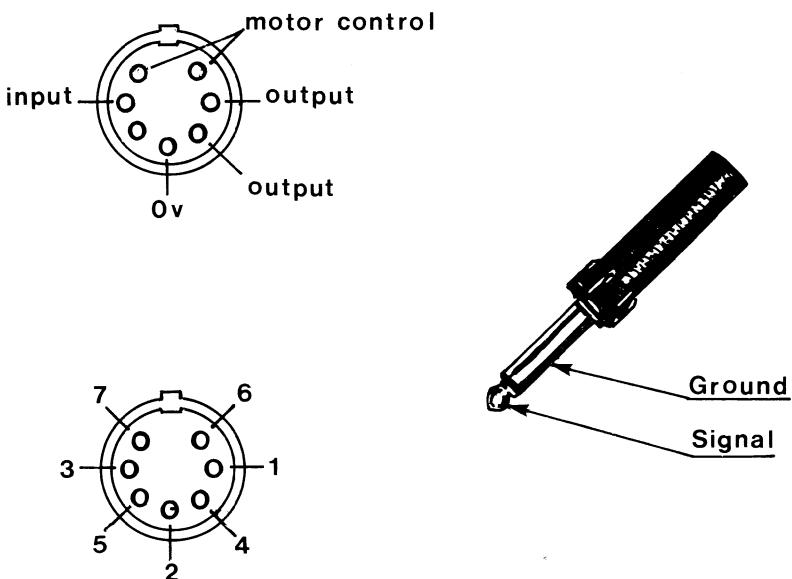


FIG. 3.13 PIN LAYOUT OF CASSETTE PORT
(as viewed from rear of case)

There are 2 ICs involved in the cassette circuit, IC4 and IC7. However, if you have a problem with trying to save a program on cassette or have difficulty in loading the BBC from cassette then you should first of all check your interconnecting cable for continuity.

With the cable disconnected from the BBC and the cassette recorder carry out the following continuity checks:

- pin 1 or pin 4 of the DIN plug (output) is connected to the microphone connection of the recorder.
- pin 3 of the DIN plug (input) is connected to the earphone connection of the recorder.

- pin 2 of the DIN plug (ground) is connected to the ground connection of the recorder.

IMPORTANT

Apply some identification mark to the various leads that are inserted into the recorder. This will avoid the crossing of connections.

REPLACE THE INTERCONNECTING CABLE IF NECESSARY and take notice of the instructions given in the BBC User Guide for volume control on your cassette recorder.

If you can find no fault with the interconnecting cable, remove and replace IC4 and IC7 in turn. Should your trouble still persist, change your cassette recorder for another and if that doesn't work, take the computer and cassette recorder to your dealer.

REMINDER

- *Keep the cover on between tests to avoid accidental damage to the board.*
- *Switch off mains power when removing or replacing IC's. Take care not to damage these devices.*
- *Follow the instructions given for straightening damaged IC pins and for storing these devices when not in use.*

The RS423 Port

If you have a problem with writing to or reading from the RS423 port then disconnect the interfacing cable and test the board circuit as follows:

With the use of a 5 pin DIN plug, see Figure 3.14 for pin assignments, make a wire connection between pins A and B and separately between pins D and E.

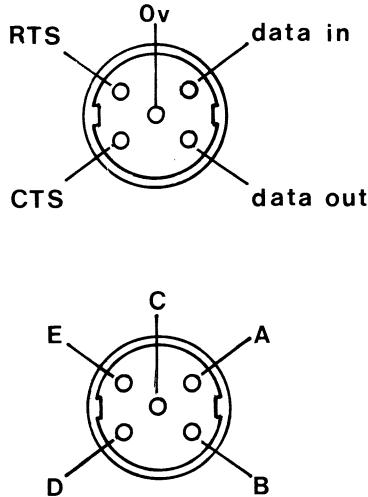


FIG. 3.14 PIN LAYOUT OF RS423 PORT
(AS VIEWED FROM REAR OF CASE)

Save the following program on disc:

```
10 REM RS423 TEST
20 *FX7,1
30 *FX8,1
40 *FX3,5
50 *FX2,1
```

Run the program.

You should see a number of rows of the screen being filled with the prompt symbol (>). After a while, the buffer will fill and the program will stop. The speaker will then sound continuously.

This test can be run again by pressing the break key and then typing OLD to recall the program.

If you do not get the results that we got, replace IC4 and IC7 in turn with known good devices.

In some RS423 installations (no use of handshake signals for example), it is possible to insert the DIN plug the wrong way round into the socket of the computer. Take care to ensure that this doesn't happen by marking the case and plug accordingly.

DISC INTERFACE

GENERAL

This section is concerned with fault symptoms that originate from the disc drive interface circuitry. The IC's involved in this interface are:

IC NUMBER	DEVICE TYPE
27	7438
77	74LS00
78	8271
79	7438
80	7438
81	74LS393
82	74LS10
83	4013
84	4013
85	4020
86	74LS393
87	74LS123
88	2764 EPROM (DFS)

All ICs listed above, with the exception of IC27 and IC77, are located in sockets for ease of replacement.

BOARD LINKAGES

BBC Microcomputers equipped with a disc filing system should have the following links in place.

Link	PCB Position	Remarks
S8	32, 15	MUST BE CLOSED TO LINK THE DISC HEAD LOAD SIGNAL TO CONNECTOR PL8.
S9	35, 128	MUST BE OPEN. DO NOT FIT IC78 WITH THIS LINK CLOSED.
S10	45, 15	MUST POINT WEST TO SELECT 5½" DISC.
S12	97, 70	MUST BE OPEN. DO NOT FIT IC76 WITH THIS LINK CLOSED.
S13	100, 67	MUST BE OPEN. DO NOT FIT IC76 WITH THIS LINK CLOSED.
S32	295, 65	MUST POINT WEST TO SELECT IC52 ROM or 2764 EPROM.
S33	295, 67	MUST POINT WEST TO SELECT IC100 ROM or 2764 EPROM.

DISC INTERFACE FUNCTIONAL REQUIREMENTS

Printed circuit boards prior to issue 4 must have the following modifications in place for the disc interface to function. Accordingly, check for the following:

- Wire link S9 has been opened. IC78 will suffer damage if it has not.
- Pin 9 of IC27 has been shortened to prevent it making contact with the board. An insulated wire-link is run from the remaining upper portion of pin 9 and the east pad of link S9.
- Link S2 is closed unless an Econet interface is fitted.
- Link S8 is closed.

COMMON FAULTS WITH THE DISC INTERFACE

The most common fault to occur with the disc drive section of the board is the failure of IC78, the disc drive controller chip. However, another common fault not to be overlooked is the fitting of cable connector PL8. Make sure that this is fitted the right way round. Connector PL8 is polarised, and the polarising key on the cable connector must locate with the corresponding cavity on PL8, see Figure 4.1.

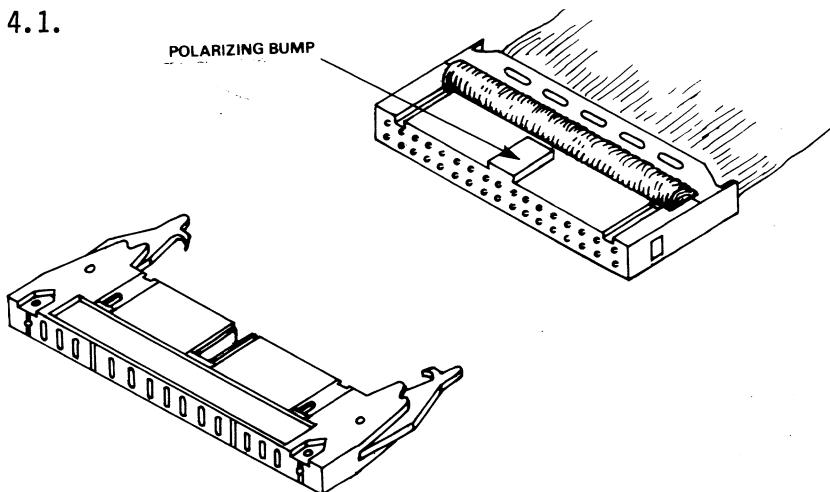


FIG. 4.1 CONNECTING PL8 THE RIGHT WAY ROUND

A reversed cable should result in a constant sound being emitted from the speaker, with the drive being constantly accessed.

It is always good practice to inspect the cable for any damage or breaks. Also, make sure that none of the pins are bent or damaged before fitting the cable to connector PL8.

NOTE

If you start to encounter disc error messages then make sure that you remove the disc and replace it with one which doesn't carry any vital information before you attempt to trace the cause of the trouble.

SYSTEM FAULTS CAUSED BY A DEFECTIVE DISC DRIVE

- No appearance of BASIC in boot-up message
- Flashing cursor below Acorn DFS heading
- Continuous speaker tone until break key is pressed
- Keyboard only responds to CTRL and BREAK keys

The symptoms above suggest a fault in either IC78, IC86 or the DFS ROM (possibly located in socket marked IC88). Check that all the ICs concerned with the disc drive interface are properly seated in their sockets: IC78 to IC87 inclusive. Check the DFS ROM also.

You can quickly check the DFS ROM by moving it from its present position to either ROM socket IC100 or IC101. If the fault is cured by doing this then inspect its original socket for damage.

If the fault persists after moving the DFS ROM then remove IC86 (located under the keyboard) and change it for a known good one. Replace IC78 if necessary. If these measures fail to rectify the fault then take the computer to your dealer.

Faults encountered when accessing the drive

The first action to take when you get error messages concerned with disc access is to change the disc for another to make sure that the fault isn't being caused by a faulty disc.

To assist you with the analysis of the following disc drive faults we suggest you minimise the number of ICs involved by removing all sideways ROMs with the exception of BASIC and the DFS. Do not remove the operating system ROM.

REMINDER

- *Keep the cover on between tests to avoid accidental damage to the board.*
- *Switch off mains power when removing or replacing IC's. Take care not to damage these devices.*
- *Follow the instructions given for straightening damaged IC pins and for storing these devices when not in use.*

Lock-out with flashing cursor when disc is accessed

The ICs which could cause such a fault are:

Both drives : IC78, IC79, IC85 and IC88

Drive 0 only: IC84

Drive 1 only: IC83

Replace each IC for a know good one.

DISC FAULT 18 displayed with or without 'BAD PROGRAM'

This error message can result from faults with: IC78, IC79, IC80, IC81, IC82, IC83, IC84 or IC87.

Check that all these ICs are properly seated in their sockets.

Replace each IC in turn with a known good one.

DISC FAULT 10 displayed.

Check that all drive IC's (IC78 to IC87 inclusive), and the DFS ROM, are properly seated in their sockets.

Check the DFS ROM and replace the other ICs in turn for a known good one.

DISC FAULT 14 displayed.

Check IC78, IC80, IC83 and the DFS ROM if this fault message appears.

Inspect the DFS ROM and replace the other ICs in turn with a known good one.

DISC FAULT OC or DISC FAULT OE is displayed.

The IC's to look at are: IC78, IC82 and the DFS ROM.

Inspect the DFS ROM and change the other ICs in turn for a known good one.

DISC FAULT 7F displayed.

The IC's to look are: IC78, IC86 and the DFS ROM.

Inspect the DFS ROM and change the other ICs in turn for known good ones.

The purpose of this section is to focus on a number of Integrated Circuits that featured prominently in previous sections. In the tables that follow we have documented the fault symptoms that these devices could individually give rise to under conditions indicated thus:

1. IC not correctly seated in its socket or,
IC is faulty.
2. Address pins or data pins shorted.
3. Bent, broken or pins shorted.

Furthermore, the following tables will identify the board position of each IC by giving its X and Y co-ordinates in millimetres from the front left hand corner of the board (see Appendix A) in addition to its PCB legend identifier.

The tables will indicate also the pins on the IC package which are assigned to power (Vcc) and ground (Vss). The IC's tabulated in this section are grouped below against the main system or sub-system in which they operate.

IC	SYSTEM/SUB-SYSTEM
1 ; 2 ; 3 ; 51 ; 52	Main System (13)
3	Keyboard (13)
2 ; 5 ; 6	Screen (13)
69	Printer Port (32)
69	User Port (34)
73	Analogue in Port (35)
4 ; 7	Cassette Port (35)
4 ; 7	RS423 Port (40)
78 ; 88	Disc Drive (43)

Note: The numbers in brackets are page numbers to which you are referred for information that is complementary to that given in this section.

IC:	1	PCB POSITION:	160 : 85
TYPE:	6502	Vcc (5V) PIN:	8
FUNCTION:	CPU	Vss (0v) PIN:	1/21

SYMPTOM/S	FAULT/S
Continuous tone from speaker CAPS LOCK LED lit	IC NOT SEATED IN SOCKET
No response from keyboard Blank screen	IC FAULTY
Symptoms as above	ADDRESS OR DATA PINS SHORTED
	BENT, BROKEN OR SHORTED PINS.

IC:	2	PCB POSITION:	160 : 145
TYPE:	6845	Vcc (5V) PIN:	20
FUNCTION:	CONTROLLER CRT	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
Screen displays border at top and bottom of screen.	IC NOT SEATED IN SOCKET
No boot-up message. Colour of display random (white most common).	
Mode other than 7 causes blank screen, but reverts to boot-up condition when BREAK key is pressed.	IC FAULTY
Keyboard input not displayed.	
Symptoms as above	ADDRESS OR DATA PINS SHORTED
Boot-up message corrupted. Multiple characters appear on screen in response to keyboard entry More than one cursor displayed.	BENT, BROKEN OR SHORTED PINS.

IC:	3	PCB POSITION:	90 : 75
TYPE:	6522	Vcc (5V) PIN:	20
FUNCTION:	KEYBOARD VIA	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
Depressing BREAK causes the boot-up message to flicker. Constant tone from speaker.	IC NOT SEATED IN SOCKET
CAPS LOCK LED lit. No response from keyboard	IC FAULTY
Symptoms as for IC1.	ADDRESS OR DATA PINS SHORTED
Symptoms as for IC3 above. Limited response from keyboard. Constant tone but variable pitch from speaker. Random response from LED's on depressing BREAK key.	BENT, BROKEN OR SHORTED PINS.

IC:	4	PCB POSITION:	128 : 141
TYPE:	6850	Vcc (5V) PIN:	12
FUNCTION:	ACIA	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
Printer cannot be selected. On entering 'SAVE' command, the cassette LED lights but no acknowledgement with 'RECORD then RETURN' message.	IC NOT SEATED IN SOCKET IC FAULTY
Symptoms as for IC1.	ADDRESS OR DATA PINS SHORTED
No response from printer. No response from cassette or print-out corrupted. Loading from cassette corrupts data. LED's for both CAPS LOCK and SHIFT LOCK respond erratically. Keyboard response locked immediately or following the entry of data.	BENT, BROKEN OR SHORTED PINS.

IC:	5	PCB POSITION:	187 : 102
TYPE:	SAA 5050	Vcc (5V) PIN:	18
FUNCTION:	TELETEXT ROM	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
No message on boot-up. Screen white with flashing cursor. Characters entered do not appear on screen. Mode other than 7 changes background to normal and displays keyboard entries.	IC NOT SEATED IN SOCKET IC FAULTY
Boot-up message corrupted. Screen does not display keyed character. Spurious characters appear on screen in response to keyboard entries.	ADDRESS OR DATA PINS SHORTED
Normal boot-up message with various background colours. Boot-up message in various colours.	BENT, BROKEN OR SHORTED PINS.

IC:	6	PCB POSITION:	214 : 71
TYPE:	5C094	Vcc (5V) PIN:	18
FUNCTION:	VIDEO ULA	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
On boot-up, system appears dead except for CAPS LOCK LED lit.	IC NOT SEATED IN SOCKET IC FAULTY
Symptoms as for IC1. CAPS LOCK and SHIFT LOCK LED's operate momentarily.	ADDRESS OR DATA PINS SHORTED
1 and 2MHz - No boot-up message. Flashing cursor and streaks across screen. 2 and 4MHz - No boot-up message. CAPS LOCK LED operates momentarily. Dead keyboard. 4 and 8MHz -as for 2 and 4MHz clocks	SHORTED CLOCK PINS.
1MHz - No boot-up message. Flashing cursor. CAPS LOCK LED lit and bleep from speaker. 2 MHz - No boot-up message. No cursor. Constant tone from speaker. CAPS LOCK LED lit. No response from keyboard. 4MHz - On boot-up, no tone from speaker. Screen remains blank. CAPS LOCK LED operates momentarily. Brief flash on screen on power-up and power-down. 8MHz - Symptoms as for 2MHz clock.	BENT, OR BROKEN CLOCK PINS.

IC:	7	PCB POSITION:	128 : 182
TYPE:	2C199	Vcc (5V) PIN:	28
FUNCTION:	SERIAL ULA	Vss (0v) PIN:	14

SYMPTOM/S	FAULT/S
No serial printer response. No cassette motor response.	IC NOT SEATED IN SOCKET IC FAULTY
Symptoms as for IC1.	ADDRESS OR DATA PINS SHORTED
No serial printer response. System may lock-up after printer selected, either immediately or following the entry of data. Speaker response, if any, may vary on boot-up, i.e. differences in pitch or length of tone. CAPS LOCK and SHIFT LOCK LED's lit when system locks-up. Printer when selected does not print keyed data, but prints data recalled from Memory.	BENT, BROKEN OR SHORTED PINS.
Printer responds but print-out corrupted. No response from cassette LED or motor on selection with SAVE command	

IC:	51	PCB POSITION:	214 : 24
TYPE:	ROM	Vcc (5V) PIN:	28
FUNCTION:	OPERATING SYSTEM	Vss (0v) PIN:	14

SYMPTOM/S	FAULT/S
Continuous tone from speaker. CAPS LOCK LED lit. No response from keyboard. Blank screen.	IC NOT SEATED IN SOCKET IC FAULTY
Symptoms as above.	ADDRESS OR DATA PINS SHORTED
Symptoms as above.	BENT, BROKEN OR SHORTED PINS.

IC:	52	PCB POSITION:	233 : 24
TYPE:	ROM	Vcc (5V) PIN:	28
FUNCTION:	BASIC	Vss (0v) PIN:	14

SYMPTOM/S	FAULT/S
No recognition of BASIC language. No response from keyboard.	IC NOT SEATED IN SOCKET
	IC FAULTY
Symptoms as above.	ADDRESS OR DATA PINS SHORTED
Symptoms as above.	BENT, BROKEN OR SHORTED PINS.

IC:	69	PCB POSITION:	160 : 29
TYPE:	6522	Vcc (5V) PIN:	20
FUNCTION:	EXTERNAL VIA	Vss (0v) PIN:	1

SYMPTOM/S	FAULT/S
System locks-up if printer port selected.	IC NOT SEATED IN SOCKET
	IC FAULTY
Symptoms as for IC1.	ADDRESS OR DATA PINS SHORTED
Symptoms as for IC1. Printer locks-up system when characters are keyed in. Printout corrupted OR Keyboard entries printed but file recalled from memory not printed. CAPS LOCK and SHIFT LOCK LED's lit when system locks-up.	BENT, BROKEN OR SHORTED PINS.

IC:	73	PCB POSITION:	100 : 73
TYPE:	D7002	Vcc (5V) PIN:	14
FUNCTION:	ADC CONVERTER	Vss (0v) PIN:	3

SYMPTOM/S	FAULT/S
Only affects Analogue Inputs.	IC NOT SEATED IN SOCKET
	IC FAULTY
Symptoms as for IC1.	ADDRESS OR DATA PINS SHORTED
Test program results unobtainable.	BENT, BROKEN OR SHORTED PINS.

IC:	78	PCB POSITION:	60 : 75
TYPE:	8271	Vcc (5V) PIN:	14
FUNCTION:	FLOPPY DISC CONTROLLER	Vss (0v) PIN:	3

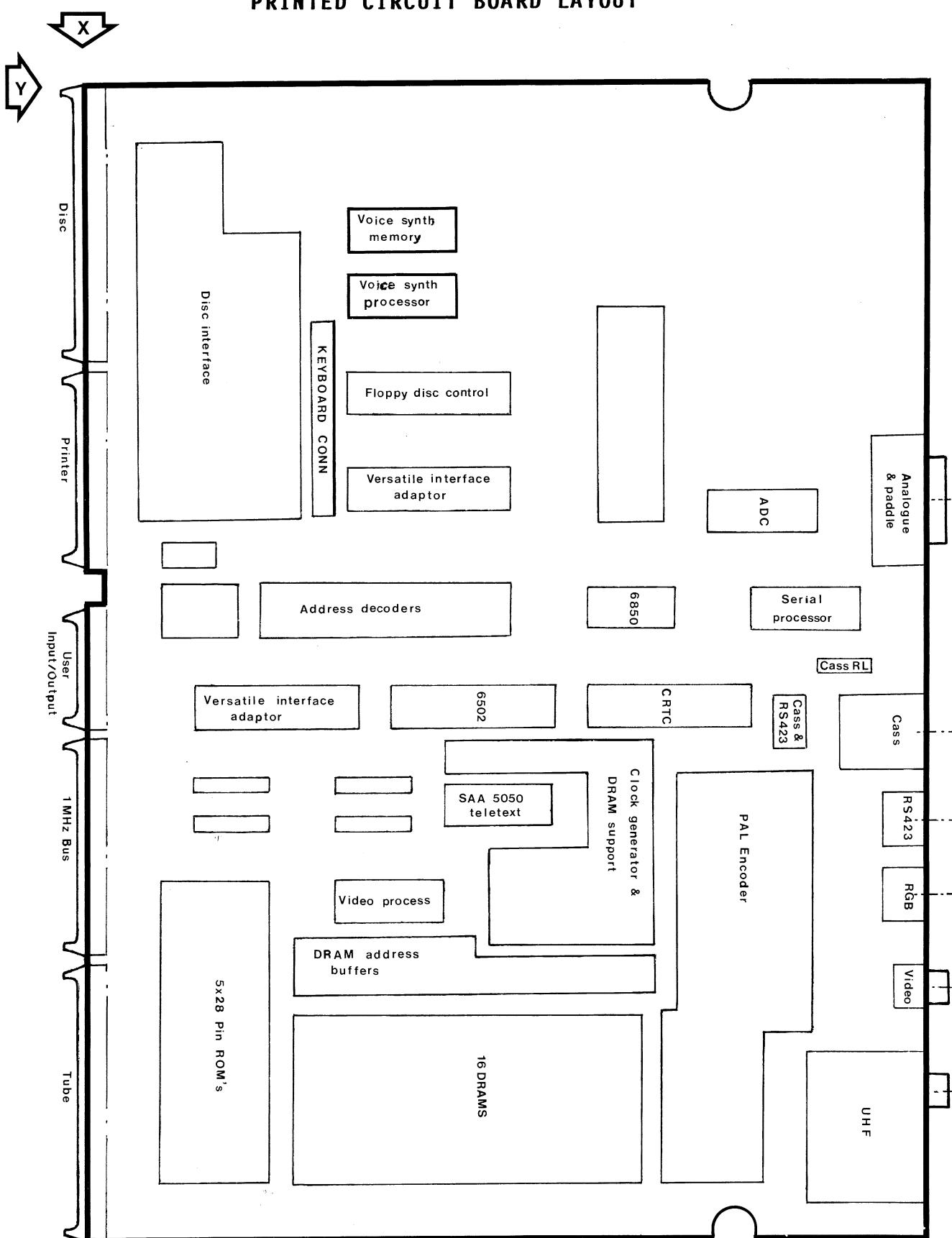
SYMPTOM/S	FAULT/S
Flashing on screen. No response from keyboard.	IC NOT SEATED IN SOCKET IC FAULTY
Symptoms as above. Disc drive failure. Screen displays error message "FAULT 14 at 00/00"	ADDRESS OR DATA PINS SHORTED
No screen display and no keyboard response. Continuous speaker tone. Drives repeatedly accessed and/or cassette motor LED lit. Disc drive error messages. Corruption of disc catalogue on screen.	BENT, BROKEN OR SHORTED PINS.

IC:	88	PCB POSITION:	252 : 24
TYPE:	ROM	Vcc (5V) PIN:	28
FUNCTION:	DFS	Vss (0v) PIN:	14

SYMPTOM/S	FAULT/S
If IC78 is installed, the system behaves as a Cassette Filing System. The cassette LED will operate when the disc drive is invoked by the user. Boot-up message omits reference to DFS system.	IC NOT SEATED IN SOCKET IC FAULTY
Speaker tone continuous. No screen display. No keyboard response. System fails to reset on BREAK or CTRL BREAK .	ADDRESS OR DATA PINS SHORTED
Flashing on screen. No keyboard response. SHIFT LOCK LED comes on at boot-up, but goes off on CTRL BREAK or BREAK .	BENT, BROKEN OR SHORTED PINS.

Appendix A

PRINTED CIRCUIT BOARD LAYOUT



Appendix B

REPLACEMENT STOCK

To avoid any unnecessary delays in returning the BBC Model B to its fully operational condition for want of spare parts, the following integrated circuits are recommended for stock holding:

IC IDENTITY BY BOARD LEGEND	DEVICE TYPE	SYSTEM FUNCTION
IC1	6502A	CPU
IC2	6845	CRT CONTROLLER
IC3 * 6522		INTERNAL VIA
IC5	SAA5050	TELETEXT ROM
IC6	5C094	VIDEO ULA
IC7	2C199	SERIAL ULA
IC69 * 6522		EXTERNAL VIA
IC73	UPD7002	ADC CONVERTOR

Appendix C

SUPPLIERS OF INTEGRATED CIRCUITS

General Purpose Supplies

FARNELL ELECTRONIC COMPONENTS LIMITED
Canal Road,
Leeds, LS12 2TU.
Tel: 0532 636311.

RS COMPONENTS LIMITED
Lammas Road
Weldon Industrial Estate
Corby
Northants, NN17 9RS.
Tel: 0536 201201.

STC ELECTRONIC SERVICES
52A High Street
Paisley, PA1 2DJ.
Tel: 041 889 1711.

Specialist Supplies

ACORN COMPUTERS LIMITED
Sales Department
Cambridge Technopark
645 Newmarket Road
Cambridge CB5 8PD
Tel: 0223 214411

(no direct sales : ask for nearest stockist)

GLOSSARY

ACK	ACKnowledge line on the printer port
ACIA	Asynchronous Communications Interface Adaptor - serial to parallel and parallel to serial converter (6850)
ADC	Analogue to Digital Converter
ADLC	Advanced Data Link Controller - Econet control IC
ASCII	American Standard Code for Information Interchange - binary code for representing alphanumeric punctuation and control characters.
BASIC	Beginners All-purpose Symbolic Instruction Code
BBC	British Broadcasting Company
BNC	Bayonet-Neill-Cancelman - the type of bayonet connector used for the video output.
BOOT-UP	Initialise and ready the system for input
BS	British Standard
CP/M	Control Program for Microcomputers - Z80 based operating system.
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CTRL	Command Control key
CTS	Clear To Send - control input on the RS423 port
DFS	Disc Filing System
DIN	Connectors such as the cassette socket, RGB socket etc.
DRAM	Dynamic RAM.
EPROM	Erasable Programmable Read Only Memory
FDC	Floppy Disc Controller
GND	Ground

IC	Integrated Circuit
ID	IDentity
IDC	Insulation Displacement Connectors - parallel cable connectors underneath the computer
IEEE488	A Parallel interface usually associated with automatically controlled test instruments.
I/O	Input/Output
IRQ	Interrupt ReQuest - control line on the 6502
 LED	Light Emitting Diode
 MOS	Machine Operating System
MPU	MicroProcessor Unit
 NMI	Non-Maskable Interrupt - control line on the 6502
 PA	Port A - one of the two ports of a VIA
PB	Port B - the other port of a VIA
PCB	Printed Circuit Board
PL	Header plug
PSU	Power Supply Unit
 QWERTY	Upper left keys on standard keyboard layout
 RAM	Random Access read/write Memory
RC	Resistor Capacitor network
RGB	Red Green Blue - individual colour signals for the VDU.
ROM	Read Only Memory
RS423C	An internationally defined convention for serial transmission of data
RTS	Ready To Send - control output on RS423 port
 SK	Socket
SW	South West

TCW	Tinned Copper Wire
TTL	Transistor Transistor Logic - a standard type of digital IC (74 - series)
TUBE	Acorn Computers Ltd Trademark for 2MHz Expansion port primarily intended for adding a second processor.
UHF	Ultra High Frequency - signal for input to a TV aerial socket
ULA	Uncommitted Logic Array - semi custom IC
Vcc	+5 Volts
VDU	Visual Display Unit
VIA	Versatile Interface Adaptor
VR	Variable Resistor
Vrr	-5 Volts
Vss	0 Volts
Z80	A commonly used 8 bit microprocessor
1MHz	1 MegaHertz - usually refers to the interface bus running at that speed.

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