# Acorn A3010, A3020 and A4000 Module Level Service Manual

# Contents

## About this manual

This manual is a module level service manual for the Acorn A3010/A3020 and A4000 series computers. It is intended as a guide for suppliers at Acorn Service Centres to enable them to trace and repair faults at a module level. Suppliers are not expected to undertake repairs at a component level, as surface mount technology is used on the printed circuit boards of the A3010/A3020 and A4000 computers. Any modules which require component level repairs should be sent to an Acorn Authorised Central Service Workshop.

This manual supplements the basic information given on system hardware in the *Welcome Guide* and *Technical Reference Manual* (available for separate purchase).

The operating system is covered at the user level in the *RISC OS User Guide*, supplied with certain models (also available for separate purchase). Programmers and users requiring a greater depth of information about RISC OS will also need the following manual:

   *RISC OS Programmer's Reference Manual*
   (a boxed set)

This manual is available from Acorn authorised suppliers.

Full details on the Acorn ARM chip set used in the workstation are given in the *Acorn RISC Machine (ARM) Family Data Manual, ISBN 0-13-781618-9*, available from:

VLSI Technology, Inc.
Application Specific Logic Products Division
8375 South River Parkway
Tempe, AZ 85284
USA
602-752-8574

or from the VLSI national distributor.

# Part 1- Fault diagnosis and repair

## Introduction

This chapter is a guide to the diagnosis and repair at a modular level of basic faults in the Acorn A3010, A3020 and A4000 series computer systems.

It consists of algorithms to enable you to trace and remedy faults in a 'dead' computer, followed by instructions for running the Acorn functional test software, which is designed to isolate faults in a computer which is partly working.

**Note:** Throughout this chapter the acronym UUT is used to mean Unit Under Test and the acronym CSW to mean Central Service Workshop.

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**SAFETY CONSIDERATIONS**

WHENEVER ANY SERVICE OR UPGRADE IS PERFORMED, ENSURE THAT ALL THE FUNCTIONAL TESTS AND SAFETY TESTS AS DESCRIBED IN THIS SECTION ARE CARRIED OUT.

FULL FUNCTIONAL AND SAFETY TESTS SHOULD BE APPLIED IRRESPECTIVE OF THE ORIGINAL FAULT OR WORK PERFORMED. FOR DETAILS REFER TO *Appendix C - Earth continuity testing* AND *Appendix D - DC insulation testing - class 1*.

FAILURE TO CARRY OUT THE TESTS IN FULL MAY RESULT IN AN UNSTABLE OR UNRELIABLE UNIT BEING RETURNED TO THE CUSTOMER.

**DANGER**

BEFORE ATTEMPTING TO OPEN THE COMPUTER OR EXCHANGE EITHER THE PSU (POWER SUPPLY UNIT) OR PCB (PRINTED CIRCUIT BOARD), ENSURE THAT YOU HAVE READ AND FULLY UNDERSTOOD ALL THE INSTRUCTIONS IN *Part 2 - Disassembly and assembly*. IN PARTICULAR, ENSURE THAT YOU DISCONNECT THE COMPUTER, MONITOR AND PERIPHERALS FROM THE POWER SUPPLY.

UNDER NO CIRCUMSTANCES SHOULD ANY ATTEMPT BE MADE TO REPAIR OR MODIFY THE PSU. ANY ATTEMPT TO DO SO WILL INVALIDATE THE ORIGINAL SAFETY TESTS APPLIED AT MANUFACTURE AND MAY CREATE A SAFETY HAZARD.

IF THE METAL SAFETY CAGE OF THE A3010/A3020 IS REMOVED EXTRA CARE MUST BE TAKEN DUE TO THE HAZARDOUS VOLTAGES EXPOSED ON THE PCB.

IF THE PCB IS REMOVED FROM THE METALWORK OF THE A3010/A3020, AND THEN CONNECTED TO THE MAINS, EXTRA CARE MUST BE TAKEN DUE TO THE HAZARDOUS VOLTAGES PRESENT ON THE BOTTOM OF THE PCB

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## Test equipment required

- DC Voltmeter
- ARM 250 Dealer Test Disc (Acorn part number 0294,825)
- a blank 1.6 MB ADFS F format write-enabled, 3.5 inch floppy disc (used as a scratch disc in the disc interface test)
- test IDE hard disc (see the section entitled *Creating a test IDE hard disc* on page F-1)
- serial port loopback plug (see *Appendix B - Serial port loopback plug*)
- headphones (32 ohm impedance)
- analogue multisync colour monitor (suitable for super VGA)
- Epson FX80 compatible printer
- blank 800K ADFS E format write-enabled, 3.5 inch floppy disc:
  - *data disc* – to store the customer's CMOS RAM configuration data
- working keyboard (0391,100) – A4000 only mouse (0914,000 or 0914,001)
- mouse test jig template (see *Appendix A - Mouse test jig template*)
- standard hand tools, such as screwdrivers and pliers
- earth testers (see *Appendix C - Earth continuity testing*)
- insulation tester (see *Appendix D - DC insulation testing - class 1*)
- 2 x joysticks – A3010 only
- T.V. – A3010 only

## Checking a 'dead' computer

This section describes the initial tests that you should perform on an apparently 'dead' computer to discover which module or upgrade is faulty. If the computer is partially working (i.e. any faults occur after a successful power-up) go straight to the section entitled *Checking a partly working computer* on page 1-3.

To diagnose the faults in a 'dead' computer, refer to the procedure given in the flowchart, *Figure 1-1: Procedure to check a 'dead' computer* on page 1-2. The sections following describe the actions to be taken when you have isolated the fault on the computer.

**Note:** You may need to reconfigure the CMOS RAM to its original (factory) default setting. Make sure that the customer is made aware of this.

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## Action if PSU fails

There are three ways in which the power supply unit (PSU) may fail:

- complete failure
- individual rail failure
- thermal shutdown

### Complete failure

The **complete failure** of the PSU is indicated by the following symptoms:

- no green LED on the front panel
- no caps lock LED response when caps lock key depressed

#### A3010/A3020

To check complete failure in the PSU, switch off, unplug, and refer to the procedure given in the flowchart, *Figure 1-2: Procedure to check complete failure in the PSU on an A3010/A3020* on page 1-5.

#### A4000

First check that the fuse in the mains plug has not blown. To do this, remove the fuse from the plug and check with a continuity tester. If it has blown then replace only with **a fuse of the same rating** ( this will be 5 Amp). If the new fuse is blown when you switch the unit on, then return the PSU to an Acorn Authorised CSW (Central Service Workshop).

### Individual rail failure

If there is an **individual rail failure** within the PSU, various functions of the computer will fail as follows:

- 5V feeds the main PCB, floppy disc and hard disc (if fitted).
- +12V feeds the video connector (SK1) on pin 12 (when driving a SCART TV) and hard disc (A4000).

#### A3010/A3020

Ensure that LK1 and LK2 are in place on the main PCB and that the flying connectors are firmly attached to the drives.

If this does not correct the fault, return the PCB to an Acorn Authorised CSW for repair.

#### A4000

Ensure that the PSU to PCB connector is securely attached to the main PCB and that the flying connectors are firmly attached to the drives.

If this does not correct the fault, return the PSU to an Acorn Authorised CSW for repair.

### Thermal shutdown

#### A3010/A3020

If a thermal shutdown is suspected then the thermal fuse of the transformer can be tested as follows:-

1   Unplug machine from the mains.

2   Strip down the machine (see *Part 2 - Disassembly and assembly*).

3   Unplug the mains lead from PL1

4   Check Internal Fuse FS1 is ok.

5   Ensure On/Off switch is ON.

Using a ohm meter check the continuity of the primary circuits, a very low resistance should be seen (4 Ohms). If the primary reads open circuit then it is likely that the internal fuse has blown.

Return the PCB to an Acorn Authorised CSW for repair.

#### A4000

If the PSU functions for a while before failing, it is likely that a controlled thermal shutdown has taken place. This is caused by a failure of a component that is internal to the PSU.

Should the PSU continue to shutdown then return the PSU to an Acorn Authorised CSW for repair.

## Action if main PCB fails

Although the main PCB is a replacement only item, there are some checks that you can make before sending a faulty PCB to an Acorn Authorised CSW.

Remove the PCB from the main unit, using the procedure given in *Part 2 - Disassembly and assembly* and inspect the board for any of the following:

- ROMs or ROMs not in correct sockets or pins lifted from sockets.
- ROM size and type links incorrectly set. See the *Acorn A3010/A3020/A4000 Technical Reference Manual* for links LK10, LK11, LK12 and LK14.
- Incorrect location and orientation of any other socketed devices.
- DRAM size links incorrectly set. See the *Acorn A3010/A3020/A4000 Technical Reference Manual* for links LK23 and LK24.
- Any loose debris lying on the PCB.

If these checks do not disclose the fault, return the PCB to an Acorn Authorised CSW for repair.

## What to do next
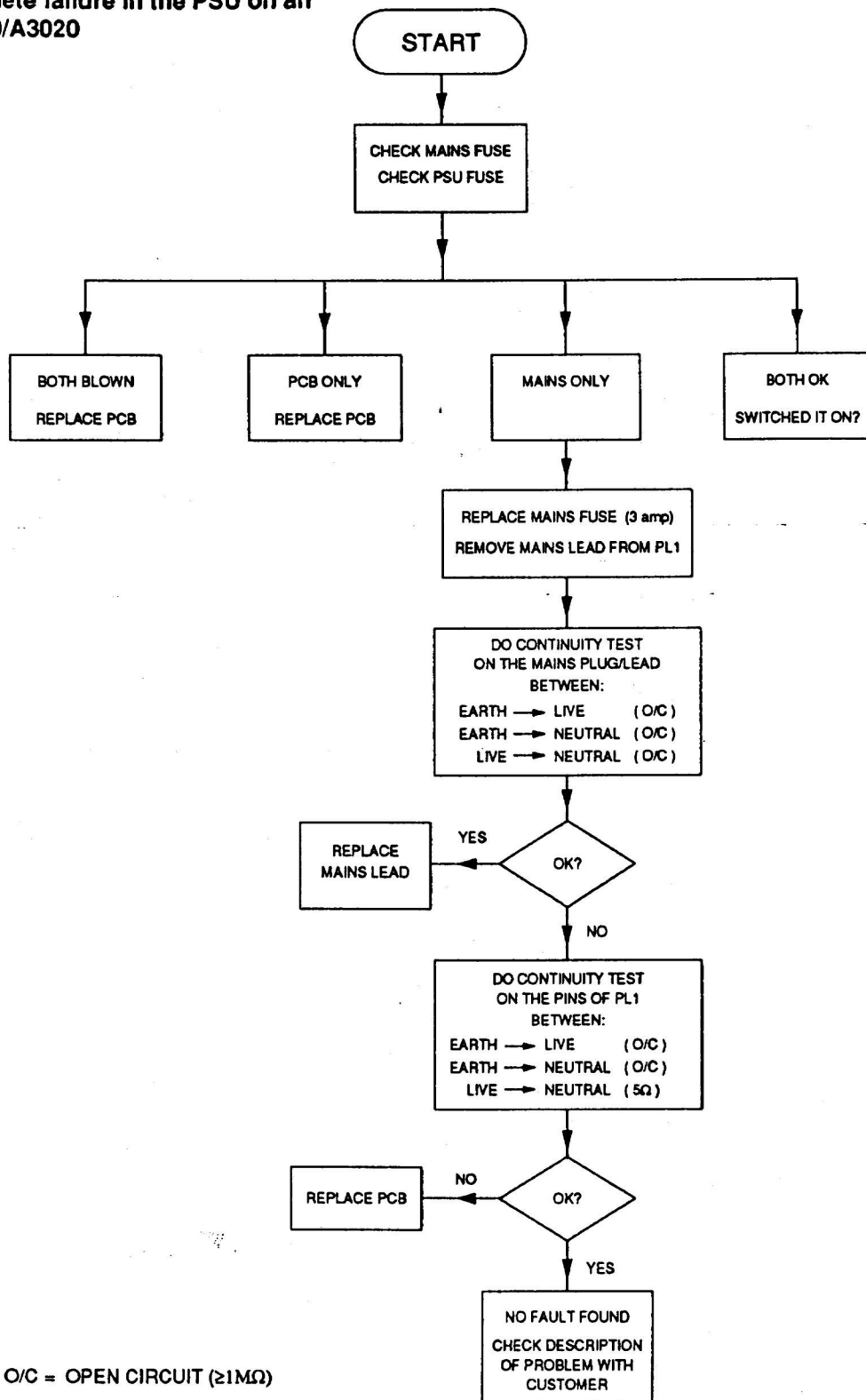
Once you have repaired a fault and the computer is functioning, we recommend that you check for and correct any other faults. This is described in the next section – *Checking a partly working computer.*

# Checking a partly working computer

The flowchart in *Figure 1-3: Procedure to check a partly working computer* on page 1-6 shows you how to diagnose and repair a partly working computer.

**Figure 1-2: Procedure to check
complete failure in the PSU on an
A3010/A3020**

```
                         ┌──────────────┐
                         │    START     │
                         └──────┬───────┘
                                │
                         ┌──────┴───────┐
                         │ CHECK MAINS FUSE │
                         │ CHECK PSU FUSE   │
                         └──────┬───────┘
                                │
        ┌─────────────┬─────────┴─────────┬─────────────┐
        │             │                   │             │
 ┌──────┴──────┐ ┌────┴──────┐   ┌────────┴───┐ ┌───────┴────┐
 │ BOTH BLOWN  │ │ PCB ONLY  │   │ MAINS ONLY │ │  BOTH OK   │
 │ REPLACE PCB │ │ REPLACE PCB│  │            │ │SWITCHED IT ON?│
 └─────────────┘ └───────────┘   └────┬───────┘ └────────────┘
                                      │
                          ┌───────────┴──────────┐
                          │ REPLACE MAINS FUSE (3 amp)│
                          │ REMOVE MAINS LEAD FROM PL1 │
                          └───────────┬──────────┘
                                      │
                          ┌───────────┴──────────┐
                          │   DO CONTINUITY TEST  │
                          │ ON THE MAINS PLUG/LEAD│
                          │       BETWEEN:        │
                          │ EARTH ──► LIVE   (O/C)│
                          │ EARTH ──► NEUTRAL (O/C)│
                          │ LIVE  ──► NEUTRAL (O/C)│
                          └───────────┬──────────┘
                                      │
     ┌──────────┐    YES     ◇────────┴────────◇
     │ REPLACE  │◄───────────◇       OK?        ◇
     │MAINS LEAD│            ◇─────────┬────────◇
     └──────────┘                      │ NO
                          ┌───────────┴──────────┐
                          │   DO CONTINUITY TEST  │
                          │   ON THE PINS OF PL1  │
                          │       BETWEEN:        │
                          │ EARTH ──► LIVE   (O/C)│
                          │ EARTH ──► NEUTRAL (O/C)│
                          │ LIVE  ──► NEUTRAL (5Ω) │
                          └───────────┬──────────┘
                                      │
     ┌──────────┐    NO      ◇────────┴────────◇
     │REPLACE PCB│◄──────────◇       OK?        ◇
     └──────────┘            ◇─────────┬────────◇
                                      │ YES
                          ┌───────────┴──────────┐
                          │   NO FAULT FOUND      │
                          │  CHECK DESCRIPTION    │
                          │   OF PROBLEM WITH     │
                          │     CUSTOMER          │
                          └──────────────────────┘
```

O/C = OPEN CIRCUIT (≥1MΩ)

# Part 2 - Disassembly and assembly

## Introduction

This chapter tells you how to break down a standard A3010, A3020 or A4000 computer into its serviceable modules, in order to carry out basic checks and replace modules found to be faulty.

It is recommended that you remove modules in the order given in this chapter, to ensure, for instance, that no cables are left connected to the particular item you wish to remove.

### A3010/A3020

The main unit houses the following:

- Keyboard
- Main PCB
- 3.5" floppy disc drive
- Hard disc drive (if fitted)
- Speaker

The PSU is part of the PCB and cannot be removed.

The mouse and monitor are separate units.

See the appropriate third-party service information for the monitor. The mouse is a service replacement only item.

### A4000

The main unit houses the following:

- Main PCB
- 3.5" floppy disc drive
- Hard disc drive
- Speaker
- PSU.

The keyboard, mouse and monitor are separate units.

See the appropriate third-party service information for the monitor. The mouse is a service replacement only item.

## A3010/3020

### Removing the top cover

#### A3010

To remove the top cover of the A3010, follow the instructions in *Appendix E: Inside the computer* in the *Acorn A3010 Welcome Guide.*

#### A3020

To remove the top cover of the A3020, follow the instructions in *Appendix E: Inside the computer* in the *Acorn A3020 Welcome Guide.*

**Note:** The only screws you need to unscrew to remove the top cover of the A3010 or A3020 are those marked with the symbol shown here.

### Removing the keyboard

1 Pull out the two flexi strips to the PCB.

2 Lift the keyboard away and put it somewhere safe.

### Removing the metal safety case

The metal safety case is made up of two parts; an upper metal envelope and a lower metal envelope.

#### Remove the metal safety case

1 Remove the two button-headed hexagon screws located underneath the PSU transformer – you will need metric hexagon keys to do this.

2 Remove the two screws at the front of the metal safety case.

3 Slide the metal safety case forward by about 5 or 6 mms (keep the floppy drive button depressed whilst easing the case evenly forward).



front of the metal safety case

4 Lift the metal safety case away from the plastic case, taking care not to damage the floppy drive button.

#### Separate the two parts of the metal safety case

1 Carefully but firmly remove the two ribbon cables to the rear of the floppy drive.

2 Remove the hexagon cap screw (3mm) at the front of the metal safety case.

# A4000

## Removing the top cover

To remove the top cover of the A4000, follow the instructions in *Appendix E: Inside the computer* in the *Acorn A4000 Welcome Guide*.

## Removing the speaker

Looking from the rear of the main unit, the speaker is located on the right hand side of the unit.

1 Disconnect the speaker cable to the PCB (LK19).

2 Remove the rubber sealant from each side of the speaker.

3 Pull the speaker directly upwards and out of the main unit.



rubber sealant          rubber sealant
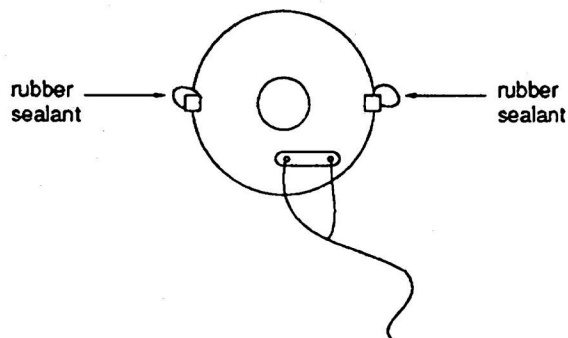
## Removing the Drive Tray

1 Remove the black snap rivet situated between the floppy and hard drives.

   **Note:** This rivet can be removed and inserted by hand and is in two parts.



Snap rivet
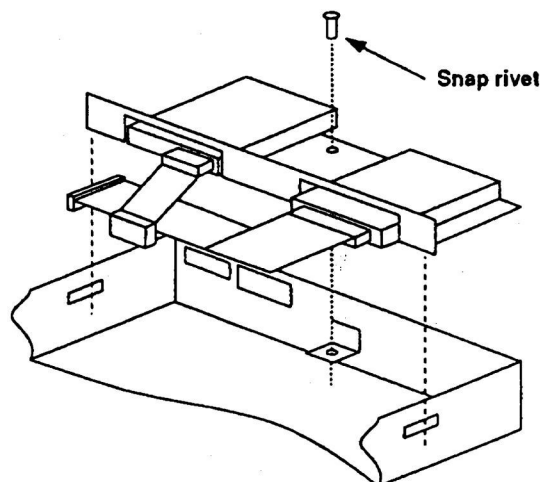
2 Disconnect the power leads from the PSU to the floppy and hard drives.

3 Disconnect the ribbon cables from the floppy and hard drives to the PCB.

4 Carefully lift the drives tray enough to disengage the ears from the metal base, and withdraw it from the front of the machine taking care not to force the floppy drive out of the front moulding.

5 Disconnect the hard drive LED lead.

## Removing the PCB

1 Having removed the drive tray disconnect the power cable from the PSU to the PCB (PL26).

2 Disconnect the LED cable to the PCB (LK16).



PL26

LK19

LK16

to hard drive          to floppy drive

**Front moulding**
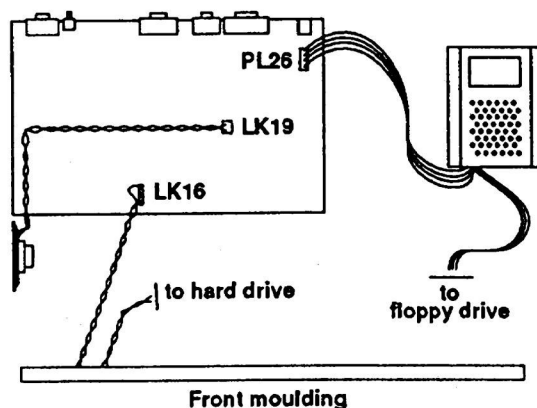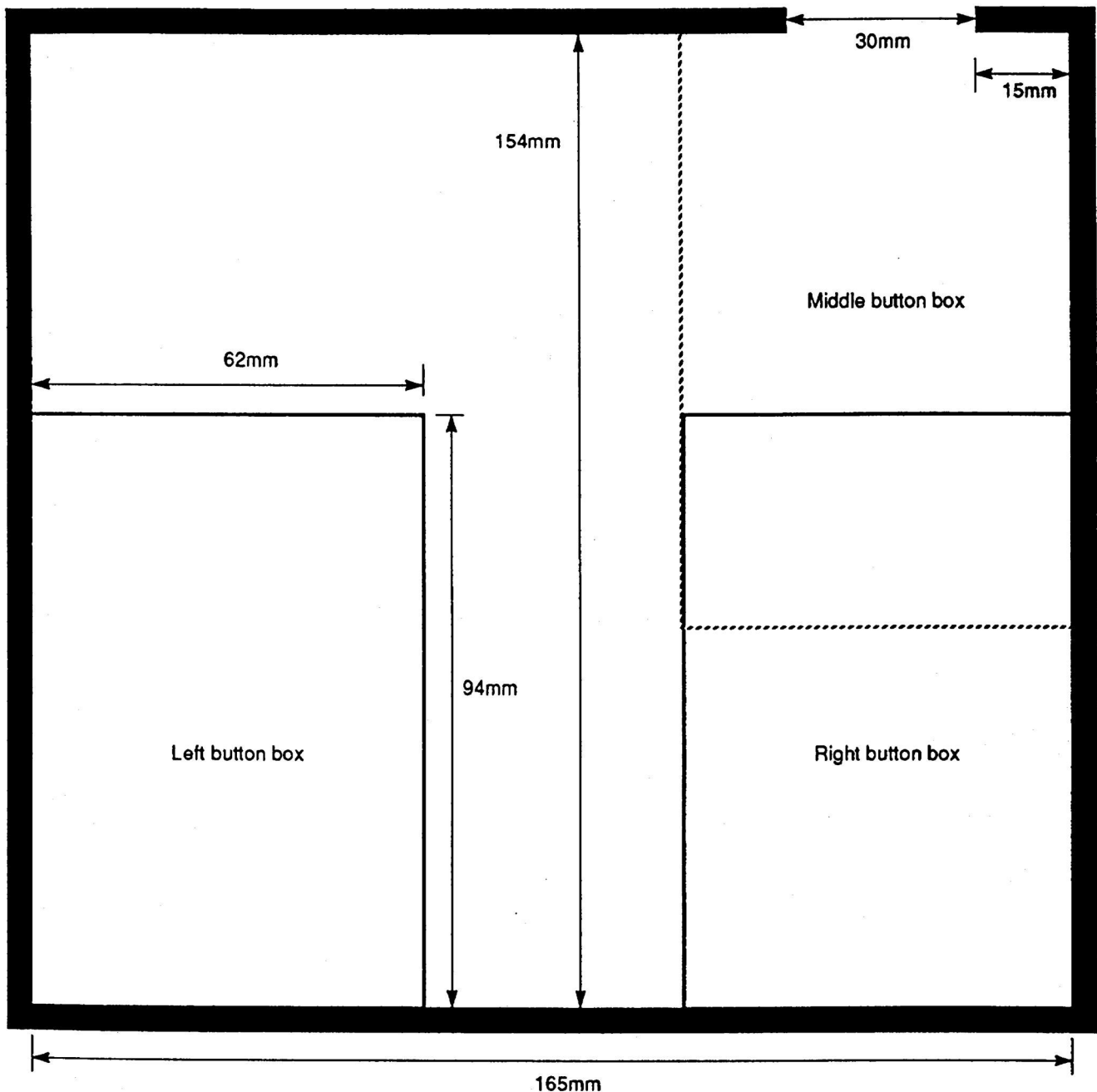
3 Remove the 3mm screw securing the PSU to the lower metal case and slide the PSU forward a few millimetres.

4 Carefully lift the rear panel a few millimetres, this will disengage the rear panel from the three castellations on the lower metal case.

5 Unclip the three clips that secure the front of the PCB to the lower metal case. The rear panel and PCB assembly can now be (carefully) removed.

## Removing the front plastic moulding

1 There are six spring plastic clips on the front moulding, three each on the top and bottom, attaching it to the main unit. Release these clips from the inside of the main unit.

2 Remove the plastic moulding.

   **Note:** There are two LEDs in the front moulding, with wires attached. Feed these wires carefully through the metal panel.

# Appendix A - Mouse test jig template



**154mm**

**30mm**

**15mm**

**62mm**

**94mm**

**165mm**

Middle button box

Left button box

Right button box

1 Using wood or metal strips, construct a test jig with the dimensions shown in the template (plan view) above.

2 Secure the test jig to a firm, flat, horizontal, non-slip surface.
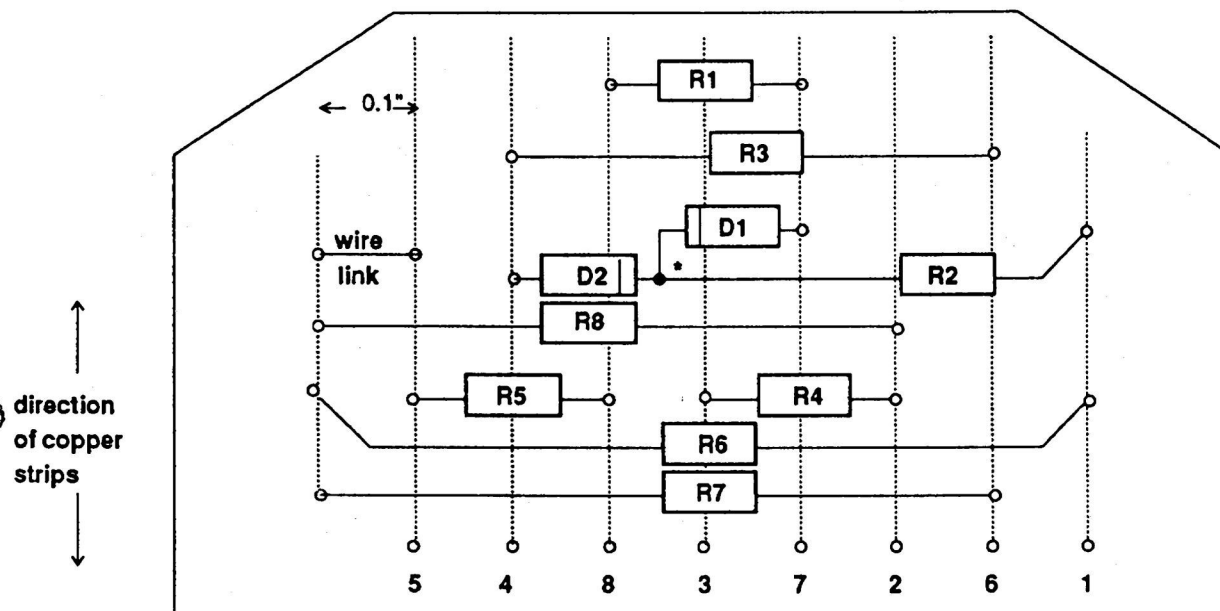
3 Mark out the three button boxes shown on the template.

**Notes:**

• The INSIDE dimensions of the jig are important.

• The sides of the jig should be LESS than 5mm high.

• The Middle and Right button boxes overlap.

**Mouse in middle button box**
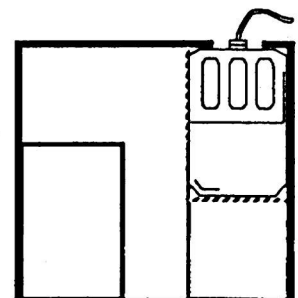
# Appendix B - Serial port loopback plug



°  hole

* components join above the board surface

| Item | Part no. | Description | Qty |
|------|----------|-------------|-----|
| 1 | 0276,081 | CIRCUIT & ASSEMBLY DRAWING | 1* |
| 3 | 0800,288 | CONR 9W SCKT 'D' ST MS SB | 1 |
| 5 | 0800,991 | CONR 9W SHELL 'D' + SCREWS | 1 |
| R1 | 0502,122 | RES 1K2 C/MF 5% 0W25 | 1 |
| R2 | 0502,122 | RES 1K2 C/MF 5% 0W25 | 1 |
| R3 | 0502,122 | RES 1K2 C/MF 5% 0W25 | 1 |
| R4 | 0502,122 | RES 1K2 C/MF 5% 0W25 | 1 |
| R5 | 0502,472 | RES 4K7 C/MF 5% 0W25 | 1 |
| R6 | | | N/F |
| R7 | 0502,472 | RES 4K7 C/MF 5% 0W25 | 1 |
| R8 | 0502,472 | RES 4K7 C/MF 5% 0W25 | 1 |
| D1 | 0790,085 | DIODE BAT85 SBL | 1 |
| D1 | 0790,085 | DIODE BAT85 SBL | 1 |

* per batch

## Assembly notes

Assemble the components onto Veroboard, and fit item 5 (the shell) to protect the assembly

Note: This is the same serial loopback as used for the A3000, A540 and A5000 computers.

# Appendix C - Earth continuity testing

## Equipment required

An earth continuity tester or appliance tester capable of sourcing 8-25A derived from an AC source with a no-load voltage not exceeding 12V, for example, CLARE A433R-IO.

It is recommended that the calibration and operation of the instrument is checked frequently enough to ensure its accuracy.

> **DANGER:**
> THE FOLLOWING TESTS INVOLVE HIGH CURRENTS BUT LOW VOLTAGES. ALL NECESSARY PRECAUTIONS MUST BE TAKEN TO ENSURE OPERATOR SAFETY DURING TESTING.

> **DANGER:**
> SWITCH OFF THE COMPUTER, DISCONNECT IT FROM THE MAINS SUPPLY, AND DISCONNECT ANY EXTERNAL PERIPHERALS AND CABLES BEFORE CARRYING OUT THIS TEST.

> **WARNING:**
> DO NOT MOVE THE TEST PROBE WHILST APPLYING THE TEST CURRENT.

## Before testing

Check the mains lead and plug for any physical damage and replace if necessary.

Consult the instructions supplied with the test equipment.

## Test procedure for the A4000

The test should be performed on a fully assembled computer and the equipment must be tested with the mains lead it will be operated with.

Using the Earth continuity tester, check the continuity between the power supply cord plug earth/ground pin and the following points:-

1  the chassis upper wrap
   Note: If you need to remove the paint from the upper wrap in order to make a good connection, do this in a place where it will not be visible to the customer. We recommend an area within the cooling slots on the side of the upper wrap.)
2  the lower wrap (metalwork) on the base of the unit
3  the rear panel
4  the expansion slot panel.

The resistance measured between the earth pin and each of the above test points shall not exceed 0.15 $\Omega$. This value includes an allowance for the resistance of the mains cable. **The duration of each test shall not exceed 10 seconds.** No waiting period between tests is necessary.
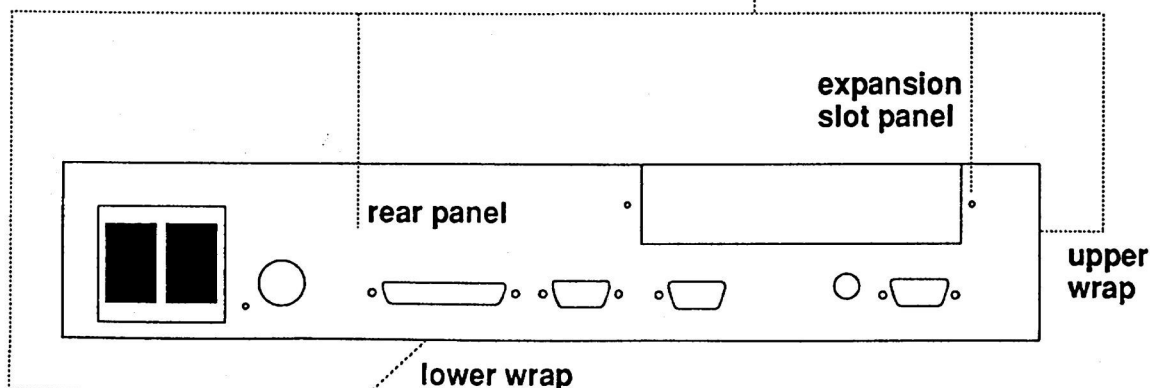
> **WARNING:**
> IF AN EXPANSION CARD IS FITTED CONSULT THE MANUFACTURER'S INSTRUCTIONS.

> **WARNING:**
> YOU MUST NOT ALLOW THE TEST PROBE TO TOUCH ANY OF THE CONNECTORS' SIGNAL PINS AS THIS WILL DAMAGE THE EQUIPMENT.

**A4000 Earth continuity test points**

expansion slot panel

rear panel

upper wrap

lower wrap

# Appendix D - DC insulation testing - class 1

## UK information only

### Equipment required

A portable appliance tester or an insulation tester that provides 500V DC ONLY.

**Note:** The computer contains RFI capacitors on the PSU input.

It is recommended that the calibration and operation of the instrument is checked frequently enough to ensure its accuracy.

> **DANGER:**
>
> THE FOLLOWING TEST INVOLVES HIGH VOLTAGES. ALL NECESSARY PRECAUTIONS MUST BE TAKEN TO ENSURE OPERATOR SAFETY DURING TESTING. NOTE THAT THE OPERATOR MUST BE TRAINED AND COMPETENT.

> **DANGER:**
>
> SWITCH OFF THE COMPUTER, DISCONNECT IT FROM THE MAINS SUPPLY, AND DISCONNECT ANY EXTERNAL PERIPHERALS AND CABLES BEFORE CARRYING OUT THIS TEST.

## Before testing

Check the mains lead and plug for any physical damage and replace if necessary.

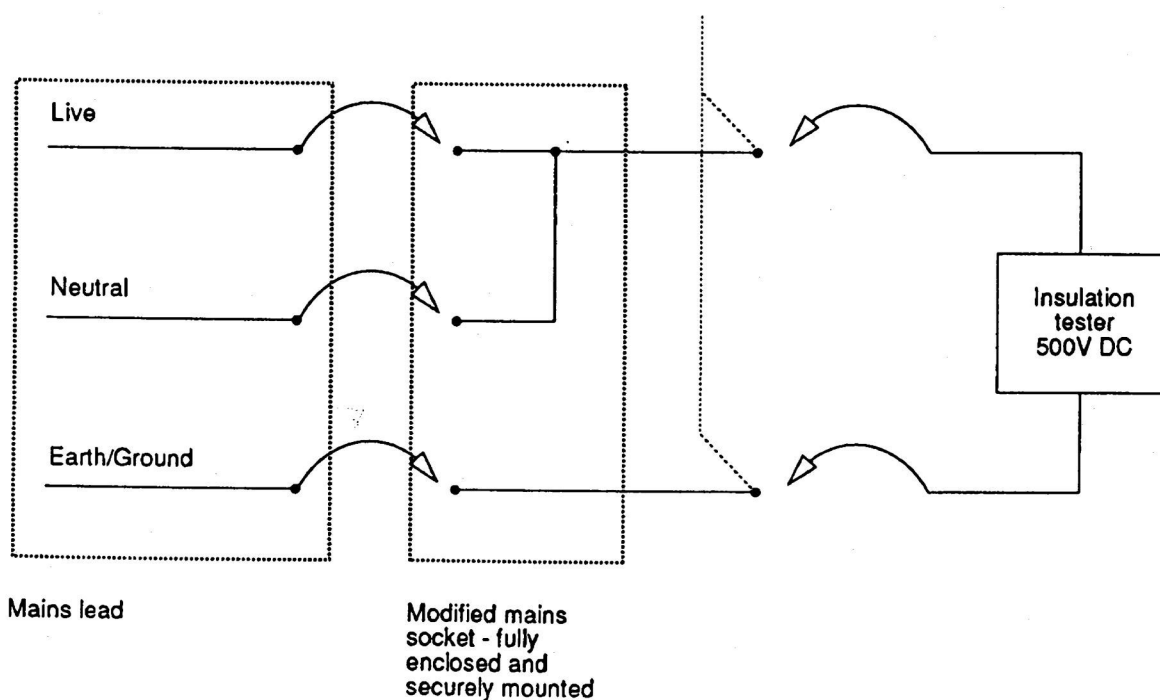Consult the instructions supplied with the test equipment.

## Test procedure

The test should be performed on a fully assembled computer.

The equipment must be tested with the mains lead it will be operated with.

1  Insert the mains lead either into the portable appliance tester, or into an adaptor, as shown below.

2  Move the computer's power switch to the ON position.

3  Apply the test voltage for LESS than 10 (TEN) seconds and then measure the resistance.

4  Pass level: GREATER than 2 (TWO) MΩ.

5  Move the computer's power switch to the OFF position and remove the mains lead from the portable appliance tester.

## Testing with an insulation tester

Insulated terminals and leads



Live

Neutral

Earth/Ground

Insulation tester 500V DC

Mains lead

Modified mains socket - fully enclosed and securely mounted

# Appendix E - Software testing

## About the tests

The Acorn Dealer Test Disc (0294,825) contains various menu-driven tests. The menus are generated from a set of text files. (You can generate new text files if you wish). There are two types of test:

- subjective – you must judge whether the equipment passes or fails these tests. For this reason it is a good idea for you to familiarise yourself with the correct results given by a known good computer (see the section entitled *Validating the test equipment* on page F-1). In this way you will be in a better position to judge faulty results.

- non-subjective – the test program passes or fails the equipment.

## How to operate the menu system

When you run the test software the main menu is displayed:

```
        MENU VX.XX UN-DEF
    (A) Test Suite
    (B) Individual Tests
    (C) Load / Save CMOS
    (D) Quit

    Select the test type of your choice
```

To select one of these menu options type the corresponding code (e.g. typing A would take you to the Test Suite menu).

### The Test Suite

If you selected option A from the main menu a list of available suite options will be displayed. These options break down into soak tests, which run themselves without any intervention from you, and functional tests, which run through a series of tests under your control. They are shown in Table 1:

### Table 1: Test suite menu

| Code | Test |
|------|------|
| A | A3010 1MB Fun. Test |
| B | A3010 1MB Soak Test |
| C | A3010 2MB Fun. Test |
| D | A3010 2MB Soak Test |
| E | A3020 2MB Fun. Test |
| F | A3020 2MB Soak Test |
| G | A3020 2MB+HD Fun. Test |
| H | A3020 2MB+HD Soak Test |
| I | A4000 2MB+HD Fun. Test |
| J | A4000 2MB+HD Soak Test |

Select the appropriate test for the machine you are testing by typing the corresponding code.

### Individual Tests

If you selected option B from the main menu a list of all the individual tests will be displayed. This list of tests is shown overleaf in *Table 2: Individual test options*. To select one of these tests type in the appropriate code.

(Table 2 also shows which tests are available for particular machine configurations.)

### General notes

During a Functional test suite sequence, the software runs through a series of individual tests prompting you to press the space bar after each test:

```
        PRESS <SPACE BAR> TO CONTINUE
```

If the computer passes the current test, the test program waits for approximately 1 second and, if you do not press the space bar in this time, continues with the next test. If you do press the space bar within the 1 second period, the program continues immediately.

If the computer fails the current test, the test program bleeps and waits for you to press the space bar. This allows you to make a note of the fault and then continue with the tests. You should also note any other failures, but bear in mind the possibility that these failures could be caused by the first recorded failure.

If you are in the Main menu and you want to run a specific test you do not have to go the Individual Tests menu first. Instead you can type in the Main menu code followed immediately by the Individual test code.

For example:

BH  would take you from the Main menu to the Printer test.

BJ  would take you from the Main menu to the Sound test.

AC  would take you from the Main menu to the A3010 2MB Fun. Test (in the Test suite).

## Connecting the customer's equipment

Connect the customer's equipment in the following order:

1  keyboard to back panel connector (A4000 only)
2  serial port loopback plug to the RS232 port
3  printer to the printer connector
4  headphones to the Headphones 32 Ohm socket
5  multi-sync analogue RGB monitor to the video socket
6  A3010/A3020 mouse to the mouse connector on the rear panel
   A4000 mouse to the mouse connector on the keyboard
7  A3010 joysticks to rear panel
8  A3010 TV to rear panel

---

that is correct for the machine configuration of the UUT (which will then configure the CMOS RAM for that particular machine).

For example, if you want to run a full functional test on an A3020 2MB machine you would type A to go from the Main menu to the Test suite menu, then C to select the A3020 2MB Fun. Test (or just type AC when you are in the Main menu).

2   A list of settings will then appear on the screen. These are the test configuration modules read from the test data file and set up in the CMOS RAM. The tests are detailed in the section entitled *Functional tests* on page E-4.

## After the tests

At the end of the functional test suite, we recommend that you:
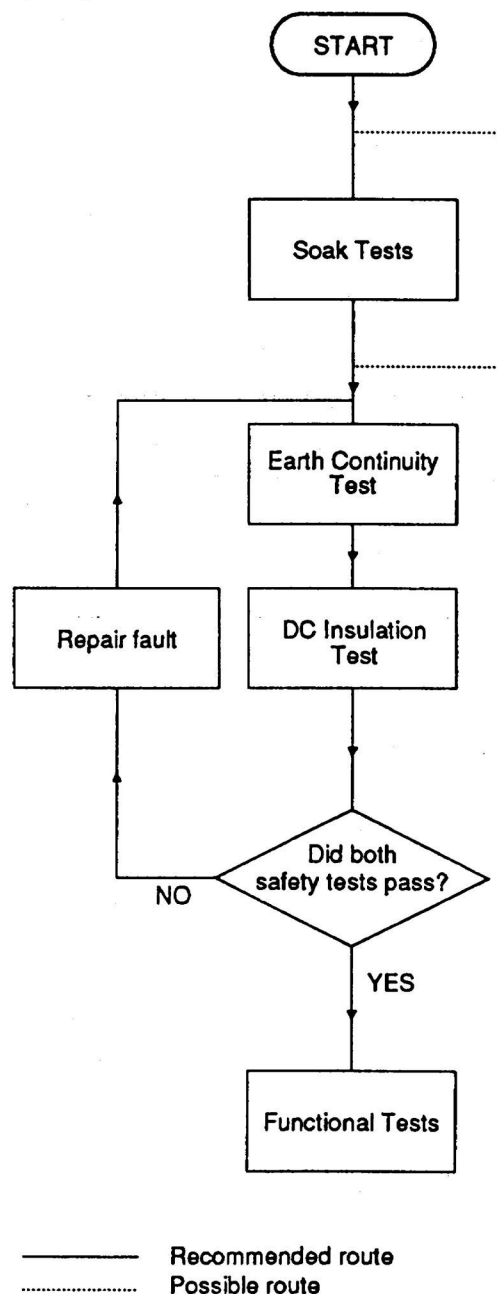
- perform the soak tests
- perform the safety tests
- retest the unit

See *Figure H-1: Procedure after repair* on page E-3 for an overview of this procedure.

Also, before returning the computer to the customer, you must perform the following tasks using the procedures described in this section:

- restore the CMOS RAM settings
- switch off the equipment
- disconnect the equipment
- replace the customer's hard disc (if necessary)

**Figure H-1: Procedure after repair**



— Recommended route
........ Possible route

## Performing safety tests

Once you have proved that the UUT functions correctly, you must perform the safety tests described in *Appendix C - Earth continuity testing* and *Appendix D - DC insulation testing - class 1.*

headphone and the next four notes in the other headphone. Press F5 if correct, or F8 if not correct, to continue. You cannot press a function key until at least one cycle of each sound channel is complete.

Remove headphones when prompted.

The screen will then clear and the sound test results will be displayed. If the test fails, refer to the following section entitled *Action if audio tests fail.*

### Action If audio tests fail

If it appears that the speaker alone is at fault, check the speaker connections. Ensure that the cable connecting the speaker to the PCB is in place. Also check the solder joints on the speaker tags and the two crimps in the shell. Repair any bad joints and try the tests again. For details of how to remove the speaker, refer to *Part 2 - Disassembly and assembly.*

If the headphones alone appear at fault, substitute a known working pair of headphones and retest.

If these actions fail to restore the audio system or the audio system is distorted or corrupted in some way, you must remove the main PCB and return it to an Acorn Authorised CSW.

## Battery backed RAM test

The following is displayed on the screen:

```
        CMOS TEST VX.XX DEALER

Copied CMOS RAM into main memory.
Passed CMOS RAM Configuration.
Passed Read - Write function.
Copied CMOS RAM from main memory.
Passed CMOS RAM Verification Test

     THIS SUB TEST HAS PASSED

  PRESS <SPACE BAR> TO CONTINUE
```

During the Configuration check of the CMOS RAM you will be requested to enter the file name for the CMOS data file that should be used for this test. This file contains the CMOS data, and will change with different configurations of unit (i.e. IDE fitted etc). You should press Return to use the default data file. If you need to use a specific file, not the default, then enter the path and filename of the data file to be used.

### Action If the battery backed RAM test falls

Check that the CMOS test data file is correct. If the test still fails, then refer to the section entitled *Action if main PCB fails* on page 1-3.

**Note:** If this test fails you cannot rely on the results of the remaining tests. This is because the CMOS RAM is used to control the test sequence and store the results.

## Disc interface test

The screen will clear and the following will be displayed:

```
FLOPPY DISC TEST VX.XX DEALER
```

```
Passed Write Protect Test.
Passed Verification Test.
Running Write Track Test 0, Drive 0

Remove the test disc from drive :0
Insert the BLANK DISC in drive :0
The BLANK DISC needs to be F Map
```

Insert the blank *scratch* disc, and the write track test continues, displaying the following on the screen:

```
Working Track 76 Sector 04 Head 00
Disc Address used &000BF000
```

The read track and erase track tests are now complete. When you are requested, put the test disc back in drive :0. Press the space bar to continue.

If the write protect test fails it will corrupt the test disc. You will then have to replace it with a new copy. A sign of this corruption is that a file called !DISC_FAIL will appear on the disc, and the disc will not boot.

If errors occur during the read test, a maximum of 12 read errors may occur per sector before the next sector is read. A total of 6 sectors are tested.

**Note:** During the soak tests only the write protect and verification tests are executed.

### Action If floppy disc drive fails

If there is no desktop icon, check the CMOS RAM configuration for "floppies 1" and reset if necessary.

Disassemble the machine (see *Part 2 - Disassembly and assembly)* and check that both the 34 way data cable and the 4 way power cable are securely connected at the rear of the drive. Also check that the data cable is connected to the main PCB at PL10 (the A3010/A3020 power cable is connected to the main PCB at PL5).

Using a voltameter, check that 0V is present on pins 2 and 3. Alos check that +5V is present on pin 1 (conductor 1 is marked with white on the cable) of the disc drive power cable. If there is no power, inspect the crimps inside the connector shell and repair or replace if possible. If the failure is with the PSU itself (A4000 only), return it to an Acorn Authorised CSW for repair.

Check the data cable by substituting a known working cable and retesting. Check the power cable (A3010/A3020) by substituting a known working cable and retesting.

As a final measure, try substituting a known working floppy disc drive. Depending on the outcome of this test, return either the main PCB or the floppy drive to an Acorn Authorised CSW for repair.

**If an icon is present but an error occurs during access,** disassemble the machine and check that the 34 way data cable is correctly connected both at the rear of the drive and on the main PCB PL10 (theA3010/A3020 power cable is connected to the main PCB at PL5).

Check the data cable by substituting a known working cable and retesting. Check the power cable (A3010/A3020) by substituting a known working cable and retesting.

## Hard disc exerciser

This program exercises the hard disc by creating 20 random data files on the disc. It then performs 4000 various operations on these files. A pass completion screen is displayed, similar to that shown below:

```
        SCSI WINCHESTER EXERCISER

Operations 4000

         Pass  Fail            Pass   Fail

File 1   104         File B    57
File 2   98          File C    70
File 3   166         File D    75
File 4   157         File E    89
File 5   86          File F    77
File 6   48          File 10   98
File 7   98          File 11   181
File 8   80          File 12   103
File 9   112         File 14   93
File A   85          File 15   114
Disc Op. : 0 Commands : 0
```

The values given to Disc Op. and Commands are 8 bit patterns decoded to be the following:

```
Disc Op.
Bit 7,6,5   Not used
Bit 4       Read Failure
Bit 3       Write Failure
Bit 2       Failed trying to close file

Commands
Bit 7       Fail try to load dummy file
Bit 6       Compact Failed
Bit 5       Verify Failed
Bit 4       Free Failed
Bit 3       Map Failed
Bit 2       CAT Failed
Bit 1       not used
Bit 0       not used
```

When complete the test will perform a verify of the hard disc.

**Note:** This program requires a minimum of 2MB RAM and 5MB HD free space. Although this test is non-destructive, a backup copy of the customers data is recommended.

## Hard disc initialiser

> **WARNING:**
> THIS TEST WILL WRITE TO THE IDE HARD DISC. YOU SHOULD FIT A TEST HARD DISC (SEE THE SECTION *Creating a test IDE hard disc* ON PAGE F-1) OR ALTERNA-TIVELY ENSURE THAT THE CUSTOMER IS AWARE THAT THEIR HARD DISC WILL BE OVERWRITTEN, AND HAS GIVEN THEIR CONSENT BEFORE YOU START. THE SOFTWARE WILL AUTOMATICALLY RUN THE INI-TIALISER, WITHOUT ANY OPERATOR INPUT.

**Note:** The figures given in the following example are for illustration only and vary according to the model of hard disc drive.

When you run the hard disc initialiser program, the screen clears and the following information is displayed (the figures given are typical for a 40MB hard disc):

```
        H A R D   D I S C   F O R M A T T E R
Format which drive (4-7)? 4
Drive 4 is an IDE drive
IDE drive ADFS:4 identifies itself as :
Description      : <manufacturer's name,
model no.>
Firmware Version : <Version no.>
Configuration    : < ? cyclinders, ?
heads and ? sectors/track>
This disc was last formatted using the
standard shape :
<manufacturer's name, model no.>
526 Cylinders, 4 Heads and 40
Sectors/Track
Parking cylinder 527, Initialisation
flag 1
Do you wish to use this shape (Y/N) ? N
Do you wish to use the standard shape
for this drive (Y/N) ? Y
   A: no more changes
   B: add defect by cylinder, head,
      byte/sector
   C: add defect by disc address
   D: remove defect
   A,B,C, or D ? A
Disc will be formatted as
<manufacturer's name, model no.>
526 Cylinders, 4 Heads and 40
Sectors/Track
Parking cylinder 527, Initialisation
flag 1
Format or just initialise the drive
(F/I) ? I
Soak test the hard disc for defects
(Long/Short/None) ? S
Are you SURE you want to do this to
drive ADFS:4 (Y/N) ? Y
Verifying
Large file allocation unit? 512
Writing defect list
Creating map
Writing map
Writing root directory
Bytes free &02910800 = 43059200
Bytes Used &00007800 = 30720

     PRESS <SPACE BAR> TO CONTINUE
```

## Hardware check

This test performs a comparison check between the test data file and the items it finds fitted to the computer. The screen will clear and the results of the comparison checks will be displayed. For example:

```
COMPUTER TYPE TEST VX.XX DEALER
```

## Keyboard and mouse tests

**Note:** For the mouse test you will need a mouse jig template to perform the test (see *Appendix A - Mouse test jig template*).

### Reset button sub-test

During this test you are asked to press the Reset button to test the operation of the switch. If this button works, the program moves onto the next sub-test automatically.

If the test fails, refer to the section entitled *Action if A4000 keyboard fails* on page E-10.

### Stuck key sub-test

This sub-test tests for stuck keys or mouse buttons. If no items are found to be stuck, the test software moves onto the next test automatically without displaying any information.

If any keys or mouse buttons are stuck down, you will see the following screen display:

S O M E   K E Y S   A R E   S T U C K

Note the keys that are stuck, reject the
keyboard or the mouse.

Press the Break key to continue and wait.

Press the Break key and the program moves to the Keyboard/Mouse report screen. Refer to the section entitled *Action if A4000 keyboard fails* on page E-10.

Throughout the following tests if you press the wrong key nothing will happen. If you press two keys (the correct key and one other) the screen is shown in inverse video and the depressed keys are shown on the screen. If a key fails to disappear after three attempts, the program displays a failure message at the top of the screen and then prompts you to press the Break key. The program then exits to the Keyboard/ Mouse report screen. Refer to the section entitled *Action if A4000 keyboard fails* on page E-10 or *Action if A3010/A3020 keyboard fails* on page E-10.

### Mouse sub-test

This tests the three buttons on the mouse and the movement of the mouse to the left, right, up and down. Each of the mouse buttons (i.e. left, middle, right) are displayed on the screen in turn, together with a pointer. You need a mouse test jig template to perform this test. See *Appendix A - Mouse test jig template*.

During this test the mouse is viewed with the cable coming out of the top of the mouse. Take care to ensure that the mouse does not 'skid' on the template when you move it.

Follow the instructions on the screen, moving the mouse from the left box to the right, then to the middle. You should eventually return to the left box.

- If the pointer does not finish in the displayed box when the mouse is in the relevant test jig box, the test has failed.
- If you cannot make a button disappear then it will be impossible to continue the test.

If the test fails, refer to the following section *Action if mouse fails.*

If the mouse if functioning correctly, the program moves on to the next test.

### Action if mouse fails

Check that you are testing the correct mouse type.

If, when you pressed the requested mouse button, nothing happens or the program repeatedly claims that two keys were pressed or the pointer will not move, then substitute a known working mouse of the same type and retest. This determines if the fault is within the mouse itself or the keyboard's mouse interface (A4000 only). If the fault is within the keyboard, refer to the section section entitled *Action if A4000 keyboard fails* on page E-10 or *Action if A3010/A3020 keyboard fails* on page E-10.

Check that roller ball is not sticking, in which case you can remove and clean it. If the mouse still fails then return it to an Acorn Authorised CSW for repair.

### Main keyboard sub-test

For this sub-test, the display clears and the main keyboard matrix is displayed with the following title at the top of the screen:

Main Keyboard Test

Press each key in turn, starting at the bottom left (Caps lock) moving across to the bottom right (Ctrl) key, then up a line to the left hand Shift key. An arrow indicates the key to press.

As you move across the keyboard pressing the keys in the correct order, the key that is pressed should disappear from the display. The test continues in this way until all the keys up to the function key F12 have been tested.

If the keyboard functions correctly, the program moves onto the next test.

### Numeric keypad sub-test

For the numeric keypad sub-test, the display clears and the cursor and numeric key matrixes are displayed on the screen. Press each key as indicated by the arrow.

If the keyboard functions correctly, the program moves onto the next test.

### Keyboard LED sub-test

This test checks that the LEDs on Caps Lock, Scroll Lock and Num Lock are working.

The screen clears and the following is displayed:

Running Keyboard LED Tests

CHECK <CAPS LOCK> LED IS ON

1   Check that the caps lock keyboard LED is the only LED on, the other two are extinguished.

2   Press F5 to PASS or F8 to FAIL the test (do this for each subsequent LED test). Check the caps lock is extinguished, hence all keyboard LEDs are off.

Turn the TV volume control up to a reasonable listening level. When you press the space bar the screen test will commence.

The TV screen should now be displaying a test card.

You are required to:-

1   Ensure that the TV has it's Auto Frequency Control (AFC) or Auto Tuning Control (ATC) turned ON.

2   Select the channel which displays the best picture possible. Do not re-tune the T.V. Do not spend too long trying to achieve the 'ideal'.

3   Using a capacitor adjustment tool adjust the variable capacitor on the PCB of the UUT (there is a hole in the top metal work, underneath the keyboard next to the PSU) until the colour fringing on the set of vertical black and white bars (second from last set of vertical black and white bars, to the left and below the centre of the circle in the middle of the test card) is reduced to a minimum (normally barely visible as a fast moving 'flicker').

4   Check the following items on the test card:

    •   correct colours of the colour bars

    •   clear, precise divide lines between the colour bars (minimum fringing)

    •   squareness and centralisation of picture (use the grid of the test card as a guide)

    •   no fringing on the vertical bars (just below the centre of the card) except for the set of bars used for tuning in (3) where the fringing must be minimal

    •   general clarity of picture.

5   Re-adjust the capacitor as necessary but always ensure that the fringing on the set of vertical bars detailed in (3) is at a minimum.

6   Check that no undue buzzing or other noise (such as that produced by a poorly tuned TV) is apparent. You are prompted to press the F5 key when a satisfactory picture is obtained. This prompt is accompanied by a sound, as are all similar prompts: the sound should be clearly audible, without undue distortion, from the TV speaker.

When you are satisfied that the 'best possible' picture has been obtained press F5. If you cannot achieve the 'best possible' picture then press F8.

TV sound should be turned down at the end of this test. If a failure occurs you should press the space bar when prompted at the end of the test.

This is a subjective test, you should note any failures.

## Video tests

The display tests are subjective tests and you should be familiar with the correct screen displays before running these tests and make a note of any failures.

The screen will clear and the following will be displayed:

```
VIDEO TEST VX.XX DEALER

Running Standard Colour Tests
```

```
PRESS <SPACE BAR> to continue.
```

These tests consist of a series of screen displays. You proceed through the tests at your own pace. When you press the space bar the screen test will commence.

### Standard colour test

The screen test displays four colour bars red, green, blue and grey scale. Each colour bar is divided into 6 sections. The number at the top of the screen is the value sent to the individual colour gun. Only one gun is driven at a time for the red, green, and blue bars. The grey scale bar is produced by equal amounts driving each of the colour guns.

Starting from the left, the first block is no units of colour, the next block contains a small amount of red (1 unit bit 0 set) the next more red (2 units - bit 1 set) continuing along until the block is a full red (15 units of red - all bits set). The left most three blocks are out-lined with rectangles of full colour. Check that the colour increases with each block, to full intensity on the right most block. This should be true for each colour bar.

The background is divided into two triangles; one brown and one grey/blue colour. Check the linearity of the dividing line and the colour of the triangles. A cursor is made up of three squares and passes across the screen from bottom left to top right. Also verify that the cursor contains three rectangular outlines in colours green, blue and red. Check the linearity of movement and also check the transparency of the cursor as it moves across the screen. Make sure that the colours do not change as the cursor moves across the screen. Verify the border colour.

Press F5 if the display is correct, or press F8 if not.

If the test fails, refer to the following section entitled *Action if video tests fail.*

### High resolution monochrome display

This test is not done.

Press the space bar to continue.

### Standard VGA display

The same display is used in a VGA mode as in the standard colour test. Repeat all the checks that were performed on the standard monitor test on the standard VGA display.

**Note:** The border is removed in the standard VGA tests.

Press F5 if the display is correct, or press F8 if not. If the test fails, refer to the following section entitled *Action if video tests fail.*

### Super VGA display

You are presented with a screen display that contains 16 squares, made from shades of red, green, blue and grey. Check that the image is sharp, clear and stable on the screen.

**Note:** The border is removed in Super VGA tests.

Press F5 if the display is correct, or press F8 if not. If the test fails, refer to the following section entitled *Action if video tests fail.*

# Appendix F - Tools for software testing

## Backing up the test disc

Before you start testing, make a backup copy of the Acorn Dealer Test Disc (0294,825) using the **Backup** option on the floppy disc drive icon.

## Validating the test equipment

Before carrying out any of the tests in this chapter, validate the test equipment. To do this, follow the procedures given in the chapter entitled *Appendix E - Software testing*.

If the test equipment fails, you should repair the test equipment and retest on a known working unit.

## Creating a test IDE hard disc

> **WARNING:**
> IT IS NECESSARY TO REPLACE THE CUSTOMER'S HARD DISC BEFORE RUNNING THE TEST SUITE, AS RUNNING THE HARD DISC TESTS MAY DESTROY THE DATA HELD ON THE DISC.

To avoid overwriting the customer's hard disc during testing, prepare a test hard disc. You will need the following equipment:

- IDE hard disc to be initialised (UUT)
- ARM250 Dealer Test Disc (Acorn part number 0294,825)
- A4000 series test station, which is made up of an A4000 series computer with the hard disc removed and a keyboard attached.

  OR

  A3020 test station, which is made up of an A3020 computer with the hard disc removed.

  Note: do not use a customer's computer for this test.
- Standard RGB colour monitor (Analogue RGB) and cable.

**Notes:**

1  Throughout the test procedure make sure that the power is the last connection made before a test commences, and the first connection removed when a test is complete.

2  The mains supply voltage must be within the rated voltage range as indicated on the PSU input label.

3  If a message is expected and has not appeared within 30 seconds then record the fault and repair the machine. If an error message appears, record the fault and, if possible, continue the test and then repair the machine.

4  If the test equipment fails three consecutive UUT's for the same fault, validate the equipment using a known good UUT and repair as necessary before continuing with the test.

**Procedure to create a test IDE hard disc.**

1  A4000

Connect the two cables to the hard disc, taking care to plug the two cables in correctly. Replace the top cover.

A3020

Connect the cable to the hard disc, taking care to plug the cable in correctly. Replace the top cover.

> **WARNING:**
> Incorrect connection of the Hard Disc to the computer can result in permanent and unrepairable damage to the Hard Disc. Always ensure that the cable is connected to the left hand set of pins, with the 'Pin 1' stripe to the right (looking at the rear of the drive).
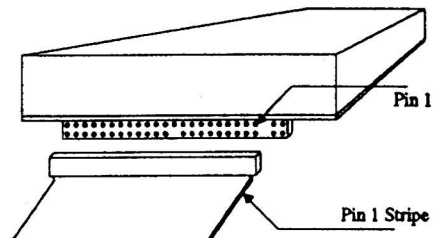


2  Connect the test station and the monitor to the mains supply. Do **not** turn on.

3  Insert the test disc into the floppy disc drive and turn on the monitor.

4  Turn on the test station whilst holding down the Delete key and Shift key (until the auto-boot file is executed)..

5  The following menu is displayed:

```
MENU VX.XX UN-DEF

(A)  Test Suite
(B)  Individual Tests
(C)  Load / Save CMOS
(D)  Quit

Select the test type of your choice
```

Select the `Individual Test` option by typing B.

6  From the list that follows, select the option `Format IDE drive 4` by pressing Q (for the A3020) or R (for the A4000). A configuration screen will then appear which will be followed by the initialiser screen. The disc is then initialised. For details of the hard disc initialiser program, refer to the information given in the section entitled *Hard disc initialiser* on page E-7.

7  When initialising is complete, you will be asked to press the space bar to continue. This produces the report screen that displays the pass/fail message.

8  Press the space bar and, when requested, turn off the test station.

9  Turn all the mains supplies to the equipment off.

# Reader's Comment Form

*A3010/A3020/A4000 Module Level Service Manual*

We would greatly appreciate your comments about this Manual, which will be taken into account for the next issue:

**Did you find the information you wanted?**

**Do you like the way the Information Is presented?**

**General comments:**

If there is not enough room for your comments, please continue overleaf

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