TRIPLE X

SERVICE MANUAL

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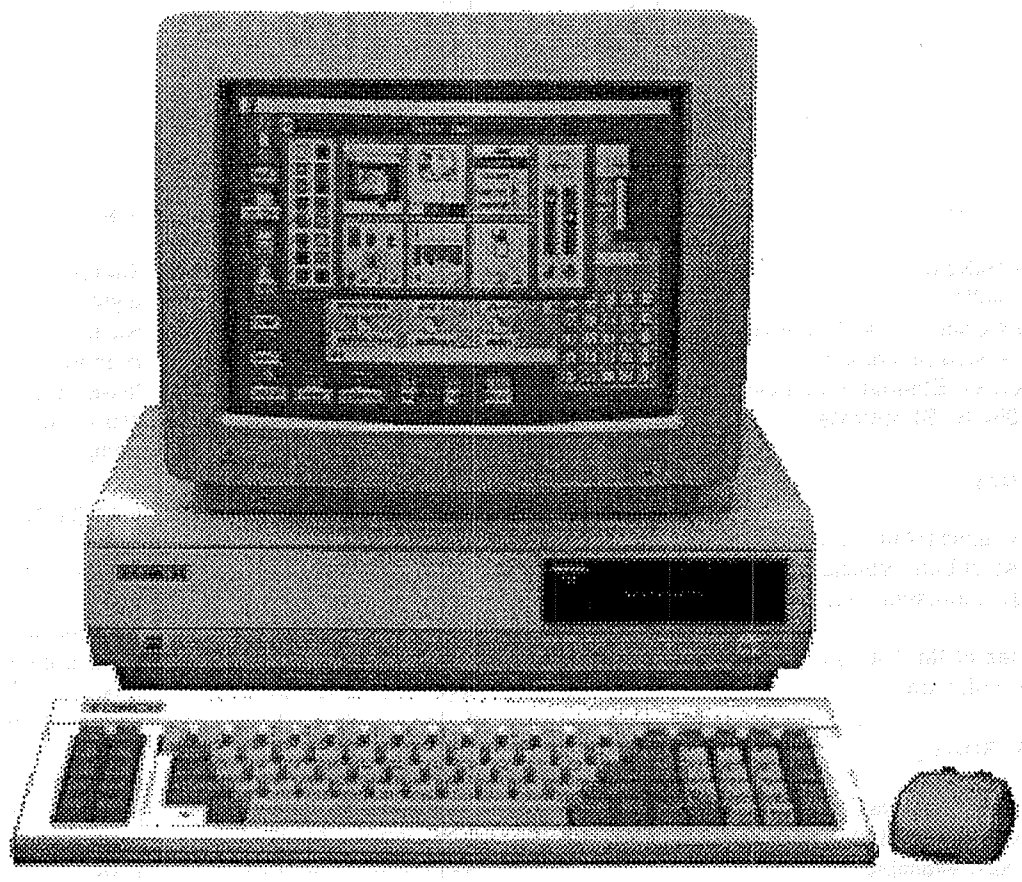
Triple X



Triple X

Triple X - a desk-top workstation which runs the latest generation of office automation e.g. Uniplex and productivity software and the full range of scientific and technical applications. Triple X offers unprecedented levels of user convenience and work efficiency. Triple X uses the Unix V operating system developed by AT&T.

Multi-tasking in its simplest form

With the unique software package, OpenTop, Torch has released the power of Unix in a user friendly, multi tasking form which everybody can understand.

Data Security is assured

Triple X is a total concept based on reliability, simplicity, performance .... and security. Only the operator possessing the appropriately coded floppy disc can control access to the system. Losing data through accidentally switching off is difficult, because Triple X checks with the operator that 'power down' really is required, and there is a battery backed configuration memory for added peace of mind.

The system you can build on

Additional memory can be incorporated utilising the VME bus.

Colour display

A 14" high resolution colour monitor offers a razor sharp information display. Operating colours may be altered using the mouse to suit the operator's preference. Standard resolution is 736 x 256 pixels with a selection of four colours from a full palette of 256.

Flexibility which works harder for you

Triple X works harder throughout the office than any comparable desktop system. Integrated software packages cover the full range of office automation, accounting, database management, wordprocessing, communications functions. The system also works with well established programming languages including fourth generation languages, assembler and Expert systems.

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TORCH
TECHNOLOGY LTD

Specifications

Processors

68010 16/32 bit microprocessor
68451 MMU
68450 4 Channel DMA controller
6303 service processor
7990 Lance Ethernet controller
NCR8350 SCSI controller

Memory

2Mb dynamic RAM standard.
50 bytes of batterybacked RAM (configuration,serial number & self test)
16Kbytes ROM (selftest, diagnostic & startup software)

Mass storage

40Mb winchester disc drive with SCSI controller. 80Mb, 190Mb and 300Mb drives also available.
Double sided 5 1/4" 720 Kbyte floppy disc drive, capable of reading IBM PC discs.

Video Display

14" standard display fully bit-mapped 736x256 pixels.
Four colours from full palette of 256.
Total of six display resolutions up to high resolution mode 736x512 and colour display of up to 16 from a palette of 256.

Audio output

Variable frequency and duration, single channel, to speaker in keyboard.

Graphics

Line, arc, ellipse, area fill, shading, half-tones etc.
Multiple fonts, proportional spacing and characters.

OpenTop

Two button mouse - no special surface required.
Intelligent keyboard to DIN standard.
Numeric keypad and separate cursor keys.
Full up/down coding, all keys programmable to any string.
Full windows, icons, mouse, pointer, menu features accessible to all Unix programs.

Network

IEEE802.3 Ethernet with B-Net TCP/IP software using on board LANCE chip set.

Operating system

Complete Unisoft Uniplus+ Unix System V.
Includes windowing, desktop manager, shared libraries, fast 'exec' and record locking.
More than 300 utilities, including C compiler, vi, csh, yacc, mail, uucp.

Peripheral connections

Three serial ports total. Expandable to 11.
Two asynchronous/synchronous serial ports with maximun transfer rate in excessof 64 K/bits per second. Used for X25, or other software for terminal support (multi user mode).
One asynchronous serial port for printer, external modem or terminal support.

Internal Functions

Battery powered clock.
Intelligent PSU with software controlled touch on/off switch.
Turbofan cooling system.
XBUS (Acorn BBC micro Bus compatible) interface.

Dimensions

Main body 450x310x130mm
Keyboard 450x160x40mm
Mouse 60x100x34mm

E & OE

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CHAPTER 1: INTRODUCTION

1.1 THE PURPOSE OF THE MANUAL

The purpose of this manual is to provide all the information necessary to find and correct faults in the Triple X workstation.

1.2 THE INFORMATION CONTAINED IN THE MANUAL

The information contained in this manual has been used by Torch Technology's service department for many years and enables a service engineer to locate a fault to one of the following parts of the Triple X:

- the power supply unit
- the on/off switch
- the power supply cables
- the base processor board
- the hard disc unit
- the disc controller board
- the hard disc data and control cables and the SCSI cable
- the floppy disc unit
- the keyboard
- the mouse
- the monitor.

When one of these parts is found to be faulty, it is replaced as a unit.

This manual does not describe how to mend the parts themselves.

1.3 GLOSSARY OF TERMS USED IN THE MANUAL

It is impossible to avoid using some scientific terms and abbreviations in a service manual, so these are included here at the start. Some of them, such as HDU, are used all the time and so it is important that the engineer is familiar with them before reading the rest of the manual.

6303R

The service processor mounted on the base processor board is a 6303R. This is an 8-bit device which controls the power-up and power-down sequence of the Triple X, and also looks after the keyboard/mouse and sound when the Triple X is running.

68010

The main processor mounted on the base processor board is a 68010. This is a 16-bit device of the Motorola 68000 family.

68450

The 68450 is a direct memory access controller (DMAC). When the processor is not using the bus, the DMAC allows peripherals to write and read data to and from main memory (including any VME memory).

68451

The 68451 is a memory management unit (MMU). It is programmed at power-up to know what memory is available on the main board and on the VMEbus, and then translates the logical address provided by the 68010 into the physical address which is put on the bus.

AC

Alternating current. This term is used to describe any voltage which varies regularly with time between a positive and a negative value. It is most usually applied to sinusoidal voltages such as the mains supply.

Backplane

On the slim and quin rings, the VME backplane consists of a common set of power lines, terminated data and address buses, and the connectors into which a VME board can be plugged.

Backup

A backup is a copy of any program or file which is kept in case the original is lost or damaged. A backup is usually kept on a medium which can be removed from the machine, such as a floppy disc or a streaming tape cartridge. A backup on the same hard disc as the original is no good if the hard disc itself fails.

Base processor board

The main board of the Triple X which is mounted in the base is called the base processor board.

Baud

A unit of measurement of the speed of serial data transmission. 1 baud is 1 bit per second.

BBC

The British Broadcasting Corporation. (The BBC made a series of television programs to educate people about microcomputers, and a certain British microcomputer carried the BBC name. The Triple X has an external bus which emulates the 1MHz bus used on the BBC microcomputer.)

BBRAM

Battery-backed RAM. The Triple X has a small amount of battery-backed RAM which holds the serial number and permissions. The Triple X won't run if the serial number isn't stored in the BBRAM.

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Please read this

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Chapter 1

Introduction

Beeps

Certain errors in the system which are detected at power-up produce a sequence of beeps which enable the engineer to diagnose the fault. These beep codes are listed in section 5.2.6

Boot disc

The boot disc is a floppy disc which is inserted into the Triple X at power-up and which contains software to start the system. When this has been done once (usually when the Triple X is new) the system subsequently boots automatically from the hard disc.

Bootstrap

The bootstrap is a short program run after power-up which loads software from another part of the computer system.

Bus

A bus is a set of parallel connections linking parts of the system which require access to the information carried on it. A bus usually has three parts - address, data, and control. The number of data lines is commonly known as the bus "width" and determines the size of the binary number which can be transferred in one bus operation.

Byte

A binary number which is 8 digits long.

Caretaker

Torch's name for the EPROM on the base processor board which contains all the software used to power-up the Triple X. The caretaker EPROM has a version number which changes with each release of the firmware.

CRC

Cyclic redundancy check. An operation which is carried out to check that a piece of data has been transmitted or loaded correctly.

Cursor

An indicator on the screen which shows where the next character typed will appear.

DC

Direct current. This term is used to describe any voltage which is either wholly positive or wholly negative. Note that DC does not imply a constant voltage, but one which is always pushing electricity in the same direction.

Debugging

The act of looking for errors in software, and removing them.

DMA

Direct memory access. This term is used to describe a transfer of data to or from memory without it having to pass through the main processor.

Dropout

The temporary removal of a signal or power supply.

EPROM

Electrically programmable read only memory. A device which can be programmed to store binary numbers and which remembers them when the power is removed. Most EPROMs are UV-EPROMs which can have their entire contents erased by exposing them to ultra violet light. Afterwards they can be reprogrammed.

ESU

Expansion storage unit. A unit which connects to the Triple X SCSI bus and allows backups of the contents of the hard disc to be made on a streaming tape cartridge.

Ethernet
A local area network which allows a number of Triple Xs, or any other suitably equipped computers, to communicate with each other.

FDU
Floppy disc unit.

File
A collection of data stored on a medium. A file must have a name and a size. It may also have other attributes such as an address on a disc, and a type, etc.

Firmware
A program stored in a ROM or EPROM which is part of the main hardware. On the Triple X, the firmware is stored in the caretaker EPROM mounted on the base processor board.

Flowchart
A diagram showing a sequence of steps to the solution of a problem.

Formatting
Writing information to a blank disc to provide a framework within which files can be stored and retrieved randomly. (Formatting a disc is like fitting the drawers in a filing cabinet.)

Hardware
The physical elements of the computer system, and not the programs or data.

HDU
Hard disc unit.

Hz
A unit of measurement of frequency. 1 Hz (hertz) is 1 cycle per second.

IC
Integrated circuit. Usually meaning the black objects on legs on a circuit board.

ICs
More than one IC (plural).

I/O
Input/output.

Kernel window
A window displayed on the screen by the operating system.

Key disc
A floppy disc which must be used on a Triple X which has lost the data in its battery-backed RAM.

Kilobyte (Kbyte)
A binary thousand bytes (2^{10} or 1024 decimal).

LED
Light emitting diode.

Limpet board
A board which plugs into the base processor board and the VMEbus, and provides the Triple X with an extra 1 Mbyte of memory (via the VMEbus).

Mains
The alternating supply which is fed to the Triple X to power it. This supply is either nominally 110V RMS or 240V RMS.

Manta board
A floppy disc controller board which is fitted to a Triple X which contains a hard disc with its own hard disc controller.

Medium
The thing on which a file is stored. For example, a floppy disc, a hard disc, a tape cartridge, an EPROM etc.

Megabyte (Mbyte)
A binary million bytes (2^{20} or 1048576 decimal).

Modem
Modulator/demodulator. A device which encodes outgoing data in a form that can be transmitted on a telephone line, and which decodes incoming data.

Mouse
A hand-sized piece of plastic with a rubber ball in the bottom which moves a pointer on the screen in sympathy with its movement across the desk.

NMI
Non-maskable interrupt. When 0V is applied to the NMI input to a processor, it stops execution of its current code and continues execution at another address. This is used on the service processor to indicate the start of the power-down sequence.

OMTI board
The hard and floppy disc controller board used in the Triple X is manufactured by OMTI. The controller is referred to in this manual as the OMTI board.

Operating system
The program which is in overall control of the function of the computer.

PCB
Printed circuit board.

PCC
Pluggable cord connector. A type of connector used for the keyboard and mouse.

Peripheral
Any piece of hardware which is plugged into the Triple X.

Port
A channel through which the Triple X can communicate with a peripheral.

PSU
Power supply unit.

RAM
Random access memory. RAM can have data written to it, or read from it, but the data is lost when the power is removed.

RF (RFI)
Radio frequency (radio frequency interference). Electromagnetic waves in a certain range are called radio frequencies. All computers generate some RF, and this can cause interference (RFI) to other equipment.

RGB
Red green blue. The three primary addition colours used in a colour monitor. The three signals from the Triple X to the monitor which determine the strength of the three colours are labelled R, G, and B.

RMS

Root mean square. This is one method of expressing an alternating voltage as a single value. It gives a value for the voltage which would cause the same amount of power loss in a resistor as would a smooth direct voltage of the same value. Other methods of expressing alternating voltages are peak (which is the highest voltage reached), and peak to peak (which is the sum of the absolute values of the highest and the lowest voltages reached).

RS423

A hardware standard for transmitting and receiving serial data.

RTC

Real time clock. A clock which counts in seconds and minutes and hours.

SCC

Serial communications controller. The serial communications IC on the base processor board which provides serial ports A and B.

SCSI

Small computer systems interface. A standard bus used to transfer data to and from the HDU, FDU and ESU.

Service processor

The service processor mounted on the base processor board is a 6303R. This is an 8-bit device which controls the power-up and power-down sequence of the Triple X, and also looks after the keyboard/mouse and sound when the Triple X is running.

Shell

The shell is a program which runs on the Triple X. Its job is to take the characters you type in at the keyboard, interpret them, and then run another program which carries out the expected task. If the characters typed in do not make sense to the shell then it gives an error message. The shell is the outer layer of the operating system through which all communication with the computer passes.

Software

Programs and data.

Streaming tape unit (STU)

A device used to backup large amounts of data, such as the entire contents of a hard disc. On the Triple X, the streaming tape unit is housed in the expansion storage unit (ESU).

Toolkit

A set of programs which is provided on the Triple X to carry out common tasks.

TTL

Transistor-transistor logic. A family of integrated circuits which perform simple functions.

VMEbus

A standard definition for a 32-bit bus which provides a link to the outside world which allows devices to transfer data to each other much faster than using a network or a serial link.

WERMA

A program stored in the caretaker EPROM which is run after power-up and whose job is to load and run the operating system.

Winchester disc drive

Hard disc drive used in HDU.

X25

An agreed worldwide standard for the transmission of packet-switched serial data over public telephone networks.

XBUS

An emulation of the BBC microcomputer 1MHz bus, see BBC.

Chapter 2

Before You Start

CHAPTER 2: BEFORE YOU START

2.1 SAFETY

2.1.1 The service engineer

- *Always remove the mains power plug from the back of the Triple X before removing any screws from the case.*

- *If you have to power-up the Triple X with the case disassembled (for example, when testing the limpet board is installed correctly), insert the mains plug into the power supply when it is disconnected from the wall socket. Check that nothing metal is lying near the PSU and then turn on the power. Do not touch the PSU itself while it is live.*

  Disconnect the PSU from the mains as soon as the test is complete and before carrying out any further work on the Triple X.

2.1.2 The Triple X

- *Never move the Triple X when it is powered-up. The hard disc is easily damaged when it is spinning.*

- *Always power-down the Triple X by pressing the touch switch so that the hard disc heads are parked correctly. Do not just switch off at the mains while the hard disc is running.*

2.2 WHAT YOU WILL NEED

2.2.1 Test equipment

- **Voltmeter** - 0 to 12V DC and 0 to 240V AC

  Used to measure the voltage of the AC mains and the DC outputs from the power supplies. Also used to check that the correct voltage is reaching the components. Should be accurate to 0.1V for checking DC voltages.

- **Torch debugging software** - available on floppy disc

  Contains a number of programs which can help with tracing faults in various components of the Triple X.

- **Components which are known to be working** - see the list of recommended spares in the appendix

  There is no easier way to find which component of the Triple X is faulty than to swap each one in turn until the machine works correctly.

2.2.2 Tools

Essential tools for dismantling the standard Triple X are marked †.
Essential tools for dismantling the Triple X fitted with a VME ring are marked ††.

- posidrive screwdriver number 0
- posidrive screwdriver number 1 †
- posidrive screwdriver number 2
- medium size flat screwdriver †
- 2.5 mm hexagon key (sometimes called Allen key or hexagon wrench) ††
- M3 metric spanner ††
- 60 watt temperature controlled soldering iron with 1.5mm bit and resin-core solder
- modelling knife
- long nose pliers (pliers with extended jaws)
- side cutters (wire cutters)

2.3 STATIC HANDLING PRECAUTIONS

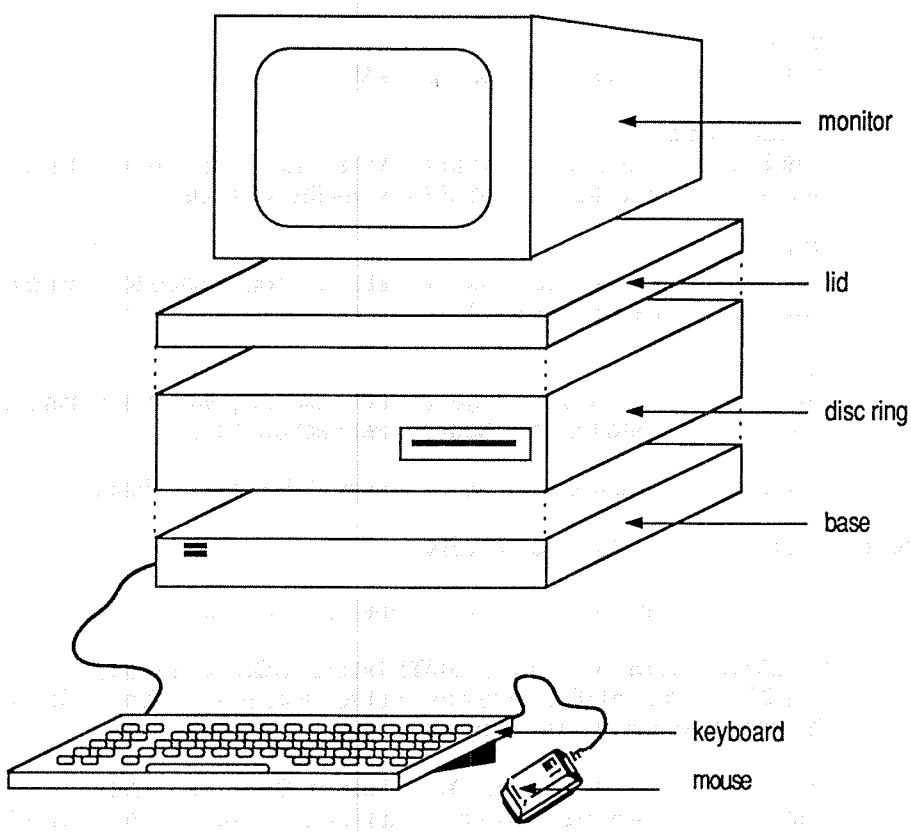
Components used in computers, such as integrated circuits, can be damaged by static discharges, and the human body can generate very high voltages. This means that, for example, the base processor board of the Triple X can be ruined simply by touching it.

To reduce the chance of this happening, it is recommended that the following precautions are taken:

- *The bench on which the Triple X is to be serviced should be made of a material which dissipates static charge. Note: the surface of the bench must not be conductive because a battery on a PCB could short circuit when placed on it.*
- *The bench should be connected to a good earth.*
- *The service engineer should wear a wrist band which connects to a proper earthing point on the bench.*
- *Never place a board on top of plastic bags or folders, and never attach sticky tape or self-adhesive labels to it.*

2.4 THE TRIPLE X WORKSTATION

Here is a diagram of a standard Triple X Workstation. The "rings" which make up the case are shown separated.



THE TRIPLE X WORKSTATION

The Triple X base contains the following:

- 100W power supply unit
- touch switch
- 68010 processor board
- limpet board (if fitted)

The Triple X disc ring contains the following:

- floppy disc unit
- hard disc unit
- OMTI board SCSI data controller

The following cables link the base and the disc ring:

- the DC power loom
- the SCSI cable

2.5 TRIPLE X CONFIGURATIONS

The following sections list the possible configurations of the Triple X.

2.5.1 VME

The base processor board has a 96-way connector which provides a standard VMEbus. The following can be plugged into it:

Nothing
The Triple X has no expansion via the VMEbus.

Limpet board
The limpet board is designed to fit in the base of the Triple X beneath the power supply unit and provides an extra 1 Mbyte of RAM via the VMEbus.

Slim ring
The slim ring is a module which extends the Triple X case to provide a single slot for a standard VME board, see section 3.1.2.

Quin ring
The quin ring is a module, larger than the slim ring, which extends the Triple X case to provide four slots for standard VME boards, see section 3.1.2.

This Service Manual covers all the above VME configurations.

2.5.2 Hard disc and SCSI controller

The Triple X can have one of the following configurations:

20 Mbyte hard disc with OMTI board SCSI controller
The 20 Mbyte hard disc drive does not have its own controller. The OMTI board controls both the hard disc unit and the floppy disc unit.

40 Mbyte hard disc with OMTI board SCSI controller
The 40 Mbyte hard disc drive does not have its own controller. The OMTI board controls both the hard disc unit and the floppy disc unit.

80 Mbyte hard disc with MANTA board SCSI controller for the FDU
The 80 Mbyte hard disc has its own SCSI controller. The MANTA board controls the floppy disc unit alone.

This Service Manual covers the 20 Mbyte and 40 Mbyte configurations only.

2.5.3 Monitor

The Triple X has a 13" colour monitor based on either Mitsubishi or Sony designs.

This Service Manual covers both these configurations.

Chapter 3

Disassembly and Reassembly

CHAPTER 3: DISASSEMBLY AND REASSEMBLY

3.1 INTRODUCTION

3.1.1 Before you start

Read the safety information in chapter 2 of this manual.

Before disassembling the Triple X, power-down the machine and disconnect the mains cable. This must be done BEFORE removing the screws which hold the case together. The mains cable plugs into the rear of the Triple X and must be pulled down to remove it.

Unplug all the other connectors from the Triple X, remove the monitor and clear the area around the computer, making sure that the work surface is clean. Place a cloth or soft workmat under the Triple X to protect the paintwork and to avoid scratching the casing.

Use the correct tools. A list of tools is given in chapter 2. The only tools required for disassembly and reassembly are:

- medium flat blade screwdriver
- number 1 posidrive screwdriver
- 2.5 mm hexagon key (to remove lid if extra ring is fitted, see 3.1.2)
- M3 metric spanner (to remove SCSI connector if extra ring is fitted, see 3.1.2).

Be careful when removing and replacing plugs and connectors. The pins of multi-pin connectors can easily be bent.

Most of the plugs used in the Triple X are polarised, meaning they are designed so that they only fit one way. Never force a connector as it may be wrongly positioned.

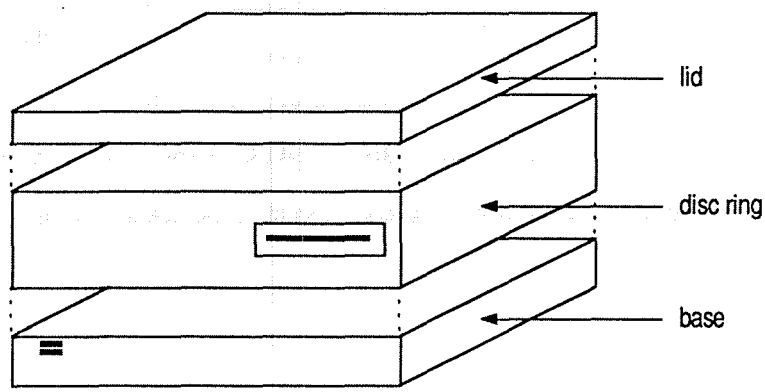
This manual does not describe repairs or adjustments below the level of printed circuit boards or other removable parts, such as the FDU, HDU or PSU (see the glossary in chapter 1). If you decide that individual components (ICs) need to be removed or added, you must read the static handling precautions described in chapter 2.

3.1.2 The Triple X "rings"

The Triple X case is made up of a base, a lid, and one or more "rings".

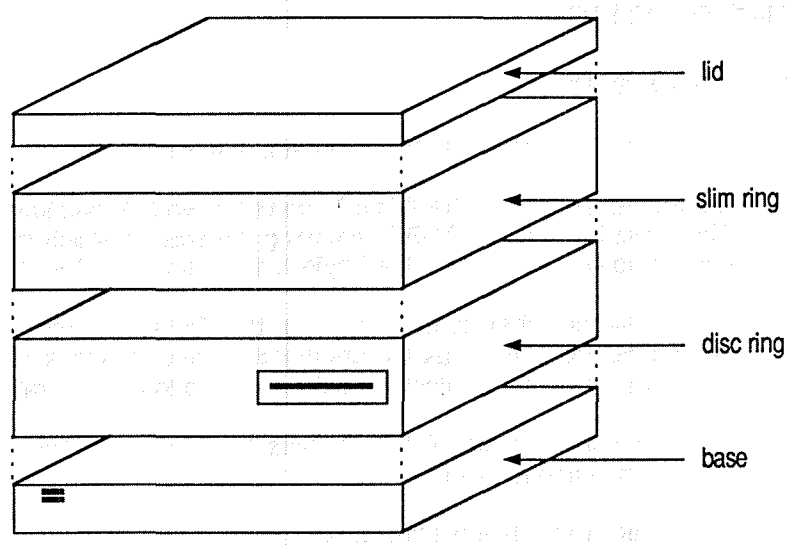
The base contains the processor board and the power supply unit.

Usually, the Triple X is fitted with just one ring which contains the two disc drives and SCSI controller card. This ring is called the "disc ring". A Triple X with only the disc ring fitted is shown in the exploded diagram below.



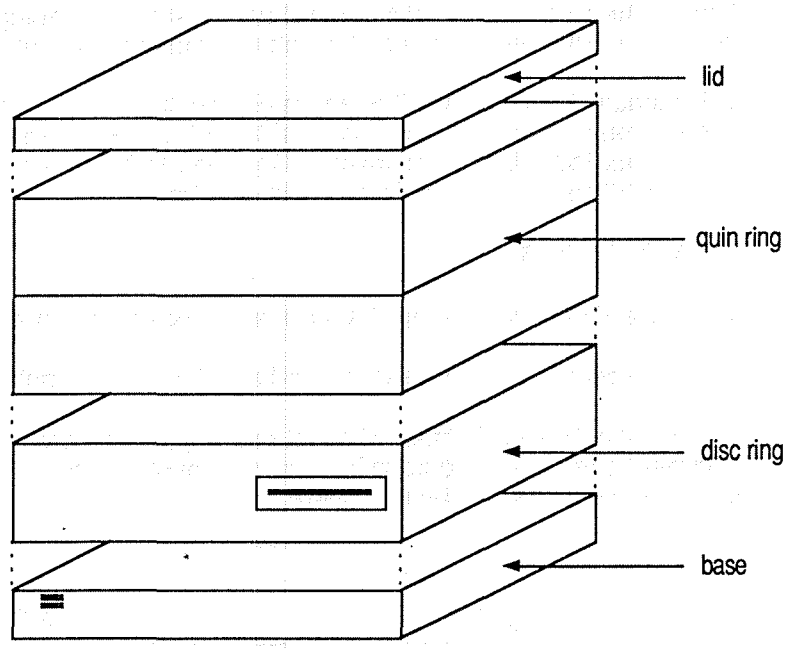
TRIPLE X SHOWING BASE, DISC RING AND LID

An extra ring called a "slim ring" can be fitted. This provides one slot for a VME card to be plugged into the Triple X. A Triple X fitted with a slim ring is shown in the exploded diagram below.



TRIPLE X SHOWING BASE, DISC RING, SLIM RING AND LID

Instead of a slim ring, the Triple X can be fitted with a larger ring called a "quin ring". This provides four slots for VME cards, and has its own power supply unit. The quin ring is twice the height of a slim ring (it is made up of two rings joined together). A Triple X fitted with a quin ring is shown in the exploded diagram below.



TRIPLE X SHOWING BASE, DISC RING, QUIN RING AND LID

Note that the two halves of a quin ring must not be separated.

3.2 THE STANDARD TRIPLE X (NO EXTRA RINGS FITTED)

3.2.1 Opening the case

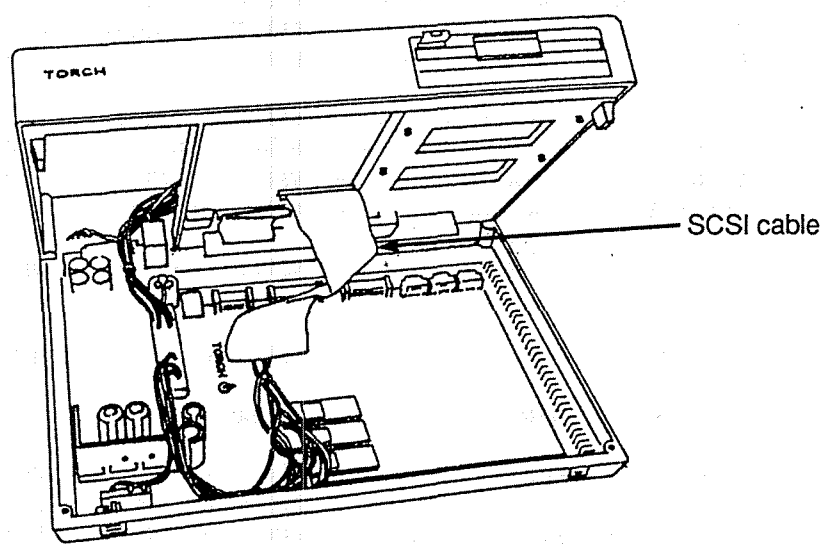
1. *Switch off the Triple X.*
2. *Disconnect all cables from the rear panel.*
3. *Remove the monitor, keyboard and mouse.*
4. *Turn the computer upside down.*
5. *Use a flat-bladed screwdriver to remove the 4 bolts, one in each corner of the base. These bolts hold together the base, disc ring, and lid.*
6. *Hold the casing together by gripping both top and bottom and then carefully turn it the right way up: on its rubber feet and with the front facing you.*
7. *Remove the lid, exposing the PSU (Power Supply Unit) to the left of the hard and floppy disc units, and the fan at the rear.*

3.2.2 Removing the disc ring from the base

1. *Follow the instructions for opening the case in section 3.2.1.*
2. *Remove two of the connectors from the Triple X PSU. These are labelled SK4 (which supplies DC power to the HDU, SCSI data controller card and FDU) and SK9 (which supplies AC power to the fan). Take care not to remove the SK2 connector, since this supplies power to the processor board from the backup battery.*

   The PSU provides power to recharge the battery, which provides power for the battery-backed clock and RAM when the Triple X is switched off. If SK2 is disconnected, even for a short time, you have to reinstall the "permissions" which are stored in battery-backed RAM. The Triple X Caretaker manual tells you how to do this.

3. *Lift the ring up at the front until it is vertical, and then let it rest on its back face on the bench behind the base. The 50-way SCSI cable can now be seen.*



THE TRIPLE X DISC RING LIFTED TO SHOW THE SCSI CABLE, PSU AND BASE PROCESSOR BOARD.

4. *Push back the levers on each side of the SCSI connector (labelled PL12 on the base processor board) and disconnect the cable.*

5. *The disc ring can now be lifted clear, showing the PSU and processor board fixed to the base.*

3.2.3 Removing the floppy disc unit from the disc ring

The following instructions apply to the Epson 680L and SD540 floppy disc units.

1. *Follow the instructions for opening the case in section 3.2.1 and for removing the disc ring in section 3.2.2.*

2. *Remove the DC power connector (J1) and the 34-way data cable edge connector (J2) from the rear of the FDU.*

3. *Pull off the earth connector from the left rear of the FDU. (Do not pull on the cable itself, pull the connector.)*

4. *Lift the disc ring so that it stands on its back edge. The FDU is attached by four M3x12 crosshead screws. While holding the FDU in place to prevent it falling, undo these screws using a number 1 posidrive screwdriver.*

5. *Lower the disc ring on to the bench again. Slide the FDU back and then lift it out from the front of the disc ring.*

   The RF shield, in the form of a metal plate covering the top of the FDU, is held in place by four M3x8 screws, two on each side. If you wish to replace the FDU, you have to remove this shield and then fit it on the new FDU.

   If you are fitting a new FDU, make sure that the link settings match those of the old one.

3.2.4 Removing the SCSI data controller board (OMTI) from the disc ring

Before handling the OMTI board, read the precautions given in section 2.3 of this manual.

The SCSI data controller board fitted to the Triple X is manufactured by the OMTI Corporation. Model 5200 controls both the HDU and the FDU. The SCSI data controller board is referred to as the "OMTI board" throughout this manual. If the Triple X is fitted with a hard disc unit which has its own controller built in, for example the 80 Mbyte CDC MN94211-91, the OMTI board is not fitted. The floppy disc unit then has its own controller called the "MANTA board".

Note: the connectors to the OMTI board are not polarised, so it is possible to plug them in the wrong way round. Before you remove the connectors from the board, make a note of which cable goes on which connector, and which way round they should be. The cables have a red or blue stripe on one side so that you can tell which way round they are.

1. *Follow the instructions for opening the case in section 3.2.1 and for removing the disc ring in section 3.2.2.*

2. *Turn the disc ring upside down. The OMTI board can be seen above the HDU.*

3. *Remove J10, the DC power connector.*

4. *Make a note of which way round the cables go that are plugged into connectors, J1, J2, J3 and J7. (J1 is a 50-way, J3 is a 20-way, J2 and J7 are 34-way connectors). When you are sure you can replace them correctly, remove the four connectors.*

   It is usually necessary to lever the connectors off gently with the thumbs behind the cable itself, taking care not to bend the pins or damage them.

5. *Remove the four M3x8 crosshead screws from the corners of the PCB using a number 1 posidrive screwdriver and lift off the OMTI board.*

3.2.5 Removing the hard disc unit from the disc ring

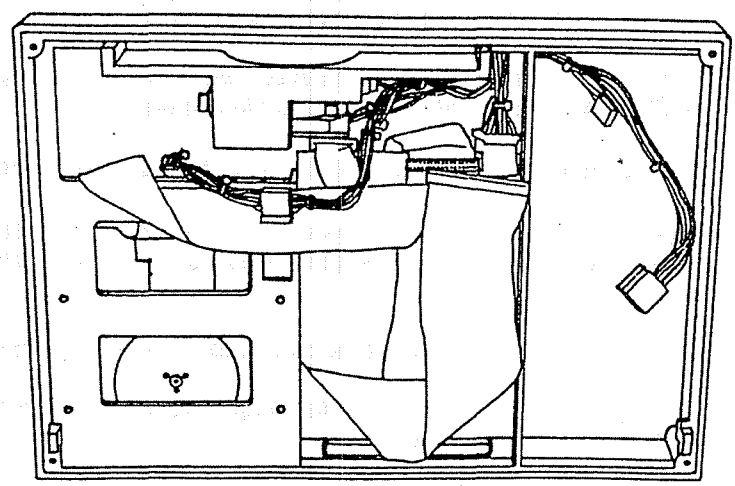
1. *Follow the instructions for opening the case in section 3.2.1, removing the disc ring in section 3.2.2 and the OMTI board in section 3.2.4. Leave the disc ring upside down on the bench.*
2. *Remove the control cable (J1) and the data cable (J2) and the DC power cable (J3).*
3. *Pull off the earth connector, between J1 and J2 on the HDU. (Do not pull on the cable itself, pull the connector.)*
4. *With the OMTI board removed, the four screws are visible and can be removed using a number 1 posidrive screwdriver. The screws are either M4x12 or 6x32UNC.*
5. *When the screws are completely undone, lift the disc ring off the HDU.*

3.2.6 Replacing the hard disc unit

1. *Place the HDU upside down on the bench, connectors facing away from you.*
2. *Place the disc ring upside down on top of the HDU and insert the four screws. Lightly tighten all four screws before any one of them is fixed. Do not overtighten the screws.*
3. *Replace the earth connector.*
4. *Replace the data cable (J2) and the control cable (J1) on the HDU. These are straight-through connections with no twists or turns in the ribbon cables.*
5. *Replace the DC power connector (J3) on the HDU.*

3.2.7 Replacing the SCSI data controller board

1. *Replace the OMTI board on its mountings.*
2. *Insert the four M3x8 crosshead screws and tighten them gently.*
3. *Replace the four cables on their connectors, J1, J2, J3 and J7. Make sure you replace them the correct way round as noted before they were removed.*
4. *Replace J10, the DC power connector.*



THE UNDERSIDE OF THE DISC RING, SHOWING THE FDU AND HDU CABLES CONNECTED TO THE OMTI BOARD

3.2.8 Replacing the floppy disc unit

1. *If you are fitting a new FDU, make sure that the link settings match those of the old one.*
2. *Replace the metal plate which forms a shield for RF interference. The shield is held on by four M3x8 screws.*
3. *Turn the disc ring the right way up and replace the FDU.*
4. *Hold the FDU in place, lift the disc ring up and insert the four M3x12 screws. Gently tighten the screws.*
5. *Replace the earth connector.*
6. *Replace connectors J1 and J2.*

3.2.9 Removing the power supply unit from the base

Before removing the power supply unit check that the key disc is available to reset the system serial number.

1. *Follow the instructions for opening the case in section 3.2.1 and for removing the disc ring in section 3.2.2.*

   Make sure that the mains power cable has been removed.

2. You have a choice:

- either to remove the DC power cable to the base processor board and lose the information in the battery-backed RAM
- or to leave the connector attached and preserve the information.

If you are removing the PSU so that you can work on the limpet board or the processor board then leave the DC power cable in place. If you want to change the PSU, or change the battery then disconnect the DC power cable (SK2).

If SK2 is removed, the data in the BBRAM has to be restored after the computer has been reassembled. Make sure that the key disc is available. See section 5.3.4.

3. *Remove the two M3x6 screws from the front of the PSU mounting.*
4. *Remove the PSU and its mounting by lifting the front and pulling it clear of the tabs at the rear. Take care not to damage the touch switch pins.*

   If the PSU is still attached to the base processor board by the DC power cable, swing the PSU over the back of the base and place it on the bench.

3.2.10 Removing the limpet board from the processor board

The limpet board, if fitted, provides an extra 1 Mbyte of memory and is plugged into the VMEbus connector on the base processor board. It also plugs into two IC sockets on the base processor board.

1. *Remove the VME ribbon cable connector from the limpet board.*
2. *Very gently rock the back of the limpet board until the pins are just free from the IC socket on the main board.*
3. *Rock the front of the limpet board very gently until it comes free from the main board.*

3.2.11 Removing the processor board from the base

Before handling the processor board, read the precautions given in section 2.3 of this manual.

1. *Follow the instructions for opening the case in section 3.2.1 and for removing the disc ring in section 3.2.2 and for removing the power supply unit in 3.2.9 and for removing the limpet board in 3.2.10.*

   Make sure that all external connectors at the rear of the base are unplugged.

2. *Remove the LED cable from PL4 (Note the colour of the wires as this connector can go either way round. The LED will not light if it is replaced the wrong way round.)*

3. *If you removed SK2 from the PSU (see note in 3.2.9, step 2), remove the power cable from the processor board (8-way connector labelled POWER, PL1).*

4. *There are 11 screws which attach the base processor board to the base and all of them must be removed.* They are located in the following positions:

   - three on the front edge (left, centre and right)
   - six along or near the back edge
   - two in the centre of the base processor board.

   All the screws are M3x6 (so they require a number 1 posidrive screwdriver).

5. *Remove the processor board from the base.*

3.2.12 Replacing the base processor board

1. *Replace the processor board in the base.*

2. *Insert the eleven screws and tighten them gently.*

3. *Replace the power connector PL1 (if it was removed) and the LED cable PL4. PL4 must be replaced the correct way round or the LED will not light.*

3.2.13 Replacing the limpet board

1. *Fit the limpet board to the base processor board making sure that all the pins are straight and are located in the correct holes in the sockets. This must be done very carefully because it is easy to bend a pin or to leave some pins out of the sockets. Check that the ears of the SCSI connector are not trapped under the limpet board.*

2. *Replace the VME ribbon cable connector to the limpet board. Hold the limpet board underneath the VME connector while you do this to support it.*

3.2.14 Replacing the power supply unit

1. *Slide the rear of the PSU into position in the base, and then lower the front until the screw holes in the PSU mounting line up with those in the base.*

2. *Insert the two screws into the front of the mounting and tighten them gently.*

3. *Reconnect the DC power cable to the processor board (SK2) if it was removed.*

4. *Put spare DC cable under the PSU mounting, and route the main DC cable down the front of the PSU to the left of the large capacitors.*

5. *Power-up the Triple X and watch the LED on the limpet board. After about 5 seconds wait, it should flash 4 times, indicating that the base processor board and limpet board have powered-up correctly. If the LED does not flash 4 times then there is a fault.*

   Power-down by pressing the touch switch once (there is a delay before the power goes off). Unplug the mains cable from the PSU.

3.2.15 Replacing the disc ring on the base

1. *Place the base (complete with its components and connectors) on the workbench with the on/off switch facing you. Place the disc ring on its rear edge on the bench behind the base.*

2. *Replace the 50-way SCSI connector (PL12) on the base processor board. Make sure that the SCSI cable does not cover the three 68000 ICs on the processor board when the disc ring is lowered on to the base. If the ICs are covered by the SCSI cable then they will overheat. The diagram in section 3.2.2 shows the three ICs and the SCSI cable. Note how the cable is folded to avoid covering the ICs.*

3. *Lower the disc ring on to the base.*

4. *Replace the DC power supply connector SK4 between the PSU and the disc ring, and the AC power connector SK9 between the PSU and the fan. Both connectors are designed so that they cannot be fitted incorrectly.*

3.2.16 Closing the case

1. *Replace the lid on top of the disc ring.*

2. *Hold the casing together by gripping both top and bottom and then carefully turn it upside down.*

3. *Insert the four 90mm fixing bolts from underneath and tighten them gently.*

4. *Turn the computer the right way up again.*

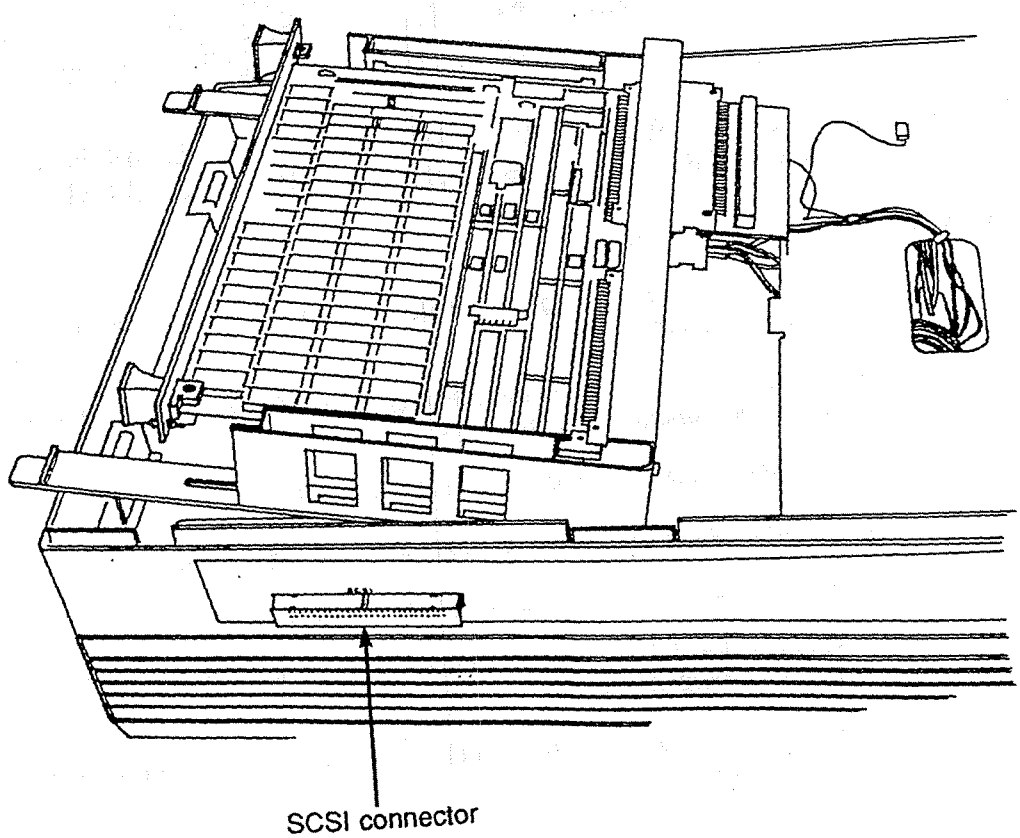
Once the Triple X has been reassembled, it can be reconnected following the diagram on the installation card.

3.3 THE SLIM RING

On a Triple X with a slim ring installed, the slim ring is fastened to the disc ring by the four 90mm bolts which come up from the base. The lid is attached to the slim ring by L-shaped brackets and fixed from the side by 2.5mm hexagon bolts.

3.3.1 Removing the slim ring

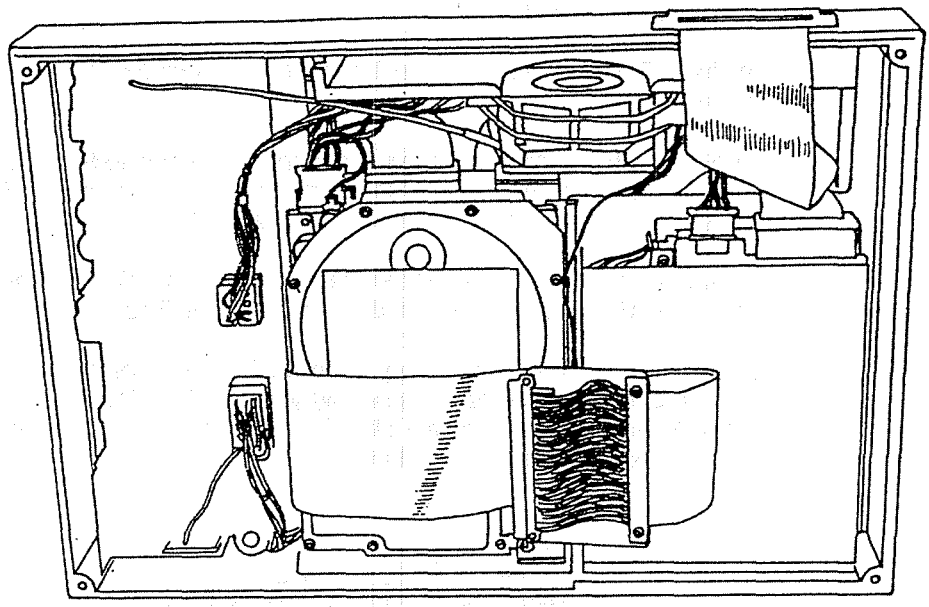
1. *Follow the instructions for opening the case in section 3.2.1. (Note that the four bolts in the base hold the base, the disc ring and the slim ring together. The lid is attached to the slim ring separately.)*
2. *Use the 2.5mm hexagon key to loosen the screws fixing the lid to the slim ring, and remove the lid.*
3. *If there is a VME card fitted in the slim ring, unlock the VME cage. There are two sliding bars on the bottom right edge of the slim ring. Push these bars left towards the centre of the case. Lift the right side of the cage so that it tilts.*
4. *You can see the VME cable underneath the cage, coming up from the disc ring through a slot in the slim ring. Disconnect the end of the VME cable from the VME backplane.*
5. *If you wish to remove the 50-way male SCSI connector extension from the rear of the slim ring (shown in the diagram below) you need an M3 metric spanner. Alternatively, you can leave it in place and the slim ring will stand on its edge behind the base and disc ring, still attached by its SCSI cable.*



THE SLIM RING, FROM BEHIND, SHOWING THE SCSI CONNECTOR, AND A VME CARD IN THE TILTED (SERVICE) POSITION

6. *Lift the slim ring and remove the DC power connector from the Triple X PSU (SK3). Do not remove the front 8-way connector (SK2) as this maintains a power supply to the battery-backed RAM on the base processor board. You can remove SK4 if you wish to make the removal of SK3 easier.*

7. *Lock the VME cage. Lift the slim ring by its right edge, feeding the VME cable back through its slot. The VME card, if fitted, can remain in place. If the SCSI cable is still attached then place the slim ring on its edge behind the base and disc ring.*



THE TRIPLE X BASE AND DISC RING WITH THE SLIM RING REMOVED, SHOWING THE DISC UNITS AND VME CABLE.

3.3.2 Replacing the slim ring

1. *Place the left-hand edge of the slim ring on the disc ring and feed the VME cable back through its slot.*

2. *Lower the slim ring on to the disc ring. If the SCSI cable was removed or if a VME card is fitted then unlock the VME cage.*

3. *Reconnect the SCSI cable (if it was removed).*

4. *Reconnect the VME cable and lock the VME cage in place.*

5. *Reconnect the DC power cable on the Triple X PSU (SK3).*

6. *Replace the lid on the slim ring and secure it using the four hexagon bolts and the 2.5mm hexagon key.*

7. *Replace the four 90mm bolts in the base which hold the base, the disc ring and the slim ring together.*

3.3.3 Fitting a VME card

Before handling VME cards, read the precautions given in section 2.3 of this manual.

1. *If the lid is fitted to the slim ring then remove it by loosening the four hexagon screws.*
2. *Unlock the VME cage. Viewed from the front, there are two sliding bars on the bottom right edge of the slim ring. Push these bars left towards the centre of the case (you may need to use a screwdriver to push them).*
3. *Lift the right side of the cage so that it tilts, and pull the two sliding bars fully to the right.*
4. *Lower the VME cage. It remains tilted for easy access to the VME card. This is called the "service position".*
5. *Slide the VME card into the uppermost slot in the cage and carefully push it home so that the connectors mate securely.*
6. *When the VME card is fitted, lift the VME cage and push the two sliding bars to the left. Lower the cage and then lock it in place by pushing the two sliding bars fully to the right.*
7. *Replace the lid on the slim ring and secure it using the four hexagon bolts and the 2.5mm hexagon key.*

3.4 THE QUIN RING

The quin ring can house up to four VME expansion cards.

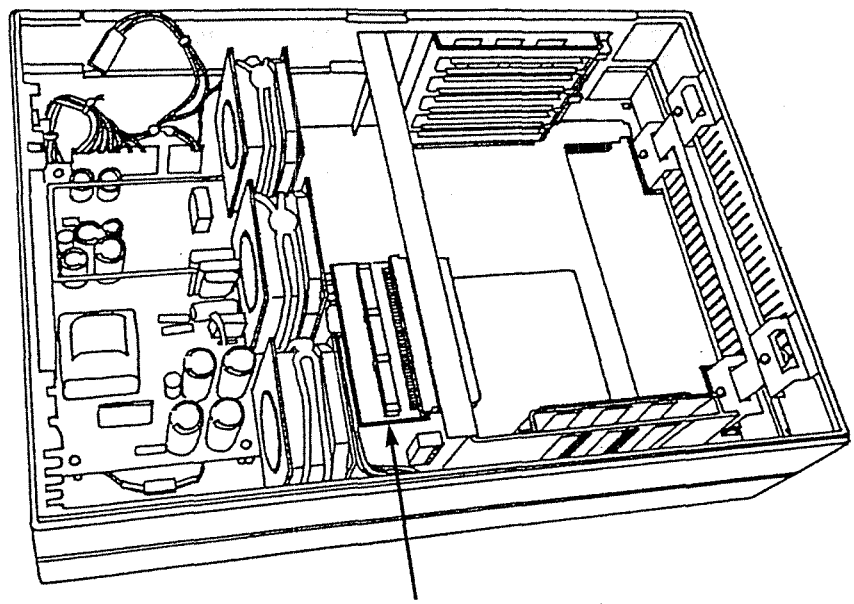
The quin ring contains a five-slot VME rack (in a separate sub-chassis), its own power supply and three extra fans.

On a Triple X with a quin ring installed, the quin ring is fastened to the disc ring by the four 90mm bolts which come up from the base. The lid is attached to the quin ring by L-shaped brackets and fixed from the side by 2.5mm hexagon bolts.

3.4.1 Removing the quin ring

1. *Follow the instructions for opening the case in section 3.2.1. (Note that the four bolts in the base hold the base, the disc ring and the quin ring together. The lid is attached to the quin ring separately.)*

2. *Use the 2.5mm hexagon key to loosen the screws fixing the lid to the quin ring, and remove the lid.*



THE QUIN RING, WITH THE LID REMOVED. ALL VME CARDS HAVE BEEN REMOVED FROM THE 5-SLOT CARD FRAME. THE TERMINATOR CARD IS IN PLACE ON THE BACKPLANE.

3. *If there are VME cards fitted in the quin ring, you need to unlock the VME cage as follows. First remove the backplane terminator from the top left edge of the backplane (this is to prevent damage to the connector when the VME rack is in the tilted service position). There are two sliding bars on the bottom right edge of the quin ring. Push these bars left towards the centre of the case. Lift the right side of the cage so that it tilts.*

4. *You can see the VME cable underneath the cage, coming up from the disc ring through a slot in the quin ring. Disconnect the end of the VME cable from the VME backplane.*

5. *If you wish to remove the 50-way male SCSI connector extension from the rear of the quin ring you need an M3 metric spanner. Alternatively, you can leave it in place and the quin ring will stand on its edge behind the base and disc ring, still attached by its SCSI cable.*

6. *The AC mains power cable to the quin ring comes up through a hole. The live (brown) and neutral (blue) cables must be disconnected from the quin ring by undoing the in-line connector.*

7. *The earth cable must be disconnected from the PSU in the base. Lift the left edge of the quin ring and remove the earth cable (green/yellow) from its tag (SK9) on the base PSU. Lower the quin ring back on to the disc ring.*

8. *Lock the VME cage. Lift the quin ring by its right edge, feeding the VME cable back through its slot. The VME cards, if present, can remain in place. Continue to lift the ring by its right edge, as though hinged, and finally remove it completely.*

3.4.2 Removing the quin ring PSU

1. *Remove the "power in" and "power out" connectors from the quin ring PSU.*

2. *Remove the four crosshead screws from the four corner pillars.*

3. *Lift the quin ring PSU out of the ring.*

3.4.3 Replacing the quin ring PSU

1. *Replace the quin ring PSU in its correct position.*

2. *Insert the four crosshead screws and tighten them gently.*

3. *Reconnect the "power in" and "power out" connectors.*

3.4.4 Replacing the quin ring

1. *Place the left-hand edge of the quin ring on the disc ring and feed the VME cable back through its slot.*

2. *Lower the right edge of the quin ring on to the disc ring and lift the left edge. Feed the earth cable (green/yellow) down from the quin ring through the hole and connect it to the earth tag (SK9) on the base PSU.*

3. *Feed the live (brown) and neutral (blue) AC mains cable up from the base through the hole and connect it to the live/neutral cable in the quin ring using the in-line connector.*

4. *Lower the quin ring on to the disc ring. If the SCSI cable was removed or if a VME card is fitted then unlock the VME cage.*

5. *Reconnect the SCSI cable (if it was removed).*

6. *Reconnect the VME cable and lock the VME cage in place.*

7. *Replace the backplane terminator on the backplane.*

8. *Replace the lid on the quin ring and secure it using the four hexagon bolts and the 2.5mm hexagon key.*

9. *Replace the four 90mm bolts in the base which hold the base, the disc ring and the quin ring together.*

3.4.5 Fitting VME cards

Before handling VME cards, read the precautions given in section 2.3 of this manual.

1. *If the lid is fitted to the quin ring then remove it by loosening the four hexagon screws.*
2. *Carefully ease the resistor terminator card from the backplane (this is to prevent damage to the connector when the VME rack is in the tilted service position).*
3. *Unlock the VME cage. There are two sliding bars on the bottom right edge of the quin ring. Push these bars left towards the centre of the case.*
4. *Lift the right side of the cage so that it tilts, and pull the two sliding bars fully to the right.*
5. *Lower the VME cage. It remains tilted for easy access to the VME cards. This is called the "service position".*
6. *Slide each VME card into the lowest free slot in the cage and carefully push it home so that all connectors mate securely and no pins are bent or damaged.*
7. *When the VME cards are fitted, lift the VME cage and push the two sliding bars to the left. Lower the cage and then lock it in place by pushing the two sliding bars fully to the right.*
8. *Replace the resistor terminator card on the uppermost connector at the rear of the backplane.*
9. *Replace the lid on the quin ring and secure it using the four hexagon bolts and the 2.5mm hexagon key.*

Note: shorting links are required between certain signal pairs when no VME board is present in the backplane connector. These link settings are listed in section 7.13.2 on VME expansion.

3.5 KEYBOARD

The only components of the keyboard which can be replaced are the key switches and the curly cable. Any other fault is cured by replacing the whole keyboard.

3.5.1 Disassembly

1. *Unplug the mouse, turn the keyboard upside down and remove the four crosshead screws, one in each corner.*

2. *Lift off the base. The keyboard PCB is protected by an insulating sheet to prevent the keys shorting out on the zinc coated case.*

3.5.2 Reassembly

1. *Replace the keyboard PCB and its insulating sheet.*

2. *Replace the base. When it is seated correctly, insert the four crosshead screws and tighten them gently.*

3.6 MOUSE

The only component of the mouse which can be replaced is the ball.

The ball can be removed very easily for cleaning or replacement:

1. *Turn the mouse upside down and pull the plastic ring surrounding the ball in the direction shown by the arrow labelled "OPEN".*

2. *When the plastic ring clicks over to one side it can be removed. Turn the mouse back the right way up and the ball falls out.*

3.7 13" COLOUR MONITORS

3.7.1 Precautions

Make sure that power has been removed from the monitor before removing the case. Dangerously high voltages are present inside the monitor when it is switched on.

To prevent fire or the possibility of shock hazard, do not expose the monitor to rain or moisture. Should any liquid or solid object fall into the cabinet, unplug the monitor and check it thoroughly before switching it on again.

3.7.2 Removing the Mitsubishi monitor casing

1. *Remove the AC power input connector at the rear of the monitor case. Remove the D-type connector from the same rear panel.*

2. *Rest the monitor face down.*

2. *Unscrew the six crosshead screws which hold the rear case in place. Two are at the top, two on the rear panel, and two underneath, half way along the base.*

3. *The plastic casing can now be lifted away.*

3.7.3 Replacing the Mitsubishi monitor casing

1. *Replace the plastic case on the rear of the monitor.*

2. *Insert the six screws and tighten them gently.*

3.7.4 Removing the Sony monitor casing

1. *Remove the AC power input connector at the rear of the monitor case. Remove the 8-way DIN connector from the same rear panel.*

2. *Unscrew the four crosshead screws from the rear face of the monitor casing and the two screws from the swivel stand.*

3. *With the monitor resting face down, the plastic casing can now be lifted away.*

4. *The front part of the monitor case can be taken off by removing the four crosshead screws. Lift the monitor chassis to the right and remove the crosshead screw which holds the LED to the monitor case. The chassis is now free from the case.*

3.7.5 Replacing the Sony monitor casing

1. *Replace the front of the monitor case and screw the LED into position.*

2. *Replace the four crosshead screws which hold the front of the monitor case on to the chassis.*

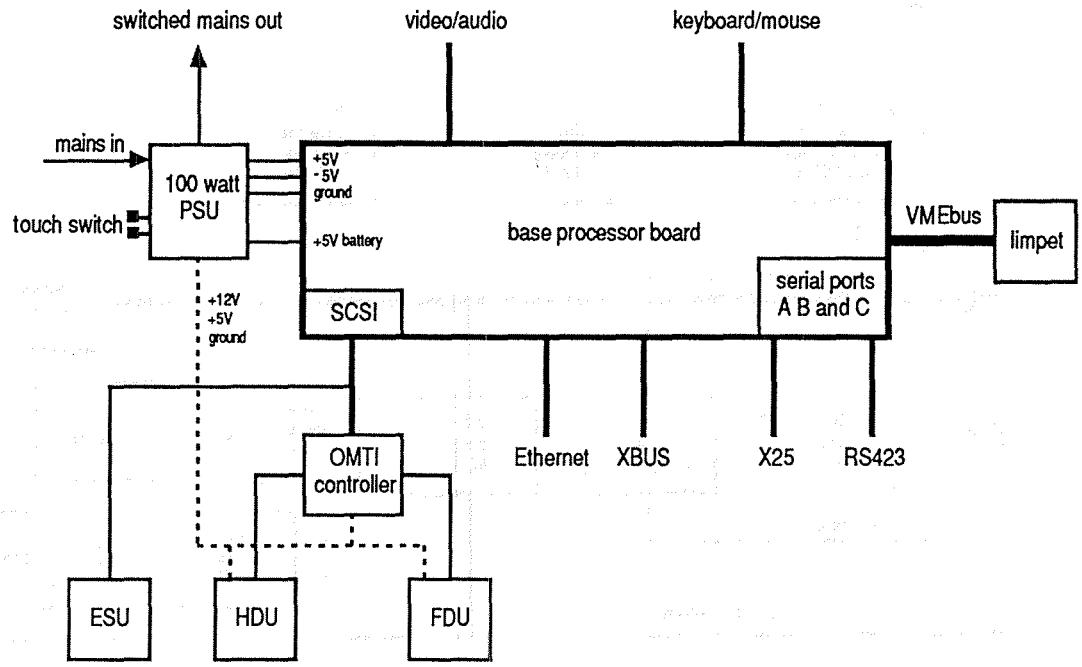
3. *Replace the case and the stand and fix them using the six screws. Tighten them gently.*

Chapter 4

Description of Triple X

CHAPTER 4: DESCRIPTION OF TRIPLE X

The following is a block diagram of the Triple X system.



BLOCK DIAGRAM OF TRIPLE X WITH LIMPET BOARD FITTED TO VMEbus

The base processor board is a 68010 processor board with 1 Mbyte of on-board RAM.

The limpet board shown on the right of the diagram provides another 1 Mbyte RAM via the VMEbus.

The OMTI board is a SCSI data controller which converts the serial data from the disc drives into 8-bit parallel data compatible with a standard SCSI bus.

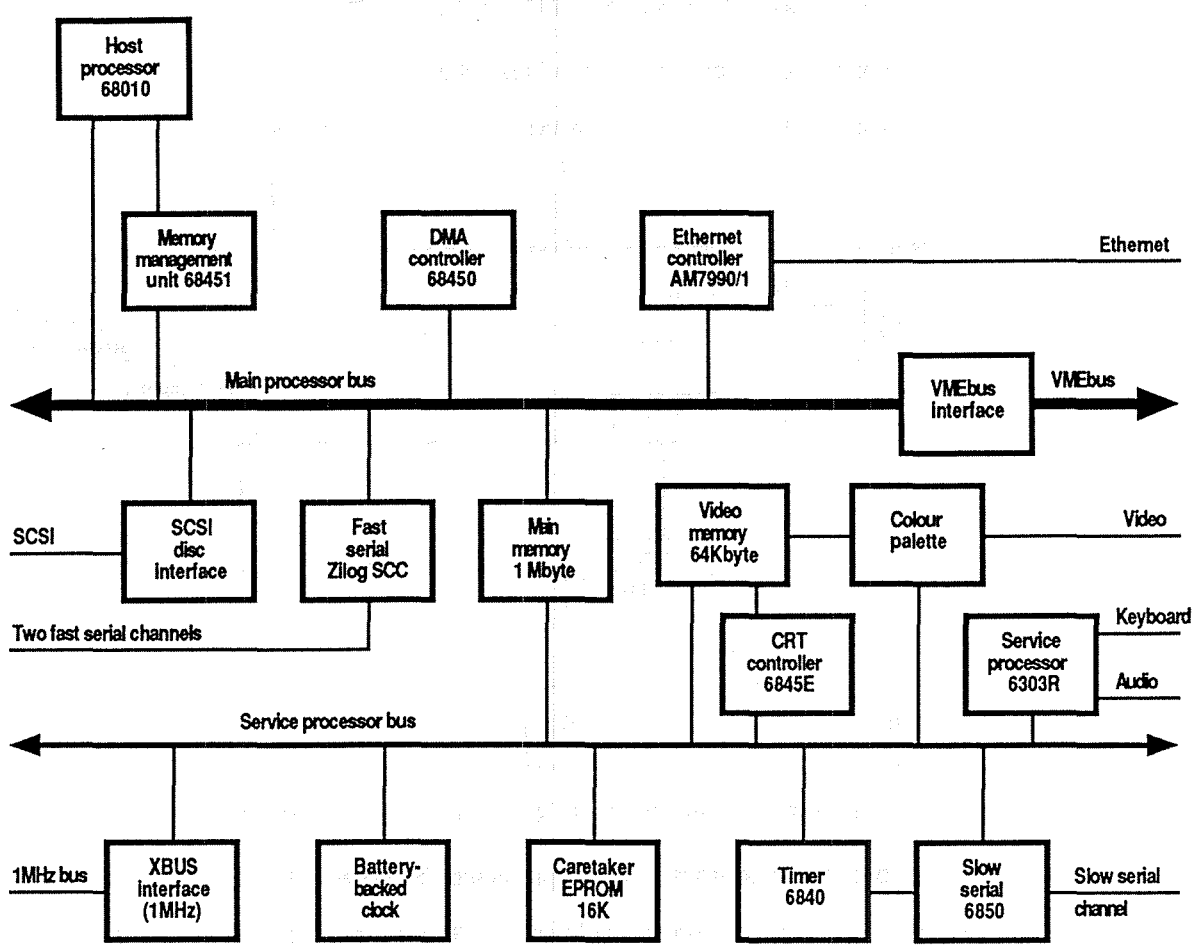
The expansion storage unit (ESU) is an optional extra which can contain another hard disc unit and/or a streaming tape for backups. It has its own power supply.

The base processor board provides a number of interfaces:

- Ethernet
- 3 serial ports
- SCSI
- video/audio
- keyboard/mouse
- 1MHz XBUS
- standard VMEbus

The 100W power supply unit supplies DC power to the base processor board, the floppy disc unit (FDU), the hard disc unit (HDU) and the OMTI board, and relays switched mains power to the monitor.

4.1 THE BASE PROCESSOR BOARD



BLOCK DIAGRAM OF BASE PROCESSOR BOARD

The base processor board is the large printed circuit board inside the Triple X case. It holds the following components:

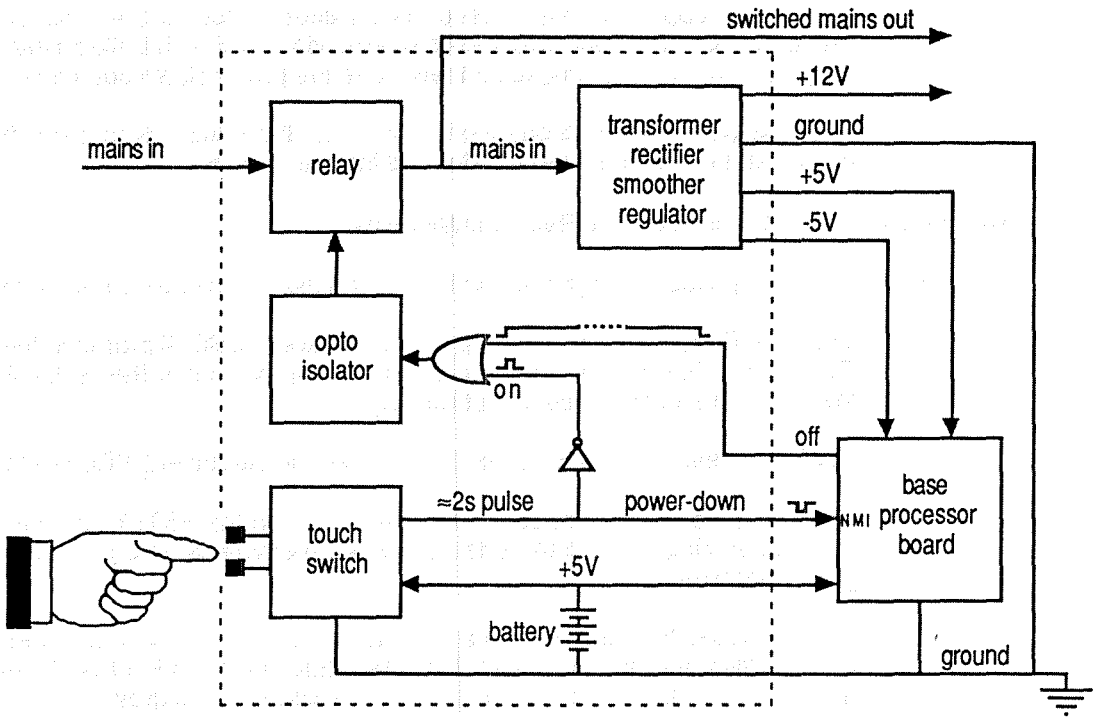
- 1 Mbyte main memory
- the 68010 main processor
- the 68451 memory management unit (MMU)
- the 68450 direct memory access controller (DMAC)
- the 6303R service processor, used to carry out tests and load the operating system on power-up, to control the peripherals (including keyboard/mouse and sound) after power-up, and to control power-down
- the video circuitry, including 64 Kbyte video memory
- the peripheral interfaces - SCSI, serial, Ethernet, XBUS, battery-backed clock, battery-backed RAM, VMEbus

4.2 THE POWER SUPPLY UNIT AND RECHARGEABLE BATTERY

The power supply unit is made up of the touch sensitive switch on the front of the Triple X case, the opto isolator which isolates the switch from dangerous mains voltages, the relay which switches the mains on and off, the transformer, the rectifier, and the smoothing circuitry.

The PSU provides +5V, -5V and +12V DC supplies transformed from the mains, and a +5V supply from the rechargeable nickel cadmium battery.

The diagram below shows the functions of the power supply unit inside the dotted box.



BLOCK DIAGRAM OF THE POWER SUPPLY UNIT

4.2.1 Functional description

When the Triple X is off, the rechargeable battery shown in the diagram provides the power for the battery-backed clock and RAM on the base processor board, and also provides the power for the touch switch and opto isolator in the power supply unit.

The touch sensitive on-off switch has two functions:

- It drives the **power-down** line low for around 2 seconds every time it is pressed. This interrupts the Triple X 6303R processor, which starts the power-down software.
- It powers the opto isolator which switches the mains relay.

When the Triple X is off and the touch switch is pressed, the following happens:

- A pulse of approximately 2 seconds duration turns on the opto isolator, via the line labelled **on** in in the diagram.
- The opto isolator switches on the relay which passes the mains voltage to the transformer.
- Power is supplied to the computer.

- One of the I/O pins of the service processor on the base processor board is connected to the opto isolator via the line labelled **off** in the diagram. This line is driven high by the service processor on power-up so that the opto isolator (and hence the power supply) remains on after the 2 second pulse has finished. If for any reason the **off** line is not driven high then the power supply shuts down at the end of the 2 second pulse.

- The Triple X starts the power-up sequence, doing a self-test and loading the operating system.

When the Triple X is on and the touch switch is pressed, the following happens:

- A pulse of approximately 2 seconds duration is fed to the NMI pin of the service processor on the base processor board, via the line labelled **power-down** in the diagram. The service processor then starts the power-down sequence.

- After the power-down sequence is complete, the 6303R processor drives the **off** line low which turns off the opto isolator and the mains relay.

4.2.2 The sequence of events after power-up

After power is applied to the processor board the following sequence of events takes place:

1. The 6303R processor executes a program (called SIMON) stored in the EPROM (called Caretaker). During this time, the 6303R processor holds the HALT line of the 68010 low, so the main processor is not running.

2. SIMON copies a program (called ERMA) from the caretaker EPROM into video memory.

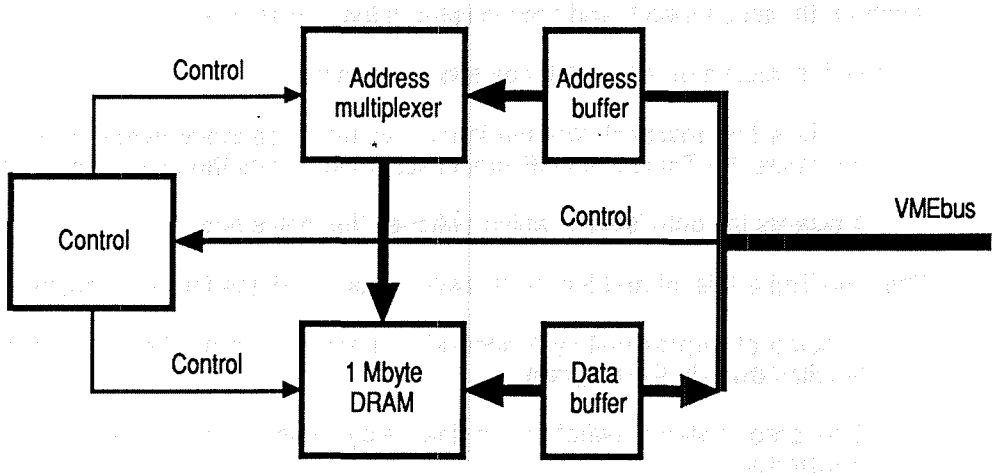
3. The service processor releases the HALT line on the 68010, and the main processor starts executing the ERMA code from video memory. At this point, the Triple X screen goes dark blue.

4. ERMA causes the 68010 to do a RAM test and then to load a program called WERMA from partition 0 of the hard disc. If this fails then it tries to load WERMA from the floppy disc (the Key Disc). At this point, the Triple X screen goes grey.

5. The 68010 executes WERMA which boots the operating system from partition 1 of the hard disc.

4.3 THE VMEbus, THE LIMPET BOARD AND THE VME "RINGS"

The VMEbus allows the Triple X to be expanded.



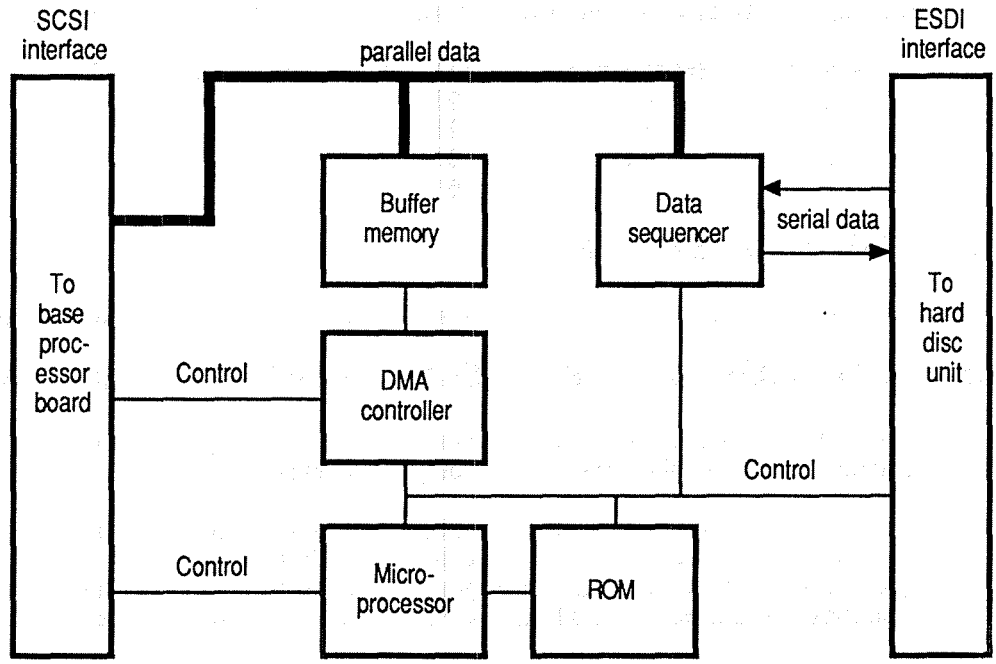
BLOCK DIAGRAM OF LIMPET BOARD

The limpet board provides the Triple X with an extra 1 Mbyte of memory via the VMEbus, and is designed so that it fits in the standard Triple X base. The limpet board is not a standard VME board and cannot be plugged into any VME system other than the Triple X.

If you wish to use standard VME boards with the Triple X, one of the Triple X VME "rings" must be fitted. These rings make the Triple X unit taller, and provide a "VME cage" into which standard VME boards can be plugged. The "slim ring" provides space for 1 VME board in its cage, while the "quin ring" has space for 4 VME boards.

4.4 THE SCSI BUS, THE HARD DISC UNIT (HDU), THE FLOPPY DISC UNIT (FDU), AND THE OMTI BOARD

The SCSI bus is used to transfer data between the Triple X and its two internal disc drives - the hard disc drive and the floppy disc drive. It can also be used to connect the "expansion storage unit" (ESU) which is housed in a separate box containing a streaming tape unit and/or a hard disc unit used for backups.



BLOCK DIAGRAM OF OMTI BOARD

The hard disc unit and the floppy disc unit cannot communicate directly with the SCSI bus - they have to have a controller board to encode the signals correctly. On a standard Triple X the SCSI controller board fitted is manufactured by "OMTI", and is known as the "OMTI board" throughout this manual. The OMTI board controls both the hard disc unit and the floppy disc unit.

The 80 Mbyte hard disc unit fitted as an option to some Triple Xs contains its own SCSI controller, so the OMTI board is not fitted. In this case, the floppy disc unit has to have its own SCSI controller fitted which is called the "MANTA board".

4.5 THE SERIAL PORTS

The Triple X has three serial ports. Two are provided by the SCC chip (serial communications controller) and the other is provided by the 6850 ACIA chip (asynchronous communications interface adapter). These three ports are called A, B and C.

Port A has its own connector on the back of the Triple X labelled "X25". This is because it is usually used for X25 data transmission, but it can be used for anything else if required.

Ports B and C share one connector labelled RS423. Port C has a standard connection pattern but port B does not. An adapter is available from Torch which plugs into the RS423 connector and provides to standard connections to serial ports B and C.

Serial port C is usually used for a printer, and port B can be used for anything else.

4.6 THE ETHERNET PORT

The Ethernet port provides access to a standard local area network, in which several machines can communicate with each other, and facilities such as storage and printers can be shared.

4.7 THE XBUS

The XBUS is an 8-bit parallel synchronous bus which runs at 1MHz.

4.8 VIDEO/AUDIO OUTPUT AND THE MONITOR

The Triple X can drive a high resolution colour monitor, and the screen modes are as follows:

Mode	Horizontal	Vertical	Bits/pixel	Colours
0	640	256	2	4
1	320	256	4	16
2	640	512	1	2
3	320	512	2	4

4.9 KEYBOARD/MOUSE INPUT

The keyboard and mouse provide a serial data stream to the Triple X service processor.

4.10 THE REAL TIME CLOCK AND BATTERY-BACKED RAM

The HD146818 clock/calendar IC contains 14 bytes of registers and 50 bytes of RAM. The registers contain the time, date and a 100 year calendar.

The IC is addressed from 0300 to 033f hex. The first ten bytes contain the clock information: the year, month, day of the week, day of the month, hour, minute and second. The next four bytes (030A to 030D hex) are control registers which should be set in the factory and left unchanged. The area from 030E to 033F is available as general purpose non-volatile RAM.

The contents of all registers and RAM are maintained by the 5V battery supply from the PSU.

Chapter 5

Fault Finding

CHAPTER 5: FAULT FINDING

5.1 LOCATING THE FAULT

Test software is available which tests the memory and the peripheral ports. A member of Torch's service department will explain how to use the test software when it is installed.

This chapter contains flowcharts, each of which gives a series of steps for curing a specific fault. Each flowchart states briefly the work that must be done, and the tests that must be carried out to check where the fault lies.

Chapter 3: Disassembly and reassembly - shows how to remove and install the component parts of the Triple X.

Faults on the Torch Triple X system are usually of three types:

- Problems in powering up the Triple X (section 5.2)

  The machine may have no power at all, or it may show faults during power-up.

  If the machine has power (the cooling fan is turning) the onboard test firmware can detect faults on the main processor board. These faults are indicated by a series of audible "beeps".

- Error messages displayed in the text window during the start up sequence (sections 5.3, 5.4 and 5.5)

  Error messages displayed on the Triple X screen are shown in the flowcharts printed between these symbols « ». Follow the flowchart which starts with the error message shown on the screen.

- SCSI codes (section 5.6)

  These codes are listed in a table together with a short description of their likely cause.

Note: Unusual types of error may not be reported by the test firmware. This could be because the tests fail too badly or because the fault does not affect the test routines.

5.2 PROBLEMS ON POWER UP

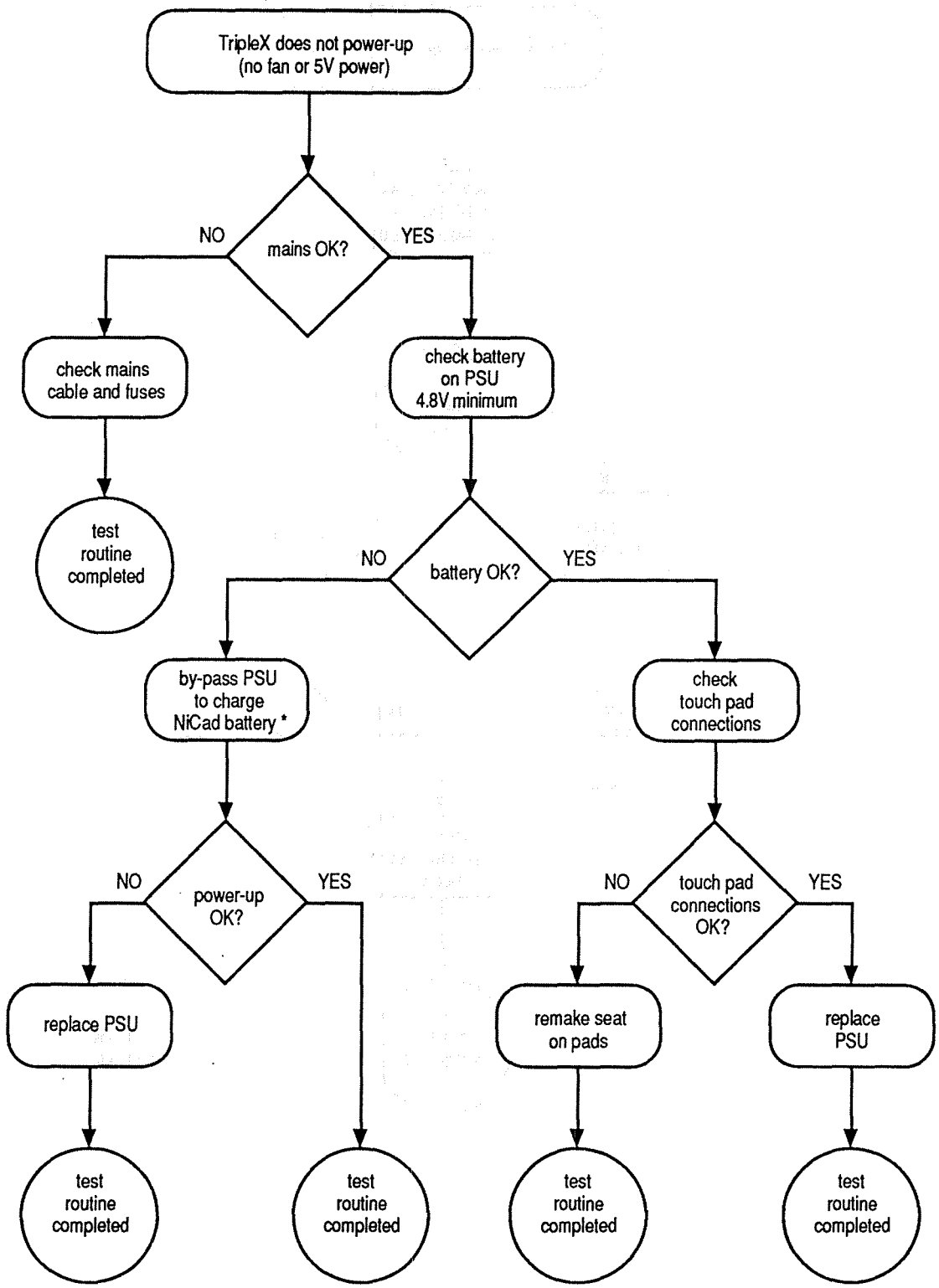
5.2.1 On/off touch switch

The On/Off switch at the front of the Triple X system unit is touch sensitive - it works by sensing the conductivity of the fingertip between the two rubber bars.

If the operator has unusually dry skin, or is working in a very dry atmosphere, there may be inadequate conductivity when lightly touching the switch. Moisten the fingertip before switching the Triple X on or off. There is no danger of electric shock because the switch is isolated.

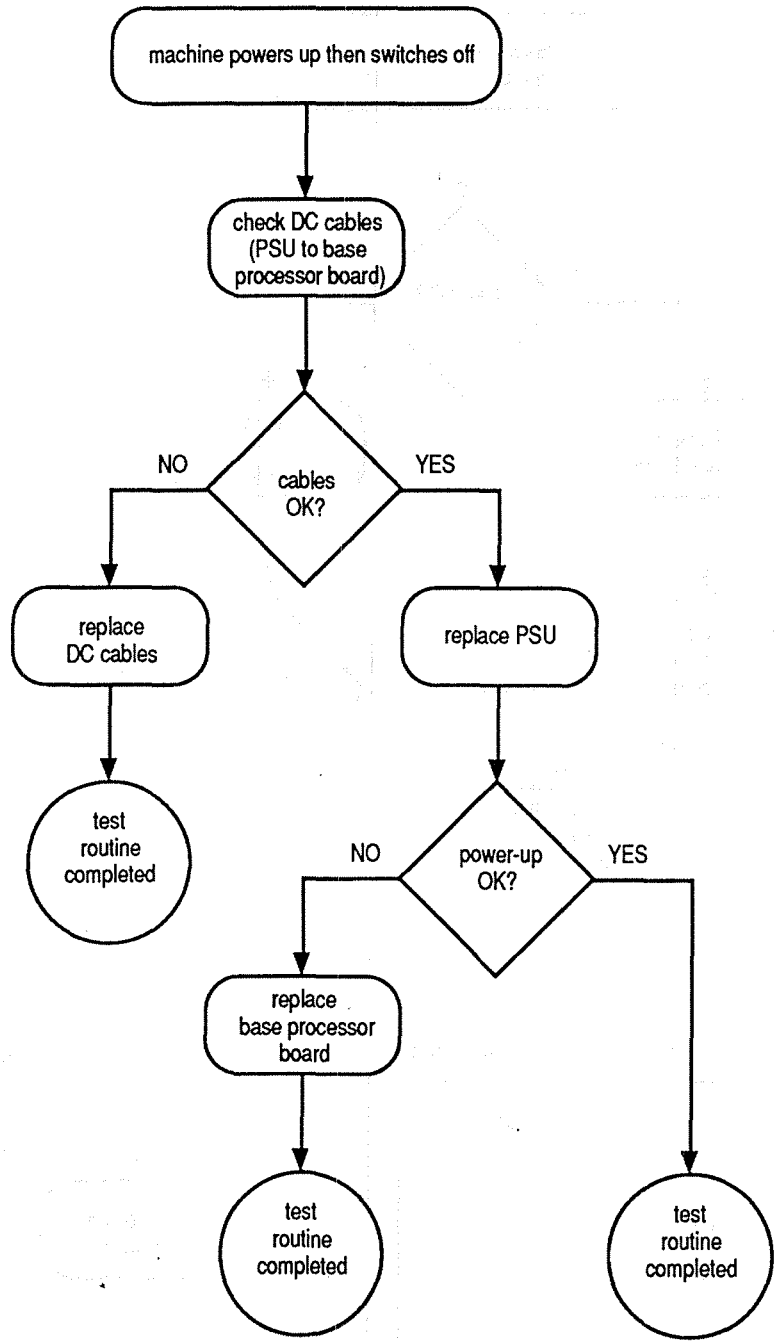
A flowchart is given on the following page to investigate the case of a Triple X which fails to power up even after the touch switch is turned on correctly.

5.2.2 Dead/no power-up

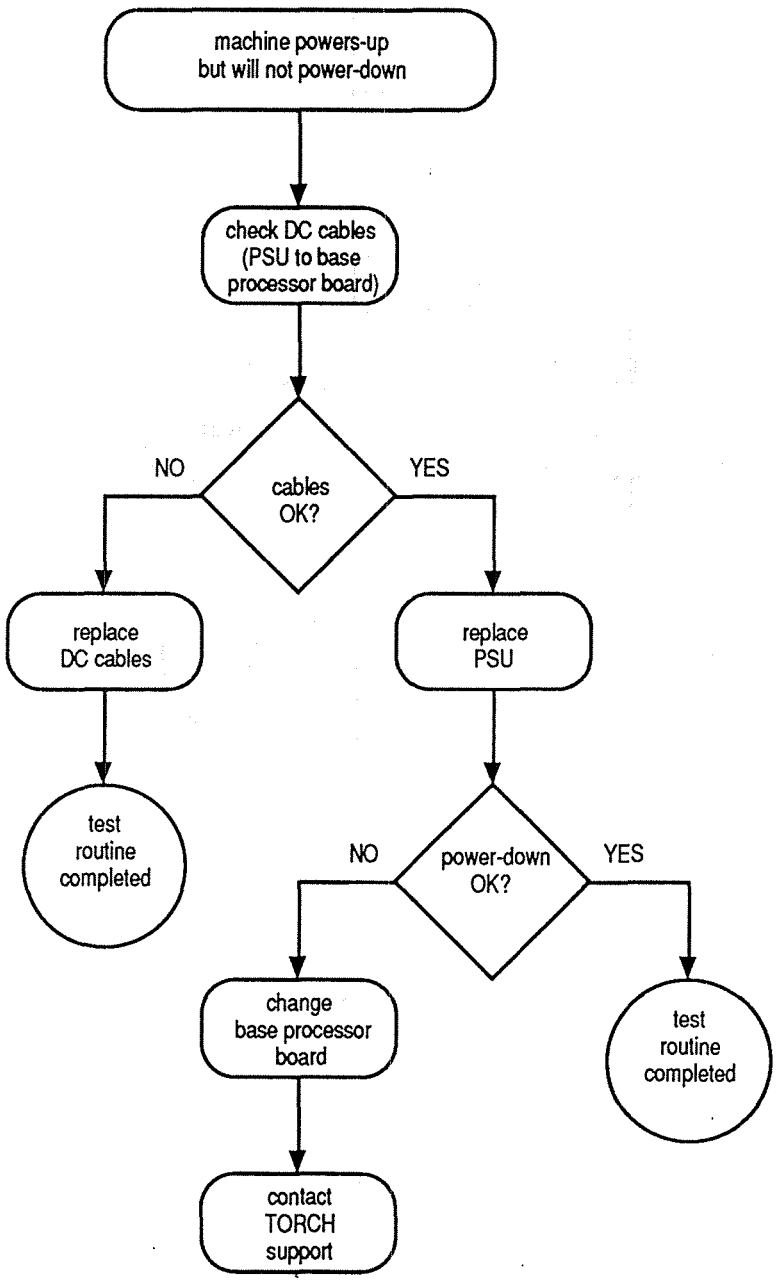


* For details of how to by-pass the PSU to charge the NiCad battery, refer to Technical Information Notice number 6 (TIN no 6) available from Torch Service Department.

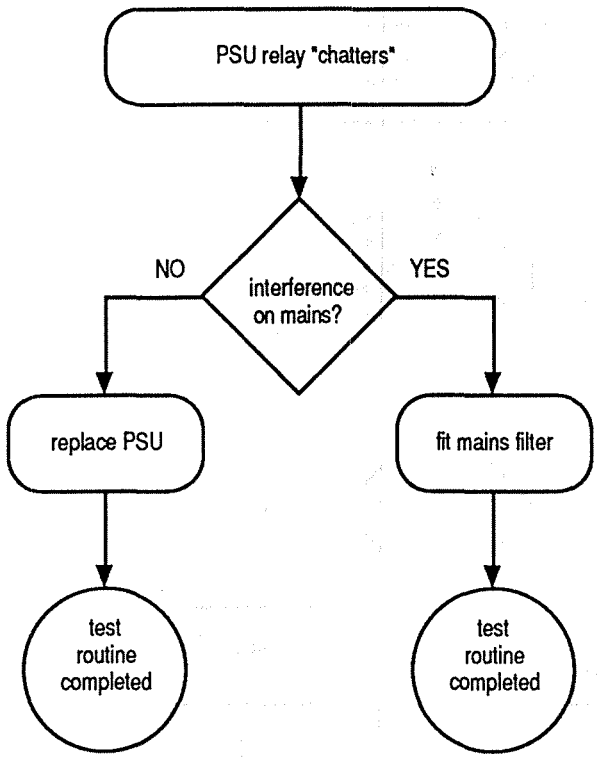
5.2.3 Machine powers-up then switches off



5.2.4 Machine powers-up but will not power-down



5.2.5 PSU relay "chatters"



5.2.6 Error beeps

To indicate a fault on the main processor board, the service processor emits four beeps. Each beep is either short or long, so the four beeps provide 16 different error codes, although only Ø to 8 are defined. These beeps are repeated, after a pause, until the computer is switched off.

A long beep represents a binary 1, a short beep a binary zero, so a sequence of four short beeps is error number Ø and a sequence of one short beep and three long beeps is error number 7.

The error numbers and their beep sequences are given below, together with a summary of the likely problem and a suggested cure.

Error Ø - EPROM Checksum Error

beep sequence: short short short short

Diagnosis: the Caretaker EPROM has become corrupt.

Action: ensure that the EPROM is seated firmly.

Error 1 - Video Controller Inoperative

beep sequence: short short short long

Diagnosis: the video controller (which provides the screen display) is not working correctly.

Action: replace the base processor board.

Error 2 - real time clock inoperative

beep sequence: short short long short

Diagnosis: the real time clock has stopped.

Action: replace the base processor board.

Error 3 - Service processor RAM Test Error

beep sequence: short short long long

Diagnosis: data stored in the service processor's internal memory is corrupt.

Action: replace the board.

Error 4 - VIDEO RAM Test Error

beep sequence: short long short short

Diagnosis: data stored in the video display memory is corrupt.

Action: replace the board.

Error 5 - Timer inoperative

beep sequence: short long short long

Diagnosis: the timer on the service processor serial port is not working.

Action: replace the board.

Error 6 - Bootstrap Download Error

beep sequence: short long long short

Diagnosis: the code copied into video memory and needed to start the main processor is not the same as the original. As a result, the processor is unlikely to start up correctly. The most probable cause is that the video memory has failed.

Action: replace the board.

Error 7 - Main Processor Timed Out

beep sequence: short long long long

Diagnosis: the service processor cannot pass control to the main processor.

Action: ensure that the main processor chip is seated firmly.

Error 8 - Main RAM test error

beep sequence: long short short short

Diagnosis: there is a fault in the Triple X main memory or limpet memory.

Action: first check that the limpet board and the VME cable are securely in place. If the problem persists, disconnect the VME-BUS and check the main processor board on its own to determine whether it or the VME system is at fault.

FAIL Line Active

beep sequence: continuous tone

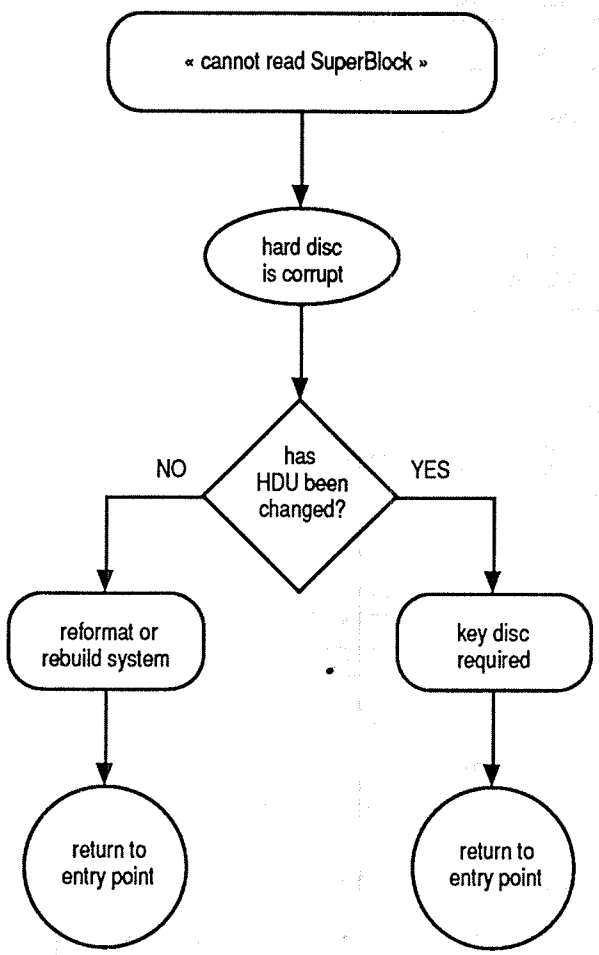
Diagnosis: a board connected to the VME expansion bus has failed.

Action: replace the board.

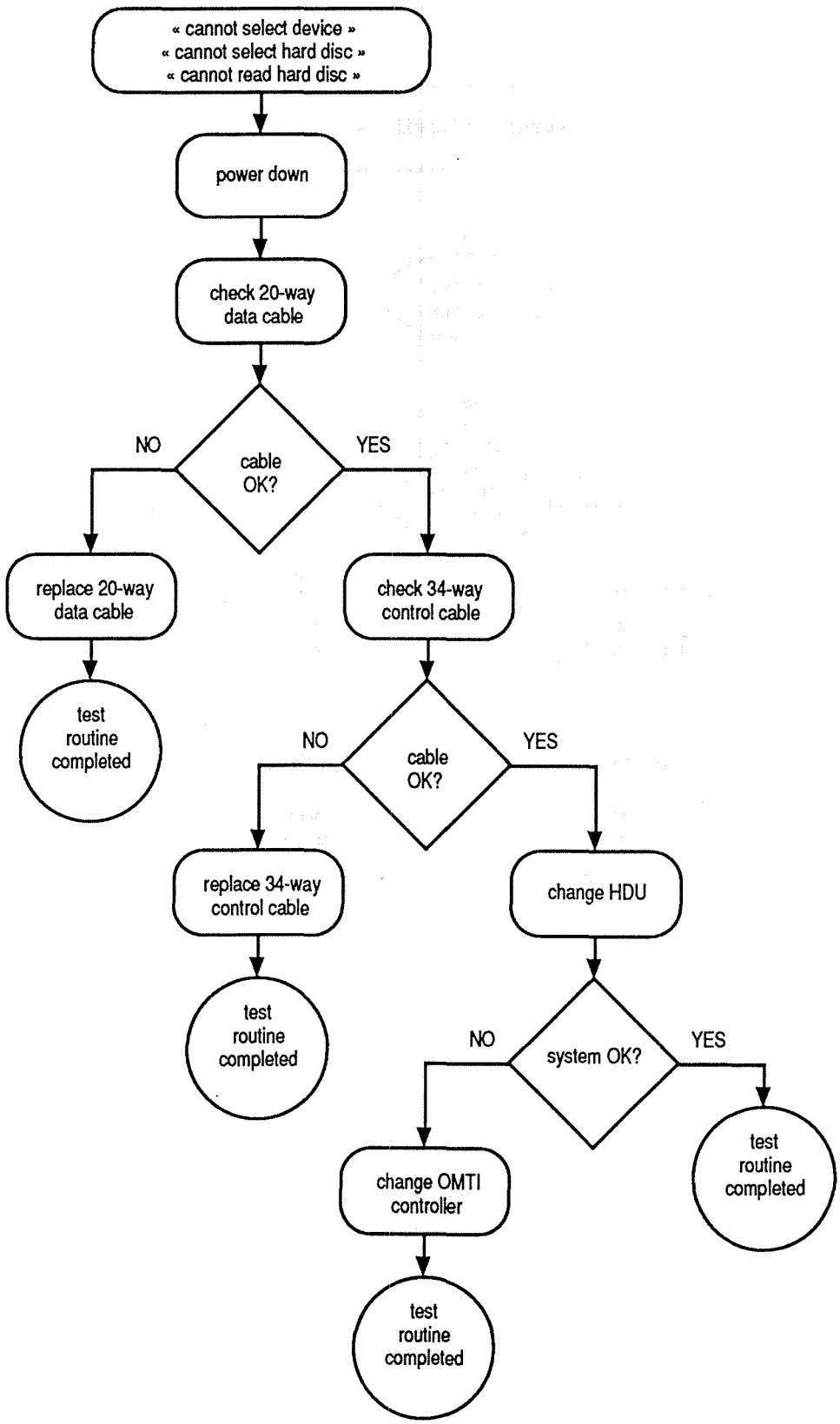
Note: a continuous tone occurring any time after the operating system has started to load means that the main processor has stopped working. Sequences of error beeps different from those listed above may be heard. These indicate that the main processor cannot continue processing.

5.3 PROBLEMS NOTIFIED BY THE CARETAKER EPROM

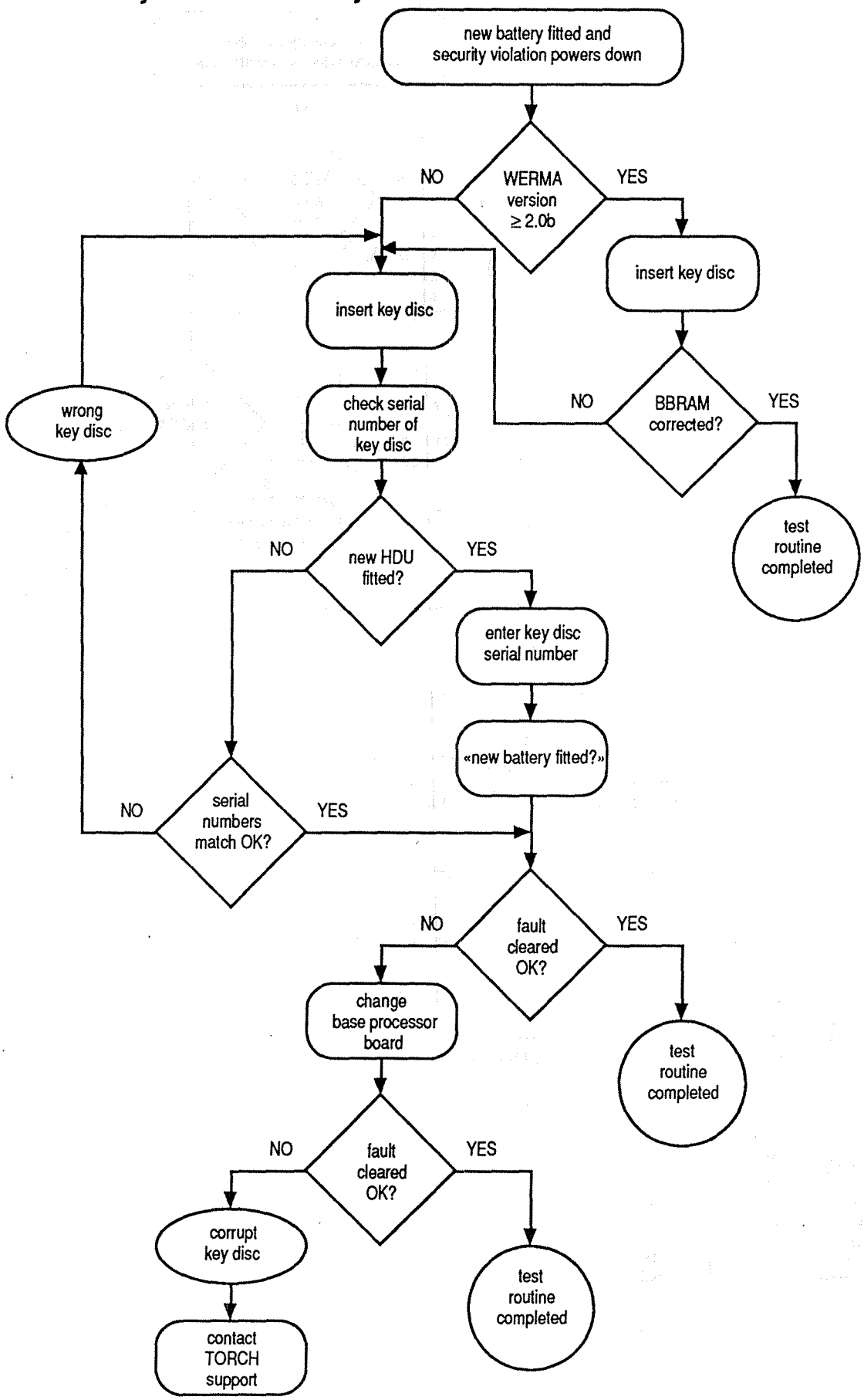
5.3.1 Cannot read superblock



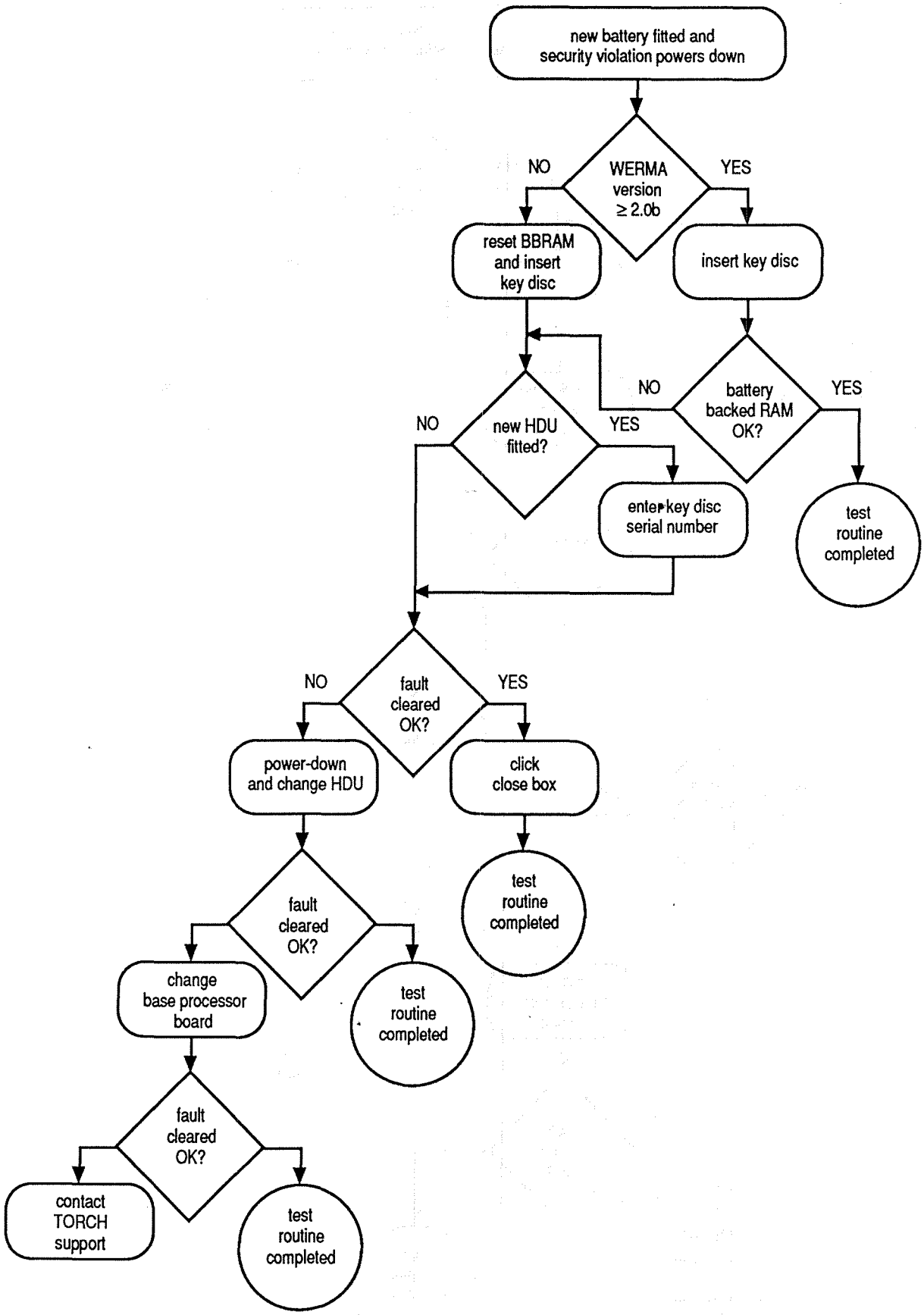
5.3.2 Cannot select device, cannot select/read hard disc



5.3.3 New battery fitted / security violated



5.3.4 Security has been violated



Resetting battery backed RAM (BBRAM):

1. *Follow the instructions for "removing the lid of the Triple X" in section 3.2.1 of this manual.*

2. There are three DC connectors on the PSU: SK2, SK3 and SK4.

   SK2 supplies DC power to the processor board and BBRAM
   SK3 supplies DC power to the Slim Ring
   SK4 supplies DC power to the disc drives and OMTI card

3. *Remove the cable from SK2 by pinching the clips on top of the plug and pulling upwards.*

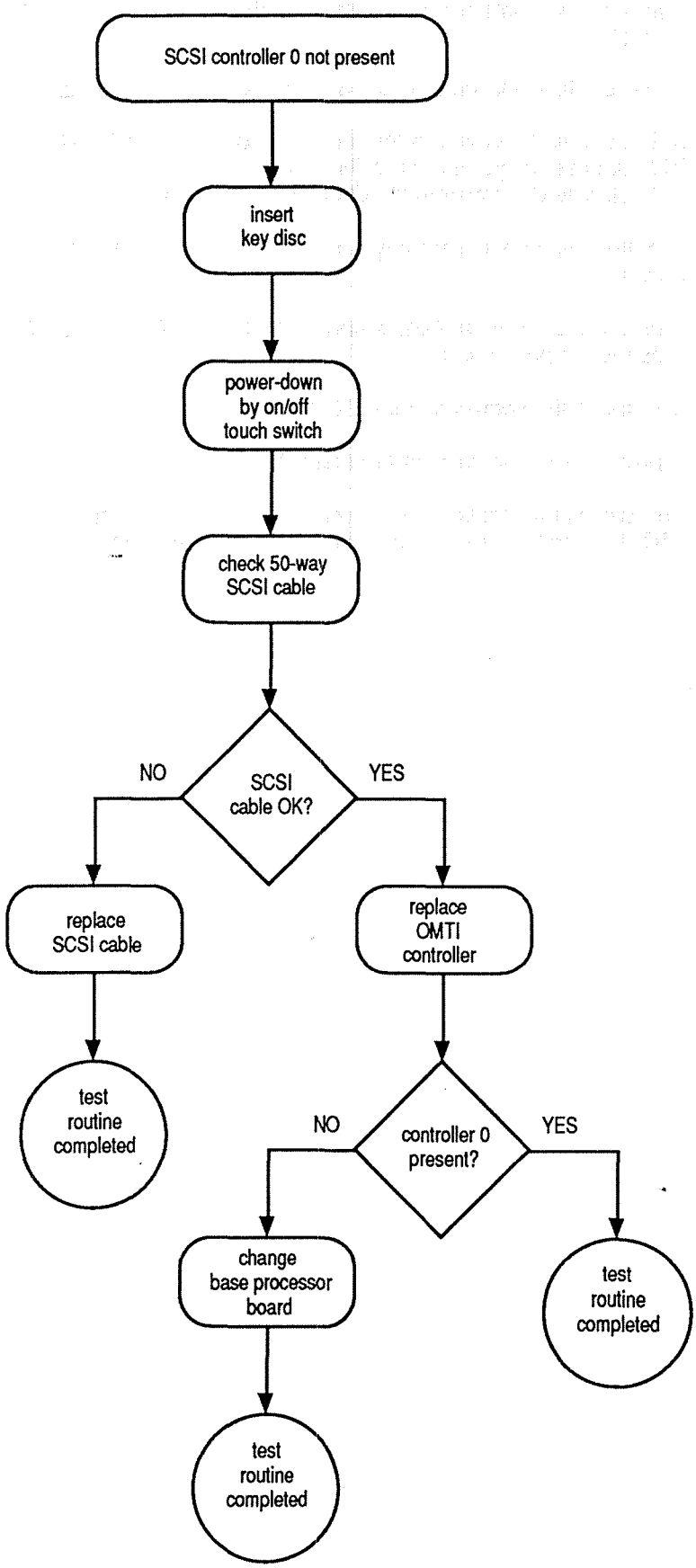
4. *Short out the white and black connectors of the flying cable to the printed circuit board (these are to pins 4 and 6).*

   This resets the contents of the BBRAM to zero.

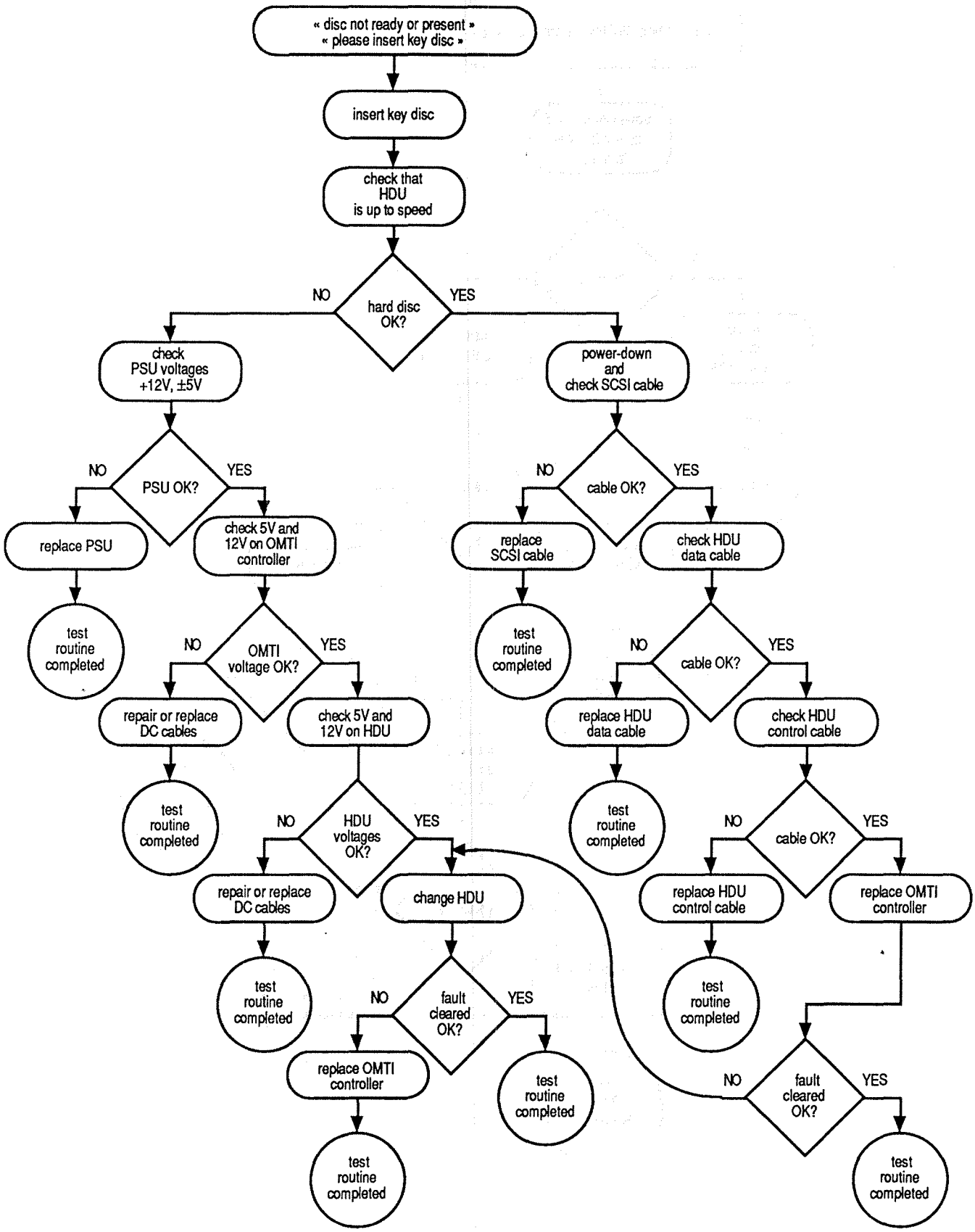
5. *Replace the connectors and reassemble the unit.*

6. *The machine prompts for the key disc on power up. You need to replace permissions in BBRAM. Permissions may include 'MUP' multi-user permissions, X.25 and BNET.*

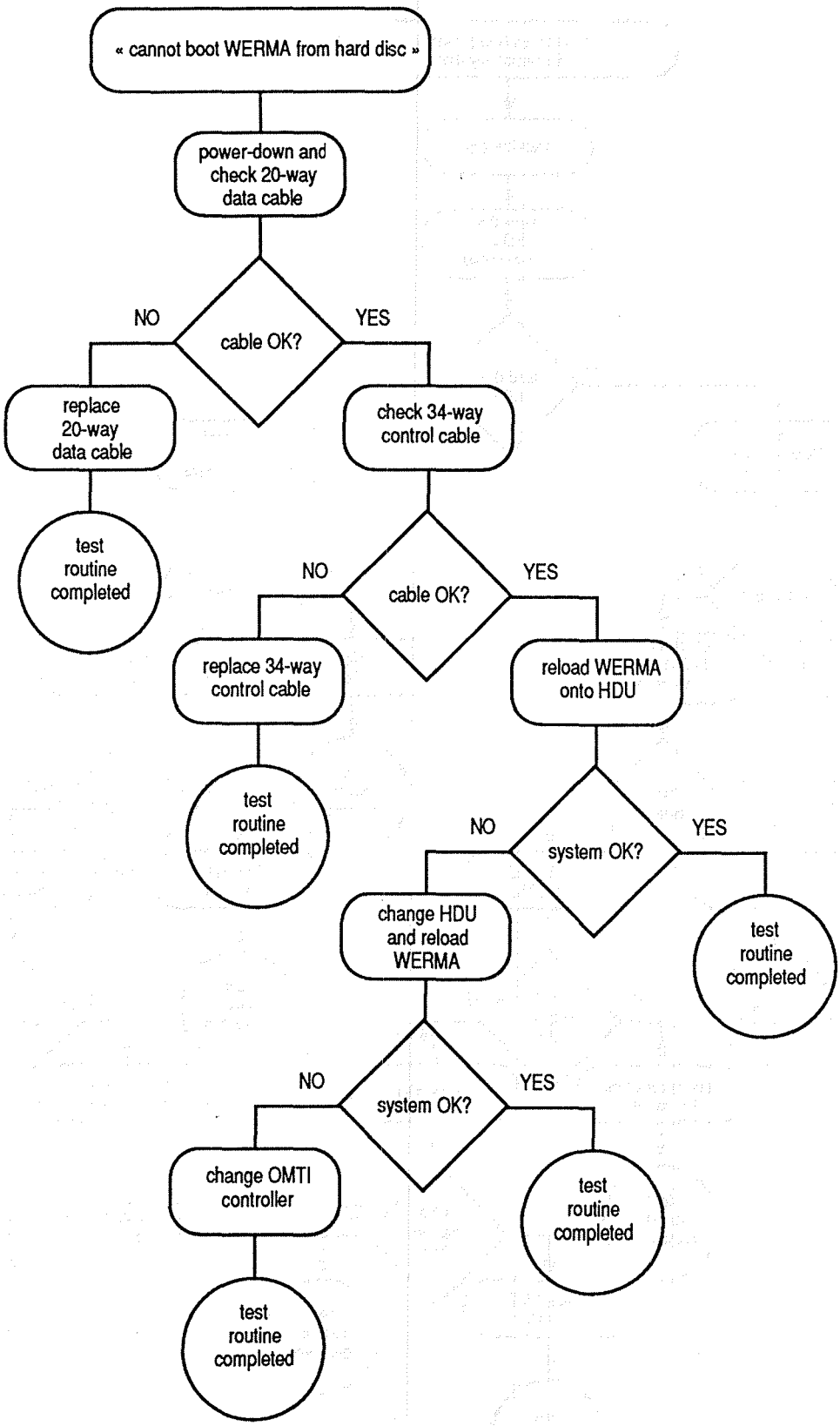
5.3.5 SCSI controller Ø not present



5.3.6 Disc not ready or present



5.3.7 Cannot boot WERMA from hard disc



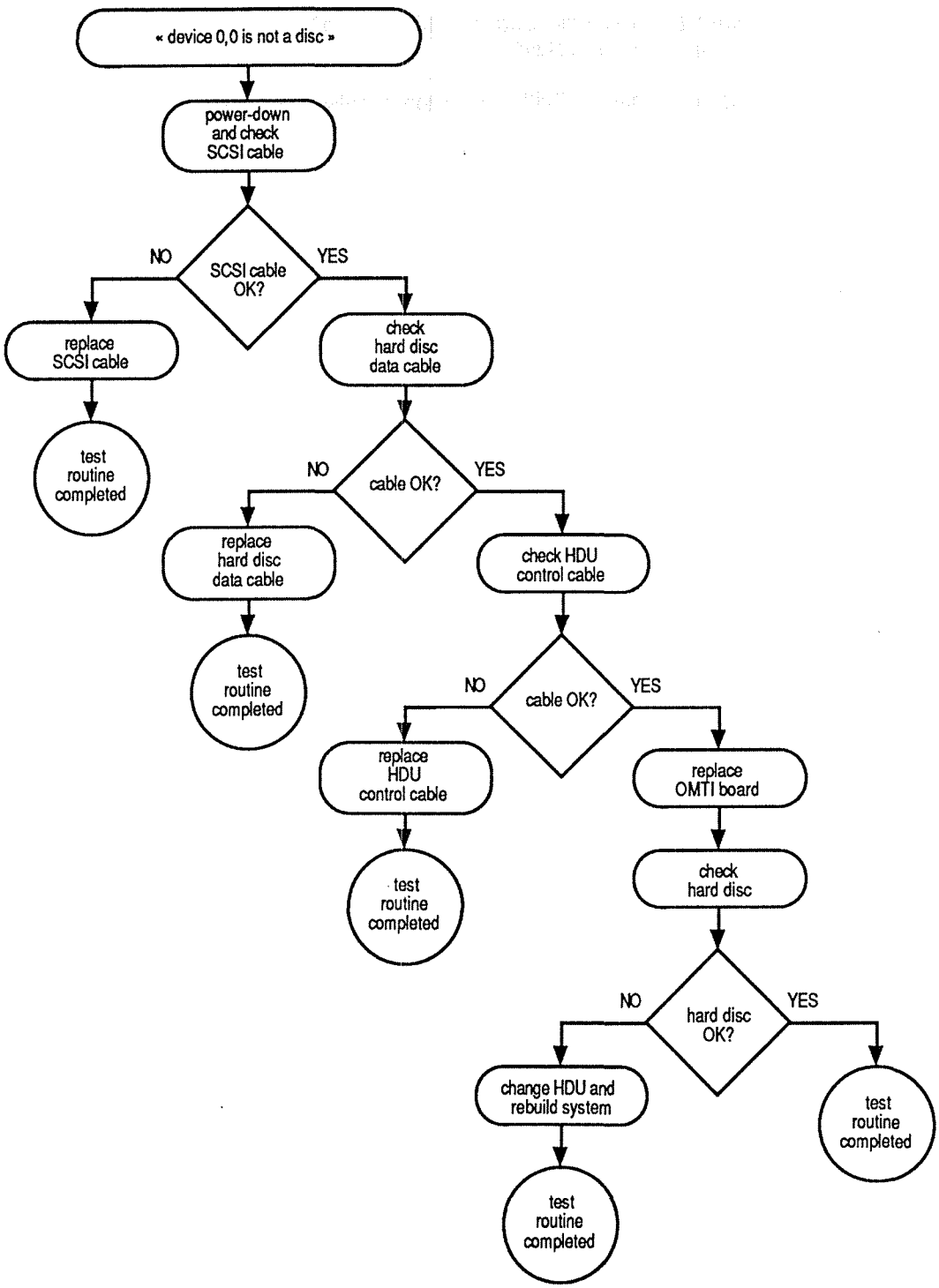
Reloading WERMA on to the hard disc:

With the above error message, a prompt to insert the key disc is issued.

1. *Insert the key disc and select the Toolkit icon. From the the Option Menu, select "Reload the Caretaker".*

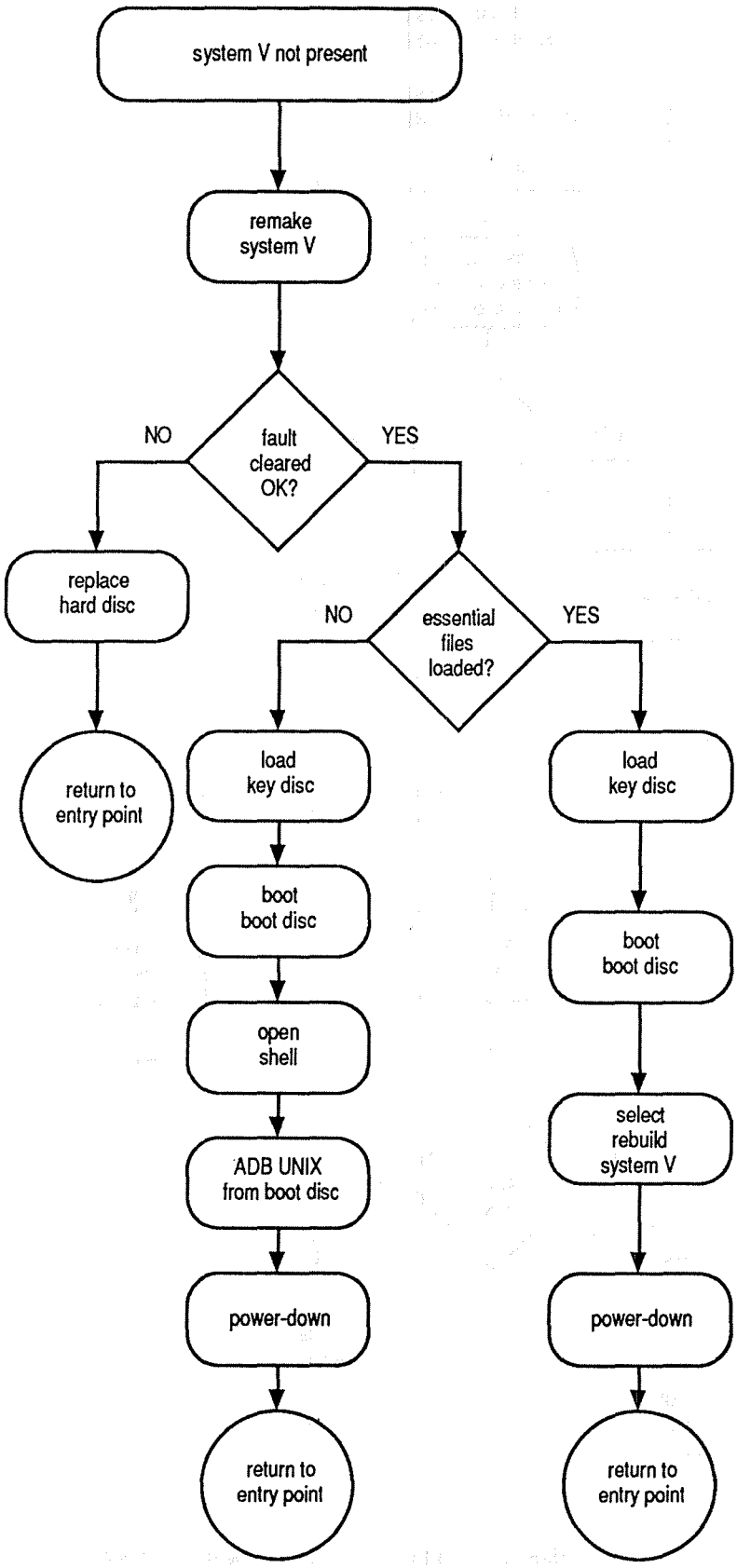
2. *When complete, 'Exit'.* This automatically reboots the system.

5.3.8 Device Ø,Ø is not a disc



5.4 PROBLEMS NOTIFIED BY THE CARETAKER DISC FILE

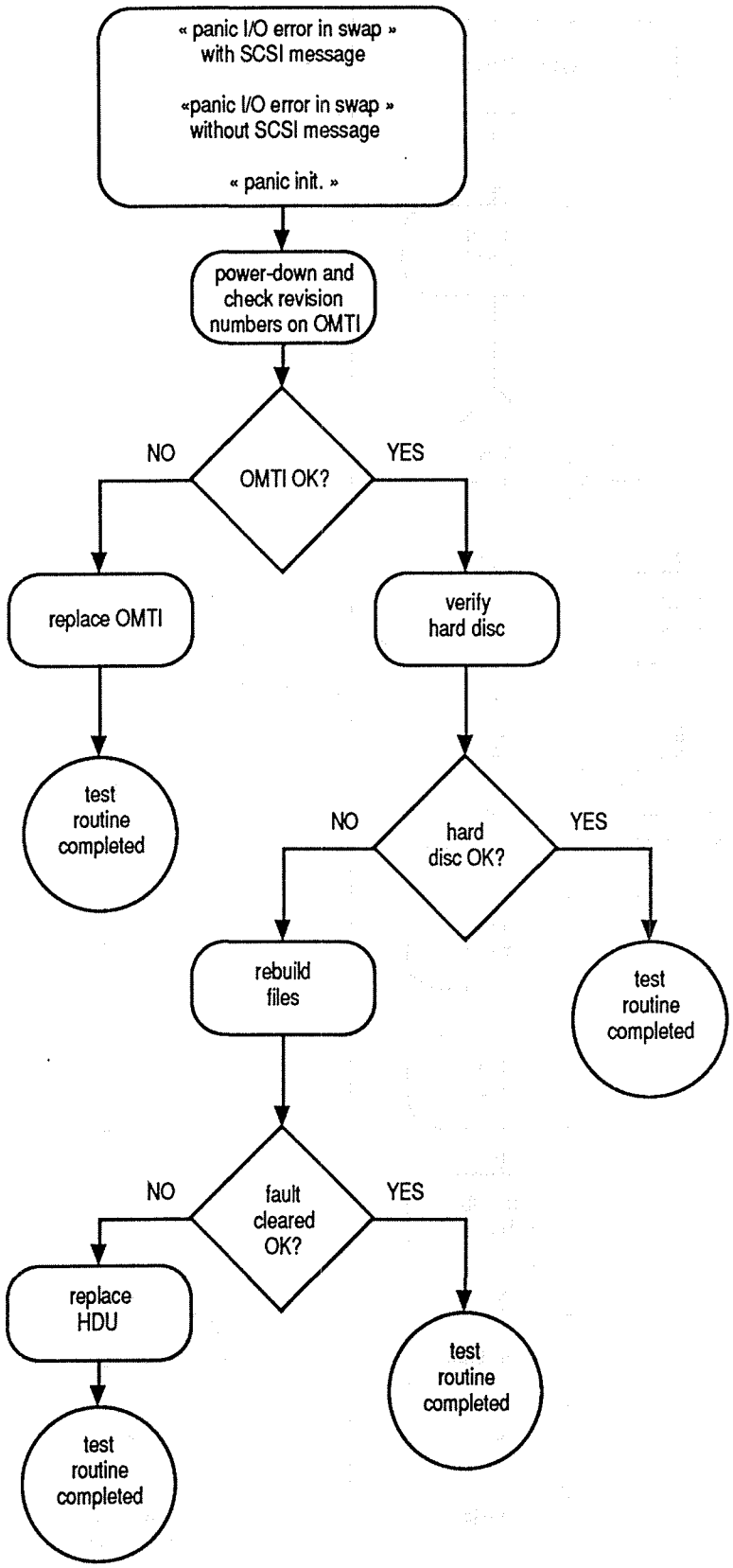
5.4.1 System V not present



A description of how to "remake System V" is given in the Caretaker guide.

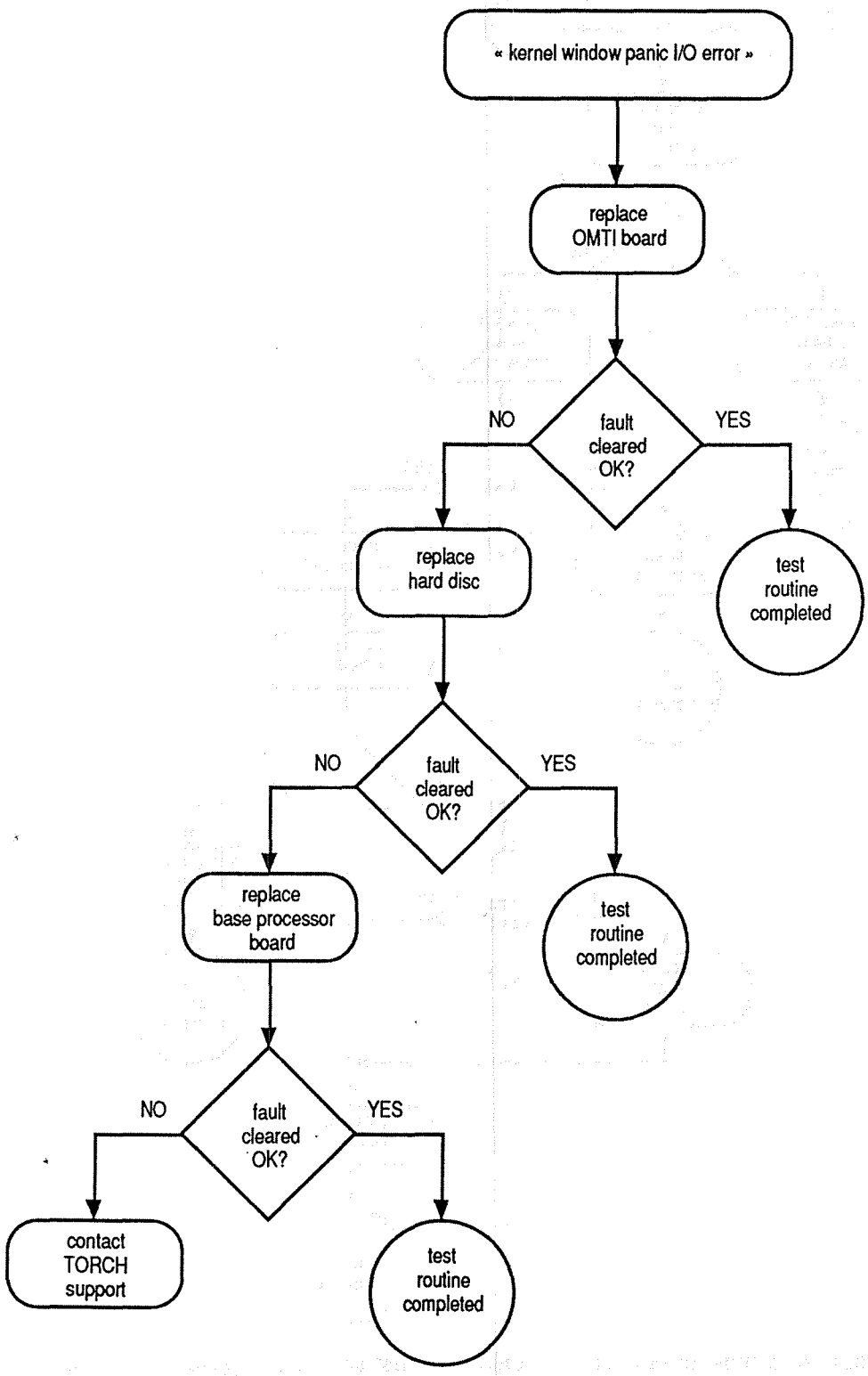
5.5 PROBLEMS NOTIFIED BY THE OPERATING SYSTEM

5.5.1 Panic I/O error

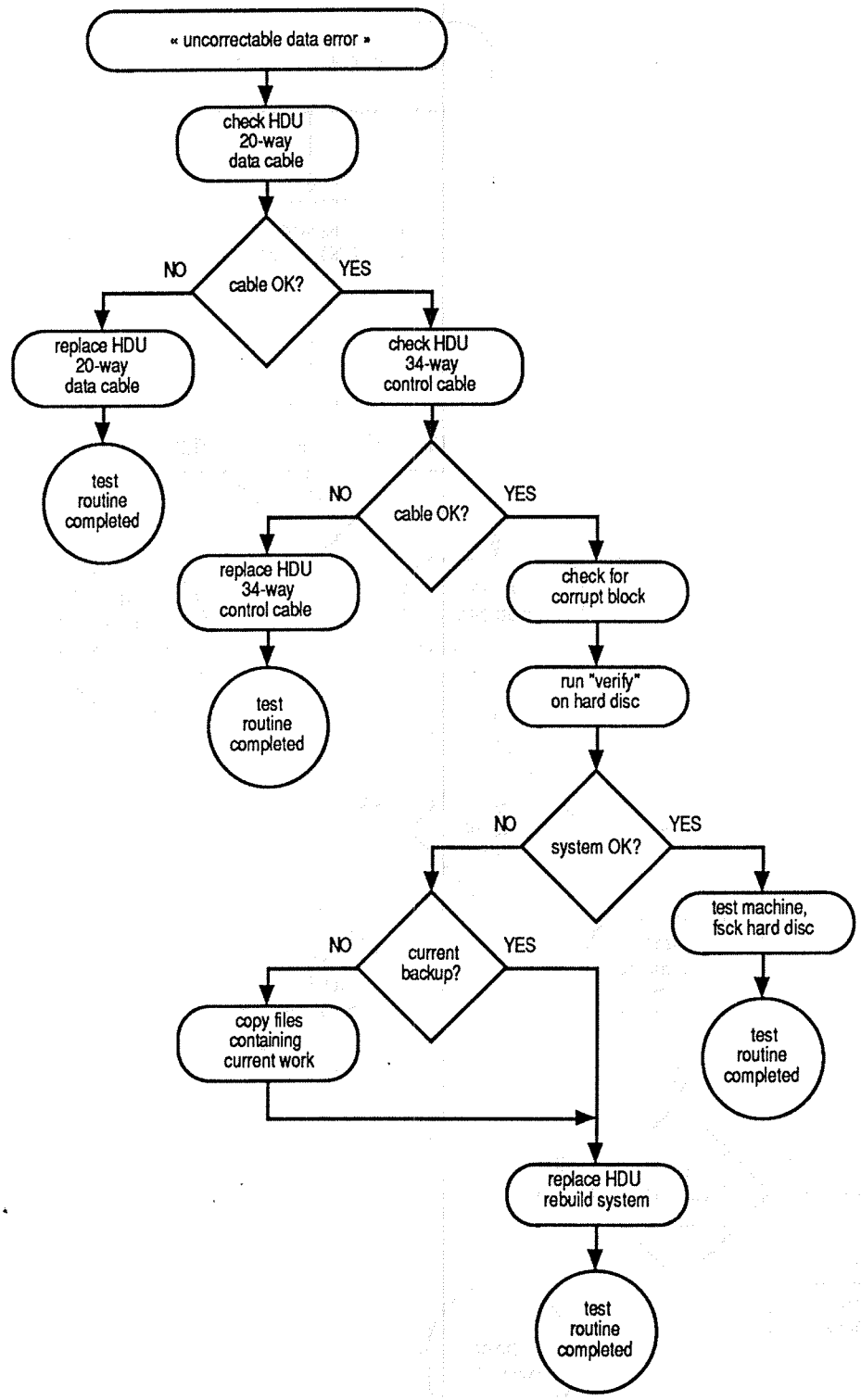


The hard disc may be verified by running the test software supplied on the disc debugging tools disc.

5.5.2 Kernel window panic I/O error



5.5.3 Uncorrectable data error



The hard disc may be verified by running the test software supplied on the disc debugging tools disc.

5.6 SCSI ERROR MESSAGES

Error	Meaning
	DRIVE ERRORS
000	No error
010	No index signal
020	No seek complete
030	Write fault
040	Drive not ready
050	Drive not selected
060	No track zero found
070	Multiple tracks selected
090	Cartridge changed
0A0	Tape exception (OMTI)
0D0	Seek in progress
	MEDIA ERRORS
100	CRC error in ID field
110	Uncorrectable data error
120	No address mark in ID field
130	No address in data field
140	No record found
150	Seek error
170	Write protected
180	Correctable data error (using error correction code)
190	Bad track flag set (OMTI)
190	ECC error during verify (Adaptec)
1A0	Incorrect interleave value
1C0	Unable to read alternate track data (OMTI)
1D0	Self test failed (Adaptec)
1E0	Illegal direct access to alternate track (OMTI)
1E0	Defective track (media errors) (adaptec)
1F0	Tape drive failure (OMTI)
	SOFTWARE ERRORS
200	Invalid command
210	Invalid command parameter/illegal sector address
220	Illegal function for drive type
230	Volume overflow
240	Bad argument
250	Invalid logical unit number in command
300	Power up diagnostic error (OMTI)
310	Floppy disc controller error (OMTI)
	OTHER ERRORS
700	No error
701	Recovered error
702	Device not ready
703	Media error
704	Hardware error
705	Illegal request
706	Unit attention (media change)
707	Write protected media
708	Volume overflow during a read or diagnostic unique
70A	Power up failed
70B	Aborted command
70D	Volume overflow during a write
9A0	Incorrect interleave factor

5.7 EXCEPTION VECTOR ASSIGNMENTS

Vector Number(s)	Address Hex	Assignment
0	000	Reset: Initial SSP
1	004	Reset: Initial PC
2	008	Bus Error
3	00C	Address Error
4	010	Illegal Instruction
5	014	Zero Divide
6	018	CHK Instruction
7	01C	TRAPV Instruction
8	020	Privilege Violation
9	024	Trace
10	028	Line 1010 Emulator
11	02C	Line 1111 Emulator
12	030	(Unassigned, Reserved)
13	034	(Unassigned, Reserved)
14	038	Format Error
15	03C	Uninitialised Interrupt Vector
16-23	040	(Unassigned, Reserved) 05F
24	060	Spurious Interrupt
25	064	Level 1 Interrupt Autovector
26	068	Level 2 Interrupt Autovector
27	06C	Level 3 Interrupt Autovector
28	070	Level 4 Interrupt Autovector
29	074	Level 5 Interrupt Autovector
30	078	Level 6 Interrupt Autovector
31	07C	Level 7 Interrupt Autovector
32-47	080	TRAP Instruction Vectors 0BF
48-63	0C0	(Unassigned, Reserved) 0FF
64-225	100	User Interrupt Vectors 3FF

Notes

1. Vector numbers 12, 13, 16 through 23, and 48 through 63 are reserved for future enhancements by Motorola. No user peripheral devices should be assigned these numbers.

2. Reset vector (0) requires four words, unlike the other vectors which require only two words, and is located in the supervisor program space.

3. The spurious interrupt vector is taken when there is a bus error indication during interrupt processing.

4. TRAP #n uses vector number 32 + n

5. Number 14 (Format Error) refers to the MC68010 only. On the MC68000 and MC68008, this vector is unassigned, reserved.

Chapter 6

The Connections to the Main Board

CHAPTER 6: THE CONNECTIONS TO THE MAIN BOARD

This chapter lists all the connections to the base processor board, giving the pin description for each one.

6.1 POWER IN

PL1 **Power in** (8-way mate-n-lok connector)

1 red	+5 volts
2 black	ground
3 orange	+12 volts
4 black	ground
5 mauve	-5 volts
6 white	+5 volts (NiCad supply for clock)
7 green	power supply off (from service processor to opto isolator)
8 yellow	power-down (from touch switch to service processor NMI)

6.2 SERIAL PORTS B AND C

PL2 **Serial ports B and C** (25-way female D-type connector)

Serial port C (slow serial)

2	txd transmit data
3	rxd receive data
4	rts request to send
5	cts clear to send
7	gnd ground
8	dcd data carrier detect
20	dtr data terminal ready

Serial port B (fast serial)

10	+5 volts
12	txd transmit data
13	rxd receive data
14	rts request to send
15	cts clear to send
22	dcd data carrier detect
23	dtr data terminal ready
24	clko clock output
25	gnd ground

6.3 XBUS

PL3 **XBUS** (34-way header connector)

1	gnd
2	r/nw (read/not write)
3	gnd
4	1MHzE (1 MHz clock)
5	gnd
6	no connection
7	gnd
8	no connection
9	gnd
10	npgfc (page FC select)
11	gnd
12	npgfd (page FD select)
13	gnd
14	nrst (active-low reset)
15	gnd
16	analog input
17	gnd
18	d0
19	d1
20	d2
21	d3
22	d4
23	d5
24	d6
25	d7
26	gnd
27	a0
28	a1
29	a2
30	a3
31	a4
32	a5
33	a6
34	a7

6.4 LED

PL4 **Power to LED** (2-pin connector)

1	+5 volts (marked "a" for anode)
2	220R to ground (R120)

6.5 KEYBOARD

PL5 **Keyboard** (6-way W polarised pluggable card connector - PCC)

1	keyrx (receive data from keyboard)
2	no connection
3	gnd
4	gnd
5	keyreset (reset keyboard processor)
6	+5 volts

6.6 MONITOR

PL7 Monitor drive (8-way DIN connector)

1	Red 0.7 volts peak to peak
2	Green 0.7 volts peak to peak
3	Blue 0.7 volts peak to peak
4	horizontal sync (TTL compatible)
5	vertical sync (TTL compatible)
6	speaker +
7	speaker -
8	ground
shield	ground

6.7 TELEPHONE

PL8 Telephone line (6-way A polarised pluggable card connector - PCC)

PL9 Telephone handset (6-way A polarised pluggable card connector - PCC)

These two PCC connectors are not used on the Triple X. They could be used for an internal modem design, or other equipment which needs to use a telephone line.

PL10 Internal connector for signals from PL8 and PL9

Has a connector fitted which links PL8 to PL9.

6.8 ETHERNET

PL11 Ethernet (15-way female D-type connector)

1	gnd
2	collision+
3	transmit+
4	gnd
5	receive+
6	gnd
7	no connection
8	gnd
9	collision-
10	transmit-
11	gnd
12	receive-
13	+12 volts
14	gnd
15	no connection
shell	gnd

6.9 SCSI

PL12 Standard SCSI connector (50-way connector)

2	db0 data bus bit 0
4	db1 data bus bit 1
6	db2 data bus bit 2
8	db3 data bus bit 3
10	db4 data bus bit 4
12	db5 data bus bit 5
14	db6 data bus bit 6
16	db7 data bus bit 7
18	dbp data bus parity
32	atn attention
36	bsy busy
38	ack acknowledge
40	rst reset
42	msg message
44	sel select
46	c/d command/data
48	req request
50	i/o input/output

All other pins are ground.

6.10 VMEbus

PL13 Standard VMEbus connector (96-way connector)

pin	row a	row b	row c
1	d00	bbsy	d08
2	d01	bclr	d09
3	d02	acfail	d10
4	d03	bg0in	d11
5	d04	bg0out	d12
6	d05	bg1in	d13
7	d06	bg1out	d14
8	d07	bg2in	d15
9	gnd	bg2out	gnd
10	sysclk	bg3in	sysfail
11	gnd	bg3out	berr
12	ds1	br0	sysreset
13	ds0	br1	lword
14	write	br2	am5
15	gnd	br3	a23
16	dtack	am0	a22
17	gnd	am1	a21
18	as	am2	a20
19	gnd	am3	a19
20	iack	gnd	a18
21	iackin	serclk	a17
22	iackout	serdat	a16
23	am4	gnd	a15
24	a07	irq7	a14
25	a06	irq6	a13
26	a05	irq5	a12
27	a04	irq4	a11
28	a03	irq3	a10
29	a02	irq2	a09
30	a01	irq1	a08
31	-12V	+5V stdby	+12V
32	+5V	+5V	+5V

6.11 SERIAL PORT A

PL14 Serial port A (fast serial - X25) (25-way female D-type connector)

2	txd transmit data
3	rxd receive data
4	rts request to send
5	cts clear to send
7	gnd ground
8	dcd data carrier detect
15	txclkin transmit clock input (synchronous)
17	rxclkin receive clock input (synchronous)
20	dtr data terminal ready

Chapter 7

Power Supplies, Peripherals and I/O

CHAPTER 7: POWER SUPPLIES, PERIPHERALS AND I/O

7.1 TRIPLE X PSU

The Triple X power supply unit is manufactured by Farnell. For a description of the operation of the PSU, see chapter 1 section 1.4.2.

7.1.1 Power in

Mains power is input through connector SK6:

SK6 AC mains power input (2-pin locking connector)
240 volts AC RMS 50/60 Hz
110 volts AC RMS 50/60 Hz

brown	live
blue	neutral

Input voltage range

SK5 and SK8 are used to select the input voltage range. Remove the connectors from these sockets, turn them over and replace them to alter the voltage. The connectors are labelled 230V on one side and 115V on the other. Note that the fan fitted is 240V. It must be replaced by a 110V fan if the supply is changed to 110V.

The input voltage ranges are as follows:

230V setting of links SK5 and SK8: 196V to 264V AC RMS 50/60 Hz

115V setting of links SK5 and SK8: 98V to 132V AC RMS 50/60 Hz

The mains is filtered by the PSU to protect against spikes.

7.1.2 Power out

The Farnell PSU provides three DC output sockets, each with the same pin description:

SK2 SK3 SK4 DC power out (8-way mate-n-lok connectors)

1 red	+5 volts
2 black	ground
3 orange	+12 volts
4 black	ground
5 mauve	-5 volts
6 white	+5 volts (battery supply for clock, rises to ≈+5.4V when PSU is on)
7 green	power supply off (from service processor to opto isolator)
8 yellow	power-down (from touch switch to service processor NMI)

7.1.3 Specification

Total power:
100W continuous
120W power-up (10 seconds)

+5V supply:

Nominal output voltage	+5V
Adjustment range	+5.0V to +5.1V factory preset at 2A load
Regulation	±2% maximum with at least 2A load
Ripple and noise	1% maximum spike amplitude
Maximum output current	10A
Minimum output current	a current of at least 2A should be drawn from the +5V supply at all times to maintain a stable voltage

+12V supply:

Nominal output voltage	+12V ± 0.2V
Adjustment range	fixed
Regulation	±5% maximum
Ripple and noise	1% maximum spike amplitude
Maximum output current	4.5A (6A during power-up)

-5V supply:

Nominal output voltage	-5V ± 0.1V
Adjustment range	fixed
Regulation	±2% maximum
Ripple and noise	1% maximum spike amplitude
Maximum output current	200mA

+5V battery supply:

Output voltage	+5V when PSU off ≈+5.4V when PSU on
Battery capacity	250mAh

Over-current protection:
Full current is maintained when the PSU is overloaded, but the output voltages drop to limit the power.

Overload protection:
The PSU can withstand continuous short circuits on any of its outputs.

Missing cycle performance:
The outputs remain in specification for a half cycle of mains dropout.

Operating temperature range:
0 to 50 degrees Celsius

RFI level:
Satisfies VDE0871 Level B and FCC15J Class B

Safety standards approval:
BS, VDE, CSA, UL

Efficiency:
Greater than 75%

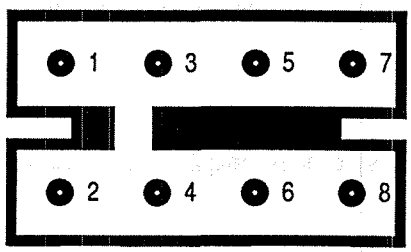
7.1.4 Connections to the PSU board

SK1 Touch switch connection (2-pin connector)

1	pad A
2	pad B

SK2 SK3 SK4 DC power out (8-way mate-n-lok connectors)

1 red	+5 volts
2 black	ground
3 orange	+12 volts
4 black	ground
5 mauve	-5 volts
6 white	+5 volts (battery supply for clock, rises to ≈+5.4V when PSU is on)
7 green	power supply off (from service processor to opto isolator)
8 yellow	power-down (from touch switch to service processor NMI)



PIN NUMBERING FOR SK2, SK3 AND SK4

SK5 Mains voltage selection link (2-pin connector)

Remove link, turn it over and replace it to alter voltage. SK8 must also be changed.

SK6 AC mains in (2-pin locking connector)

brown	live
blue	neutral

The earth cable is attached separately on a tag which is labelled SK9, see **SK9**.

SK7 Switched mains output (2-pin locking connector)

This output is taken to a connector on the back of the Triple X where it is used to power the monitor.

SK8 Mains voltage selection link (2-pin connector)

Remove link, turn it over and replace it to alter voltage. SK5 must also be changed.

SK9 Switched mains output (2-pin locking connector)
and quin ring Earth (spade connector)

This output is used to drive the fan in the base, and also the quin ring power supply and fans when a quin ring is fitted.

The quin ring earth tag on the PSU is labelled SK9. It also has the earth symbol ⏚ next to it. This is used only when a quin ring is fitted.

7.1.5 Testing the PSU

Make sure that the Triple X is unplugged at the mains when lifting the ring - otherwise the mains input is live and the fuse holder may short on the zinc-coated lid. All fuses should be fitted with a plastic insulating hood.

1. *If the machine appears dead, check that the battery is good and that there is +5V on pin 6 of the DC output connectors SK2, SK3 and SK4. If the battery is dead then the PSU cannot turn on. If in doubt replace the battery.*

   To check that the NiCad battery is being charged when the power supply is switched on, make sure that the battery is receiving extra voltage (5.4V).

2. *If the power supply won't turn on, even with a new battery, check the mains input and the mains fuse.*

3. *When the power supply is switched on, check whether it is producing any low voltage on the DC output connectors. Note that if the processor board is not powered then the PSU only switches on for 2 seconds after pressing the touch switch before turning itself off again.*

7.1.6 Correcting

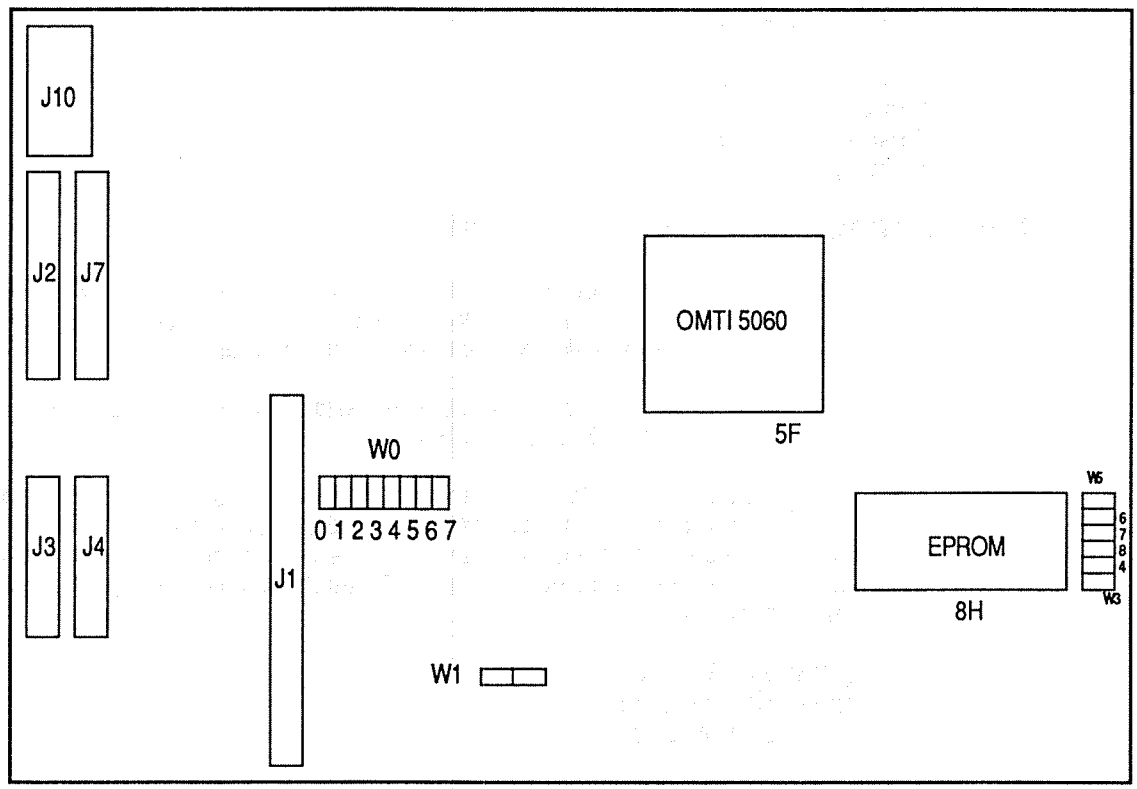
Any fault in the PSU, apart from a battery or fuse, requires replacement of the whole unit.

7.2 OMTI DISC CONTROLLER BOARD

The OMTI 5200 connects to a standard SCSI interface and can control up to two hard disc units and four floppy disc units. Up to eight OMTI boards can be on the SCSI bus at the same time, each having a different device number set using the link on W0, see diagram and 7.2.2.

If the Triple X is fitted with a hard disc unit which has its own controller built in, the OMTI board is not fitted. The floppy disc unit then has its own controller called the "manta board".

7.2.1 Connectors and connections



THE OMTI 5200 DISC CONTROLLER BOARD

J1 SCSI Interface (50-way)

Connects the OMTI board to the base processor board.

J2 HDU control (34-way)

ST506 standard control cable

This cable is attached to both hard discs if two are fitted.

J3 HDU data (20-way)

ST506 standard data cable

Attached to the first hard disc drive.

J4 HDU data (20-way)

ST506 standard data cable

Attached to the second hard disc drive (if fitted).

J7 FDU data (34-way)

ST400 standard

This cable is attached to all floppy disc drives fitted.

J10 DC power (4-way)

1 red	+5V
2 black	ground
3 black	ground
4 orange	+12V

7.2.2 Link settings and hardware revisions

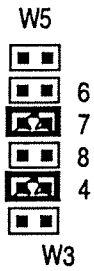
1. *The firmware should be version "D" or greater (alphabetically). The version is indicated as a suffix to the 27128 EPROM. The EPROM is component 8H on the right of the PCB, near links W5 to W3, as shown in the diagram above.*

2. *The OMTI 5060 chip is component 5F shown in the diagram above and should be revision number 20506-2 or 20506-B.*

3. *Check that link 0 on W0 is closed (W0 is a set of eight 2-pin connectors shown on the board in the diagram above). W0 sets the SCSI device number. If link 0 is closed then the OMTI board is device number 0. If there is more than one OMTI board on the SCSI bus then the one with device number 0 has the lowest priority. W0 should look like the diagram below.*

4. *W1, a 2-pin connector shown in the diagram of the board, should have a link fitted. Its position does not matter because the Triple X does not use parity.*

5. *Check that the W5 to W3 links on the right of the board as shown in the diagram above, look like the diagram below.*



6. *All other links are soldered closed by the manufacturer, except for W14 (motor ready) and W15 (motor on), which are both open.*

7.2.3 Testing the OMTI board

- *Check that the EPROM and the 5060 chip are the latest issue.*

7.2.4 Correcting

In most cases, it is necessary to replace the OMTI board. Contact Torch Service Department for information.

7.3 FLOPPY DISC UNIT (FDU)

The latest FDU used on the Triple X is the Epson 680L. This is a high density floppy disc drive meaning that it can store 1.6 Mbytes of data on one disc. On the Triple X, it is not used in high density mode and stores 800 Kbytes of data on one disc.

On earlier Triple Xs, the FDU was the Epson SD540. This is a double-sided double-density floppy disc drive storing 800 Kbytes of data on one disc.

Both of the FDUs fitted on the Triple X use the standard Shugart ST400 interface.

7.3.1 Connections

DC power

1 red	+5V
2 black	ground
3 black	ground
4 orange	+12V

Data and control

ST400 interface standard

7.3.2 Formatting

The Torch formatting specification is as follows:

- Bytes per sector 512
- Sectors per track 9
- Tracks per inch 96
- Interleaving factor 1

This gives 800 Kbytes per disc.

Other settings, for example the 1.6 Mbyte high density mode, must be selected using the Triple X software and by setting links on the FDU.

7.3.3 Link settings on Epson 680L/SD540

If the FDU needs replacing, some links have to be set or checked before a new unit is installed. These links are labelled SS1 and SS2 on the board, next to the 34-way edge connector. Use a working Triple X FDU as a guide to the link positions.

7.3.4 Testing the FDU

- *Format floppy with* **-u** *option.*

7.3.5 Correcting

In most cases, it is necessary to replace the FDU. Contact Torch Service Department for information.

7.3.6 The manta board floppy disc controller

If the Triple X is fitted with a hard disc unit which has its own controller built in, the OMTI board is not fitted. The floppy disc unit then has its own controller called the "manta board". This board is located on the shield around the floppy disc unit.

7.4 HARD DISC UNIT (HDU)

The standard HDUs on the Triple X are the D5126H 20 Mbyte and D5146H 40 Mbyte both manufactured by NEC, and the CDC MN94211-91 80Mb manufactured by Control Data Corporation. Other drives may be fitted, by special order. If the Triple X is fitted with a hard disc unit which has its own controller built in, such as the CDC MN94211-91, the OMTI board is not fitted. The floppy disc unit then has its own controller called the "MANTA board".

7.4.1 Connections

DC power

1 red	+5V
2 black	ground
3 black	ground
4 orange	+12V

Data and control

20-way data cable and 34-way control cable, ST506 standard

7.4.2 Testing the HDU

- The HDU carries out a self-test on power-up. Faults are indicated by a coded series of flashing lights on the front of the HDU.

7.4.3 Correcting

In most cases, it is necessary to replace the HDU. Contact Torch Service Department for information.

7.5 EXPANSION STORAGE UNIT (ESU)

The expansion storage unit is used to backup files. The ESU contains a streaming tape unit and/or a hard disc unit, a controller card, a power supply unit (manufactured by Farnell) and a fan.

The streaming tape unit used in the ESU is an Archive Corporation model 2060S Viper 1/4" tape drive, with a standard 50-way SCSI interface connection.

7.5.1 Connections

Standard SCSI 50-way connectors.

7.5.2 Testing the ESU

- *Load the tape streaming software and select "monthly backup".*

7.5.3 Correction

In most cases, it is necessary to replace the ESU. Contact Torch Service Department for information.

7.6 KEYBOARD AND MOUSE

The keyboard uses conventional metal contact switches.

The Triple X mouse is based on the Alps UDA020134A.

7.6.1 Connections

Keyboard connector (6-way right-hand W polarised pluggable cord connector - PCC)

1	transmit data
2	Link through
3	ground
4	ground
5	reset input
6	+5 volts

No more than 300mA should be drawn from the +5V supply rail.

Mouse connector (6-way right-hand W polarised pluggable cord connector - PCC)

1	ground
2	+5 volts
3	transmit data

The transmit data signals are TTL levels, 1200 baud, using one start bit, 8 data bits, 1 stop bit, and no parity. A 1 is represented by a signal between 0V and 0.4V and a 0 by a voltage between 2.4V and 5V.

The reset input is a TTL level signal which is driven low to reset the keyboard.

7.6.2 Testing the keyboard

1. *Power-up the Triple X with the keyboard plugged in but without a mouse.*
2. *Hold down the ◇ key and press the ↑ ↓ ← → keys. The mouse pointer should move around on the screen when you press these keys.*

A keyboard fault is displayed on power-up in the kernel window.

7.6.3 Correcting

If the above test fails, use a good keyboard and mouse with the Triple X. If the good ones work with the Triple X then the fault is in the keyboard, mouse, or cables. If the Triple X still doesn't work with a good keyboard then the fault is in the Triple X. Replace the base processor board.

- Take care when repairing faulty key switches. Use the smallest size point on the soldering iron because the PCB tracks can be lifted if overheated. Work quickly to avoid overheating.
- Problems can occur because of wires breaking inside the mouse cable.
- If you have an intermittent fault, the PCC plugs may need re-crimping: use a proper crimping tool.
- Zinc plated keyboard cases short out the keyboard PCB unless an insulator is used. If individual keys or rows of keys are not functioning, check that there is an insulator below the keyboard PCB.
- Because the keyboard is programmable, faults which could appear to be the keyboard may be caused by mains noise, mains spikes, etc.

7.6.4 Testing the mouse

1. *Check cursor movement on screen.*

2. *Check the mouse switches by doing left and right clicks. The floppy disc icon provides a simple test: a left click on the floppy disc icon allows read/write access to a mounted floppy disc whereas a right click allows read access only.*

7.6.5 Correcting

The only component of the mouse which can be replaced is the ball.

- The ball can be removed very easily for cleaning or replacement:

1. *Turn the mouse upside down and pull the plastic ring surrounding the ball in the direction shown by the arrow labelled "OPEN".*

2. *When the plastic ring clicks over to one side it can be removed. Turn the mouse back the right way up and the ball falls out.*

3. *Use a cleaner such as isopropyl alcohol or any suitable cleaner which is harmless to plastics to clean the ball. Wipe the dirt off the rollers by using a cotton bud or small brush which has been soaked in the cleaning fluid.*

- *Check the cables on the entry point into the mouse as these can break.*

- *Check the crimp connections on the pluggable cord connector (PCC).*

If the above checks are not effective, it is necessary to replace the keyboard or mouse.

7.7 RGB AND AUDIO OUTPUT

7.7.1 Connections

RGB (8-way DIN connector)

1	Red 0.7V peak to peak
2	Green 0.7V peak to peak
3	Blue 0.7V peak to peak
4	horizontal sync (TTL compatible)
5	vertical sync (TTL compatible)
6	speaker +
7	speaker -
8	ground
shield	ground

7.7.2 Testing the display and sound

- *RGB: Use another monitor. Check the RGB cable. Replace the base processor board if necessary.*
- *Buzzing is normally due to faulty earth screening at one of the ends. Solder the screen if you have this problem.*

7.7.3 Notes

- The internal speaker can produce a buzzing noise with different coloured desktops/screens.
- LINK1 is used should you wish to drive an external interface or adapter.

  When LINK1 is in position B, the speaker is driven from pins 6 and 7 with positive and negative signals.

  When LINK1 is in position A, pin 6 is used as a +5V output to an external device. The speaker has to be driven from pins 7 and 8 with the negative signal and ground. This means that the audio output signal strength is halved.

  The following table shows how pins 6, 7 and 8 are used with LINK1 in positions A and B:

Pin	Position A	Position B
6	+5V	*speaker +
7	*speaker-	*speaker-
8	*ground	ground

  * and * show which pins the speaker is connected across.

7.8 MITSUBISHI AND SONY 13" MONITORS

The Triple X is available with either the Mitsubishi FA3415ATKE or the Sony CPD-1301E 13" high resolution monitors.

7.8.1 Connections

As shown in section 7.7 above.

7.8.2 Adjusting the Mitsubishi controls

The controls on the front of the monitor are, from the right:

- BRIGHTNESS: turn this control the make the screen brighter or dimmer.
- CONTRAST: turn this control to vary the light and dark shades.
- H SIZE: turn this control to change the width of the picture.
- H POSITION: turn this control to move the picture right or left.
- V SIZE: turn this control to change the height of the picture.
- V POSITION: turn this control to move the picture up or down.

The controls on the rear of the monitor should be set as follows:

- INPUT SIGNAL: this switch has two positions and should always be set to ANALOG when used with the Triple X.
- SCAN: set to NORM
- MODE: set to PRESET
- TTL COLOR: has no effect when the INPUT SIGNAL is set to ANALOG.

7.8.3 Adjusting the Sony controls

The controls are hidden under a cover on the rear panel which you pull open:

- BRIGHTNESS: turn this control to make the screen brighter or dimmer.
- H SHIFT (horizontal shift): turn this control to centre the display of the Triple X.
- V HOLD (vertical hold): turn this control if the display rolls vertically.
- RGB input selector: this switch has three positions, but should always be set to ANALOG when used with the Triple X.

7.8.4 Testing the monitor

Any loss of quality in the picture is immediately noticed by the person using the Triple X.

1. *If the screen is blank, adjust the BRIGHTNESS control to maximum.*
2. *Check that the power is on and that the monitor is switched on.*
3. *Check that the Triple X is switched on and that the cable joining the Triple X to the monitor is plugged in correctly at both ends.*

7.8.5 Correcting

In most cases, if the above tests don't help, it is necessary to replace the monitor. Contact Torch Service Department for information.

7.9 SERIAL PORTS (RS423)

The Triple X has three serial ports, for connection to devices such as printers, terminals and modems. The three serial ports are brought out onto two 25-way D-type connectors as shown in 7.9.1.

Name	Normal use*	Processor board	Connection
Port A	X25 synchronous	SCC channel A	X25 D-type (V24)
Port B	Terminal or modem	SCC channel B	non-standard
Port C	Printer	6850 ACIA	RS423 D-type (V24)

* Can be used for anything, but normally used for the purpose shown.

Because Port B has a non-standard connection on the D-type connector, TORCH supplies a splitter cable (product code XA2RS423). This cable converts the single D-type into two D-type connectors with standard V24 connections. The standard V24 connections are those shown below for serial port A.

7.9.1 Connections

Serial port A (fast serial - X25) (25-way female D-type connector)

2 txd transmit data
3 rxd receive data
4 rts request to send
5 cts clear to send
7 gnd ground
8 dcd data carrier detect
15 txclkin transmit clock input (synchronous)
17 rxclkin receive clock input (synchronous)
20 dtr data terminal ready

Serial ports B and C (25-way female D-type connector)

Serial port C (slow serial)

2 txd transmit data
3 rxd receive data
4 rts request to send
5 cts clear to send
7 gnd ground
8 dcd data carrier detect
20 dtr data terminal ready

Serial port B (fast serial)

10 +5 volts
12 txd transmit data
13 rxd receive data
14 rts request to send
15 cts clear to send
22 dcd data carrier detect
23 dtr data terminal ready
24 clko clock output
25 gnd ground

7.9.2 Testing the serial ports

- *Use the software serial test called HOST available from Torch.*

Before the test software is used, a 25-way male D-type connector has to be inserted in the serial port with the following pins linked:

2 « » 3	12 « » 13
4 « » 5	14 « » 15
8 « » 20	22 « » 23

This forms a "loop back" connector which links txd to rxd, rts to cts, and dtr to dcd for each of the ports. They can then be tested without the use of a peripheral.

7.9.3 Notes

- Most problems with serial ports are caused by incorrect hardware handshaking.
- Printer characters may be lost with software handshaking (XON/XOFF flow control, DTR protocol). This slows down the machine.

7.10 ETHERNET

7.10.1 Connections

Ethernet (15-way female D-type connector)

1	gnd
2	collision+
3	transmit+
4	gnd
5	receive+
6	gnd
7	no connection
8	gnd
9	collision-
10	transmit-
11	gnd
12	receive-
13	+12 volts
14	gnd
15	no connection
shell	gnd

7.10.2 Testing Ethernet

- Ethernet can only be tested by connecting the Triple X to a network.

7.10.3 Notes

- Refer to IEEE 802.3 specification. This is the version of the Ethernet specification used by the Triple X).
- Standard network commands "ruptime" and "rwho" indicate who has been on the network and for how long. Refer to the "Ethernet User Guide" for further details.

7.11 XBUS (1MHz BUS)

The XBUS is an emulation of the BBC microcomputer 1MHz bus, but for a limited variety of peripherals. (The BBC microcomputer is a British 8-bit microcomputer which is very popular in British schools.)

7.11.1 Connections

XBUS (34-way header connector)

1	gnd
2	r/nw (read/not write)
3	gnd
4	1MHzE (1 MHz clock)
5	gnd
6	no connection
7	gnd
8	no connection
9	gnd
10	npgfc (page FC select)
11	gnd
12	npgfd (page FD select)
13	gnd
14	nrst (active-low reset)
15	gnd
16	analog input
17	gnd
18	d0
19	d1
20	d2
21	d3
22	d4
23	d5
24	d6
25	d7
26	gnd
27	a0
28	a1
29	a2
30	a3
31	a4
32	a5
33	a6
34	a7

7.12 QUIN RING PSU

The Quin ring has its own power supply unit to provide DC power for the VME boards plugged into it.

Very early quin rings were fitted with a PSU manufactured by Astec. The Astec PSU is not now used and if you find a quin ring with an Astec PSU fitted you should contact Torch Service Department who will supply a replacement.

The quin ring PSU is now manufactured by BPS, and the details below are for the BPS quin ring power supply unit.

7.12.1 Specification

Total power:
120W continuous

+5V supply:

Nominal output voltage	+5V
Regulation	±1% maximum with at least 1A load
Adjustment	Using trimmer VR1
Ripple and noise	50mV peak to peak
Maximum output current	10A continuous, 12A peak
Minimum output current	a current of at least 1A should be drawn from the +5V supply at all times to maintain a stable voltage

+12V supply:

Nominal output voltage	+12V
Regulation	±10% maximum
Ripple and noise	100mV peak to peak
Maximum output current	4A continuous, 6A peak
Minimum output current	a current of at least 0.5A should be drawn from the +12V supply at all times

-12V supply:

Nominal output voltage	-12V
Regulation	±10% maximum
Ripple and noise	100mV peak to peak
Maximum output current	1A continuous, 1A peak

Overload protection:
The PSU can withstand continuous short circuits on any of its outputs.

Missing cycle performance:
The outputs remain in specification for a full cycle of mains dropout (minimum 20ms).

7.12.2 Connections to the PSU board

AC mains power input (3-way mate-n-lok connector)
240 volts AC RMS 50/60 Hz
110 volts AC RMS 50/60 Hz

1 brown	live
2 blue	neutral
3 green/yellow	earth

DC power out (13-way mate-n-lok connector)

3 orange	+12 volts
5 red	+5 volts
6 red	+5 volts
8 black	ground
9 black	ground
10 pink	-12 volts

7.12.3 Testing the quin ring PSU

- *Check the mains fuse, the AC input wiring and the DC output wiring.*

7.12.4 Correcting

Any fault in the PSU, apart from the fuse, requires replacement of the whole unit.

7.13 THE VMEbus

The VMEbus allows the Triple X to be expanded.

The normal Triple X (without either a slim ring or a quin ring fitted) can have an extra 1 Mbyte of memory fitted to the VMEbus by installing a limpet board. Most Triple Xs have the limpet board fitted as standard.

A Triple X with a slim ring can have any standard VME board fitted, and a quin ring allows up to four standard VME boards to be fitted to the Triple X.

Power to the slim ring is taken from the Triple X power supply. The quin ring has its own power supply and cooling fans.

The Triple X automatically "bus sizes" VME RAM cards (such as the "Triple Meg" RAM card - XEX2MEG) and addresses them in the space from 2Mb upwards so that they follow on immediately above the Triple X's main memory.

If the board comes from Torch, it is supplied with a new kernel containing the correct device driver.

7.13.1 Connections

Standard VMEbus connection.

7.13.2 Processor board links to control the VME settings

The following link settings are for issue 4 base processor boards.

Link	Function	Install	Remove
LNK2	BG0IN pull up	Slot 1	Not Slot 1
LNK3	BG1IN pull up	Slot 1	Not Slot 1
LNK4	BG2IN pull up	Slot 1	Not Slot 1
LNK5	Level 3 Arbiter	Enable	Disable
LNK6	SYSRESET driver	Enable	Disable
LNK7	SYSCLOCK driver	Enable	Disable
LNK8	VME Interrupt Bit 2	Level 3,2,1	Level 7,6,5,4
LNK9	VME Interrupt Bit 1	Level 5,4,1	Level 7,6,3,2
LNK10	VME Interrupt Bit 0	Level 6,4,2	Level 7,5,3,1
LNK11	VME Interrupt IRQ1	Level 1	Not level 1
LNK12	VME Interrupt IRQ2	Level 2	Not level 2
LNK13	VME Interrupt IRQ3	Level 3	Not level 3
LNK14	VME Interrupt IRQ4	Level 4	Not level 4
LNK15	VME Interrupt IRQ5	Level 5	Not level 5
LNK16	VME Interrupt IRQ6	Level 6	Not level 6
LNK17	VME Interrupt IRQ7	Level 7	Not level 7
LNK18	VME Interrupt Enable	Disable	Enable

- Those links marked "Slot 1" should only be installed if the Triple X board is in slot 1 of the VME backplane.
- LNK8, LNK9 and LNK10 are a binary coding of the interrupt level on the VMEbus. This same level is set up on LNK11 to LNK17 in a non-coded form.
- If the VME interrupts are not being used then LNK18 should be installed. Exactly one link (no more) must be present in the link block LNK11 to LNK18.

Shorted links are required between the signal pairs listed below when no VME board is fitted to the VME backplane. The way in which the pins are paired off is indicated by the boxes printed on the PCB.

BG0IN	« »	BG0OUT
BG1IN	« »	BG1OUT
BG2IN	« »	BG2OUT
BG3IN	« »	BG3OUT
IACKIN	« »	IACKOUT

Near the edge of the VME backplane (close to the bottom of the rack when in position) are three further links: SYSRESET, SYSFAIL and ACFAIL. These should be left open.

7.14 RAM EXPANSION BOARDS

The limpet board is fitted as standard to most Triple Xs and provides an extra 1 Mbyte of RAM. It is connected direct to the VMEbus connector on the base processor board, and is mounted on top of the processor board, underneath the PSU.

The Triple Meg RAM card provides an extra 2 Mbyte of RAM. It is connected to the VME backplane either in a slim ring or a quin ring. Up to three Triple Meg boards can be fitted to a single Triple X system.

7.14.1 Testing the RAM boards

- RAM is tested on power up.
- The RAMTEST program on the "test" disc can be used to test RAM locations. It sizes all the memory available on the VMEbus, and tests both the main memory and the VME memory.

7.14.2 Correction

If removing the board and cleaning the contacts fails to clear a problem, it is necessary to replace the board. Contact Torch Service Department for information.

Appendices

APPENDICES

PARTS LISTS

Triple X base

(a) moulded base tray
(b) rubber bumpon feet x 4 (white)
(c) Torch manufacturer's label
(d) service warning label
(e) plastic touch pads x 2
(f) on/off label x 1
(g) green LED
(h) insulating sheet
(i) base processor board
(j) M3x6 PAN HD POSI processor board retaining bolts x 11
(k) M3 plain and fibre washers x 11 (for j)
(l) LED cable 2-way 55mm
(m) Farnell 100 watt PSU mounted on limpet bracket
(n) M3x6 PAN HD POSI PSU retaining bolts x 2
(o) M3 shakeproof washers x 2 (for n)
(p) DC cable 8-way 410mm
(q) serial number label
(r) limpet board and VME cable

Disc ring

(a) moulded ring
(b) plastizote pad
(c) ETRI fan with 300mm cable
(d) black retaining band
(e) HDU
(f) HDU metal cover
(g) 6-32 UNC or 4-6 PAN POSI HDU metal cover retaining bolts x 4
(h) 6-32 UNC or 12-14 PAN POSI HDU retaining bolts x 4
(i) plain washers x 4 (for h)
(j) OMTI board (if 20 Mbyte or 40 Mbyte HDU fitted)
MANTA board (if 80 Mbyte HDU fitted)
(k) M3x6 PAN HD POSI disc controller board retaining bolts x 4
(l) M3 fibre washers x 4 (for k)
(m) FDU
(n) FDU metal cover
(o) M3x8 PAN HD POSI FDU metal cover retaining bolts x 4
(p) shakeproof washers (for o)
(q) M3 12-14 PAN HD POSI FDU retaining bolts x 4
(r) plain washers x 4 (for q)
(s) disc controller to HDU cable 34-way 90mm
(t) disc controller to HDU cable 20-way 90mm
(u) ribbon cable clamp
(v) disc controller to FDU cable 34-way 300mm
(w) base processor board to OMTI cable 50-way
(x) DC cables PSU to OMTI, HDU, FDU
(y) Torch label
(z) HDU warning label

Keyboard

(a) moulded cover
(b) Torch label
(c) plastic LED lens
(d) keyboard PCB
(e) 6-way 0.1" molex connector
(f) keyboard curly cable
(g) cable tie (small)
(h) black telephone socket
(i) plastic insulating sheet
(j) insulating sheet retaining clips x 2
(k) moulded base
(l) M3x10 PAN HD POSI keyboard retaining bolts x 4
(m) M3 washers for x 4 (for l)
(n) manufacturer's label
(o) plastizote feet x 4
(p) piezo speaker

Slim ring

(a) tray ring
(b) M4 cage nuts x 4
(c) SCSI backpanel
(d) M4 nuts (for c)
(e) grommet strip
(f) 2 slot card cage
(g) card cage card guides x 4
(h) support rail
(i) 2 slot backplane
(j) M3x10 PAN HD POSI nuts and washers x 6 (for h & i)
(k) sliding props x 2
(l) M4 spring clips and washers (for k)
(m) SCSI cable (already fitted to base processor board)
(n) M3 nuts and washers (for m)
(o) VME cable (already fitted to base processor board)
(p) backplane DC cable
(q) VME terminator
(r) cover retaining brackets x 2
(s) M4x6 PAN HD POSI retaining screws x 4 (for r)
(t) earth cable and tag
(u) M4x6 PAN HD POSI screw, nut and washer (for t)

Quin ring

(a) tray ring
(b) M4 cage nuts x 4
(c) SCSI backpanel
(d) M4 nuts (for c)
(e) grommet strip
(f) 5 slot card cage
(g) card cage card guides x 10
(h) support rail
(i) 5 slot backplane
(j) M3x10 PAN HD POSI nuts and washers x 6 (for h & i)
(k) sliding props x 2
(l) M4 spring clips and washers (for k)
(m) fan with 2 way lead
(n) commoning block
(o) retaining bolts (for n)
(p) quin ring PSU mounting bracket
(q) screws and nuts (for p)
(r) quin ring PSU to backplane cable
(s) quin ring PSU
(t) quin ring fans x 3
(u) EPDM bands x 3
(v) SCSI cable (already fitted to base processor board)
(w) M3 nuts and washers (for v)
(x) VME cable (already fitted to base processor board)
(y) earth cable and tag
(z) VME terminators x 2
(aa) spacer ring
(bb) blanking panel
(cc) blanking panel M4 retaining nuts
(dd) ring-ring brackets x 2
(ee) retaining screws x 4 (for dd)
(ff) lid retaining brackets x 2
(gg) M4x6 PAN HD POSI x 4 (for ff)

LIST OF RECOMMENDED SPARES

		Number of systems:	1-10	11-25	26-50	51-75
Triple Xs						
			Number of spares			
100-1061	Base processor board		1	2	2	3
100-1056	Farnell PSU		1	2	2	2
100-1040	OMTI 5200 controller		1	2	2	2
107-1008	Epson 5.25 inch floppy disc drive		1	1	2	2
107-1012	NEC 20Mb disc drive		1	1	2	2
107-1014	NEC 40Mb disc drive		1	1	2	2
106-1010	Monitor: 13 inch		1	1	2	2
100-1054	Keyboard PCB		1	1	2	2
100-1055	Mouse		1	1	1	2
112-1168	Hard disc data cable		1	2	2	2
112-1169	Hard disc control cable		1	2	2	2
112-1170	Floppy drive cable		1	1	2	2
112-1171	SCSI cable		1	2	2	2
Slim and quin rings						
100-1064	BPS PSU		1	1	2	2
100-1063	2Mb expansion board		1	1	2	2
112-1188	VME cable		1	1	1	2
112-1197	SCSI cable		1	1	2	2
ESUs						
100-1068	Adaptec controller		1	1	2	2
100-1074	Tape drive		1	1	1	2
100-1056	Farnell PSU		1	1	2	2
112-1210	Controller to tape drive cable		1	1	1	2

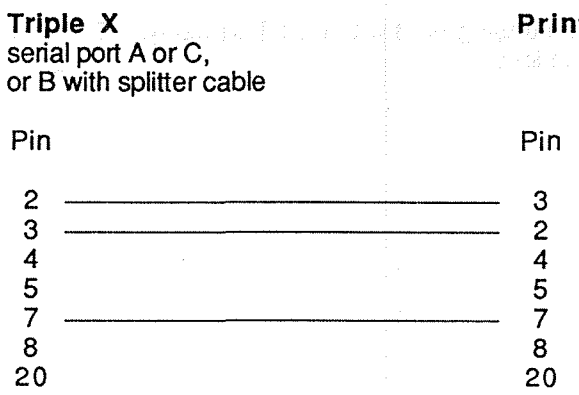
CONNECTING A PRINTER

This section should help you connect printers and terminals to the Triple X. Before beginning, remember to turn off the system. (The system should be switched off when rewiring any connector.)

The following method can be applied to any of the three serial ports, A, B or C. For RTS/CTS-style hardware, handshake printers or terminals, use ports A or B only.

1. For printers with XON/XOFF flow control, set to XON/XOFF mode.

2. Make a cable which has the following connections:



The purpose of this cable is to check data transfer to the printer.

3. Send data to the serial port, for example port C, by using the command:

```
cat /etc/rc>/dev/ttya
```

   The **/etc/rc** file should be printed out. However, if the printer is slow or has no buffering, there may be some missing characters.

4. If the printer baud rate is not the default (9600 baud) and cannot be set to 9600, use **stty** to set the Triple X to the correct rate for the printer.

5. This step ensures that the Triple X can determine when the printer is turned on. This prevents output going nowhere if it is not.

   First connect pin 20 of the printer to pin 8 of the Triple X.

   Next connect pin 8 of the printer to pin 20 of the Triple X.

   These connections allow the Triple X to monitor the DTR signal of the printer with its DCD input. DTR is activated when the printer is turned on.

   Now repeat the command given in 3. above and check that the Triple X waits until the printer is turned on before printing. (If you have problems, perhaps the printer does not provide the DTR signal.)

6. Assuming that the printer supports XON/XOFF handshaking for flow control, everything is now ready for use. The **lp** printer facilities set up XON/XOFF protocols as standard.

   If you do not intend using **lp**, set the protocols by typing the following: (the example given is for Port B)

```
stty ixon ixoff </dev/ttyb
```

   Test that the flow control does not cause loss of characters by printing a large file, such as **/etc/termcap**.

7. If the printer requires hardware flow control, it can only be connected to serial port A or port B. In this case, the pin connections should be as follows:

Triple X		Printer
2	———	3
3	———	2
4	———	5
5	———	4
7	———	7
8	———	20
20	———	8

The Triple X stops sending data if the CTS signal (pin 5) or the RTS signal from the printer (pin 4) is held low.

TESTING A PRINTER

The following checks are useful if you experience difficulties with a printer.

- The **lp** printer may have been disabled by a previous attempt to use a printer which was not correctly connected. To re-enable the printer, type:

```
enable <printer-name>
```

- The scheduler may not be running. Check that there is an entry by typing

```
/usr/lib/lpsched
```

  in the file **/etc/rc**. Refer to "Inside System V" for instructions on how to to restart **lpsched**.

- The baud rate may be incorrect. Although the **stty** command can be used as a temporary measure, the best permanent solution is to replace the line **/usr/lib/lpsched** in the file **/etc/rc** by the following:

```
(
trap " 1
stty *baud-rate* < /dev/*printer-port*
/usr/lib/lpsched
exec sleep 10000 < /dev/*printer-port*
) &
```

  The **trap** line is necessary to prevent the **stty** and **sleep** commands from being killed when the **/etc/rc** command is executed.

- Flow control for the printer is normally XON/XOFF when using the default **lp** interface **printer**. However, the Triple X's hardware flow control (using DTR/DCD) is always enabled so that printers not supporting XON/XOFF protocols should still work correctly, provided that the lines are properly connected (see step 7. of the previous section).

  XON/XOFF flow control can be selected for other ports by adding extra **stty** commands in the line above the **trap** command, shown in 3. above.

  Although the solution given in 3. above does work, we recommend that only the **lp** interface provided be used.

- The desired devices may not be associated with the **lp** printers. To change the device of ***printer-name***, use the following command:

```
/usr/lib/lpadmin -p*printer-name* -v/dev/*printer-port*
```

  (For further details refer to "Inside System V".)

- For testing purposes we recommend using the following shell script:

```
while :
do
echo "abcdefghijklmnopqrstuvwxyz"
echo "abcdefghijklmnopqrstuvwxyz"
echo "Testing" > /dev/tty
done > /dev/*printer-port*
```

  This causes the alphabet to be printed repeatedly. The message "Testing" appears in the window from which the shell script was invoked. This message disappears after a time when the printer buffers are almost full, then continues periodically during the printing.

TRIPLE X HARDWARE SPECIFICATION

The Triple X is designed to operate within certain environmental conditions. If there is any doubt about the site, contact Torch Service Department.

Power requirements

Voltage range: 196V - 264V AC RMS
or 98V - 132V AC RMS

Frequency range: 47Hz - 63Hz

Voltage selection is by power supply link change and fan exchange on the Triple X and quin ring, and by power supply board exchange on 13" colour monitors.

Power consumption:

Triple X: 100W
13" colour monitor: 100W

Environmental

	Operating	Non-operating
Temperature range (°C)	5-35	0-60
Humidity range (non-condensing)	10-80%	10-80%
Vibration (0 to 60 Hz)	0.2g	0.5g
Impact	2g	15g
Temperature gradient	10 °C/hr	
Altitude	0 to 3000m	-300m to 3600m

MTBF 10,000 hours
MTTR 1 hour

Dimensions

Main body 450 x 310 x 130mm
Keyboard 450 x 160 x 40mm

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