Inside Triple X

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Please read this

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We reserve the right to make changes without notice both to this publication and to the product which it describes.

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REFERENCE SECTIONS

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Contents

User Sections

Reference Sections

7.0 The Processor Board

8.0 General Notes on Components

9.0 General Reference

Appendices

1.0 Overview

1.1 The Aims of this manual

1.2 Product overview

1.3 Triple X modification system

1.1 The Aims of this manual

The aims of this manual are:

* to help train service engineers
* to act as a reference for trained engineers
* to explain installation of upgrades and expansion units
* to explain fault diagnosis and rectification

for the complete Triple X family of computers, upgrades and peripherals.

There are no user serviceable parts inside the Triple X, so this manual is specifically aimed at the Service engineer.

Assumptions and Restrictions

The reader of this manual is assumed to have an understanding of floppy and Winchester disc drives, monitors and the principles of how microcomputers work, in addition to the ability to use an oscilloscope and Digital Volt Meter (DVM). The reader should also be familiar with all current electrical Safety Regulations.

This manual covers the servicing and repair of sub-assemblies with instructions as to how to isolate and replace these sections. It does not include component repair of circuit diagrams, details of which can be found in the product design manual "Triple X Exposed".

The service engineer should also become familiar with the contents of other manuals relating to the Triple X, especially the TORCH Caretaker manual; a complete list of these is given as Appendix F, at the end of this manual.

Structure

This manual is divided into three main parts:

The User Sections for how-to-do-it information

The Reference Sections for specifications

The Appendices for information which may frequently need updating.

Each section has its own icon for ease of identificaton plus additional special icons when helpful.

This manual is provided in looseleaf form so that additional or updated information can easily be added. In additon, provision is made for engineers to make their own notes.

Circulation

This manual is provided free to all registered service engineers who have attended the Triple X Service Training Course, as well as to all TORCH Service Centres. Any ammendments and additions to this manual will be distributed to all manual holders. Service engineers wishing to attend a Triple X Training Course should apply on the form at the back of the manual.

1.2 Product overview

1.2.1 The Processor board

The Triple X uses a single high performance processor board.

A single chip "service processor" handles the low bandwidth peripherals and tests and bootstraps the main processor. This simplifies the software and hardware and enhances both serviceability and system security. Triple X uses standard peripheral interfaces (Ethernet, SCSI, X25, VME, RS423 for connection with other devices. The system incorporates such features as battery-backed clock and configuration memory, software-controlled "power-down", comprehensive self-test routines and industry standard high capacity media. All these features ensure that the system is as simple as possible to install, use and service.

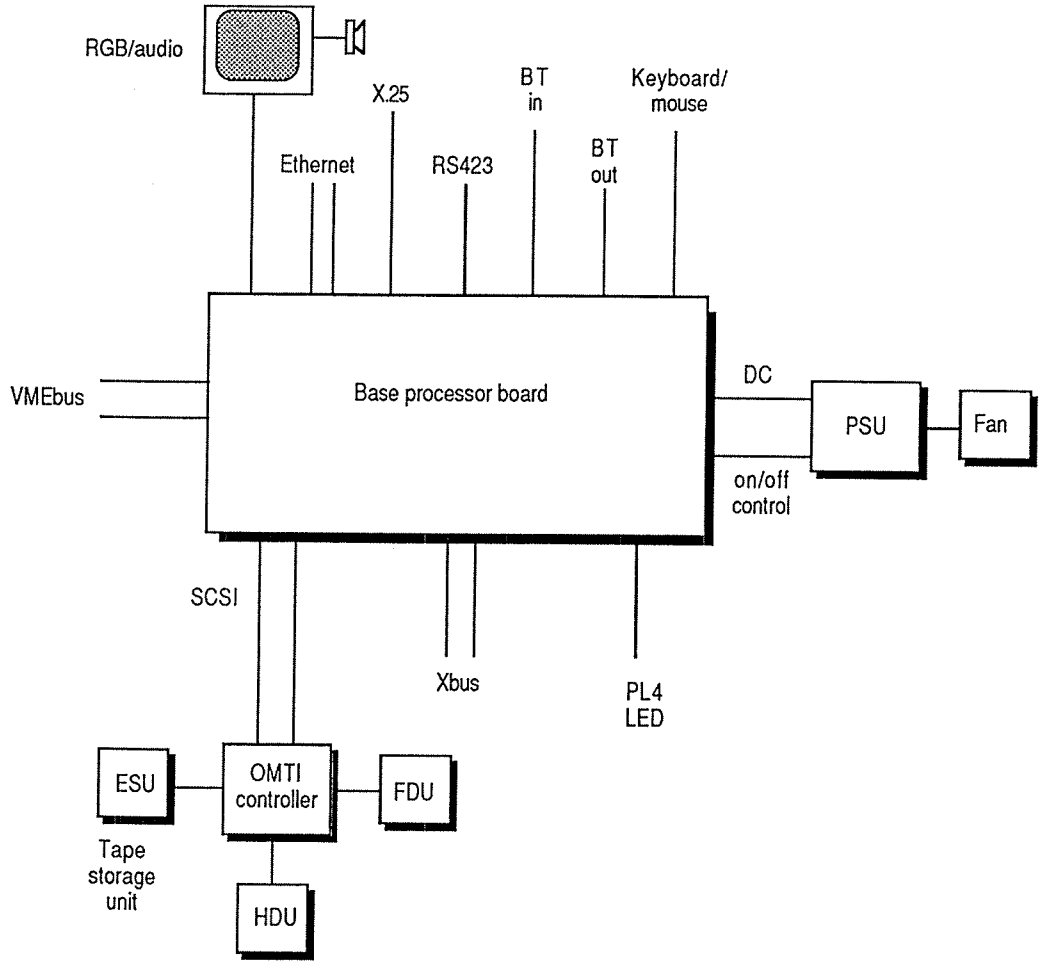


Fig. ?? Block diagram of the Triple X system

1.2.2 Processing Power

A 68010 running at 8 MHz, supported by the 68450 Direct Memory Access controller and the 68451 Memory Management Unit ensures that sufficient processing and I/O capability is available for multi-tasking operations. These capabilities can be further increased by use of the accelerator upgrade pack. Use of the 68451 MMU ensures compatibility with the "generic" System V Unix implementations and allows the use of object code from a wide range of other 68000 based computers.

1.2.3 Memory

The system's standard memory of 1088K (64K + 1Mb) is directly accessible at high speed from the processor. Additional memory can be provided by VME bus expansion.

1.2.4 Peripherals

Triple X uses the industry standard SCSI interface which can be connected to Hard Discs, Floppy Discs, and Streaming Tapes through the appropriate controller. Standard peripherals are a 20Mb (PC20) or 40Mb (PC40) Winchester drive together with a 720Kb floppy disc drive. Buffering on the SCSI interface allows the DMA controller to transfer data from the fastest (10Mbits/s) hard disc drives to memory with minimum interference with the processor's concurrent use of memory. A range of storage options is offered using SCSI based "Expansion Storage Units" (ESU). A typical ESU will provide a 1/4" Streaming Tape Unit for backing up data, with 40Mb of auxiliary hard disc storage.

1.2.5 Serial communications

The Zilog SCC handles all serial communication protocols. Two synchronous or asynchronous serial data channels are supported, with full frame/CRC checking on synchronous packets and intelligent DMA assistance from the 68450 DMA controller.

The serial ports can be used either to support fast serial devices or for communication channels running X25, HDLC, SDLC or similar protocols equipped with appropriate drivers.

1.2.6 Networking

Full IEEE802.3 Ethernet support is provided on the main processor board by the powerful "LANCE" Ethernet chipset in the Ethernet pack. The Ethernet is given direct access to the main memory, to prevent the bottlenecks imposed by conventional buffering schemes. The LANCE Ethernet controller obeys instructions held as linked lists in memory, and can therefore carry out Ethernet operations while the processor continues to carry out other tasks. The Ethernet allows high-speed transfer of messages to other systems.

1.2.7 Video modes

The standard mode is Mode 0. Other modes are possible.

Video Mode	0	1	2	3
Bits per Pixel	2	4	1	2
Pixels per row	736	368	736	368
Number of Rows	256	256	512	512
Number of colours	4	16	2	4
Typical use	standard	CEPT 3/ NAPLPS	High res.	Screen switching

1.2.8 Video palette

The video palette is controlled by the I/O service processor. It consists of a 16 by 8-bit write-only memory. Each of the 16 bytes specifies a different colour. The colour palette allows a choice of eight different levels of red and green and four different levels of blue.

1.2.9 Service processor

To handle miscellaneous low bandwidth peripherals, a dedicated single chip microprocessor (6303R) is provided. This Service Processor (SSP) has direct access to the screen memory, a portion of which is allocated for the transmission of commands from UNIX to the SSP. The SSP therefore has a channel to the 68010 for the transmission of data and commands at DMA speeds. The SSP has its own internal RAM and ROM, and controls several peripheral devices:

* the battery backed clock and non-volatile status information, such as password and machine serial number;

* the X-BUS, a 1MHz bus, used for additional peripherals (such as the TORCH Multi-speed auto-dial auto-answer modem, TOMAC 16 channel multiplexer, or IEEE bus controller);

* an asynchronous serial interface offering 75-19200 baud;

* a single channel sound output for tone generation or audible warning;

* a link to the intelligent power supply for program controlled power-down;

* a serial keyboard and mouse;

* the screen controller and palette.

1.3 Triple X modification system

Any modification to Triple X hardware must be marked on the Modification record label inside the unit. This is located either on the underside of the lid or on the top of the floppy disc cover.

Each modification is given one of the following priority levels:

Level 5 - modifications to future production units only when current stocks are exhausted.

Level 4 - modifications to all production units taking immediate effect.

Level 3 - as Level 4 but including retrospective modifications when units already in the field are visited or returned for another reason.

Level 2 - as Level 4 but including retrospective modifications to all units in the field via planned visits or return programme.

Level 1 - Safety modifications: all units as soon as possible including immediate notification of fault to users.

Details of retrofitting the modifications as well as the components required for any upgrade kit are included in the appropriate Release Notices.

All modifications to the computer and monitors must be recorded by circling the correct code on the Modification Record label. In addition, whenever possible, modified components (e.g. EPROMS) will be labelled with a TORCH EPROM label marked with the appropriate issue number.

The list of current Modifications and priorities is given in Appendix D.

2.0 Before you start

2.1 Safety

2.2 Warnings

2.3 Maintenance strategy

2.1 Safety

*** Diagrams of safety symbols

The normal precautions for working with electrical appliances should be strictly observed. The switched mode power supply/supplies fitted in the Triple X, some of the expansion units and the CM10/CM13 monitors have dangerous voltage levels present, and should not have their covers removed whilst they are still receiving mains power.
As a general principle, remove all power connectors and cables to peripheral devices before removing the case of any unit.

2.2 Warnings

*** static hazard icon

2.2.1 Static handling precautions

When handling integrated circuits and other electronic components, the engineer should take care not to cause damage by electrostatic discharge. A human finger can discharge as much as 40,000V of "static", and, as the table below shows, damage may be caused by just a few hundred volts.

Device type	Voltage
MOSFET	100 - 200
JFET	140 - 7000
CMOS	250 - 3000
Bipolar transistors	400 - 7000
Schottky TTL	1000 - 2500

A workbench designed for repairing computers and their components should be conductive and suitably grounded. A conductive floor mat is also recommended.

When handling board level assemblers on the customer's premises, a grounded wrist strap should be worn.

2.2.2 Radio Frequency Interference

This equipment has been designed to comply with the limits for a Class B computing device, pursuant to Subpart J or Part 15 of FCC rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits should be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.

2.3 Maintenance strategy

The philosophy behind the maintenance and on-site support of the Triple X family is based on the following:

The Objective is to return the customer's system in the same condition it was in when it left the TORCH plant. In addition, the service engineer should aim to make operational the enhancements that have been installed by the customer or distributor since delivery.

The Method is to follow the procedures described in this document and taught in TORCH Customer Engineering courses. If help is required, contact TORCH central support.

The Strategy is to ensure that the customer is given the best service from his on-site representative as quickly as possible and to see that the customer understands the steps taken to rectify their problems.

To allow the engineer to get the Triple X back into service as soon as possible and to reduce the machine's down time to a minimum, both the hardware and software design is highly modularised. The modular design means that modules get replaced, not individual components. This procedure should be followed, even when it is apparently clear that a particular component (such as an IC or a resistor) is at fault.

Engineers on a site visit should resist the temptation to repair or replace individual components (such as ICs or capacitors) for two reasons:

1. The paramount requirement of servicing is to provide the fastest possible turnround for the customer.

2. To ensure good customer relations and confidence in the company and its products, the service engineer should not involve the customer any more than is necessary in the "problem".

3.0 Assembly and Disassembly

3.1 Introduction

3.2 Triple X system unit

3.3 Keyboard and Mouse

3.4 10" colour monitor

3.5 13" colour monitor

3.1 Introduction

Before you disassemble the Triple X, it is essential to decide whether or not it is actually necessary to open the unit in order to correct a problem. In order to determine this, check the index for section 5, 'Fault Finding', which describes the symptoms of various types of faults and how to correct them. It is possible that a particular problem may be rectified without disassembly of the unit.

If you find it is definitely necessary to take the Triple X apart, read section 1 of this manual, which includes necessary information on safety, the modification system and TORCH's maintenance strategy.

This manual is not intended to cover repairs or adjustments below the level of PCB assemblies or other removable modules, such as the FDU, HDU or PSU (see section 9.1 Glossary). However, if you find that individual ICs need to be removed or added, be sure to follow the 'Static handling precautions' outlined in section 2.2.

Before beginning any servicing of the Triple X, always power down the machine and disconnect all leads and connectors (especially the mains). This must be done BEFORE removing the screws which fasten the ring and base unit.

Clear the area around the unit, 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. Remember that a Triple X costs the customer about as much as a saloon car! So great care must be taken not to damage or scratch the system as you disassemble and reassemble it.

Use the appropriate tools. A comprehensive list of recommended tools is given in section 9.2. The Triple X has been designed so that it only requires tools which are part of an engineer's standard kit. The only essential tools are three Posidrive screwdrivers (sizes 0, 1 or 2), a 2.5mm Allen key and a medium flat blade.

Take special care in removing and replacing plugs and connectors. In particular, the pins of multi-pin connectors can easily be bent and permanent damage may result. Use the "ears" of the connectors to release the cable and plug, if these are available. This avoids straining the cable or weakening the connection.

Most of the plugs used in the Triple X are polarised, so never force them closed; they may be incorrectly positioned.

3.2 Triple X system unit

The Triple X system unit is comprised of two main modules: the Base Unit, which contains the main processor board and Power Supply Unit, and the Disc Ring which contains the Hard Disc Unit, Floppy Disc Unit and SCSI data controller.

3.2.1 Disassembling the disc ring

Opening up the Computer Unit

1. Make sure the Triple X is switched off and disconnect all cables from the rear panel. Remove the monitor, keyboard and mouse.

2. Turn the computer unit upside down and with the correct size of flat-bladed screwdriver remove the 4 bolts, one in each corner of the unit. These bolts secure the three parts of the casing - the lid, ring and base.

3. Hold the casing together by gripping both ends of the unit and then carefully return the unit to its normal position - on its rubber feet and with the front of the unit facing you.

4. 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.

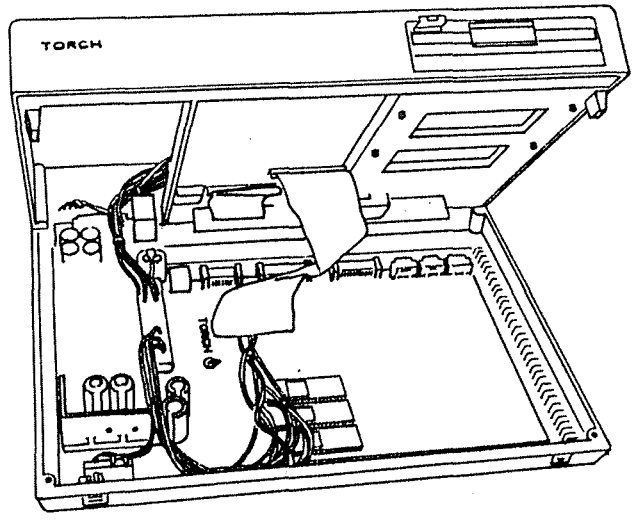


Fig. 3-1 The Triple X system unit opened up to show the SCSI cable, PSU and base processor board.

Removing the disc ring from the base unit

1. Remove the lid of the Triple X cabinet, following the instructions given above. If you prop a ring on the workbench along its back edge (which is often useful, as it can minimise the number of cables that have to be removed), take care that the ring does not overbalance and fall.

2. Remove the two Amphenol DC connectors on the Triple X PSU. These are identified as SK4 (which supplies DC power to the HDU, SCSI data controller card and FDU) and SK9, which supplies the power to the Aux/Fan. Take care NOT to remove the SK2 connector, since this supplies DC power to the Base Processor assembly.

   Note that the PSU provides power to recharge the battery backup. This enables the Triple X to retain its:

   * Serial number, and

   * Permissions on some software (such as the network station number).

   If SK2 is disconnected, even for a short period, you will have to go through certain procedures to reinstall these permissions. Instructions on these operations are given in the Triple X 'Caretaker' manual.

3. Hinge the ring up. This will reveal the 50-way SCSI cable. The ring can be placed on its end on a level surface for better access to the base unit.

4. Push the ears back on the SCSI connector (this is identified as connector PL12 on the base processor board) and disconnect the cable.

5. The complete ring sub-system can now be lifted clear, exposing the PSU and base processor board fixed to the base unit.

3.2.2 Replacing the disc ring

*** This section not yet available

3.2.3 Removing the Floppy Disc Unit

The following instructions apply to the EPSON SD-540 Floppy Disc Drive unit. If other makes or models of FDU are subsequently fitted, some of the details of removal and fitting may vary slightly. For details on other drive types, refer to section 8, General Notes on Components.

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

2. Remove the DC input connector (J1) and the 34-way data cable edge connector (J2). The screened earth lead on the left hand side of the drive must also be removed (this is a pull off connector - remove and replace with a pair of snipe-nosed pliers).

3. Tilt the ring up so that it stands on its end. The FDU is attached by four M3 X 12 crosshead screws.

4. Slide the FDU back past its bevel and lift out from the front of the disc ring cabinet. The RF shield in the form of a metal plate covering the top of the floppy disc assembly is held in place with four screws, two on each side. If the FDU is to be replaced, you will have to remove this shield and re-fit it on the replacement FDU.

   Link settings on Epson FDU SD-540

   If the drive needs replacement, some link settings will have to be checked before the replacement unit is installed.

   The required link settings are:

   SS2 link 2 and 5 closed
   SS1 link 3 closed

   A location diagram of the PCB attached to the FDU is given below, with the position of the links indicated.

   Also, check that the terminator pack, RA1, is in place. Its position is indicated on the PCB location diagram below.

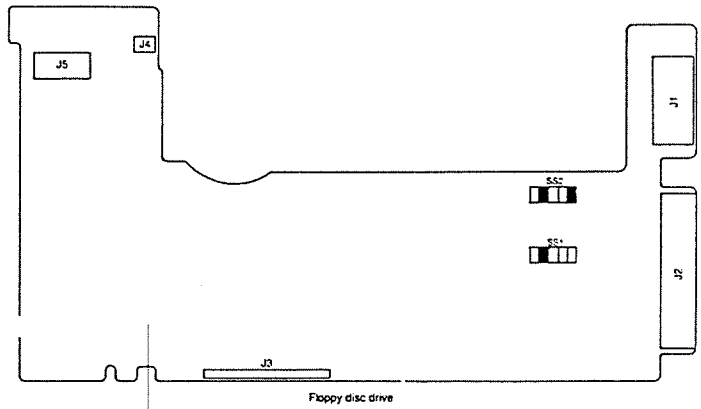


Fig. 3-2 Link positions on the Epson SD-540 PCB

3.2.4 Replacing the Floppy Disc Unit

1. Ensure that the link settings are correct and replace the metal plate which forms a shield for RF interference. The shield is secured by four M3 x 8 screws.

2. Replace the FDU assembly in the disc ring cabinet and reattach the earthing tag connector on the left at the rear of the FDU chassis.

3. Fix the unit to the cabinet with the location screws (of type M3 x 12). Finally, replace the connectors J1 and J2.

3.2.5 Removing the SCSI data controller board

The SCSI data controller board normally fitted to the Triple X is manufactured by the OMTI Corporation. This is a proprietary board which carries out the functions of an intelligent data controller using SCSI data protocols: Model 5200 controls both the Winchester and floppy disc drive units. The SCSI data controller is referred to as the 'OMTI' throughout this manual.

Note: The connectors to the OMTI card are not polarised, so it is possible to plug connectors in the wrong way round. Note that the cable itself has a red stripe corresponding to pin 1, and this can be used as a guide to orientating the connector on the card.

1. With the disc ring removed from the base unit, the OMTI card can be viewed from the underside of the HDU.

2. Remove J10, the 4-way DC lead. (AMP-type)

3. Remove the cable connectors, J1, J2, J3 and J7. (J1 is a 50-way, J3 is a 20-way, J2 and J7 are 34-way connectors).

   Note that these connectors do not have "ears", so it is usually necessary to lever the connectors off gently with the thumbs behind the cable itself, taking care not to bend pins or damage them.

4. Remove the four M3 x 8 crosshead screws from each corner of the PCB. If the disc ring is in the upright position, or tilted, you will need to support the assembly as you withdraw the screws.

5. Lift off the OMTI assembly.

   Before you replace the OMTI 5200, check the link settings and upgrade status of the board. The location of the cable connectors and link settings are given in section 8.1.2 ('SCSI data controller board') in this manual.

3.2.6 Removing the Hard Disc Unit

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

2. The following instructions assume that the OMTI 5200 disc controller board has already been removed. Instructions for carrying out this task are given in part 3.2.7 of this manual.

3. Remove the control (J1) and data (J2) cables and (J3), the DC power cable. Pull off the earth connector from the tag on the HDU housing using snipe-nosed pliers. (The tag is situated between J1 and J2.)

4. With the OMTI board removed, the four M4 x 12 screws are visible and can be loosened. Before removing the screws however, make sure that the HDU is supported. This is to prevent damage to the recording heads or the surface of the discs should the unit fall.

   * Use a "PZD 2" Pozidrive screwdriver to loosen the screws. (All other screws on the ring require a "PZD 1" driver).

5. With the screws loosened, but still affixed to the Noryl (moulded foam) casing, the HDU can be gently removed. The unit is automatically locked in a "ship" position - so long as the correct power off sequence has been followed. The screws are only held by friction in the noryl casework: they should be removed completely before removing the hard disc.

3.2.7 Replacing the Hard Disc Unit

1. There is a moulded slot in the disc ring cabinet so that the front bezel of the HDU can be lined up. Two stabilizing lugs at the rear of the cabinet ensure that the drive is seated squarely.

   All four screws should be lightly tightened before any one of them is fixed. Do not overtighten the screws.

2. Replace the earth cable on its tag and the data and control cable on the HDU. These are straight-through connections with no twists or turns to the ribbon cables.

3. Turn the unit over and replace the DC connector on the HDU last.

4. Replace the SCSI data controller card.

5. Take the base unit (complete with its components and connectors) and place it on the workbench with the on/off switch facing you. Place the disc ring unit on its rear edge, using the lip as a hinge, and lower.

6. Now replace the 50-way SCSI connector (J1) on the OMTI card. Plug in the cable so that pin 1 is to the centre of the OMTI PCB.

7. Replace the 34-way HDU controller connector (J2) and the 20-way HDU data cable (J3).

Replace the disc ring

8. With the disc ring seated squarely on the base unit, tilt the cabinet up to allow the four 90mm fixing bolts to be replaced from underneath.

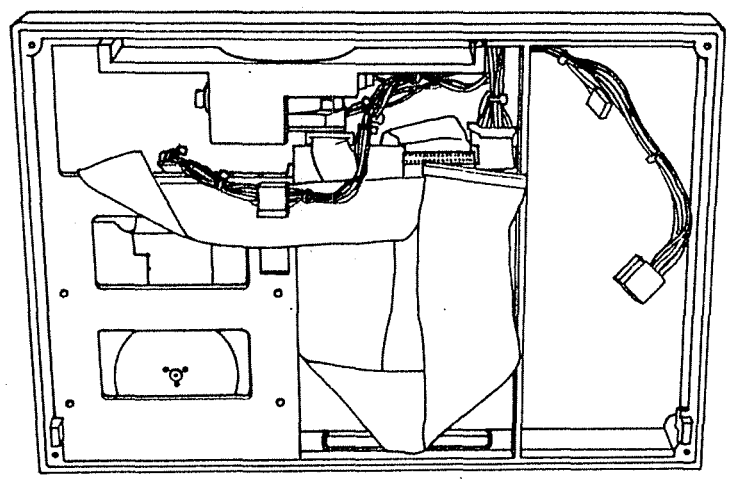


Fig. 3-3 The underside of the disc ring, showing the FDU and HDU cables connected to the SCSI data controller card.

3.2.8 Replacing the SCSI data controller board

*** This section is not yet available

3.2.9 Removing the Power Supply Unit

Before removing the Power Supply Unit check that the "key disc" for the system will be available to reset the system serial number.

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual. This procedure will expose the base unit and the Triple X PSU. Remove the disc ring and set it aside.

   Again, make sure that the mains power lead has been removed from the unit.

2. Disconnect the DC power cable between the main (base processor board and PSU. Disconnect the lead to the fan unit.

   Note that with the disconnection of the power supply to the base processor board, all information in battery backed RAM will be lost, including the permissions and serial numbers of the machine which are used to check security violations.

   This data will have to be restored after the computer has been fully reassembled. Ensure that the Key disc is available when the machine is re-assembled and started up.

3. Remove the two M3 x 6 screws at the front of the PSU chassis. The unit (PSU and chassis) may be removed by lifting at the front and withdrawing the unit clear of the locating tabs at the rear.

4. Take care not to damage the touch pad pins.

3.2.10 Removing the main processor board

The main processor board occupies the whole of the base tray to the right of the Triple X PSU.

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

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

2. Remove the Triple X PSU. This operation is described in section 3.2.9, above.

3. Remove the LED cable (from PL4) and the power cable (8-way Amphenol, marked "POWER"). The main processor board is now ready for removal.

4. There are 11 screws which attach the main processor board to the base tray; all of them need to be removed. They are located in the following positions:

   Three at the front edge (centre, right and left corners).

   Six along or near the back edge.

   Two in the centre of the base processor PCB.

   All the screws are M3 x 6 (so they require a PZD1 screwdriver).

3.2.11 Reassembling the System Unit

Reassembling the Triple X is a straightforward reverse of the procedure for disassembling, but note the following points:

* The SCSI connector is not polarised, so make sure that you reconnect the cable with the identifying stripe on the RIGHT. Press the connector down firmly (so that the ears on the socket return to their upright positions) and lock it in place. Refit the fan unit cable.

* Replace the two power supply connectors between the PSU and the base processor board. The connectors are designed so that they cannot be fitted incorrectly.

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

3.3 Keyboard and Mouse

*** Not yet available

3.4 10" colour monitor

The CM10 is a 10" colour monitor based on the Sony CPD-1000E high resolution character display.

The monitor is designed for use with both analog and digital RGB input. The TORCH Triple X produces analog output. The CM10 uses a super fine pitch Trinitron character display with a CPD-1000E anti-glare dark screen and P22 phosphors. The maximum screen resolution is 640 X 240 dots.

The instructions in this section simply refer to the disassembly and subsequent re-assembly of the CM10 casing to allow the monitor (and RGB adaptor) to be adjusted, repaired or exchanged. Detailed signal adjustments (such as Beam landing, convergence and white balance) require specialist skills and equipment, and are outside of the scope of this manual. Refer to the Sony CHM-1001012/CHM 1001-22 Service Manual for further details.

3.4.1 Precautions

*** safety symbol icon

Make sure that power has been removed from the monitor before removing the case. Dangerously high voltages are present inside the unit; remember that servicing the CM10 should only be carried out by qualified personnel.

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

3.4.2 Removing the CM10 monitor casing

1. Place the CM10 face down on a clean, soft surface.

2. Remove the two M4 X 20 crosshead screws from the rear corners of the lower casing.

3. Place the unit on its pedestal once more and grip the top of the casing by the sides of the upper moulding, towards the rear of the unit. Lift the casing away; it is hinged about the retaining lip at the front. If the lid is stiff it can be levered off manually. On no account should a hard object be used (such as a screwdriver) since this will damage the paintwork.

Fig. 3-4 location of fixing screws on the CM10 and the lifting position for removal of upper casing.

4. Place the monitor and lower casing face down once more and slide the circular pedestal towards the back of the unit. This will expose two M4 X 15 Pozidrive pan head screws on the curved pedestal base, which can now be removed.

5. Remove the two M4 X 7 crosshead screws from the rear of the lower casing, viewed from above.

6. All four retaining screws have now been removed, so that the base unit can now slide out horizontally. You will find removal easier if the on/off rocker switch is set to ON (i.e. the green dot is in the down position). The base casing is attached to the monitor's chassis by means of two wires leading to the loudspeaker. If you need to remove the base casing more than just a few inches from the rest of the unit, you will have to disconnect the speaker wires from the Molex connector on the RGB adaptor board (see below).

7. The 8-way DIN socket and RGB adaptor board (Part Number 100-1059) can be detached from the monitor's chassis, if necessary, by removing the two small crosshead retaining screws using a 'PZD 0' screwdriver.

3.4.3 Replacing the CM10 monitor casing

1. With the monitor and chassis face down on a clear, soft surface, replace the base unit by sliding it horizontally so that it comes to rest on the front bezel. Replace the two 4 X 15 screws beside the circular pedestal stand and two 4 X 7 screws which fix the rear of the casing to the chassis lugs.

2. With the unit on its base, hold both sides of the lid unit and tilt approximately 30 degrees to the horizontal. Slide the unit forward so that the lip of the top front edge engages with the edge on the front bezel. Lower the lid so that it is firmly seated on all sides.

3. Now place the entire casing face down so that the two parts of the case can be locked together by the two 4 X 20 crosshead screws. The screws are placed in their deep slots at the sides of the base unit towards the rear.

3.5 13" colour monitor

The CM13 is a 13" colour monitor based on the Sony CPD-1301E high resolution character display.

The monitor is designed for use with both analog and digital RGB input. The TORCH Triple X produces analog output. The CM13 uses a super fine pitch Trinitron character display with a CPD-1301E anti-glare dark screen and EBU phosphors. The screen resolution is 800 X 240 dots.

The instructions in this section simply refer to the disassembly and subsequent re-assembly of the CM10 casing to allow the monitor (and RGB adaptor) to be adjusted, repaired or exchanged. Detailed signal adjustments (such as Beam landing, convergence and white balance) require specialist skills and equipment, and are outside the scope of this manual. Refer to the Sony CHM-1001012/CHM 1001-22 Service Manual for further details. Other, less technical, information is given in the Sony CPD-1301E/1000E Operating Instructions booklet.

3.5.1 Precautions

*** safety symbol icon

Make sure that power has been removed from the monitor before removing the case. Dangerously high voltages are present inside the unit; remember that servicing the CM13 should only be carried out by qualified personnel.

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

3.5.2 Removing the CM13 monitor casing

1. Remove the AC power input connector from 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 remove the ??

3. With the monitor resting face down, the plastic casing can now be lifted away, leaving the CPD-1301E chassis and bezel.

If required, the front bezel can be taken off by removing the two?? crosshead screws on the ??

The circuit assemblies within the chassis, the controls, components and test points are in the same position as the CM10 chassis. Refer to section 3.4 in this manual for further information.

3.5.3 Replacing the CM13 monitor casing

*** This section is not yet available

4.0 Installing Upgrades

4.1 Slim ring

4.2 Quin ring

4.3 Expansion Storage Unit

4.4 Accelerator board (68O2O/68881)

4.5 Ethernet

4.6 Modem

4.1 Slim ring

The Slim ring houses the memory expansion module. An additional two megabytes of memory is currently provided by a single PME 2EP assembly, connected by the VME (96-way) cable.

Slim rings (and Quin rings) are attached to the system lid by L-shaped brackets and fixed from the side by 2.5mm Allen key bolts. The bottom unit is secured in the same way as the PC20/40 modules (that is, by four 90mm bolts, one at each corner).

Note: Follow the instructions supplied with the board when installing Memory.

4.1.1 Installing the Slim ring

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

   Fitting the VME and SCSI cables

2. Remove the short lead that connects the LED on the front of the base unit to the base processor board.

3. Remove the two screws at the front of the PSU, lift it from the base unit and place it alongside the Triple X; this avoids disconnecting the board's power supply lead.

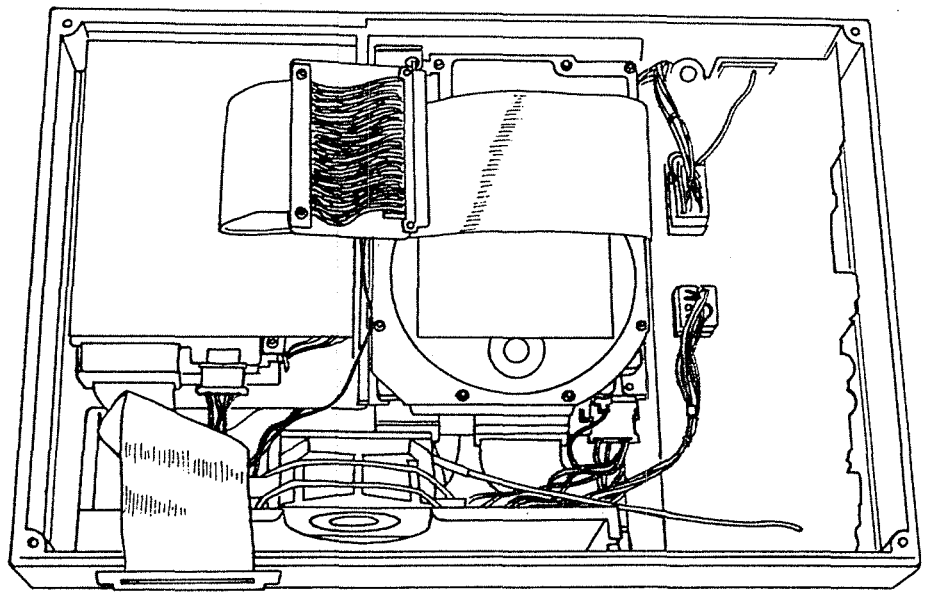


Fig. 4-1 The Triple X system unit with the lid removed, showing the disc unit and PSU. The 96-way VME cable is folded over.

4. Remove the 11 screws from the base processor board (including the two screws located in the middle) and lift up the left hand edge of the board. Plug one end of the VME lead into the VME bus connector. Note that the connector is polarised.

5. Replace the base processor board and its securing screws. Reconnect the LED lead.

6. Certain links will need to be set on the base processor board. The link settings will depend on the version of the board in the machine and which VME card is fitted. (See Section 8.2.2 'VME expansion' for details.)

   If you are fitting a Triple Meg board to an issue 4 base processor board, insert links LK5 and LK6 which are adjacent to the VME connector. Link LK7 should also be inserted if the system clock driver is required.

7. Fold the VME cable over the main board. Replace the PSU and screw it into place.

8. Plug the centre connector of the new SCSI lead into the base processor board with the indicator stripe on the right hand side, connecting to pin 1.

9. Replace the standard ring feeding the VME cable up between the PSU and the hard disc unit. Place the rear end of the SCSI lead between the hard disc unit and the fan enclosure. Plug the free end of the SCSI lead that is fitted with a female connector into the SCSI data controller card on the standard ring. Note that the red stripe should be positioned towards the centre of the card. Ensure that both SCSI connectors are fitted securely and that the ears of the sockets return to the fully upright position.

10. Reconnect the fan power lead.

Fitting the Slim ring

11. Retract the sliding props from the securing brackets on the base plate of the Slim ring and tilt the VME board cage upwards. Then lift the cage out of the ring. Place the Slim ring on top of the standard ring.

12. Feed the VME cable through the large cut-out slot near the centre of the Slim ring base plate and the trailing end of the SCSI lead through the cut-out slot at the rear of the base plate.

13. Insert the SCSI connector in the cut out in the rear facing panel of the Slim ring and bolt it into place using the washers and nuts supplied. Ensure that any slack in the SCSI cable is folded beneath the base of the Slim ring.

14. Secure the Slim ring to the Triple X base and disc ring by replacing the bolts that were removed from the unit on disassembly. To avoid tilting the Triple X, position the unit so that it overhangs the edge of the work bench by about 3 cm. This enables you to insert the bolts from the underside.

15. Replace the cage assembly in the Slim ring ensuring that it rests on the locating notches towards the centre of the ring and fits underneath the lip on the baseplate.

16. Plug the VME lead into the lowest connector in the cage, tilt the right hand side of the cage upwards and pull out its sliding props so that they rest on the top edge of the ring, holding the cage in the tilted position.

Fitting a VME card

Note: Before handling VME cards, or individual ICs which may be changed on the boards, be sure to follow the precaution for dealing with static electricity discharge. These precautions are outlined in section 2.2 of this manual.

17. Slide the VME card into the uppermost slot in the cage and carefully push it home so that the connectors mate securely.

18. Lower the cage and connect its power supply lead to the centre power connector on the Triple X PSU by feeding the lead through the cut-out above the PSU. Move the sliding props to lock the cage in place.

Reassembling the unit

19. Using the Allen key supplied, unbolt the lid retaining brackets from the top of the Slim ring by inserting the key through the ventilation slots adjacent to the securing bolts.

20. Fix the brackets to the lid of the Triple X using the cross head screws supplied. Secure the lid to the Slim ring using the Allen key.

4.1.2 Removing the Slim ring

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

2. Take out the four 90mm bolts from the corners of the underside of the base unit, if these have not already been removed. The bolts hold together the casing, including the lid, slim and disc rings and base.

3. Raise the Slim ring (attached to the disc ring, if fitted) from the base unit and remove the DC power connector from the Triple X PSU. Do not remove the front 8-way connector (SK2) as this maintains a power supply to the battery-backed RAM.

4. Remove the VME cable (this is located underneath the terminator pack connected to the VME back panel).

5. Remove the 50-way male SCSI connector extension; this is located at the rear of the base unit, above the Floppy Disc Unit, and is labelled 'SCSI' on the case.

6. Ease the Slim ring off by the right-hand edge, feeding the VME cable back through its slots. The 2EP memory expansion card, if present, can remain in place. Lift the ring by its right edge, as though hinged, and remove completely.

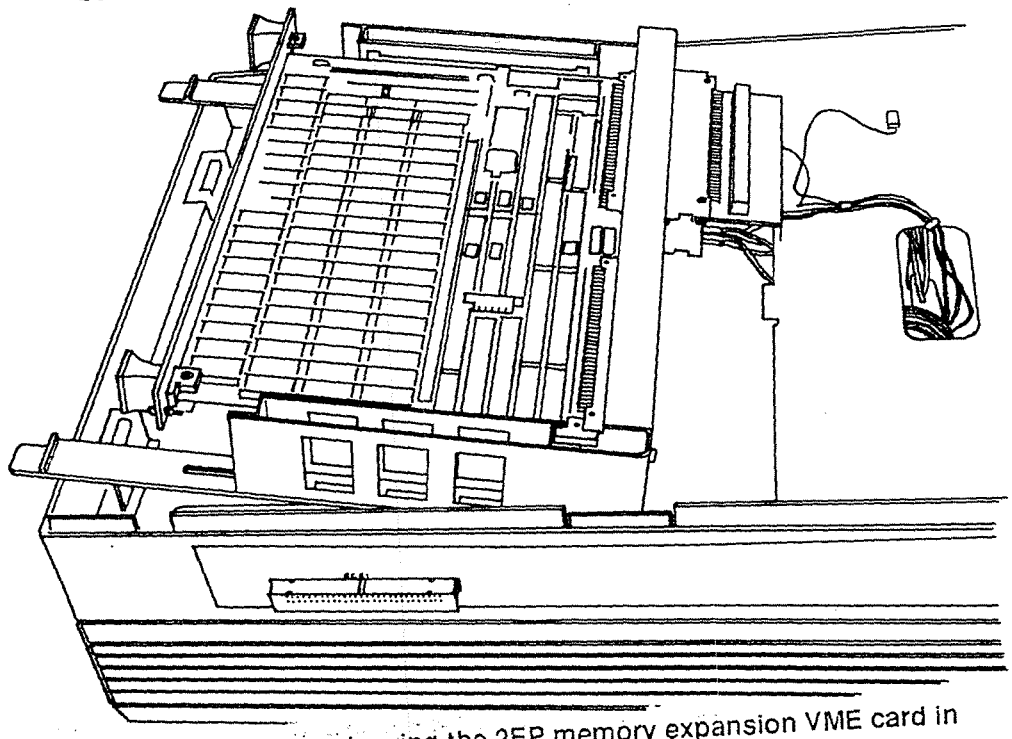


Fig. 4-2 The Slim ring, showing the 2EP memory expansion VME card in the 'service position'.

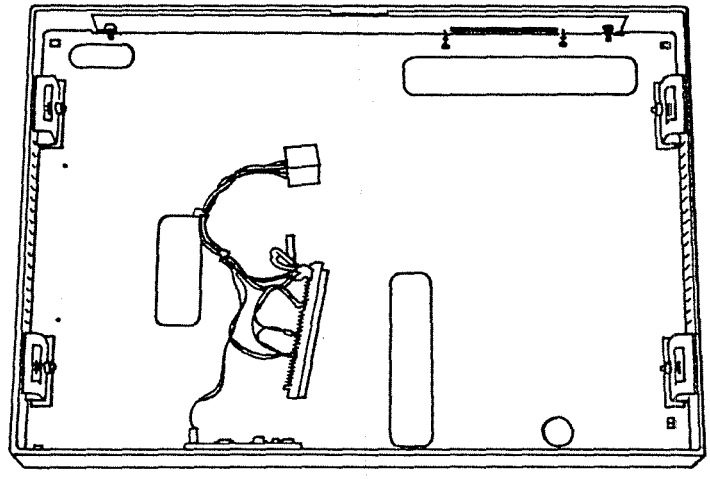


Fig. 4-3 The Slim ring, with the sub-chassis removed.

Reassembly

To reassemble the Triple X unit, carry out the above sequence of actions in reverse order.

4.2 Quin ring expansion

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

The expansion module is comprised of a five-slot VME rack (in a separate sub-chassis), an auxiliary power supply and three supplementary fan units.

Quin rings (and Slim rings) are attached by L-shaped brackets and fixed from the side by 2.5mm Allen key bolts. The bottom unit is secured in the same way as the PC20/40 modules (i.e., by four 90mm bolts, one at each corner).

4.2.1 Installing the Quin ring

Opening up the Computer Unit

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

2. Hold the casing together by gripping both ends of the unit and then carefully return the unit to its normal position - on its rubber feet and with the front of the unit facing you.

3. Remove the lid exposing the Power Supply Unit (PSU) to the left of the hard and floppy disc units, and the fan at the rear.

Gaining Access to the Main Processor Board

4. Remove the fan by unplugging the 2-way connector SK9 in the centre rear of the PSU and releasing the retaining neoprene band.

5. Disconnect the ring DC supply by removing the rear-most of the 8-way connectors SK4 at the centre right of the PSU. You will need to squeeze together the two plastic catches before it can be removed.

   DO NOT remove the front 8-way connector SK2 as this supplies power from the battery on the PSU to the battery-backed RAM on the board.

6. Carefully tilt up the front of the ring using the back edge as a hinge. You will then be able to see the flat SCSI ribbon cable connecting the ring to the base processor board.

   Disconnect the SCSI cable from the board by pushing apart the two ears on the socket.

7. The complete ring sub-system can then be lifted clear, exposing the PSU and base processor board. Disconnect the SCSI lead from the ring assembly.

Fitting the VME and SCSI cables

8. Remove the short lead that connects the LED on the front of the base unit to the processor board.

9. Remove the two screws at the front of the PSU, lift it from the base unit and place it alongside the Triple X, thus avoiding disconnection of the board's power supply lead.

10. Remove the 11 screws from the base processor board (including the two screws located in the middle) so that the left hand edge can be tilted upwards and the VME lead plugged into the VME bus connector.

11. Replace the base processor board and its securing screws. Reconnect the LED lead.

12. Certain links will need to be set on the base processor board, depending on which version of the board is in the machine and which VME card is fitted. (See Section 8.2.2 'VME expansion' for details.)

13. Fold the VME cable over the main board to the right. Replace the PSU and screw it into place.

14. Plug the centre connector of the new SCSI lead into the base processor board with the indicator stripe on the right hand side.

15. Replace the standard ring feeding the VME cable up between the PSU and the hard disc unit and the rear end of the SCSI lead between the hard disc unit and the fan enclosure. Plug the free end of the SCSI lead that is fitted with a female connector into the OMTI controller card on the underside of the disc ring. Note that the red stripe should be positioned towards the centre of the card. Ensure that both SCSI connectors are fitted securely and that the ears on the sockets have been returned to their upright positions.

16. Fit the new fan into the fan housing on the Triple X disc ring, securing it with the fan retaining band. Connect the fan and ring power leads to the Triple X PSU. Note that all of the power supply connectors are designed so that they cannot be fitted incorrectly.

Fitting the Quin ring

17. Remove the top resistor terminator card from the cage. Retract the sliding props from the securing brackets on the base plate of the Quin ring. Disconnect the two power leads from the cage, folding them back over the cooling fans and lift the cage assembly out of the ring.

18. Place the Quin ring on top of the standard ring, feeding the trailing end of the fan power lead through the cut out in the base of the Quin ring at the rear left hand corner. Plug the fan lead into the trailing socket connected to the Quin ring PSU.

19. Feed the VME cable through the large cut out near the centre of the Quin ring base plate and the trailing end of the SCSI lead through the cut out at the rear of the base plate.

20. Insert the SCSI connector in the cut out in the rear facing panel of the Quin ring and bolt it into place using the washers and nuts supplied. Ensure that any slack in the SCSI cable is folded beneath the base of the Quin ring.

21. Secure the Quin ring to the Triple X base and standard ring by replacing the bolts that were removed from the unit on disassembly. To avoid tilting the Triple X, position the unit so that it overhangs the edge of the work bench by about 3 cm. This enables you to insert the bolts from the underside.

22. Replace the cage assembly in the Quin ring, ensuring that it rests on the locating notches towards the centre of the ring and fits underneath the lip on the baseplate.

23. Plug the VME lead into the lowermost connector in the cage, tilt the right hand side of the cage upwards and pull out its sliding props so that they rest on the top edge of the ring, holding the cage in the tilted ('service') position.

4.2.2 Fitting VME cards

1. 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.

   Note: If temperature problems are encountered the front panels can be removed from the cards to allow improved air circulation.

2. Lower the cage and reconnect its power supply leads and the terminator card. Move the sliding props to lock the cage in place.

4.2.3 Removing VME cards

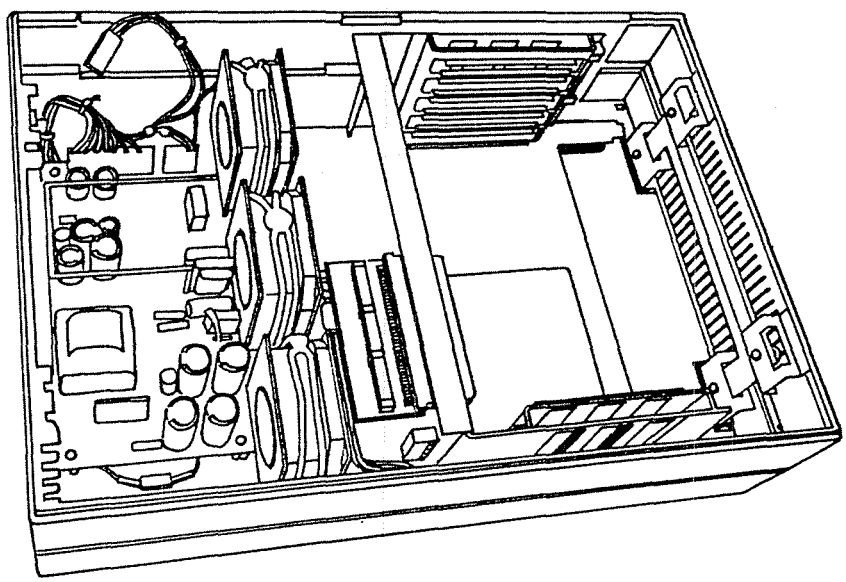


Fig. 4-4 The Quin ring, with the lid removed. All VME cards have been removed from the 5-slot card frame. The terminator card is in place on the backplane.

1. With the Quin ring exposed, carefully ease the resistor terminator card from the backplane (this is to prevent damage to the connector when the VME rack is in the hinged 'service position').

2. Withdraw the pair of sliders from the 'locked position' and lift the VME sub-assembly from its outside edge. Now extend the sliders so that the rack can rest in the tilted 'service position'.

3. Pull the appropriate VME card out of the rack by easing it squarely from the backplane connector and edge retainers. Remove, test or replace the card.

4. Withdraw the pair of sliders from the edge of the Quin ring, lower the rack gently and push the pair of sliders towards the ventilated slots at the side of the ring to lock the sub-chassis.

5. Replace the resistor terminator card on the uppermost connector at the rear of the backplane.

4.2.4 Reassembling the Quin ring

1. Links which short the circuit are required between certain signal pairs when no VME board is present in the backplane connector. These link settings are listed in section 8.2.2 'VME expansion' in this manual.

2. Using the Allen key supplied, unbolt the lid retaining brackets from the top of the Quin ring by inserting the key through the ventilation slots adjacent to the securing bolts.

3. Fix the brackets to the lid of the Triple X using the cross head screws supplied. Secure the lid to the Quin ring using the Allen key.

4.2.5 Removing the auxiliary fan unit

1. Release the right-hand loop of the neoprene band which retains the fan.

2. For early models of the PSU: the power connection to the fan is next to 'RLA 1' (relay) at the back in the right-hand corner.

   For later models of the PSU: the power connector to the fan is next to the mains I/O on the rear edge of the PCB.

   In the case of both the early and the later models of the auxiliary PSU, the power connection which supplies the fan is identified as 'SK9': it is also marked 'FAN/AUX'.

3. Lift the fan unit out.

4.2.6 Replacing the auxiliary fan unit

1. Ensure that the mains lead for the auxiliary fan is trailing to the left of the unit for correct orientation, thus:

Fig. 4-5 Correct orientation of the fan unit.

2. Replace the fan unit and secure with the neoprene band; reconnect the mains lead to 'SK9' or 'FAN/AUX'.

4.2.7 Removing the auxiliary (Astec) PSU

1. Remove the 'power in' and 'power out' connectors (these are of the RIDGCO type). Ease the plastic spring retainer away to allow the plug to be withdrawn from the connector. On the long connector, it is enough to open one end of the plastic base spring before easing the plug away from its connector.

2. Remove the four cross-head screws from the four corner pillars.

3. Lift the auxiliary PSU free by holding each end of the PCB.

4.2.8 Replacing the auxiliary PSU

Replace the auxiliary PSU by reversing the above procedure.

4.3 Expansion Storage Units

Expansion Storage Units can provide a 1/4" streaming tape unit for backing up data. There is also provision for an auxiliary hard disc unit, in addition to the HDU on the Triple X disc ring.

The ESU is housed in a Triple X base unit, ring and lid, with the on/off touch switch blanked out. The ESU is designed as a stand-alone unit: it is not intended that the unit should be stacked.

Power is supplied by a Farnell 100W power supply unit, modified by capacitor C31 being shorted out. The PSU is secured by six M3 x 6 pan head Posidrive screws. One DC loom supplies power to the disc drive, controller and LED, the other DC loom is connected to the tape drive, controller and LED. The unit is cooled by an ETRI model 126LJ fan, taking power from a 2-way Molex conector to the PSU.

4.3.1 Hard Disc Unit

The HDU is controlled by an OMTI 5200 card. Ensure that the controller card is fitted with the latest versions of firmware by referring to section 8.1.2, 'SCSI data controller board'.

Three ribbon cables are connected to the disc controller: a 50-way cable to the backplate (400mm), a 34-way data cable and a 20-way control cable (both 90mm) to the disc drive.

4.3.2 Streaming Tape Unit

The standard streaming tape unit supplied is the Archive Scorpion model 5945 1/4" tape drive. It is controlled by the Adaptec ACB-3530 streaming tape controller card, mounted on a plate with six M3 x 6 pan head Posidrive screws.

The tape controller has two 50-way cables - one to the tape drive itself and one to the backplate - each 300mm long.

4.4 Accelerator Board (68O2O/68881)

4.4.1 Software - installing the new kernel

Note: All Triple X systems with Issue 1.3 of System V already have kernels that support the 68020. However systems with Issue 1.2 must have a kernel with 68020 support installed PRIOR to fitting the Accelerator Board.

Please follow the instructions supplied with the Accelerator board.

4.4.2 Hardware - installing the accelerator board

The Accelerator board is fitted in place of the 68010 chip, which is the large chip located towards the centre of the front edge of the main processor board and labeled IC143. This chip should now be removed from its socket while taking very great care to avoid bending either the chip or its legs. It is recommended that the correct extraction tool is used to avoid damage to the chip or the main processor board.

Once the 68010 has been removed, its legs should be pushed into antistatic foam to protect the chip from physical and electrical damage,in the unlikely event that it is needed again.

To insert the Accelerator board, position it so that the two square processor chips are towards the rear of the Triple X and the legs on the underside rest over the IC143 socket. After ensuring that none of the legs overhang the socket at either end, gently push the board down by applying pressure evenly to both ends until the sleeves on the legs lie flush with the top of the socket.

Now reassemble the computer unit in the usual way; this is described in section 3.2.11 of this manual.

NB Ensure the SCSI cable does not ccme into contact with the accelerator board when the system has been re-assembled. Overheating is likely to occur if this is not done.

4.5 Ethernet

4.5.1 Installing the Ethernet upgrade pack

1. Power down, remove all connectors from the system unit, then remove the disc ring. Instructions for carrying out this task are given in part 3.2.1 of this manual.

2. Note, however, that you do not need to remove the 8-way connector (SK2) from the PSU. Power is supplied from the battery on the PSU to maintain the battery-backed RAM on the base processor board.

3. With the disc ring raised carefully on its end, you will be able to see the flat SCSI ribbon cable connecting the ring to the base processor board. Disconnect the SCSI cable from the board by pushing apart the two ears on the socket.

   The complete ring sub-system can now be lifted clear, exposing the PSU and processor board fixed to the base.

4.5.2 Inserting the Chip Set

Important Note

Approximately 100 Triple X systems have been supplied with an Issue 2 base processor board, which does not support IEEE802.3 Ethernet. If a system was supplied prior to April 1986 or as a "non-Ethernet" system, it may use an Issue 2 board. Refer to the TORCH Support Database for further details.

The three Ethernet chips can now be inserted into the three sockets immediately behind the SCSI connector on the base processor board. The individual chips are easily distinguished because they have 48, 26 and 16-pins respectively. The chip set consists of the following:

* The LANCE (Ethernet controller)
  in socket IC139, 48-pin package.

* Transceiver
  in socket IC140, 26-pin package.

* DIL isolation transformer pack
  in socket TR1, 16-pin package.

Insert each chip with pin 1 to the right, away from the PSU (just like the other chips on the board). Orientate each chip so that either:

* a printed '1' is in the top right corner

or

* a notch at the end of the chip is to the right

or

* a circular well (depression) at the end of the chip or in one corner is facing right. (Ignore the shallow moulding marks.)

To insert a chip, locate one row of pins in the appropriate row of socket holes and gently press the chip towards these pins so that the row of pins on the other side are in line with their socket holes. (It is advised to use a proper chip insertion tool for this job.) When all the pins are properly located, firmly and squarely press the chip home, using equal pressure at both ends. Take care not to bend the delicate pins.

4.6 Modem

4.6.1 Installing the Triple X Modem

It is most important to note that the installation procedure used will depend upon the issue number of the base processor board in your Triple X. You will find this number printed on the board between the three large processor chips and the SCSI connector.

Insert a plastic pillar into each of the four holes in the base processor board. Two of these holes are adjacent to the right-hand edge of the board; the other two are located towards either end of the 'TORCH COMPUTERS LTD' label. The ends of the pillars should have their collars nearest to the board.

Hold the modem card, component side up, and make sure that the edge with the Insulation Displacement Connector (IDC) is facing you. Fold the ribbon cable under the modem card, checking that the edge of the ribbon cable marked with a stripe is on the right-hand side. Plug the 34-way connector into the IDC on the base processor board. This connector is positioned about 7cm in from the right-hand edge of the board and is labelled 'PL3 X-BUS'. The cable must not be twisted while you are doing this or the plug will be incorrectly inserted.

Hold the edge of the modem card with the IDC facing the front of the Triple X. Now secure the modem card to the base processor board by inserting the top of the plastic pillars in the card.

Points specific to Issue 4 boards

Remove the 12-way Molex plug labelled 'PL10': this is located at the rear right-hand corner of the base processor board. (Discard this part if you like as you will not need to use it again.) Plug the 12-way Molex connector which leads to the modem card onto PL10. (You will find that there is only one way this can be fitted correctly.)

Release the cable tie that secures the 4-way power socket to the rest of the DC loom and links the base processor board to the PSU. Connect this socket to the plug on the front facing edge of the modem card, keeping the locking ridge uppermost.

Points specific to Issue 2 boards

If the DC loom which links the base processor board to the PSU does not have a free 4-way connector, you will have to install the replacement loom supplied with the modem. To do this, remove the existing loom by squeezing together the plastic catches on the 8-way connectors at either end and re-insert the replacement loom.

Note: Swapping these cables results in a temporary loss of power to the battery backed RAM, so you will find that the Triple X will ask for the key disc to be inserted the next time it is booted up.

As PL10 has only 6 pins on Issue 2 boards, you will have to take extra care when connecting the lead from the modem. Capacitors C3 and C4 (located immediately to the left of the Molex connector) should be bent slightly forwards towards IC10. Now plug the 12-way Molex lead onto the base processor board, making sure that the three wires leading to the modem are on the right. Only the six pins on the right of the 12-way connector should be used to mate with PL10. The remaining six pins will overhang to the left of PL10, above capacitors C3 and C4.

5.0 Fault Finding

5.1 Isolating and Identifying the Fault

5.2 Problems on Power up

5.2.1 On/off touch switch
5.2.2 Dead/no power up
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'

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
5.3.5 SCSI controller 0 not present
5.3.6 Disc not ready or present
5.3.7 Cannot boot WERMA from hard disc
5.3.8 Device 0,0 is not a disc

5.4 Problems notified by the Caretaker disc file

5.4.1 System V not present

5.5 Problems notified by UNIX

5.5.1 Panic I/O error
5.5.2 Kernel window panic I/O error
5.5.3 Uncorrectable data error

5.6 SCSI error messages

5.1 Isolating and Identifying the Fault

Several diagnostic aids are provided with the Triple X. These enable the engineer to isolate problem areas in the shortest possible time. In some cases, such as with error messages appearing in the kernel window, the fault can be remedied without taking the system unit apart. In other cases, the engineer can use a fault flowchart to correct the problem. In these instances, the flowchart provides an overview of the work that needs to be done. Practical details of the procedure for removing and installing modules are given in the appropriate parts of section 3 - 'Assembly and Disassembly' and section 4 - 'Installng Upgrades'.

Faults on the Torch Triple X system fall into three major categories:

1. Problems in powering up the Triple X

   Given that the system unit is receiving power (the cooling fan, for instance, is revolving) the onboard test firmware can detect certain faults on the main processor board. These faults are indicated to the user by a series of audible "beeps", in the same way as some Winchester disc drives indicate problems by a flashing LED. This class of fault is dealt with in section 5.2.

2. Error messages may be displayed in the text window during the start up sequence.

   Some error message strings form the starting point to a set of flowcharts which aim to quickly identify and give a procedure to remedy the most common faults. This class of fault is dealt with in sections 5.3, 5.4 and 5.5.

3. The SCSI data controller card issues its own set of diagnostic codes. These codes are listed in a table given in section 5.6, together with a short description of their likely cause.

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

5.2 Problems on Power up

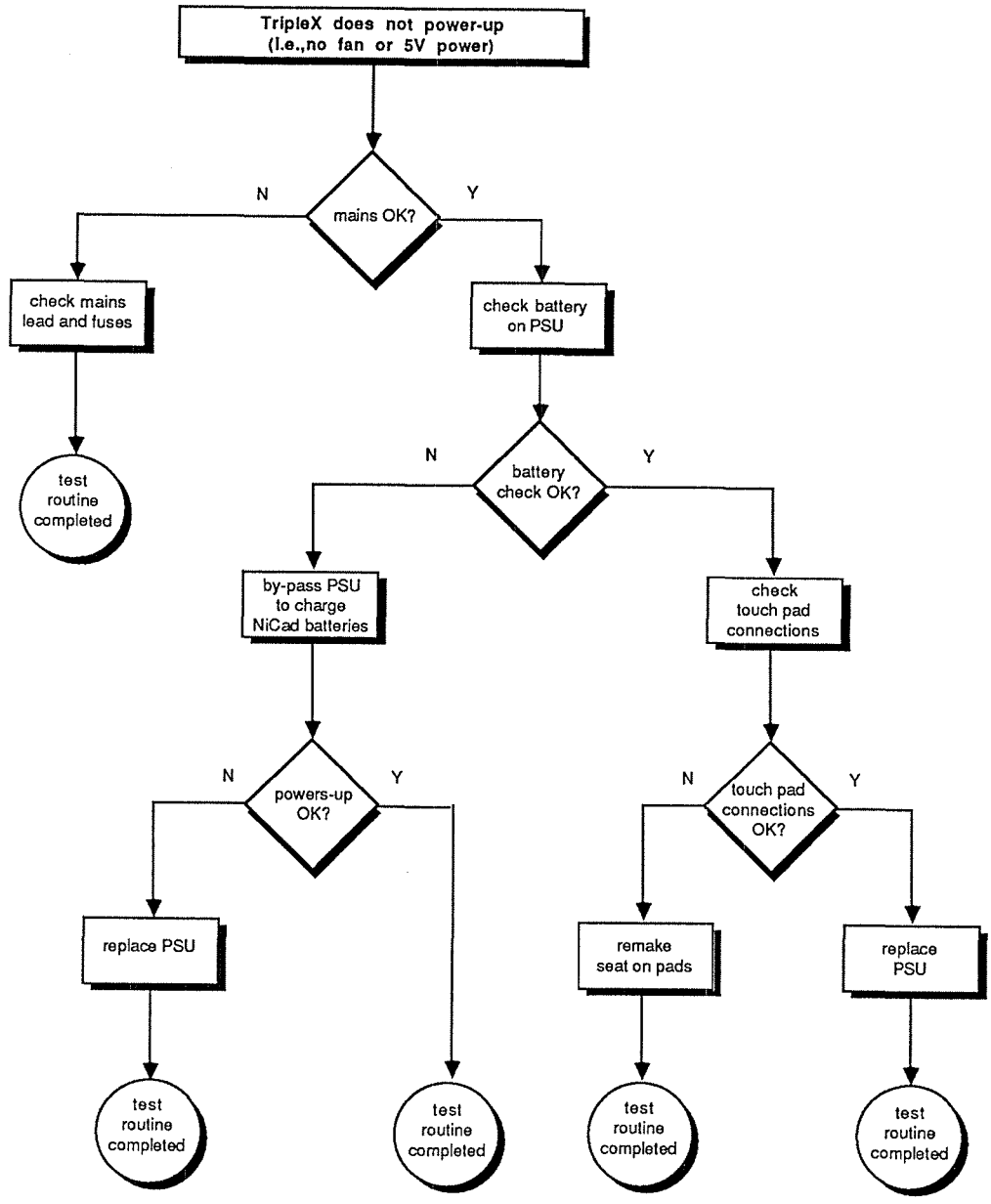
5.2.1 On/off touch switch

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

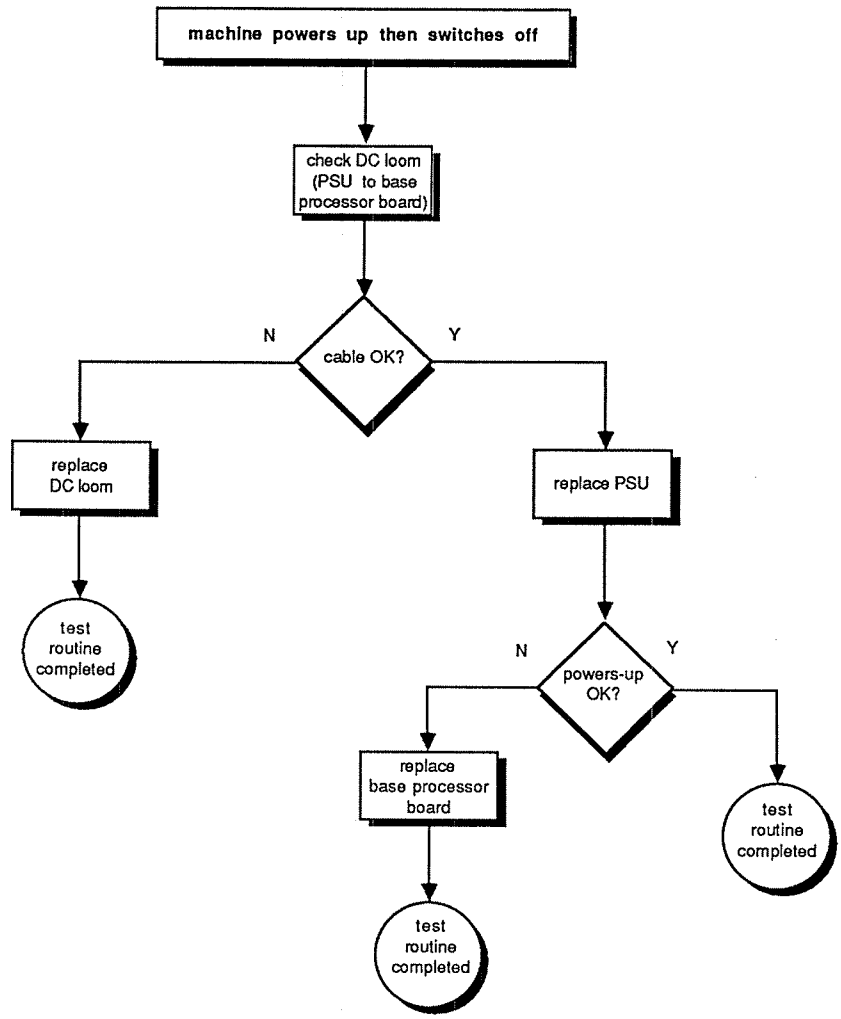
If the operator has unusually dry skin, or is working in a very dry atmosphere, there may be inadequate conductivity in lightly touching the switch. In either case, try moistening the fingertip before switching the Triple X on or off: there is no danger of electrical shock because the switch is fully 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.

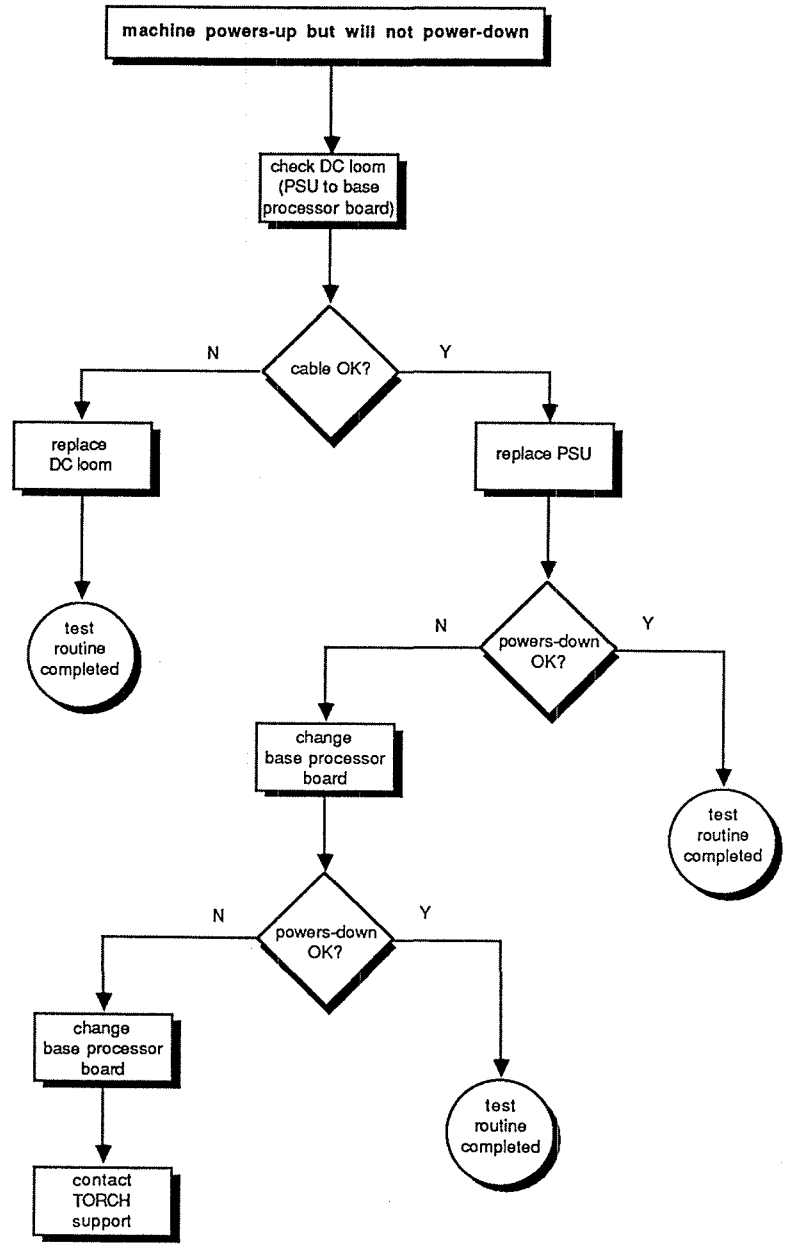
5.2.2 Dead/no power up



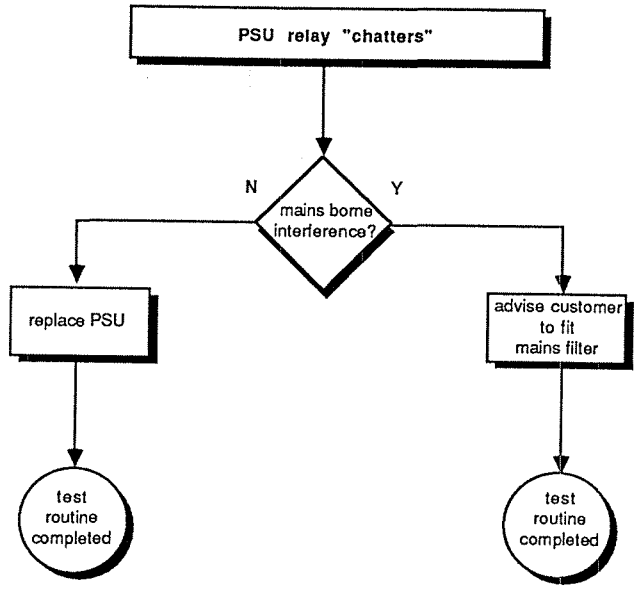
5.2.3 Machine powers up then switches off



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 in the main processor board, the service processor emits a sequence of four long and/or short beeps. These signals are repeated, after a pause, until the computer unit is powered off.

A long beep represents a binary 1, a short beep a binary zero.

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

Note: Except for faulty EPROM (Error 0) or faulty processor (Errors 7 & 8) all other beep errors are best cured by replacing the board. With EPROM and processor errors, first check that the chip is fully inserted in the board before attempting to replace it (especially in the case of 68020 processors on their daughter board).

Error 0 - 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 determines what is seen on the screen) is not working correctly.

Action: Replace the board.

Error 2 - RTC inoperative

beep sequence: Short Short Long Short

Diagnosis: The real time clock has stopped.

Action: Replace the 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 - FAIL Line Active

beep sequence: continuous tone

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

Action: Replace the board.

Note: a continous tone occuring any time after the operating system has started to load means that the main processor has stopped working.

Error 9 - Main RAM test error

beep sequence: Long Short Short Short

Diagnosis: There is a fault in the Triple X's memory circuits.

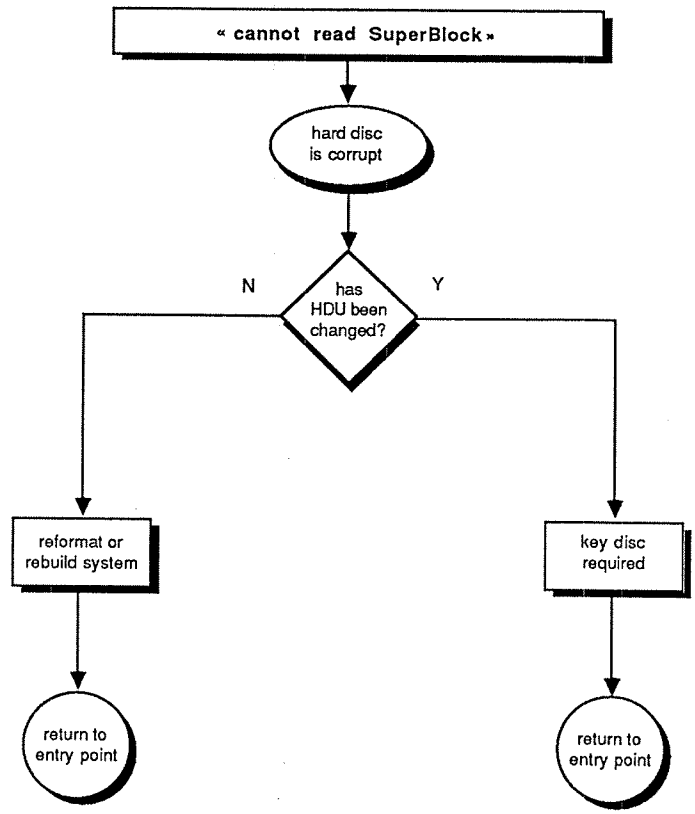
Action: If extra RAM if fitted on the VME-BUS, first check that these cards and the VME cable are securely in place. If the problem persists, disconnect the VME-BUS and check the main processor board on its own to determine whether it or the VME system is at fault.

Other notes

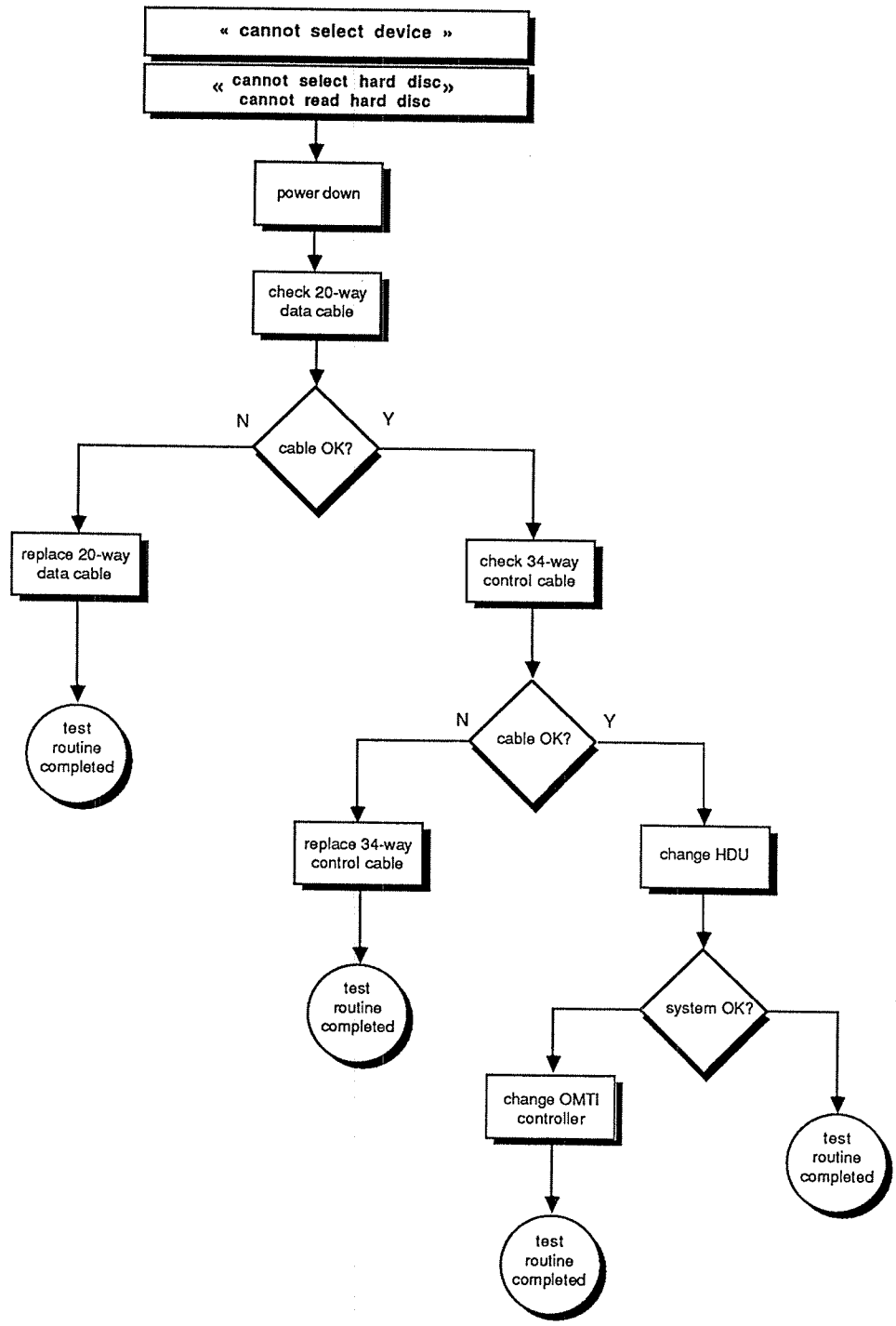
Sequences of error beeps different to those listed above may be heard. These indicate that the main processor cannot continue processing.

5.3 Problems notified by the Caretaker EPROM

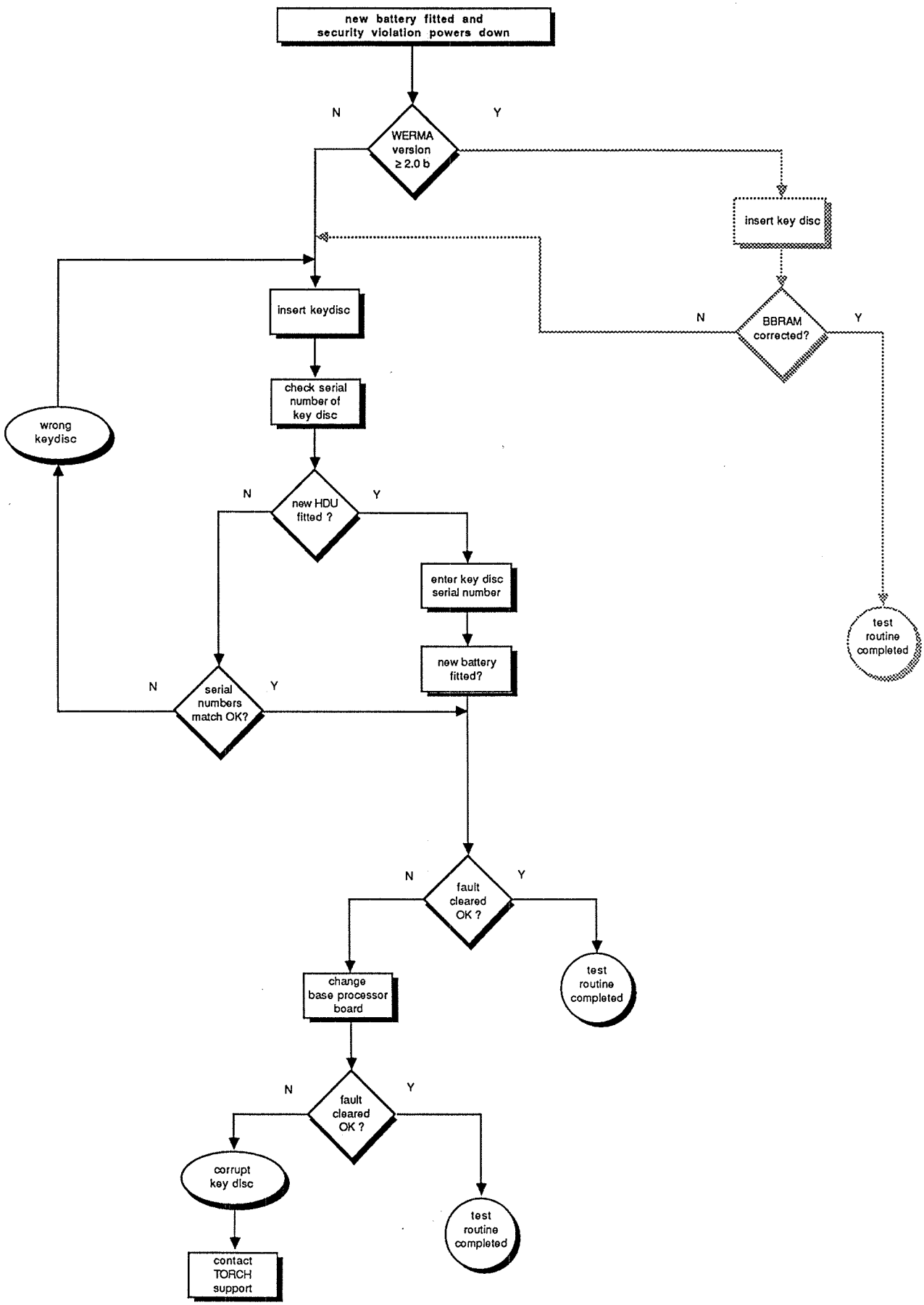
5.3.1 Cannot read superblock



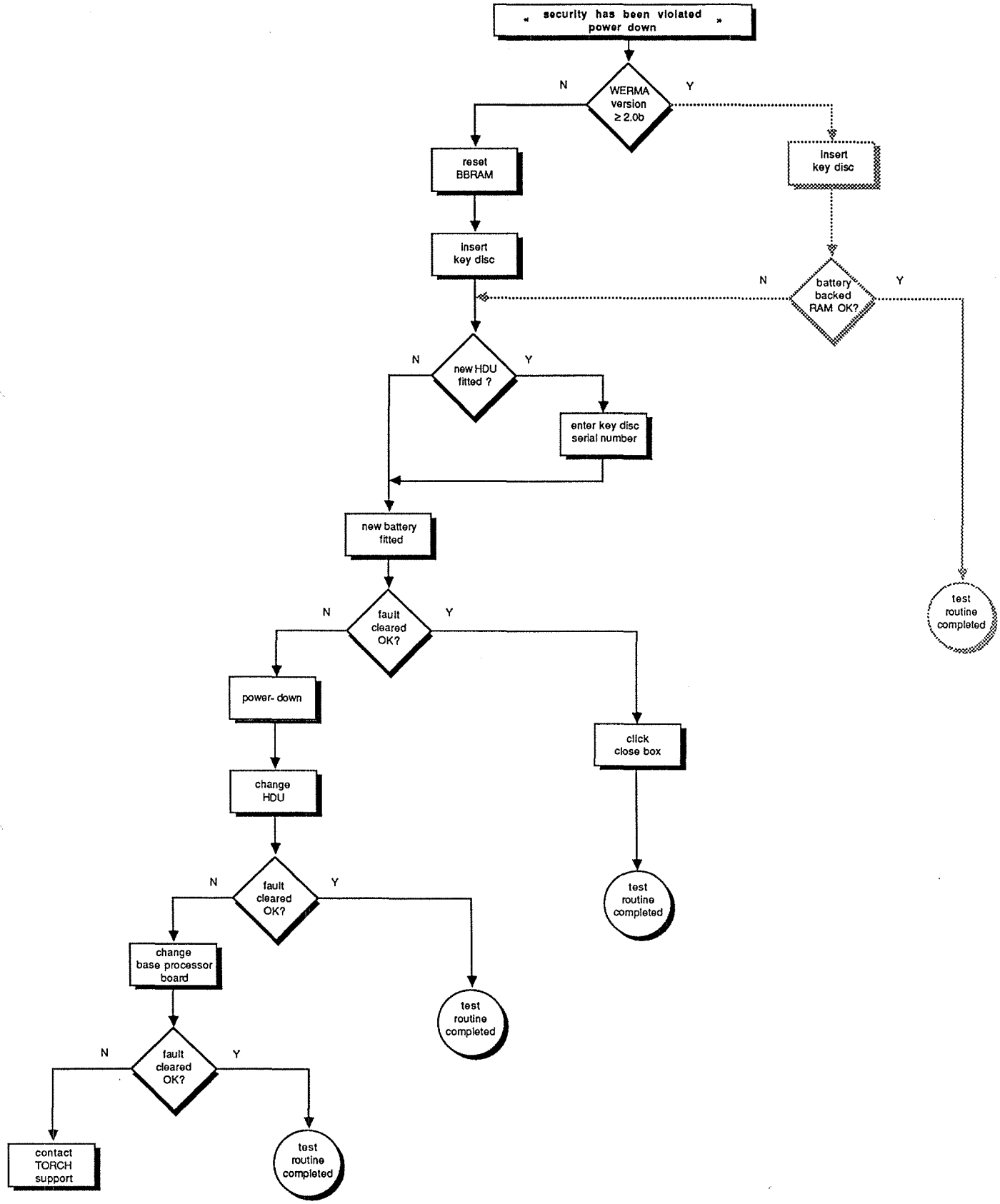
5.3.2 Cannot select device, cannot select/read hard disc



5.3.3 New battery fitted/security violated



5.3.4 Security has been violated



Note: 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 lead from SK2 by pinching the clips on top of the plug and pulling upwards.

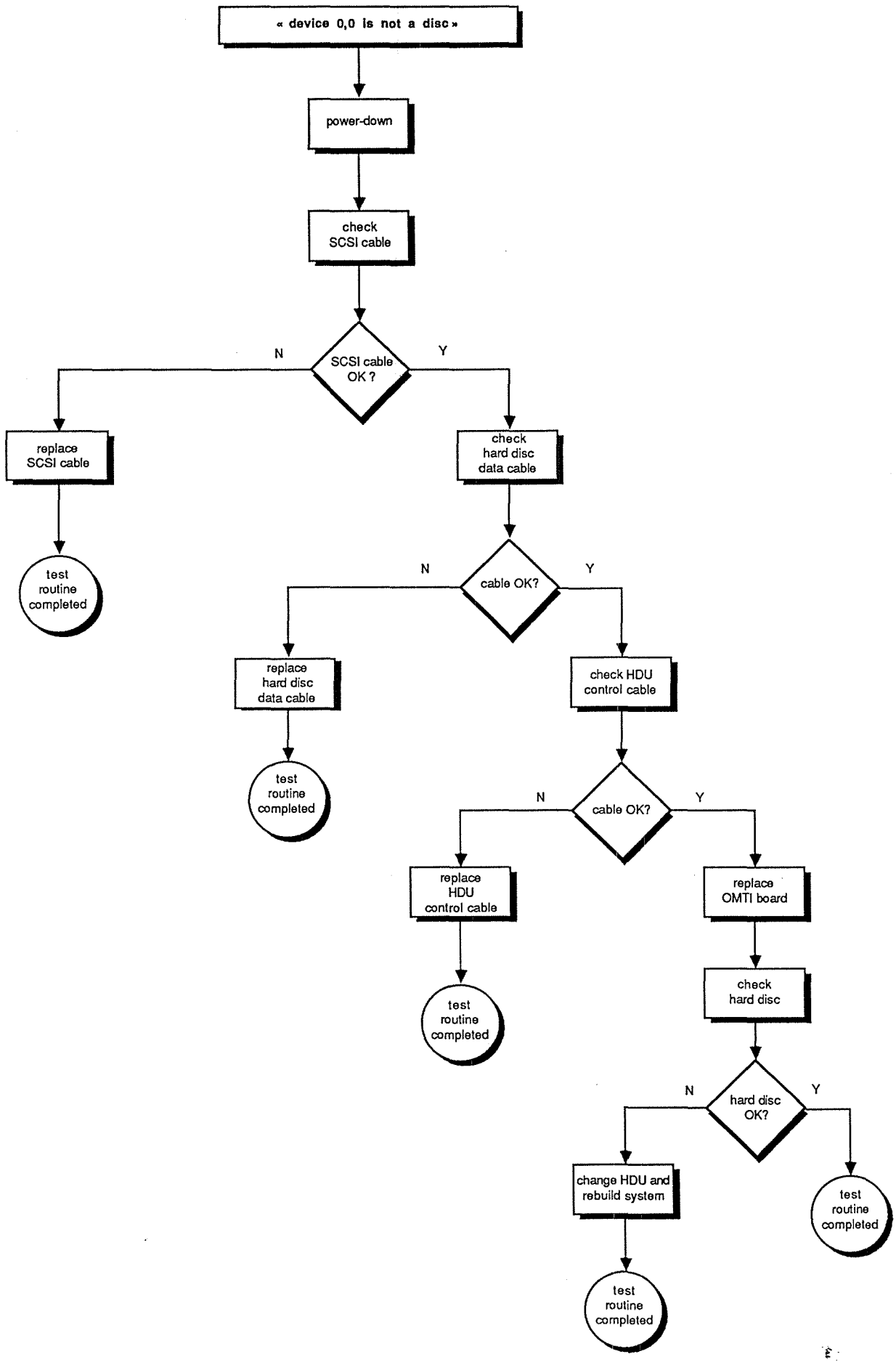
4. Short out the white and black connectors of the flying lead to the printed circuit board (these are to pins 4 and 6).

   This will have the effect of resetting the contents of the BBRAM to zero.

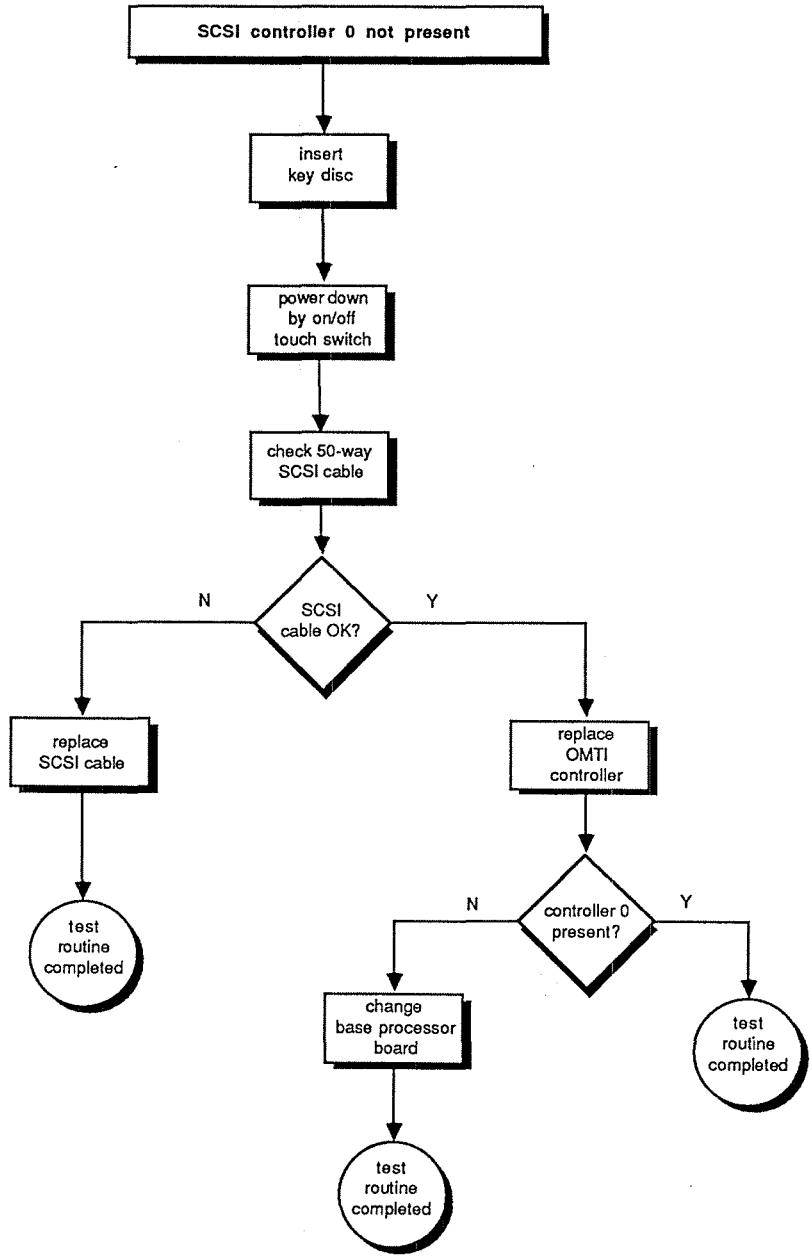
5. Replace the connectors and reassemble the unit.

6. The machine will now prompt for the key disc on power up. You will have to replace permissions in BBRAM. Permissions may include 'MUP' multi-user permissions, X.25 or BNET.

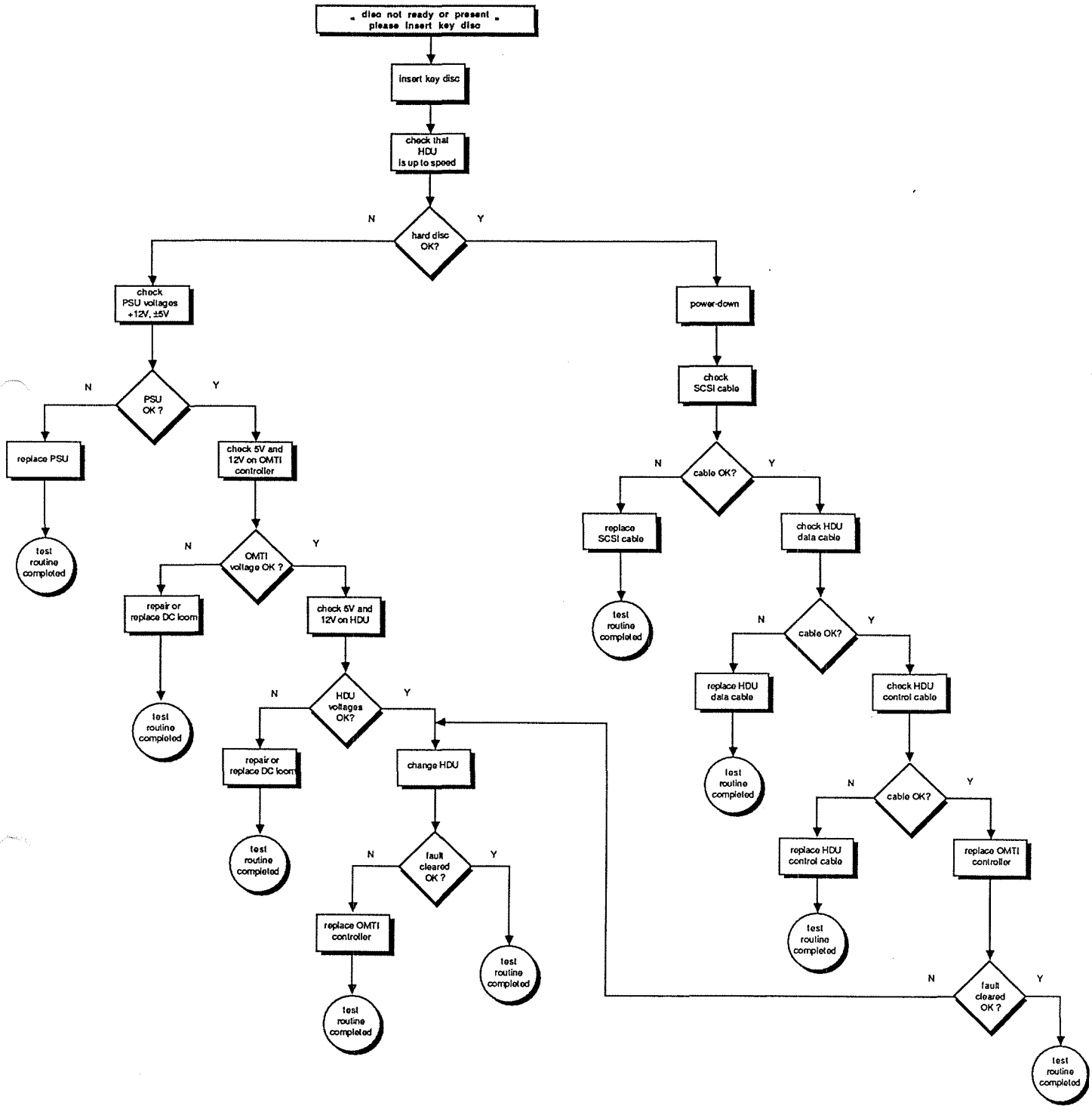
5.3.8 Device 0,0 is not a disc



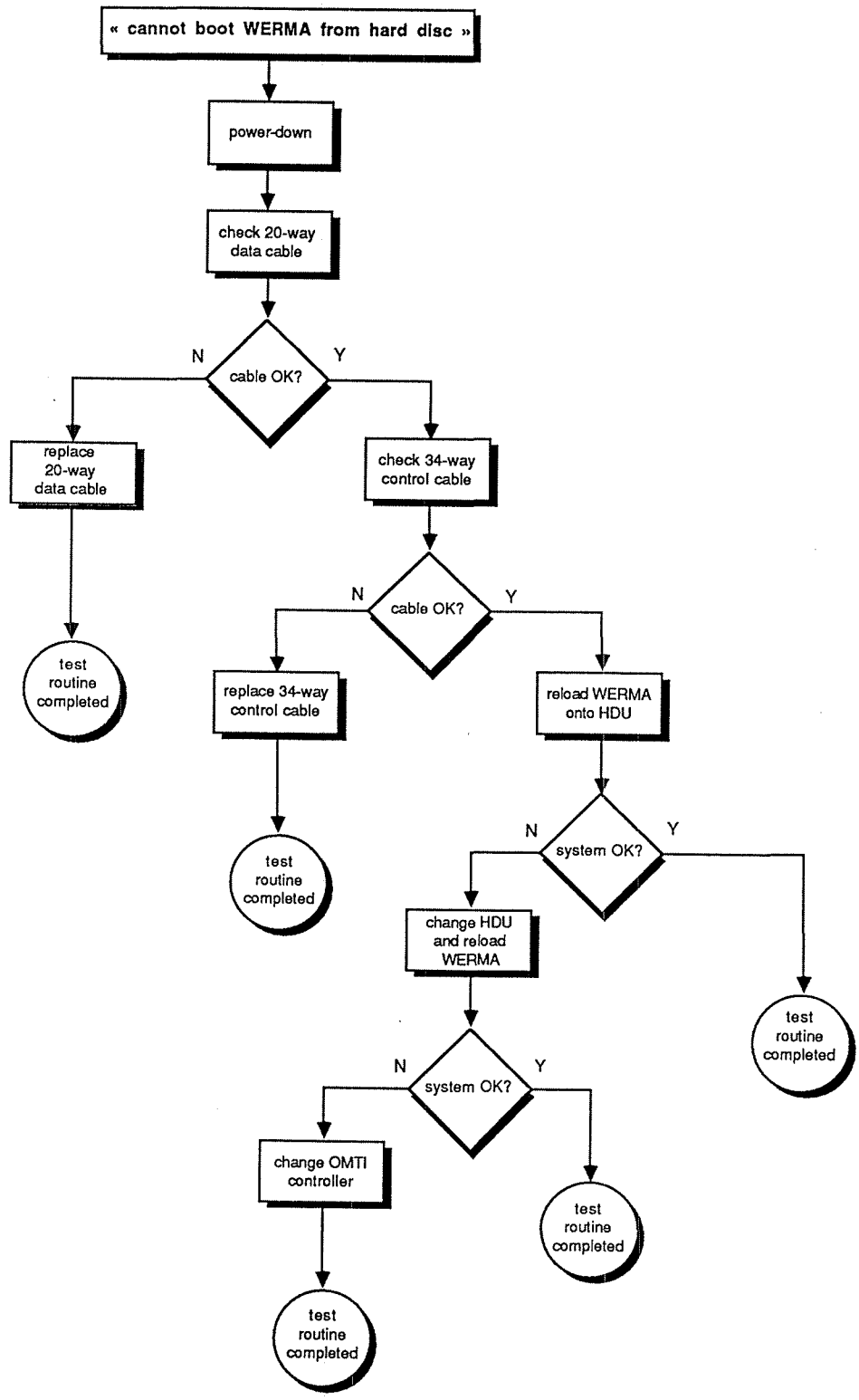
5.3.5 SCSI controller 0 not present



5.3.6 Disc not ready or present



5.3.7 Cannot boot WERMA from hard disc



Note: Reloading WERMA on to the hard disc:

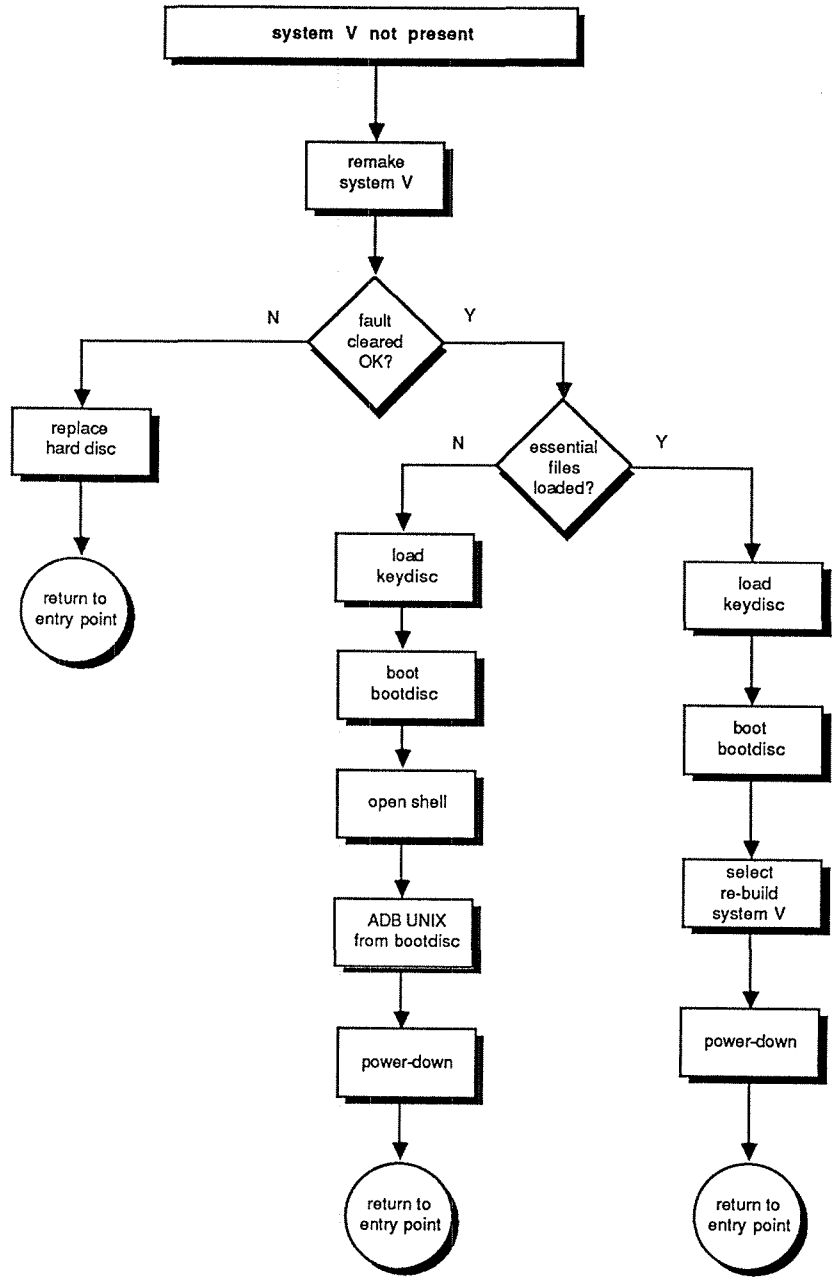
1. With the above error message, a prompt to insert the key disc will be issued.

2. Insert the key disc, select the Toolkit icon. From the the Option Menu, select "Reload the Caretaker".

3. When complete 'Exit'. This will automatically reboot the system.

5.4 Problems notified by the Caretaker disc file

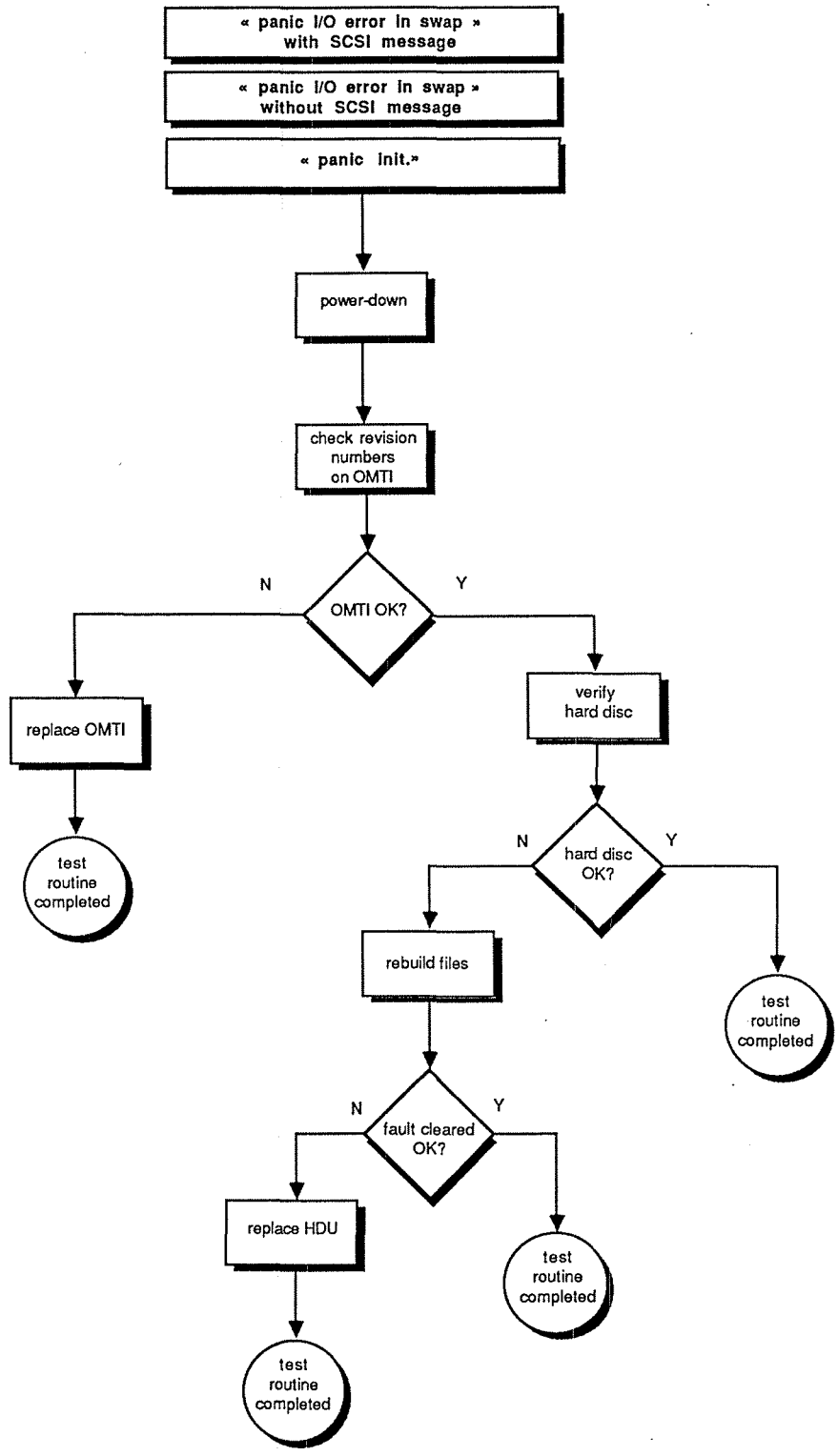
5.4.1 System V not present



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

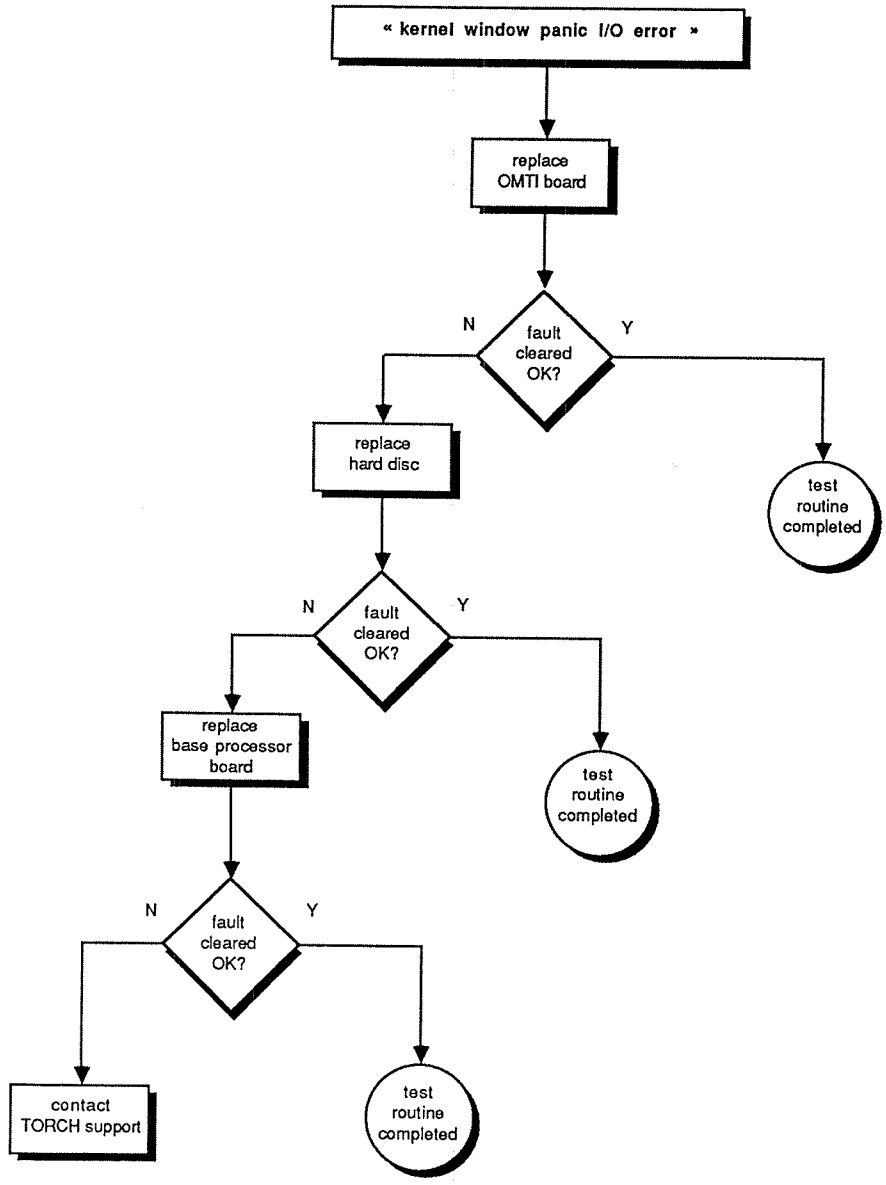
5.5 Problems notified by UNIX

5.5.1 Panic I/O error

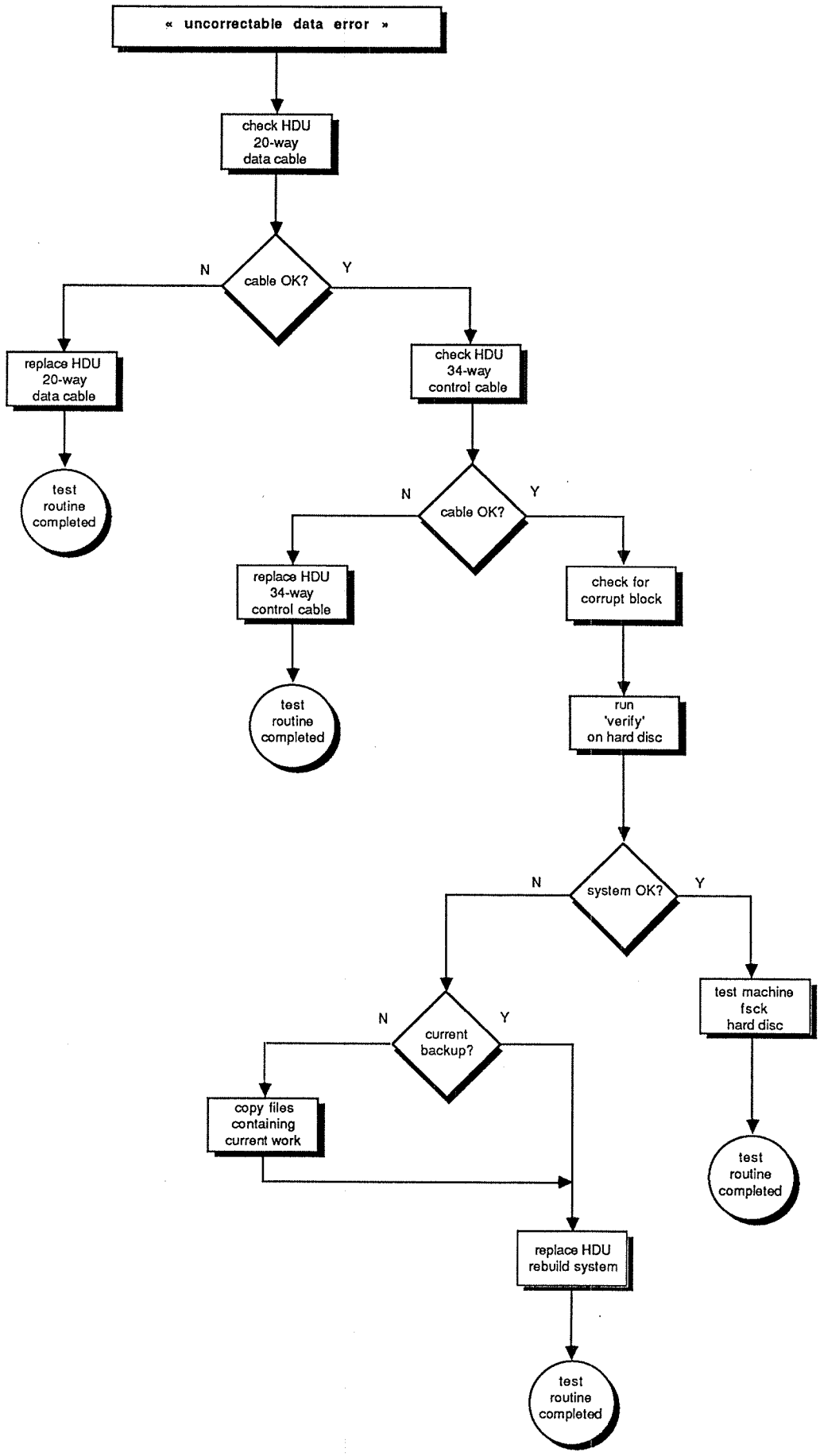


Note: The hard disc may be verified by running the test software supplied on the disc debugging tools disc. This is described in section 6.6 of this manual.

5.5.2 Kernel window panic I/O error



5.5.3 Uncorrectable data error



Note: The hard disc may be verified by running the test software supplied on the disc debugging tools disc. This is described in section 6.6 of this manual.

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 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)

MIXED 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 05F	(Unassigned, Reserved)
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 0BF	TRAP Instruction Vectors
48-63	0C0 0FF	(Unassigned, Reserved)
64-225	100 3FF	User Interrupt Vectors

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 only require 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

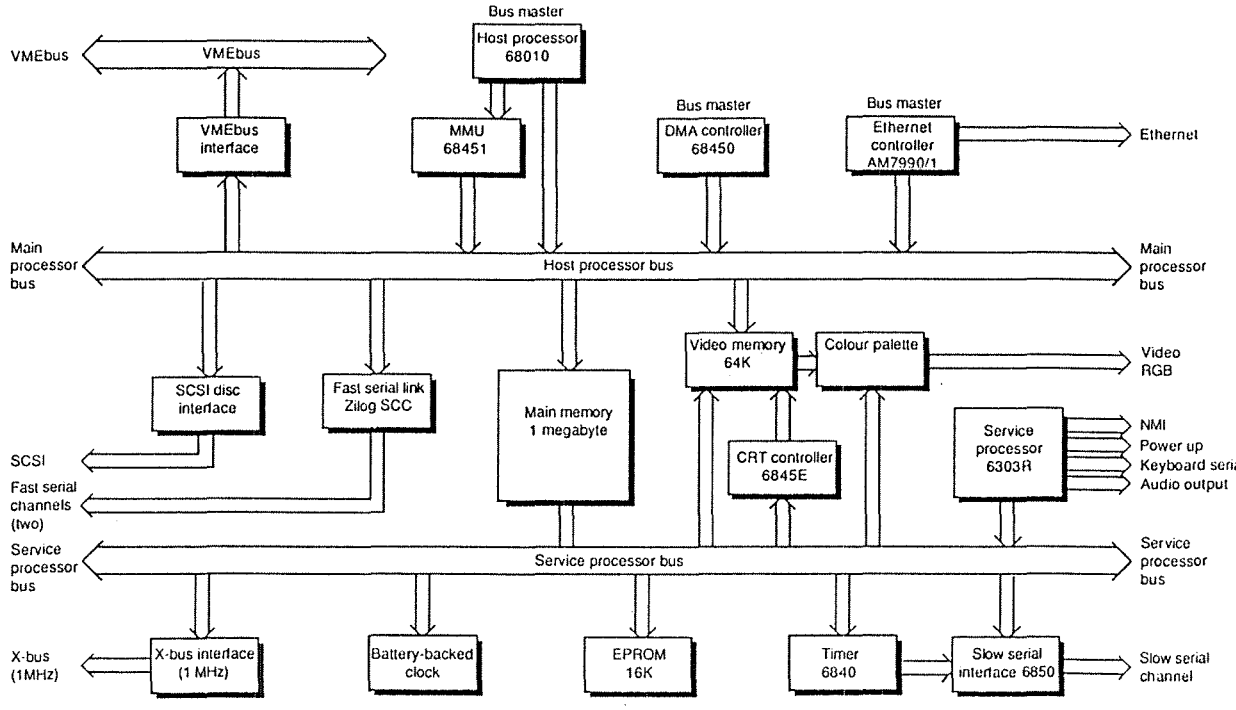
5. Number 14 (Format Error) refers to the MC68010 only. On the MC68000 and MC68008, this vector is unassigned, reserved.

6.0 Software Aspects

*** This section being rewritten

7.0 The Processor board

7.1 Summary of the interfaces



Connectors and connections

```
PL1 - Power in (8-way mate and lock connector)
     red       1 - +5 volts
     black     2 - ground
     orange    3 - +12 volts
     black     4 - ground
     mauve     5 - -5 volts
     white     6 - +5 volts (NiCad supply for clock)
     green     7 - power supply control out (power up)
     yellow    8 - power supply touch pad in (NMI)


PL2 - Slow serial (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
         20 - dtr  data terminal ready
```

SCC - channel two (25-way female D-type, connector)

```
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
```

PL3 - X-BUS (34-way header, connector)

Note: The X-BUS is an emulation of the BBC microcomputer 1MHz bus, but for a limited variety of peripherals (the most important of which is the modem).

```
 1 - gnd                          18 - d0 \
 2 - r/nw  (read/not write)       19 - d1  |
 3 - gnd                          20 - d2  |
 4 - 1MHzE (1 MHz clock)          21 - d3  |
 5 - gnd                          22 - d4  > data bus
 6 - n/c                          23 - d5  |
 7 - gnd                          24 - d6  |
 8 - n/c                          25 - d7 /
 9 - gnd                          26 - gnd
10 - npgfc (page FC select)       27 - a0 \
11 - gnd                          28 - a1  |
12 - npgfd (page FD select)       29 - a2  |
13 - gnd                          30 - a3  |
14 - nrst  (active low reset)     31 - a4  > address bus
15 - gnd                          32 - a5  |
16 - analog input                 33 - a6  |
17 - gnd                          34 - a7 /
```

PL4 - Power to LED (2-way Molex pins, connector)

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

PL5 - Keyboard (6-way W polarised BT type connector)

```
1 - keyrx  receive data from keyboard
2 - no connection
3 - gnd
4 - gnd
5 - keyreset 2 spaces reset keyboard processor
6 - +5 volts
```

PL7 - Monitor drive (8-way DIN, connector)

1 - Red 0.7 V p-p
2 - Green 0.7 V p-p
3 - Blue 0.7 V p-p
4 - horizontal drive TTL compatible
5 - vertical drive TTL compatible
6 - speaker +
7 - speaker
8 - ground
shield - ground

PL8 - Telephone line (6-way A polarised BT-type connector)

2 - line
4 - anti-tinkle
5 - line

PL9 - Telephone handset (6-way A polarised BT-type connector)
(note that PL8 and PL9 are connected in parallel)

2 - line
4 - anti-tinkle
5 - line

PL10 - Modem (6-way Molex pin strip; 12-way Molex on Issue 4 boards)

2 - line
4 - anti-tinkle
5 - line

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

1 - gnd
2 - collision+
3 - transmit+
4 - gnd
5 - receive+
6 - gnd
7 - nc
8 - gnd
9 - collision-
10 - transmit-
11 - gnd
12 - receive-
13 - +12 volts
14 - gnd
15 - nc
shell - gnd

PL14 - SCC channel one (25-way female D-type, connector)

2	- txd	transmit data
3	- rxd	receive data
4	- rts	request to send
5	- cts	clear to send (D-type pins as above)
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

Mains power input (240 volts 50 Hz (UK), 110 volts 60 Hz (USA))

live
neutral
earth

Points to note

A self-test routine is entered as part of the powering up sequence. If any problems are encountered, these will usually be identified by an on-screen error code message, or a repeated set of beeps. See section 5 of this manual, or the 'Caretaker Guide' for further details.

How to test

1. A self-test is conducted on power-up.

2. If there is any doubt about the functioning of the base processor board, use the test disc provided.

How to correct

Since the Triple X processor board is multi-layered, replacement of the board is necessary in nearly every case. Contact TORCH Service Department for specific instructions.

7.2 Keyboard Serial Port

Connectors and connections

Specified in section 7.1. The keyboard serial port uses a 6-way W polarised BT-type connector attached to PL5 of the base processor board.

Points to note

Take special care when repairing faulty ICs or switches. Use the smallest size point on the soldering iron as the PCB tracks can be lifted if overheated. Try to work quickly to avoid general overheating.

Problems have been encountered with wires breaking within the mouse lead. See section 8.1.6.

If intermittent problems are encountered, the BT polarised plugs may need re-crimping: use a proper crimping tool.

How to test

Power up with the keyboard plugged in but WITHOUT a mouse. You should be able to move the cursor using the directional keys in association with the "diamond" control key.

How to correct

To eliminate the keyboard or the mouse as a source of the fault, replace each in turn with a known good device.

7.3 Serial ports (RS423)

Connectors and connections

```
Slow serial 25-way female D-type, connector PL2
          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


SCC channel two 25-way female D-type, connector PL2
         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


SCC channel one 25-way female D-type, connector PL14
          2 - txd        transmit data
          3 - rxd        receive data
          4 - rts        request to send
          5 - cts        clear to send (D-type pins as above)
          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
```

Triple X Communications Ports

The Triple X is equipped with three serial ports, for connection to devices such as printers, terminals and modems. Due to space restrictions at the back of the Triple X, the ports are brought out onto two 25-way D-type connectors:

Name	Typical Function*	Internal Connection	Pinout
Port A (/dev/ttya)	X25 synchronous link	SCC Channel A	X25 D-type V24
Port B (/dev/ttyb)	Terminal or modem	SSC Channel B	Non-standard on RS423 D-type
Port C (/dev/ttyc)	Printer (eg PCP)	6850 (on Service Processor)	V24 on RS423 D-type

* The 'typical function' is what most systems will connect through this port. Many other configurations are, of course, possible.

Since Port B uses non-standard pinouts on the RS423 connector, TORCH supplies a special splitter cable (product code XA2RS423). This cable 'fans out' the connector into two D-type connectors with normal V24-style pinouts, e.g. Pin 2 = Tx, etc.

For details of the pinout connections of these ports, refer to the System V Issue 1.2 upgrade pack.

Points to note

1. Most problems encountered with serial ports result from incorrect hardware handshaking. A typical problem is that long serial cables with pin 3 of the Triple X (RXDATA) may be wired on Port C (RS423) but pin 3 is not used at the printer end.

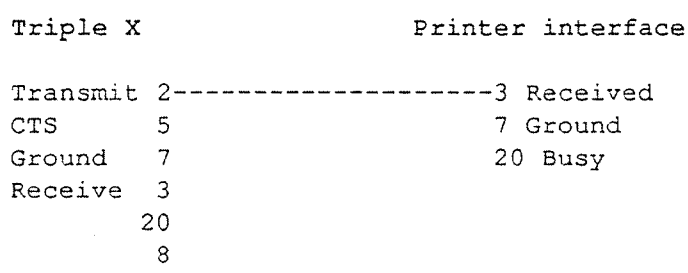
2. Printer characters may be lost with software handshaking (XON/XOFF flow control, i.e., DTR protocol). This will slow down the machine.

How to test

Use the Software serial test.

How to correct

Wire pin 3 to pin 7:



7.4 Ethernet

Connectors and connections

PL11 Ethernet (15-way female D-type)

1	gnd
2	collision+
3	transmit+
4	gnd
5	receive+
6	gnd
7	nc
8	gnd
9	collision-
10	transmit-
11	gnd
12	receive-
13	+12 volts
14	gnd
15	nc
shell	gnd

Points to note

Refer to IEEE 802.3 specification (this is the version of the Ethernet specification adhered to by the Triple X). This is documented in the "Green Book", which should now be used in place of the "Blue Book".

The ISOLAN transceiver performs the functions of receiving and transmitting data, detecting data collisions on the network, performing the 'heart-beat' (SQE) test and protecting the network from data packets which are too long. The transceiver is available in two versions: with or without 'heart-beat'. In addition, three interchangeable coaxial cable connections are possible, including N-series, a cable piercing tap (for standard Ethernet cable) and a BNC connection for thin Ethernet cable (for use with networks which include PCs).

Type 1110-1 is attached to the Triple X and provides the 'heart-beat' (SQE) test. Type 1111-1 is used for connecting repeaters on an Ethernet.

Further details are available in the ISOLAN brochure. See Appendix F.

How to test

Faults can only be detected by using the network. Typical problems are "timing out" for one computer. Machines are locked out by the transceiver if a computer continuously transmits, so that no single machine can lock out the system.

Standard network commands 'ruptime' and 'rwho' will indicate who has been on the network. Refer to the "Ethernet User Guide" for further details.

How to correct

Not applicable.

7.5 RGB and audio output

Connectors and connections

PL7 Monitor drive (8-way DIN, connector)

```
          1 - Red   0.7 V p-p
          2 - Green 0.7 V p-p
          3 - Blue  0.7 V p-p
          4 - horizontal drive TTL compatible
          5 - vertical drive TTL compatible
          6 - speaker +
          7 - speaker
          8 - ground
     shield - ground
```

Points to note

1. The internal speaker can produce a buzzing noise with different coloured desktops/screens.

2. LNKI is required to drive an external interface or adaptor.

How to test

Audio: Ensure tone on power up. Check that the speaker is working and that the wiring is alright. Replace the base processor board if necessary.

RGB: Check the standard 1V output with an oscilloscope. Try another monitor if there is a fault in one colour only. Check the RGB lead. If necessary, replace the base processor board.

How to correct

1. Buzzing is normally due to faulty earth screenings at one of the ends. Solder the screen if you experience this problem.

2. LNKI should normally be left in position B, since the audio output has + and - outlets and is not grounded. It should only be moved to position A if it is required to drive an external RGB interface or adaptor (+5V) on pin 6 - "SPKR". Before this modification is carried out, however, SPKR (pin 6) should be removed from the DIN connector in the monitor and connected to pin 8 (GND). This will have the effect of halving the audio output.

7.6 Telephone Modem

Connectors and connections

PL8 Telephone line (6-way A polarised BT-type connector)
2 - line
4 - anti-tinkle
5 - line

PL9 Telephone handset (6-way A polarised BT-type connector)
(note that PL8 and PL9 are connected in parallel)
2 - line
4 - anti-tinkle
5 - line

Connecting the Triple X to a telephone line

The following instruction explain how to install the telephone lead supplied as part of the Triple X Telecoms Expansion pack. The lead consists of a 3m 4-way cable terminated with a BT610A plug at either end.

Plug one end of the cable into the socket furthest to the right of the two (white) telephone sockets, as viewed from the rear of the Triple X. The plug has to be inserted into the Triple X with the locking catch on the left. The other end fits into any suitable telephone line socket.

If a telephone handset is also to be connected, this can normally be plugged into the other socket (on the left). However, on some early Triple X's (serial numbers less than 12001080) the handset will not operate correctly when connected directly to the Triple X. In this case use a T-piece to connect both the Triple X and the handset to the line socket.

Points to note

The connectors for versions 2.1 and 4.0 of the base processor board are different . (You have to bend three capacitors forward since the 12-pin connector should overhang the 6-pin connector.) For full details please refer to the documentation on Boards 2.1 and 4.0 in "Installing the Modem".

How to test

See the TORCH "Telecoms Guide" for instructions on how to carry out the modem test.

To do a basic test, load the Telecom Manager while in a superuser shell. Right click twice on the Telecoms icon. Type:

```
£mset audio
```

This switches the audio output to the internal Triple X speaker (located in the colour monitor).

Test also with Dial-a-disc or Telecom Gold; if not connected, the screen message "No suitable line found" will appear. The modem will not work unless it can detect a dial tone.

A quick check from a UNIX shell is to type:

```
>voicedial 16.
```

Ensure that 'mset audio' has been enabled before this test, otherwise no sound will be heard.

How to correct

Not applicable.

7.7 X-BUS (1MHz bus)

Connectors and connections

34-way header, connector PL3

1	gnd	18	d0 \
2	r/nw (read/not write)	19	d1 |
3	gnd	20	d2 |
4	1MHzE (1 MHz clock)	21	d3 |
5	gnd	22	d4 > data bus
6	n/c	23	d5 |
7	gnd	24	d6 |
8	n/c	25	d7 /
9	gnd	26	gnd
10	npgfc (page FC select)	27	a0 \
11	gnd	28	a1 |
12	npgfd (page FD select)	29	a2 |
13	gnd	30	a3 |
14	nrst (active low reset)	31	a4 > address bus
15	gnd	32	a5 |
16	analog input	33	a6 |
17	gnd	34	a7 /

Note: The X-BUS is an emulation of the BBC microcomputer 1MHz bus, but for a limited variety of peripherals.

The most important of these is the modem option available for the Triple X. Details of the One Megahertz bus are given in Chapter 28 of 'The Advanced User Guide for the BBC Microcomputer' by Bray, Dickens and Holmes.

Points to note

Any problems with the X-BUS will usually be related to faulty connectors or to software drivers. The correct working of software drivers is the responsibility of the software engineer. Any other faults are likely to reside in the peripheral equipment itself.

How to test

Since the X-BUS is designed to operate with peripheral equipment, this must be checked first if any fault occurs. If the peripheral equipment is proved to be functioning correctly, the X-BUS signal levels should be checked from connector PL3 on the base processor board. A list of these signals is given above.

How to correct

Not applicable.

7.8 Real time clock

Connectors and connections

Not applicable. A general description of the RTC is given below.

The HD146818 clock/calendar chip contains 64 bytes of registers and RAM. Some of these registers contain the time, date and a 100 year calendar. It is clocked by a 32.768KHz crystal. None of the interrupt and alarm functions are used.

When the system is powered down, a battery backup supply operates, which saves the contents of the clock, calendar and RAM. The timer and calendar, therefore, need only to be set up in the factory or if there is a hardware failure in the clock circuitry. Apart from these registers there are 50 bytes of RAM which can be used by the system as non-volatile locations.

The chip 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.

Register A should be programmed with 20 hex. Bit 7 of register A should be read before accessing the timer registers. This UIP bit (update in progress) goes high when the counters are changing, so users should be aware that the reading of the counters might cause a mis-read or malfunction. If the UIP bit is zero then the software has 244 machine cycles to access the registers (after which the UIP bit should be checked again). A routine which accesses clock counters should disable processor interrupts unless all interrupt routines are short and infrequent.

Register B should be set to 06 hex. This selects the 24 hour mode and makes the counters work in binary and not BCD.

Register C is a read-only register which contains information about interrupts. Since the interrupt line is not connected this register is not used.

Register D contains one read-only bit which is always set high after this register is read. If it is low it indicates that the battery-backed power to the clock has failed and means that the clock and RAM contents are not valid. This register should be checked when the system is powered up.

The four registers should be set up shortly after the battery is first installed since the chip draws extra power from the battery until the timer starts running.

There is a restriction on the maximum amount of accessing allowed to the chip. The clock chip should not be accessed at a rate exceeding 250 KCycles/second over a 100uS period. In addition, the daylight saving function should not be programmed into register B. This will be corrected in a new version of the chip which may be ready in time for production.

Points to note

The accuracy of the real time clock has been improved on versions of the kernel from 1.50 onwards, issued with system discs 1.3 onwards.

How to test

Over a period of a few days, check the accuracy of the Triple X clock against a reliable timepiece.

How to correct

Report any problems to the TORCH Service Department.

7.9 68020 Accelerator Board

Connectors and connections

Not applicable. A general description of the 68020 Accelerator Board is given below.

The Accelerator Board plugs into the Triple X main board and provides a 32/32-bit 68020 processor and a 68881 floating point maths co-processor, together with interface circuitry to the 16/24-bit bus on the main board.

Points to note

The 68020 accelerator board should only be operated with versions 1.5 onwards of the kernel (released with system discs 1.3 onwards). These versions of the kernel automatically discriminate between the 68010 and 68020 processors.

How to test

A self-test is carried out on power up.

How to correct

If a problem is encountered, replace the accelerator board.

8.0 General Notes on Components

8.1 Standard components

8.1.1 Farnell (Triple X) PSU
8.1.2 OMTI disc controller board
8.1.3 Floppy Disc Unit
8.1.4 Hard Disc Unit
8.1.5 Sony 10" display
8.1.6 Keyboard and Mouse

8.2 Optional components

8.2.1 Astec (VME) auxiliary PSU
8.2.2 VME expansion
8.2.3 RAM expansion boards
8.2.4 Modem
8.2.5 Streaming Tape Unit (STU)
8.2.6 Sony 13" display

8.0 General notes on components

This section provides hardware information on components which is not covered in the fault finding or peripherals sections.

In particular, a list of connectors and signal pinouts for each of the replaceable modules is given, where appropriate.

Those components which are part of the standard Triple X system are listed in 8.1; optional components can be found in 8.2.

8.1 Standard Components

8.1.1 Farnell (Triple X) PSU

Description

In addition to the processor board, the Triple X contains disk drives and controllers which draw power at +12V. The continuous power rating of this supply is 100W and 120W during power up.

In addition to the +5V and +12V rails, the power supply produces small amounts of power at -5V and at +5BB (the battery-backed +5V rail). It also contains interface circuitry to an on-off touch switch and interface circuitry to support a 2-wire handshake with the Triple X processor.

The Farnell PSU provides three DC output sockets, each with the same pin allocations.

DC output power 8-way mate and lock plug

red	1 - +5V
black	2 - ground
orange	3 - +12V
black	4 - ground
mauve	5 - -5V
white	6 - +5V (NiCad supply for battery backed clock)
green	7 - power supply control out (powerup)
yellow	8 - power supply touch pad in (NMI)

Operation

Mains power is input through connector PL1. This is switched into the unit by a relay controlled by the touch switch circuitry. The switched mains is then fed to the switched mode power unit, the mains output socket PL2 and the fan power socket PL3.

The switched mode power unit converts the mains to DC power supplies of +5V, +12V and -5V, all referenced to the same 0V line.

The power control circuitry has three functions:

1. It interfaces a touch switch to the mains relay so that the unit can be turned on and off using the switch.

2. It provides a two line handshake to the Triple X processor to control the power up and power down sequences.

3. It provides a low-current +5V battery backup supply.

The PSU has been designed to protect the Triple X computer system from accidental power down: the computer locks the power on until the machine can be powered down without damaging or losing data.

The user controls power-on/off by touching a pair of conductive rubber pads moulded into the Triple X case. These connect to PL4 on the power supply through a pair of metal contacts.

The touch on-off switch has two functions:

1. It drives the 'Triple X out' handshake line low every time it is pressed. This interrupts the Triple X processor, which initialises the appropriate power-down software.

2. It powers the mains relay by using the battery.

The 'Triple X in' line is a PSU input used to gate the mains relay on. When powered up, 'Triple X in' is sent high by the Triple X processor, which in turn gates the +5V rail to the relay and locks it on. The processor will only release 'Triple X in' when it is ready to turn the power supply off.

Input Voltage Range

Link selectable between 196V to 264V at 50 Hertz
and 98V to 132V at 60 Hertz

Note: The mains is filtered to protect against spikes.

DC Output

Three DC output voltages are produced at +5V, +12V and -5V, referenced to a common 0V line. The majority of the power is drawn from the +5V rail (used for TTL logic) and from the +12V rail (used for disc drive control). There is power trading between the +5V and +12V outputs.The power supplies are able to handle the spikes and ripple caused by these devices.

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

MTBF: not specified

Overload Protection: The unit can withstand continuous short circuits on any of its outputs.

RFI level: The unit satisfies VDE0871 Level B and FCC15J Class B.

Safety standards approval: BS, VDE, CSA, UL

Efficiency: greater than 75%.

Power output:

100W unit	100W continuous
	120W power-up (10 seconds)

Minimum current: A current of 2A will always be drawn from the +5V supply.

Over-current protection: if the unit is overloaded, full current will be maintained but the output voltages will drop to limit the power.

Operating temperature range: 0 to 50 degrees Celsius.

Storage temperature range: -40 to +85 degrees Celsius.

Combined regulation: A specification is given for the maximum allowable deviation in output voltage due to the combined effects of line voltage variation, load current variation, temperature variation, drift, and interaction from the other power outputs. Parameters vary over the specified permissible range (apart from the load on the +5V line which is always guaranteed to be at least 2A).

+5V Supply:

Nominal Output Voltage	5V
Adjustment Range	5.0V to 5.1V factory preset at 2A load
Combined Regulation	_+2% maximum from 2A load
Ripple and Noise	1% maximum spike amplitude
Maximum output current (50W)	6A
Maximum output current (100W)	10A

+12V Supply:

Nominal Output Voltage	12V _+ 0.2V
Adjustment Range	Fixed
Combined Regulation	_+5% maximum
Ripple and Noise	1% maximum spike amplitude
Maximum output current (50W)	1A
Maximum output current (100W)	4.5A (6A during power up)

-5V Supply:

Nominal Output Voltage	-5V _+ 0.1V
Adjustment Range	Fixed
Combined Regulation	_+2% maximum
Ripple and Noise	1% maximum spike amplitude
Maximum output current (50W)	200mA
Maximum output current (100W)	200mA

Connectors and connections

Mains power input 240V 50Hz (UK), 110V 60Hz (USA), connector PL1.
IEC chassis plug
live
neutral
earth

Switched mains power output, connector PL2.
IEC chassis socket
live
neutral
earth

Touch switch 2 spring loaded contacts
1 - pad A
2 - pad B

Fan (240V or 110V, depending on input) 2-way Molex, connector PL3.
live
neutral

PL1 Mains input power connector.

PL2 Switched mains output power connector.

PL3 Switched mains output for fan.

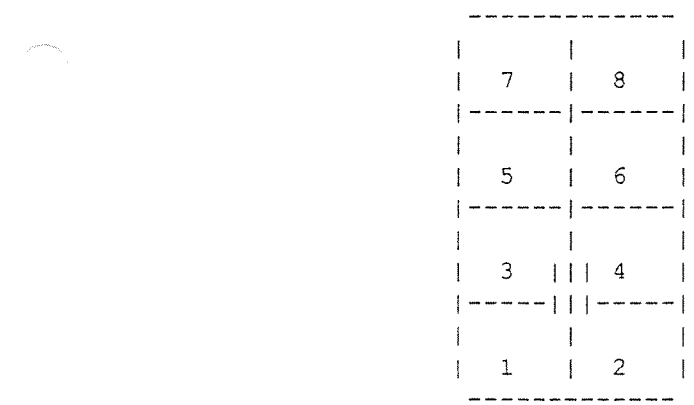
PL4 Touch switch connections.

PL5 First DC output connector.
Pinout:

Pin 1	+ 5V
Pin 2	0V
Pin 3	+12V
Pin 4	0V
Pin 5	- 5V
Pin 6	+5BB
Pin 7	Triple X in
Pin 8	Triple X out

PL6 Identical to PL5.
Second DC output connector.

PL7 Identical to PL5.
Third DC output connector.



The polarisation bar is indicated.

Fig. 8-1 TOP VIEW of PCB header plug for PL5, PL6 and PL7.

Points to note

1. 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 PSUs should be fitted with a plastic insulating hood.

2. Older PSUs have the AUX SK9 FAN socket in a different place. New PSUs fitted to replace these may also require another fan as the lead to SK9 will be too short.

How to test

1. If the machine appears dead, check that the mains input is live across SK6; check the fuse. Place voltmeter across pins 4 and 6 of the DC connector SK2, SK3 or SK4. The meter should read approximately 5.1V.

2. Check the current out across the following pin of PL1:

pin 1 +5V
pin 2 GND

pin 4 GND
pin 5 -5V
pin 3 +12V

3. To check that the Nicad battery is being charged, make sure that the battery is receiving extra voltage (5.3V or 5.4V).

How to correct

Any fault in the PSU will require replacement of the unit.

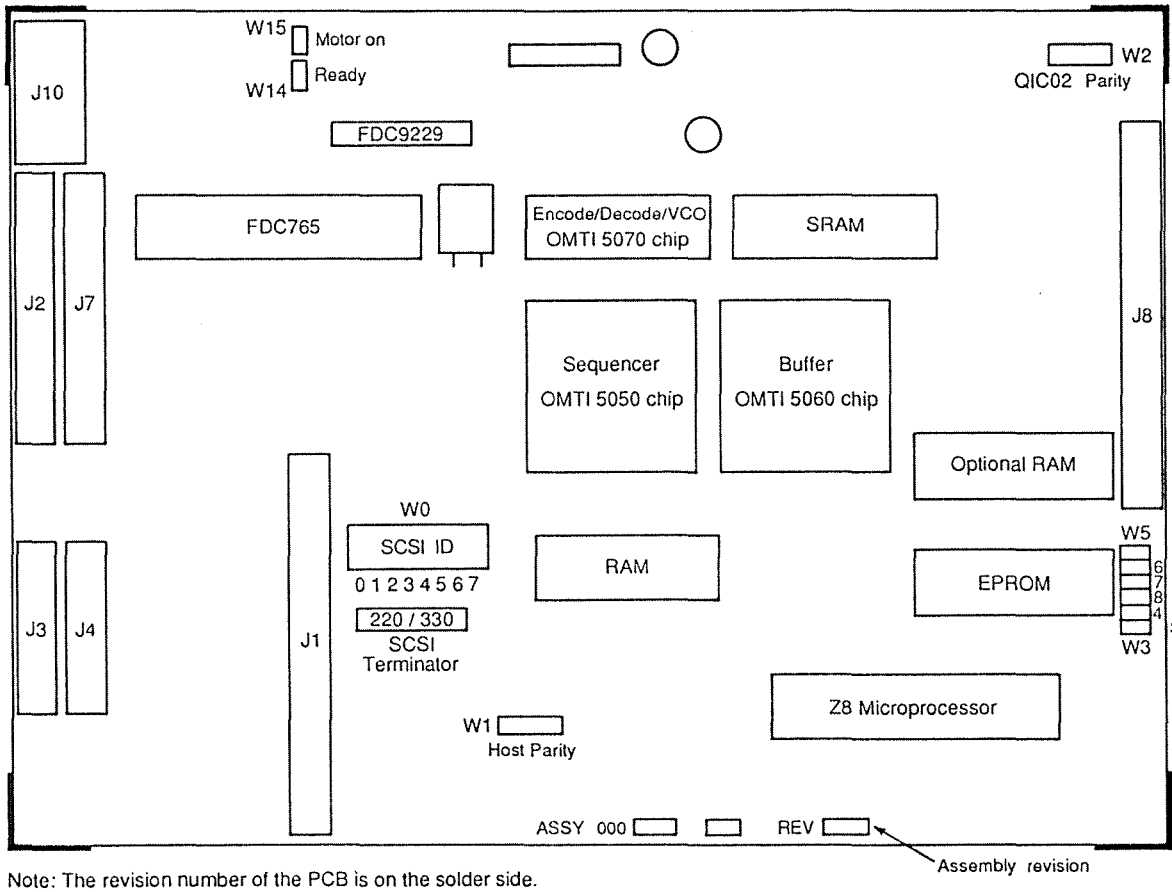
8.1.2 OMTI disc controller board

Description

The OMTI 5200 is a two HDU and single FDU controller with an SCSI controller. Up to 8 boards can be on the SCSI bus at the same time.

Connectors and connections

- DC power
- SCSI bus
- floppy drive ST400 standard
- data cable ST506 standard
- control cable ST506 standard



Note: The revision number of the PCB is on the solder side.

Fig. 8-2 Component location diagram for OMTI 5200 board

J2	HDU control	34-way
J3	Currently used HDU data	20-way
J4	Secondary HDU (if fitted)	20-way
J7	FDU data	34-way
J10	DC power	4-way AMP

Link settings and hardware revisions

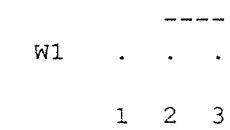
1. The firmware should be version 'D' or greater (alphabetically). The version is indicated as a suffix to the 27128 EPROM: this is component 8H on the right of the PCB, below conector J8.

2. The OMTI 5060 controller chip (5F, see the component location diagram, fig. 8-1) should be revision number 20506-2 or 20506-B.

3. Set up or check that W0 - the SCSI identifier - has a link between the first pins. W0 defines the SCSI device priority: ID 7 is the highest priority in a multi-controller configuration, but the recommended setting allocates zero priority.

W0	7	open
	6	open
	5	open
	4	open
	3	open
	2	open
	1	open
	0	shorted

4. Set up or check that W1 - the Host Parity link - has a jumper which connects the centre and right-hand pins. With pins 2 and 3 jumpered, parity is disabled.



5. Set up or check that the links on the right-hand edge of the board have the following settings:

W5	open	LUN
	open	6
	shorted	7
	open	8
	shorted	4
W3	open	SECTOR SIZE

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

Points to note

Refer to the list of link settings given above before assuming that the unit is faulty.

How to test

1. Check that the EPROMs (including the 5060 Memory Management Unit) are the latest issue.

2. Test by using the SOAKTEST disc.

3. Enter a superuser shell and carry out a "find" operation. (This will search for the whole filing system.)

To check and locate files containing bad blocks from a shell as superuser, type:

```
find {where} -print | while read line
do if dd <$line >/dev/null 2>&1
then:
else  echo bad block in $line
fi
done
```

{where} is the full or local path(s) to be searched for bad blocks. (e.g: find /start -print)

Whenever dd reads a file with a bad block in it, a message will be printed on screen and in the kernel window.

Look for SCSI error reports in each case. The above operations will exercise the disc thoroughly.

How to correct

In most cases, it will be necessary to replace the unit. Contact TORCH Service Department for specific information.

8.1.3 Floppy Disc Unit

Description

The FDU is an 80 track DSDD 5 1/4" unit using a standard Shugart ST400 interface with a 34-way edge-connector. It is manufactured by EPSON.

Connectors and connections

- DC power
  - 1 - +5V
  - 2 - gnd
  - 3 - gnd
  - 4 - +12V

- ST400 interface standard

Formatting Specification:

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

Other settings are software selectable.

Access time:

Track to track	3 milliseconds
Setting time	15 milliseconds
Head Load time	35 milliseconds
Spindle Motor speed	300rpm

Link settings on Epson SD-540:

If the FDU needs replacing, some links have to be set or checked before a new unit is installed. These links have the component numbers 'SS1' and 'SS2' marked on the board, as illustrated below.

see Fig 3-3

Fig. 8-3 Epson SD-540 PCB, showing the location of SS1, SS2

	link
SS1	3 set
SS2	2 and 5 set

In addition, before mounting the FDU in the Triple X disc shield:

1. Check that the terminator pack RA1 is in place. This is a 16-pin DIL package (150R). Component RA1 is located on the PCB between SS1/SS2 and the edge connector J2.

2. Replace the metal plate which forms the RF shield with the four M3 X 8 screws.

Points to note

1. Sometimes the discettes may not eject. This is most likely due to a distortion in the metal linkage from the release/lock button resulting from the button being forced. This problem can usually be remedied by inserting a "scratch" floppy disc and closing the button. With a small pair of long-nosed pliers, the linkage can usually be straightened.

2. If the drive is out of alignment either an SCSI error will appear or you will notice a failure to read/write a "foreign" floppy disc. Realignment cannot be done in the field: simply replace the unit.

3. Some problems have resulted from sticky labels becoming detached from the disc. Remove the disc and strip down. DO NOT force a jammed floppy as the drive head could be damaged.

How to test

1. Use the SOAKTEST disc.

2. If a second machine is available, format and save a file on this known good machine. Test whether this file can be used on the suspect machine.

3. Do an 'fsck' on an unmounted floppy by typing

   /etc/fsck /dev/rfloppy

How to correct

If the simple remedies given above are not effective, the unit should be replaced in the field. Contact TORCH Service Department for specific information.

8.1.4 Hard Disc Unit

Description

The standard HDUs on the Triple X are the D5126 (20Mb) and the D5146 (40Mb), manufactured by NEC. Other drives may be fitted, by special order.

Connectors and connections

- DC power
  - 1 - +5V
  - 2 - gnd
  - 3 - gnd
  - 4 - +12V

- data cable as ST506 standard (20-way)

- control cable as ST506 standard (34-way)

Points to note

Early machines, with serial numbers beginning 0109... and 0129... have had problems with the main spindle motor drive: although they receive 12V, they do not come up to full speed. The problem is due to media thickness tolerance. To correct, change the drive.

How to test

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

2. Use the following sequence of commands (test A and B) to thoroughly exercise the disc controller and drive:

Test A: Seeking and swapping test.

First open a shell by clicking a shell icon.

Then type:

```
while :
do /etc/fsck -n
done
```

Repeat the first two operations to increase the amount of seeking and swapping carried out by the hard disc.

Test B: Bad blocks/media test

First select a shell as a superuser.

Then type:

```
while :
do
for i in b c d e
do
     dd    if=/dev/rdisk0$i    of=/dev/null  bs=17k
done
done
```

Repeat the first two operations to thoroughly test the media.

How to correct

In most cases, the unit will have to be replaced. Contact TORCH Service Department for specific information.

8.1.5 Sony 1O" display

Description

The standard TORCH CM10 display is based on the Sony Trinitron (R) CHM-1001E-22 colour tube, with a resolution of 800 x 240 dots. The picture tube employs P22 phosphors of 0.26mm pitch and the unit has an 8-pin standard RGB interface. An adaptor board handles RGB sync and audio speaker, and the chassis is mounted in a plastic case designed by TORCH.

Connectors and connections

```
Monitor drive 8-way DIN socket
          1 - red   0.7V peak-to-peak
          2 - green 0.7V peak-to-peak
          3 - blue  0.7V peak-to-peak
          4 - horizontal drive TTL compatible
          5 - vertical drive TTL compatible
          6 - speaker +
          7 - speaker -
          8 - ground
     shield - ground
```

Monitor Chassis Specification: Physical Characteristics

Height	196mm (+/- 1mm)
Width	232mm (+/- 1.5mm)
Depth	313mm (+/- 4mm)
Weight	Approx. 6Kg

Picture Tube:
10 inch fine pitch (0.26mm trio) TRINITRON colour tube

Anti-glare finish	Direct chemical etch
Body	Darktinted
Phosphor type	P22
Deflection angle	90 degree
Implosion protection	Tension Band

Environmental:

Operating temperature	0 to 55 degree C (inside cabinet)
Operating humidity	5 to 80% (non-condensing)
Operating altitude	0 to 10,000 feet
Storage temperature	-20 to +60 degrees C
Storage altitude	0 to 40,000 feet
Vibration (packaged)	5Hz - 50 Hz 0.83G $0.015G^2/Hz$

Shock (packaged):

Top, right, left, rear, front face	50cm drop height
Bottom face	60cm drop height

Controls:

Internal: Horizontal hold, Horizontal width
Vertical height, Horizontal centre
Vertical centre, Focus control
RGB Drive, RGB Background
Convergence adjust

External: Power On/Off, Brightness
Contrast, Vertical hold, H-shift

Electrical Characteristics:

Power Requirement:

Power input	198-264 Vac 50/60Hz
Power consumption	48W maximum

Internal main power inlet connector for earth, live and neutral.

Internal fuse protection on live circuit.

Video input signal:

Analog 0.7VP-P
Red, Green, Blue
Active polarity positive

Vertical sync input:

TTL compatible
Pulse rate 42HZ to 62Hz
Pulse width 200us to 600us
Non-interlace

Horizontal sync input:

TTL compatible
Pulse rate 15.625KHz +/- 300Hz
Pulse width 4.0us to 7.0us

Signal ground inputs:

0V signal ground
Frame ground available as tag on chassis

Signal input connector:

Male 10-pin right-angled Molex connector

Video drive format:

Dot clock rate	15MHz
Horizontal resolution	640 dots
Vertical resolution	256 lines (50Hz)
Character matrix	8 x 10 or 8 x 8
Active display area	120mm (H) x 149mm (W)

(Refer to timing chart attachment.)

Points to note

The 10" display is found to be highly reliable.

How to test

Not applicable

How to correct

In most cases, the unit will need replacing if a colour is omitted.

8.1.6 Keyboard

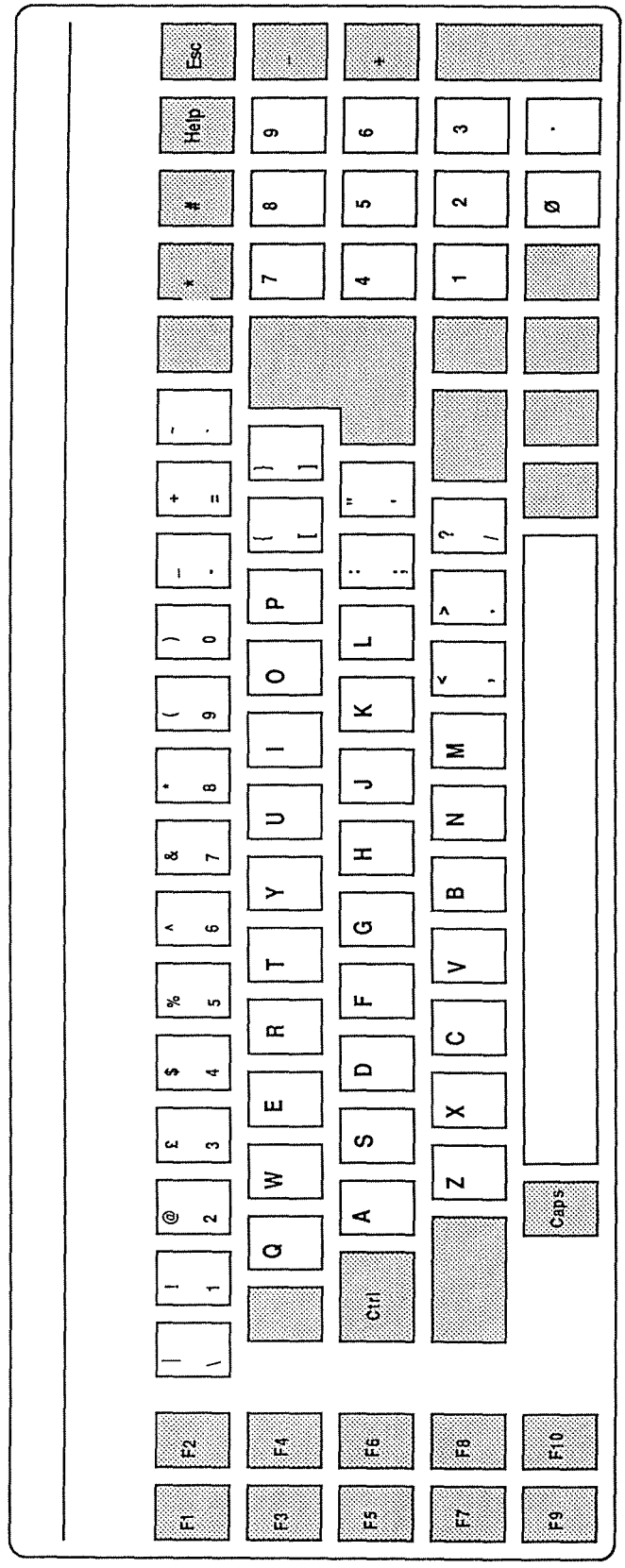


Fig. 8-3 diagram of keyboard

Connectors and connections

- keyboard cable

- pointing device
  1 - gnd
  2 - power +5V
  3 - rxdata

The key matrix uses conventional metal contact switches.

Power Requirements

The keyboard is provided with 0V and +5V power supplies, connected using thick PCB tracking from the serial output connector. No more than 300mA should be drawn from the +5V supply rail.

Input supply rating: +5V _+2% 300mA
Ripple and Noise: 100mV

Serial Output Interface

Keyboard
Serial keyboard output is via a line cord and line plug.

The line cord specifications are: 80cm of flex from plug to entry point of moulded case. The 40cm nearest the keyboard is curly, the other 40cm is straight. The cable conforms to BT specification CW1311 type 6CA (6 core cable). The cord is soldered directly to the keyboard PCB and gripped with an on-board cable grip.

The line plug specifications are: 6-Way W Polarisation BT type plug. The Bicc-Vero part number is 900-71052F. This part has polarisation so that it will NOT fit a phone socket.

Line plug pinout:

Pin 1	Transmit (out-going) data
Pin 2	Link through
Pin 3	0V
Pin 4	0V
Pin 5	Reset
Pin 6	+5V

The transmit data is a TTL signal with a standard 1200 baud serial rate using one start bit, 8 data bits, 1 stop bit and no parity. A 'one' bit is represented by a voltage between 0V and 0.4V and a 'zero' bit by a voltage between 2.4V and 5V.

Pin 2 should be connected to pin 2 of the serial input connector.

Pins 3 and 4 are 0V power supply inputs.

Pin 5 is the rest input. This is a TTL level signal which is driven low to reset the keyboard. It should also be tracked to the reset line on the serial input connector.

Pin 6 is the +5V power supply input.

Environmental conditions:

Operating	Non-Operating
Ambient temp 0 to 55°C	-25 to 65°C
Ambient humidity 30% -90% (RM)	95% or less
Vibration 0.5g	1g
Impact	3g

Mouse

Mouse cable (terminates in BT plug, type 631W)

1 - gnd
2 - power +5V
3 - txdata transmitted data

The TORCH Triple X mouse is based on the Alps JSBOX-10; the cable is approximately 135mm long.

The mouse is terminated by a 6-way W Polarisation BT type plug. The connector has polarisation so that it will not fit a phone socket. The Bicc-Vero part number 900-71052F.

Points to note

Keyboard

1. Zinc plated keyboard cases will short out on the keyboard PCB unless an insulator is used.

2. Early keyboards with white coloured control keys can cause problems. They should be exchanged for the new type if they fail.

3. As the keyboard is programmable, faults which could appear to be the keyboard may be caused by mains noise, mains spikes, etc.

4. If there is intermittent working of whole keyboard, check the BT crimp connections.

5. If individual keys or rows of keys are not functioning, check that there is an insulator below the keyboard PCB.

Mouse

1. Mouse Maintenance

   * Disconnect the mouse from the keyboard and turn it over. Push the retaining clip down towards the 'open' arrow and lift off. Remove the ball.

   * Use a cleaner such as isopropyl alcohol (available from chemists) or any suitable cleaner which is harmless to plastics (available from stockists such as R S Components). Wipe the dirt off the rollers by using a cotton bud or small brush which has been soaked in the cleaning fluid. DO NOT pour any liquid directly into the mouse.

   * Clean the ball in the same way before putting it back in the mouse case and replacing the retaining cover.

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

3. Check the crimp connections on the BT connector.

How to test

Keyboard

A keyboard fault is displayed on power-up in the kernel window. Keys may repeat upon opening a shell. The remedy is to replace the keyboard PCB, with keys.

Mouse

Check cursor movement on screen.

Check the switches by left and right clicks. The floppy disc icon, for example, provides a simple test: a left click on a floppy disc icon will give both read and write when mounted whereas a right click will give read only access when mounted.

How to correct

If the simple remedies given above are not effective, it will probably be necessary to replace the unit(s). In the case of the keyboard, the customer must keep the original plastic case.

8.2 Optional components

8.2.1 Astec (VME) auxiliary PSU

*** This section is not yet available

8.2.2 VME expansion

Description

The Triple X VME Interface:

Because of its built-in high speed VMEbus interface, the Triple X can be expanded while retaining its high level of performance. The interface gives the main 68010 processor access to a wide range of extra facilities, provided by plug-in VME boards and allowing, for example, increased memory or specialist graphics processing.

It is also possible to install VME processor cards on the VMEbus. It is necessary, however, to have a separate area of VMEbus memory for message passing between the 68010 and the VMEbus processor(s). The Triple X has one megabyte of memory on-board which cannot be accessed by the VMEbus.

The Triple X VME interface conforms to the VMEbus Specification Rev C. Using the terminology of this specification, the interface has a DTB (Data Transfer Bus) Master Sub-system and a Controller Sub-system. The DTB Master Sub-system contains a Requester Module, a Master Module and an Interrupt Handler Module. The Controller Sub-system contains an Arbiter, a System Clock Driver and a System Reset Driver.

Triple X Slim and Quin Rings:

Specially designed expansion rings for the Triple X computer provide either 2 or 5-slot backplanes, together with a special 96-way "umbilical" cable to link one of the backplane slots to the Triple X board.

Power to the 2 slot backplane (Slim Ring) is taken from the existing 100W power supply. The 5-slot backplane expansion (Quin Ring) is supplied complete with an additional power supply and cooling fans.

Mounting the Triple X in a VME Rack:

The Triple X board can be plugged into a standard double or triple height backplane, although care must be taken with the Ethernet connector. The board will project out of most racks by about 200mm but the electrical behaviour will be satisfactory. A DC power loom must be made up to supply power to the Triple X board.

Software Notes:

VME RAM cards (such as the "Triple Meg" RAM card - XEX2MEG) which are configured to the address space from 2Mb upwards, are automatically detected and made available to the system. Other boards require a special device driver.

If the board is provided by TORCH, it will be supplied with a new kernel containing the correct device driver.

Connectors and connections

VME Specification:

Master Data Transfer Options
    A24:D16
    TOUT = 16 to 32 microseconds (fixed)

Arbiter Options
    One

Requester Options
    R(3)
    ROR

Interrupt Handler Options
    Any one of IH(x) where 1 <= x <= 7 (stat)

Interrupter Options
    No interrupter

Environmental Options
    Operating temperature: 0 to 50 degrees C
    Maximum Operating Humidity: 90%

Power Options
    No power drawn - separate power connector

Physical Configuration Options
    NEXP - but non-standard depth along runner edge

VME board link options:

Two sets of link options are presented below: one for Issue

4 base processor boards and another for Issue 2 boards.

Points to note

Issue 4 Triple X 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

Notes:

1. Those links marked "Slot 1" should only be installed if the Triple X board is in slot 1 of the backplane.

2. LNK8 to 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-encoded form.

3. If the VME interrupts are not being used then LNK18 should be installed. Exactly one link should be present in the link block LNK11 to LNK18.

Issue 2 Triple X Board

Link	Function	Install	Remove
LNK25	Do not install		Always
LNK26	SYSCLOCK driver	Enable	Disable
LNK27	Level 3 Arbiter	Enable	Disable
LNK28	SYSRESET driver	Enable	Disable

Links 14 to 20 and links 29 to 31 set up the level on which interrupts are received. This has no connection with the internal VME interrupt level, which is always level 1. Links 29 to 31 have two positions A or B, one of which should always be used. Position B is nearer to the VME connector than position A.

Interrupt Level	Links to be inserted			
7	14	29A	30A	31A
6	15	29A	30A	31B
5	16	29A	30B	31A
4	17	29A	30B	31B
3	18	29B	30A	31A
2	19	29B	30A	31B
1	20	29B	30B	31A

Link settings on the VME board:

Shorted links are required between the signal pairs listed below when no VME board is present in the backplane connector. The way in which the pins are paired off is indicated by the boxes screen printed onto 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.

Powering VME Boards

Issue 2 Triple X Board:

On the Issue 2 Triple X board, the +5V power supply is connected through to pins A32, B32 and C32 on the VMEbus connector so that VME cards can be powered via the VMEbus If the VMEbus backplane is powered from a separate PSU to the Issue 2 board it is essential that the two power supplies are not interconnected. Consequently, if the Triple X board is plugged directly into a standard VME backplane, pins A32, B32 and C32 of the PL13 connector must be cut. These pins form the last row of the connector, near the middle of the board and very close to links 25 to 28.

Note that this modification is not necessary when using the Triple X Quin Ring, since these pins are not wired through the special flexible 96-way VME cable.

Issue 4 Triple X Board:

On the Issue 4 Triple X board, the +5V power supply is not taken to the VME connector and so all VME boards must be powered via a separate loom.

Slim & Quin Rings

The +5V standby rail is NOT supported by the battery; it is connected to the normal +5V rail.

The Slim Ring does NOT provide a -12V rail to the VME backplane.

The current available from the power supply on the Quin Ring for use by the VME boards is shown below:

+5V at 8A
+12V at 2.8A
-12V at 1A

How to test

Not applicable.

How to correct

In most cases, it will be necessary to replace the unit. Contact TORCH Service Department for specific information.

8.2.3 RAM expansion boards

Description

The Triple Meg RAM card provides an extra 2Mb RAM Expansion via the VMEbus.

Up to three boards can be fitted per system (giving a total of 7Mb RAM in conjunction with the 1Mb on the Stickleback board).

Connectors and connections

Standard VME connections are used; see the previous section (8.2.2) for a brief specification.

Points to note

Not applicable.

How to test

RAM is tested on power up: in addition, the SOAKTEST program on the 'disc debug tools' disc can be used to test RAM locations.

How to correct

If removing the unit and cleaning the contacts fails to clear the problem, it will probably be necessary to replace the unit. Contact TORCH Service Department for specific information.

8.2.4 Modem

Description

The TORCH/Dacom modem covers V.21, V.23, V.23bis and V.24 specifications. It plugs into the X-BUS on the base processor board, along with BT sockets which provide line in/line out connections.

Connectors and connections

- DC power
- BT line
- X-BUS (as X-BUS on the base processor board)

Points to Note

1. The DaCom modem only works with Issue 4 base processor boards - XXXPCs with issue 2 boards must be upgraded to Issue 4 at the same time as this Pack is fitted.

2. The modem driver is provided on all systems - no special kernel is required. The Telecoms Manager software must be loaded for correct operation.

   In addition, permission to operate must be in battery-backed memory. To check that the Telecoms Manager is loaded, enter a superuser shell and type:

   ```
   £ showbbr
   ```

   This will display the permissions. "X25" is required for PSS operation.

3. The DaCom modem is not currently approved for direct connection in the Triple X.

4. Identification: Triple X units which have the modem factory fitted are distinguished by the Model number on the serial label having a 'T' suffix, e.g. XXXPC40/T.

5. Take special care when plugging in internal line connections.

How to test

1. Voice dial (see previous note) - use dial-a-disc as a simple test.

2. If no line is present the modem will not operate.

How to correct

*** This section is not yet available

8.2.5 Streaming Tape Unit (STU)

Description

The Streaming Tape Unit makes the backing up of files on hard disc an easy and efficient task. The STU is normally housed in the Expansion Storage Unit (ESU), a self-contained unit the same size as the Triple X. The ESU contains the tape drive unit which accepts standard 1/4" data cartridges along with a controller card, a switched mode power supply (manufactured by Farnell) and a fan.

The STU uses an Archive Corporation model 5945C standard 1/4" data cartridge, with an Adaptec Inc. 400066 controller card and a standard 50-way SCSI interface connection on both ends. Both units receive mains power from the Triple X.

Connectors and connections

Standard SCSI pinouts are used.

Points to note

The internal Farnell PSU has been modified so that C31 is linked out. This enables the tape unit to be powered up by the Triple X.

How to test

Load the tape streaming software and select option "monthly backup".

How to correct

In most cases, it will be necessary to replace a faulty unit. Contact TORCH Service Department for specific information.

8.2.6 Sony 13" display

Description

See section 8.1.5 (Model reference is CHM-1001E-12). The TORCH model number is CM13.

Connectors and connections

```
Monitor drive 8-way DIN socket
          1 - red   0.7V peak-to-peak
          2 - green 0.7V peak-to-peak
          3 - blue  0.7V peak-to-peak
          4 - horizontal drive TTL compatible
          5 - vertical drive TTL compatible
          6 - speaker +
          7 - speaker -
          8 - ground
     shield - ground
```

Adjusting rear panel controls:

The brightness, horizontal shift and vertical hold can all be adjusted from controls concealed by a flip-up cover on the rear panel of the CM13.

Push the panel upwards from the bottom to reveal the three controls set in a well, as shown in the diagram below.

Note: The slider switch should always remain set to 'ANALOG'.

Fig. 8-4 Rear panel of the CM13, showing controls

1. BRIGHTNESS control: the centre setting is normal.

2. H SHIFT (horizontal shift) control: turn this control to centre the display of the Triple X.

3. V HOLD (vertical hold): Adjust this control if the display rolls vertically.

4. RGB input selector: this switch has three positions, but should always be set to 'ANALOG' to receive output from the Triple X.

Points to note

The RGB output driver stage has been modified. On the CRT base (the square PCB fitted to the neck of the tube) there is a bridged metal shield which covers half the PCB. Underneath this shield are three diodes. These prevent internal flashover, which could destroy one of the RGB output transistor devices.

It is important that this modification has been carried out. Contact TORCH Service Department if the diodes are not present.

How to test

The unit should be replaced if a defect is noted in the display quality (for instance, a colour is omitted) but the 13" display has been found to be highly reliable.

How to correct

In most cases, it will be necessary to replace the unit. Contact TORCH Service Department for specific information.

9.0 General Reference

9.1 Glossary of special terms

Accelerator board
An upgrade pack which replaces the 68010 processor with a 68020/68881.

Backing up
Creating a copy of a file or disc to insure against data loss or corruption.

BBRAM
Battery-Backed RAM. This is an area of memory which is maintained by a battery supply so that it retains its contents when mains power is removed.

BOOT disc
The disc which contains instructions to start up the computer and load an operating system without use of files on the hard disc.

Bootstrap
A series of instructions used to load subsequent programs once the initial operating system has been loaded.

Caretaker
The program that loads the Triple X operating system. The Caretaker is contained partly in ROM and partly on disc.

DCE
Data Circuit Equipment. Usually synonymous with Modem. A computer or a data recording or generating device which which needs an interface with another computer.

DTE
Data Terminal Equipment. A device at which a communicaton path begins or ends.

EPROM
Electronically Programmable Read Only Memory: Memory whose contents cannot be changed by the operator.

ESU
The Triple X External Storage Unit. For example, the ESU-ST contains a 60Mb streaming tape backup unit.

Ethernet
A local area network which makes use of coaxial cable. It operates at 10 megabits per second and can link several hundred terminals together.

FDU
Floppy Disc Unit: The replaceable module which houses the floppy disc and related components.

Files
An area of space on a disc containing programs or data which makes up and is named a 'program'. Each program is stored in a specific file, to be kept accessible and separate from the others.

Formatting
Preparing a new magnetic disc for use or re-preparing an old one that contains only unwanted files.

Hard disc
Also known as a 'Winchester' disc, a hard disc stays permanently in its drive and holds much greater amounts of information than a floppy disc. Data stored on hard discs can be accessed quickly.

HDU
Hard Disc Unit: The replaceable module which houses the hard disc and related components.

Inkjet printer
A printer that forms dot-matrix characters by applying small drops of electrostatically controlled ink to paper.

Kernel window
An area (window) that displays copyright information and messages from the central part (the kernel) of the Triple X operating system.

Key disc
A special disc supplied with the Triple X which contains the serial number and the hard disc toolkit plus a backup copy of the Caretaker.

Matrix printer
An impact printer which forms characters by a series of tiny dots rather than by printing shaped characters.

Modem
MOdulator/DEModulator: A device which converts analogue voltages to audible signals or digital information, and vice versa.

Mouse
The hand-held device connected to the computer which controls the position of the pointer on the screen when moved along the desktop.

OMTI 5200
A proprietory disc controller card. Model 5200 controls one FDU and up to two HDUs.

Operating system
A set of programs which manage the computer's communication with its screen, keyboard, mouse, disc drives and desktop displays. The Triple X uses System V UNIX.

Password
A special codeword which must be used in order to gain access to a system or (in some cases) an application program.

PSN
Packet Switching Network. A public network over which information is assembled in packets before distribution.

PSU
Power Supply Unit: The device which provides the direct current voltages required by the internal circuits of the computer.

Quin ring
A housing containing the 5-slot VME-BUS extension to the Triple X.

Restoring a file
Replacing a file which has been removed or deleted.

RGB
Red, Green, Blue: The three primary colours. Combinations of the intensities of these three signals allow all colours to be formed on a (colour) monitor.

SCSI
Small Computer Systems Interface: a common interconnecting bus for microcomputers and high speed peripheral devices.

Security
The series of checks and operations which prevent (1) loss of data, or (2) use of programs or access to data by anyone unauthorised to do so.

Serial number
A unique set of numbers found on the label at the rear of the Triple X and also held in the computer's memory on the hard disc for security checks. The serial number identifies the exact model of the computer or its components. Specify the serial number whenever purchasing additional or replacement parts or for maintenance purposes.

Service processor
A small processor, subservient to the CPU.

Shell
A UNIX term for the program which interprets and obeys commands given by the user.

Slim ring
A housing containing the 2-slot VME-BUS extension to the Triple X.

System V
The version of the UNIX operating system which is implemented on the Triple X.

Toolkit
A set of utility programs used in program development.

Verify hard disc
A check to see that the hard disc is correctly formatted and the data on it is uncorrupted.

VME-BUS
Versatile Multibus Europe: a specification for connecting modules within high performance 32-bit computers, based on a 96-pin backplane.

Window
An area of the screen which gives a view of selected data.

X.25
A CCITT Recommendation specifying the interface between a Packet Switching Network and a computer. The interface is described on three levels: Level 1 deals with the circuit interface between a DTE and a DCE (the same as CCITT V.24). Level 2 specifies the 'frames' in which packets are sent. Level 3 specifies the 'packet-level' interface.

X.29
A CCITT Recommendation which specifies the interface between the Packet Assembly/Disassembly (PAD) facilities of a PSN and a computer.

X-BUS
An interface which is pin-compatible with the BBC 1MHz bus.

9.2 Recommended tools

Assembling or disassembling the Triple X does not require any specialised tools. Make sure, however, that you have at least a Pozidrive number 0, 1 and 2 screwdriver and a set of metric Allen keys. All other tools necessary for servicing will usually be included in a standard engineer's toolkit.

The suggested contents of such a kit are listed below. The corresponding part numbers from the Farnell Electrical Components catalogue have been included for guidance, since this supplier is only one of several.

T100 B	Digital multimeter
VC201	Soft vinyl carrying case
7890	Snipe-nosed pliers
7490	Flat-nose pliers
CK3867	Combination pliers
CK3751	Diagonal cutters
45-121	Wire strippers
XN200	Knife
XNB203	Spare blades
XHT700	Tweezers
P184	Pocket screwdriver
148-071	Pozidrive no. 0
148-072	Pozidrive no. 1
148-073	Pozidrive no. 2
148-039	Screwdriver flat
148-046	Screwdriver flat
4411P	Allen keys metric
44CGV	Adjustable spanner
318-362	Storage box
XS240	Soldering iron
DS10	Desoldering tool
357SEB	Side cutters
D622	Reel solder
146-090	Iron stand
S405	Trimming tools (plastic screwdriver)

Note: A complete kit of tools can be purchased from TORCH Customer Engineering.

9.3 Parts List and Exploded Diagrams of Assemblies

*** This section is not yet available.

9.4 List of recommended spares

PC 20 & 40	Systems 1-10	11-25	26-50	51-75
100-1061 Base processor board	1	2	2	3
100-1056 Farnell 100W 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
106-1008 Monitor: 10 inch	1	1	1	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 Astec 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
ESU				
100-1068 Adaptec controller	1	1	2	2
100-1074 Tape drive	1	1	1	2
100-1056 Farnell 100W PSU	1	1	2	2
112-1210 Controller to tape drive cable	1	1	1	2

9.5 Connecting a Printer

The following guidelines will 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.) Thoroughly read the section on printers and printing in the 'Inside System V' guidebook, then follow the procedure explained below to connect up your printer.

Note: The following method can be applied to any of the three ports. 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. Prepare a lead which has the following connections:

Triple X (A or C, B via splitters) Pin		Printer Pin
2	----------	3
3	----------	2
4		4
5		5
7	----------	7
8	N/C	8
20	N/C	20

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

3. Now send data to the appropriate port (e.g. 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 it to the correct rate. (Refer to the appropriate section for instructions on how to modify it permanently.)

5. The next step will ensure that the Triple X can determine when the printer is actually turned on. This prevents output 'going nowhere' if it is not.

First wire pin 20 of the printer to pin 8 of the Triple X. Next wire pin 8 of the printer to pin 20 of the Triple X. This allows 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: (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. (Refer to the appropriate section for instructions on how to modify permanently.)

7. If the printer requires hardware flow control, it can only be connected to 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 will stop sending data if the CTS signals (pin 5) or the RTS signals from the printer (pin 4) go low.

Testing a Printer

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

1. 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>

2. 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.

3. 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' comands from being killed when the '/etc/rc' command is executed. (Note: This point was omitted from the example given in Issue 2 of the Gold Card Newsletter.)

4. 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 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, illustrated in 3) above.

   XON/XOFF flow control may not easily be tested simply by redirecting output from a command to the appropriate device, unless the port is held open by a command running in the background. (See Gold Card Newsletter, Issue 2.)

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

5. 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'.)

6. 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 will cause the alphabet to be printed repeatedly. The message 'Testing' will appear in the window from which the shell script was invoked; this message will stop after awhile, when the printer buffers are almost full, then continue periodically during the printing.

APPENDICES

Appendix A: Triple X Model Codes

Appendix B: Triple X Hardware Specification

Appendix C: Manufacturing Parts List

Appendix D: List of Modifications

Appendix E: Training Course Application Form

Appendix F: List of Associated Publications

Appendix G: Contact Information

Appendix A - Triple X Model Codes

INSERTS: TRIPLE X Product List

Appendix B - Triple X Hardware Specification

The Triple X family is designed to operate within certain environmental conditions. If there is any doubt about site suitability, installation should be delayed until an experienced engineer has conducted a survey.

Power requirements

Voltage range:	196V - 264V A/C
	or 98V - 132V A/C
Frequency range:	47Hz - 63Hz

Voltage selection is by power supply link change and fan exchange on Triple X PC20 and PC40, and by power supply board exchange on 10" and 13" colour monitors.

Power consumption:	Triple X PC20 and PC40	100W
	10" and 13" colour monitors	100W

Environmental

	Operating	Non-operating	
Temperature range	5-35	0-60	deg. C
Humidity range:	10-80%	10-80%	non cond.
Vibration:	0.2g	0.5g	0-60Hz
Impact:	2g	15g	
Temperature gradient:	10 C/hr (non-condensing)		
Altitude:	0 to 3,000m	-300m to 3,600m	

Safety and EMC Standards

No approvals have been sought, but the Triple X has been designed to meet all relevant standards.

MTBF	10,000 hours
MTTR	1 hour

Dimensions

Main body	450 x 310 x 130mm
Keyboard	450 x 160 x 40mm
10" monitor	260 x 330 x 265mm

Appendix C - Manufacturing Parts List

INSERTS: Triple X Manufacturing Parts Lists

Appendix D - List of Modifications

INSERTS: List of Triple X Modifications

Appendix E - Training Course Application Form

INSERTS: Training course application forms

Appendix F - List of associated publications

*** This section is not complete

"Isolan Transceiver Types 1110 and 1111"
BICC Data Networks Ltd.
1 Frogmore Road
Hemel Hempstead
Herts HP3 9RJ
Telephone (0442) 218383

OMTI data controller

Sony 10" and 13" colour monitors

Information to be supplied by TORCH Computers Ltd.

EPSON FDU

Information to be supplied by TORCH Computers Ltd.

Rodime HDU

Information to be supplied by TORCH Computers Ltd.

Farnell PSU

Information to be supplied by TORCH Computers Ltd.

Astec PSU

Information to be supplied by TORCH Computers Ltd.

Alps Mouse

Information to be supplied by TORCH Computers Ltd.

TORCH PUBLICATIONS

The Caretaker Guide

Installing Software from a Floppy Disc

Guide to System V

Ethernet User Guide

Telecoms Guide

Appendix G: Contact Information

The primary contact point for all customers is with their supplier. All engineering queries and requests for advice should be referred to the Customer Engineering Manager at TORCH Head Office.

United Kingdom and Central Contact Point

TORCH Computers Limited
Abberley House
Great Shelford
CAMBRIDGE
England
CB2 5LQ

Telephone: +44 (223) 841000
Telex: 818841 TORCH G
Fax: +44 (223) 840223

Norway

Computec AS

Netherlands

ECD

New Zealand

CCL

Australia

HRC-Time
CATSCO

Sweden

To be announced

USA

To be announced

France

To be announced

Further information on some of the assemblies may be obtained from the following suppliers:

Product	Supplier
D5126 D5146 Disc drives	NEC Business Systems (Europe) Ltd. Camden Office 35 Oval Road London NW1 7EA England
SD540 Disc drive	Epson (UK) Ltd. Dorland House 388 High Road Wembley Middlesex HA9 6UH England
10 and 13 inch monitor	Sony (UK) Ltd. Unit 1, Causeway Estate Lovett Road Staines Middlesex TW18 3AM England
2EP 2Mb VME Memory card	Plessey Microsystems Ltd. Water Lane Towcester Northants. NN12 7JN England
SA70 1304/1400 Power supply	Astec Europe 8B Portman Road Reading Berkshire RG3 1EA England

For further information regarding the servicing of the Triple X, write to:

The Service Department
TORCH Computers Ltd.
Abberley House
Gt. Shelford
Cambridge CB2 5LQ
England

For other support information, write to the Support Department at the above address.