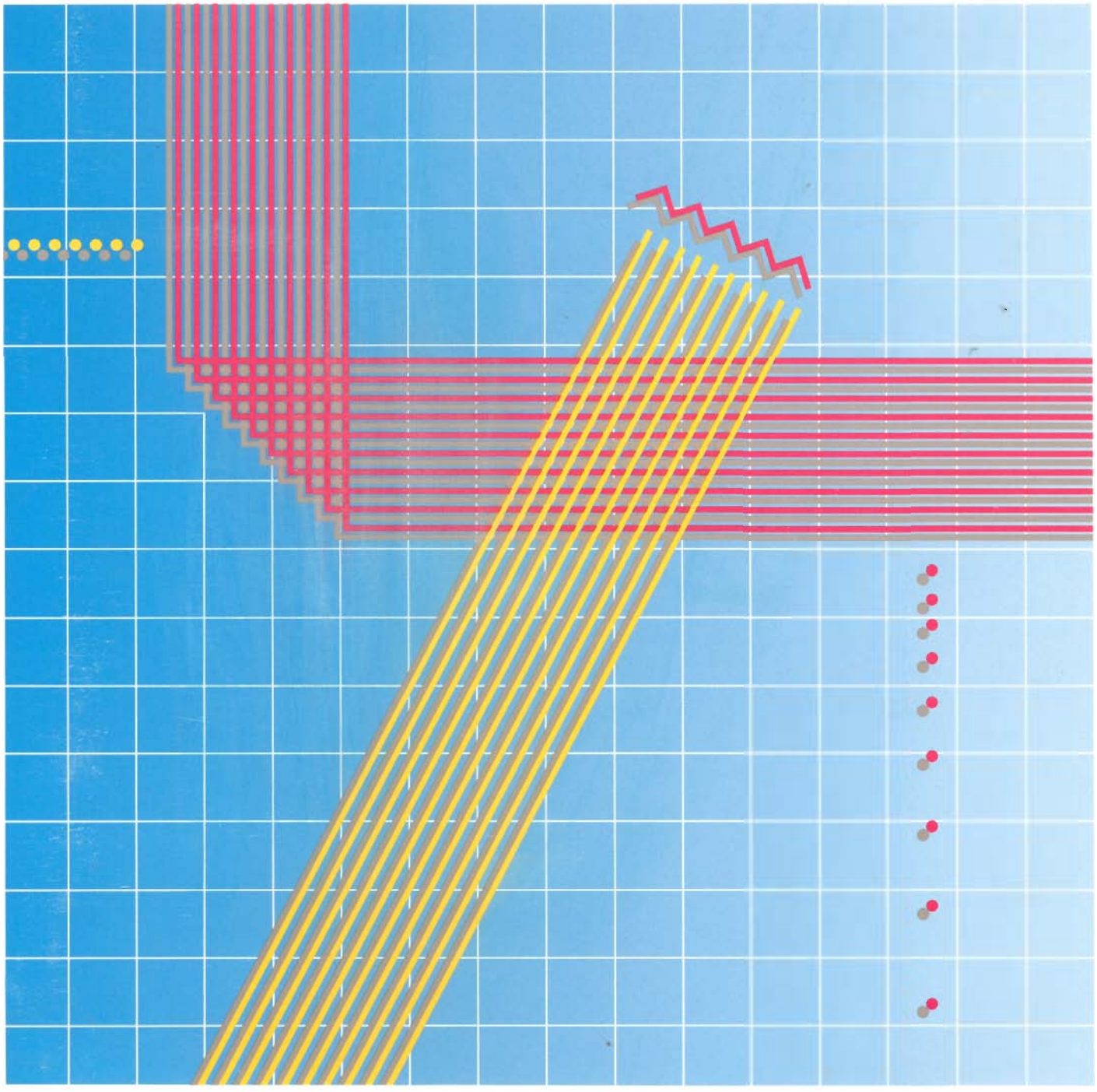
HEWLETT PACKARD

HP 2345A
Datacomm and Terminal Controller

Installation and Service Manual



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2345A
Datacomm and Terminal Controller

Installation and Service Manual

HEWLETT PACKARD

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Manual Part Number 02345-90021

Printed in France.
September 1989

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First Edition . . . . . October 1989

List of Effective Pages

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Effective Pages	Date
All	September1989

Safety Considerations

This product and related documentation must be reviewed for familiarization with safety markings before operation.

Safety Symbols

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

Indicates earth (ground) terminal. This symbol is sometimes used in the manual to indicate circuit common connected to a grounded chassis.

Warning

The warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

Caution

The caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Servicing

Warning Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

General

Warning SAFETY EARTH GROUND - The HP 2345A is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety ground must be provided from the main source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and must be secured against any unintended operation.

RFI

For the United States

Federal Communications Commission (FCC)

The U.S. Federal Communications Commission (in 47 CFR 15.818) has specified that the following notice be brought to the attention of the users of this product.

Warning

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device in accordance with Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

For Japan

This apparatus is a class 1 ITE which complies with the V CCI standard to prevent radio interference in industrial and commerical environments. However, operating this equipment in a residential area may cause interference. Please note this equipment must be installed and used in accordance with the operating manuals.

この装置は，第一種情報装置(商工業地域において使用されるべき情報装置)で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）基準に適合しております。

従って，住宅地域またはその隣接した地域で使用すると，ラジオ，テレビジョン受信機等に受信障害を与えることがあります。

取扱説明書に従って正しい取り扱いをして下さい。

For the German Federal Republic

Funkentstörung Deutschland Herstellerbescheinigung

Hiermit wird bescheinigt, daß das Gerät

HP2345A

in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Wird das Gerät innerhalb einer Anlage betrieben,

- so muß bei Inanspruchnahme der Allgemeinen Genehmigung FTZ 1046/84 die gesamte Anlage der o.g. Genehmigung entsprechen.
- die mit einer FTZ-Serienprüfnummer gekennzeichnet ist, und für die eine Betriebsgenehmigung vorliegt oder beantragt wird, so sind in der Regel keine weiteren Schritte notwendig.

Voraussetzung für die Einhaltung der betreffenden Bestimmungen ist die Verwendung von geschirmten Kabeln. Diese sind vom Betreiber bereitzustellen.

Manufacturer's Declaration

This is to certify the equipment, part number HP2345A, is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation, the right to check the series for compliance with the requirements was granted.

If this equipment is to be operated with a system,

- and if the general license is being claimed, the complete system has to comply with the General Licensing requirements.

- which has its own FTZ-Serial-License, and for which an operating license has been granted or requested, usually no further steps are necessary.

Compliance with applicable regulations depends on the use of shielded cables. These are to be provided from the user.

For UK Only

1. Interconnection directly, or by way of other apparatus, of ports marked "WARNING, CONNECT ONLY APPARATUS COMPLYING TO BS6301 TO THESE PORTS" with ports not so marked may produce hazardous conditions on the network and advice should be obtained from a competent engineer before such a connection is made.

2. WARNING, CONNECT ONLY APPARATUS COMPLYING WITH BS6301 TO THE DATACOM PORTS.

3. Connection to the network must be disconnected before the equipments power plug is removed.

4. Connection to the network must not be hard-wired.

Preface

Purpose of This Manual

This manual describes how to install the HP2345A Datacommm and Terminal Controller into your Local Area Network. It provides information designed to help you identify and locate simple faults associated with the hardware.

Audience

This manual is intended for the Hewlett-Packard Customer Engineer (HPCE) whose responsibility it is to install and maintain the HP2345A. To make best use of this manual you should be familiar with the basic concepts of asynchronous and synchronous data-communications and data networks. To assist you in understanding the function of the DTC you should read *Getting Started with the DTC* and the *Using the OpenView DTC Manager*

Organization of this Manual

The chapters contained in this manual are summarised as follows:

Chapter 1

Introduction - This chapter gives a general view of the HP2345A Datacomm and Terminal Controller (DTC). It describes the general construction of the DTC.

Chapter 2

Site Requirements - This chapter lists the physical, environmental and electrical specifications of the DTC, and specifies the requirements for the installation site.

Chapter 3

Installation Procedures - This chapter describes how to install the DTC, either as a "Standalone" unit or mounted within Hewlett-Packard supplied cabinets (HP46298A / B / C). Detailed information is provided on system connections.

Chapter 4

Power Up and Self test Sequence- This chapter describes how to switch on the DTC and recognise the Self test sequence. A full description of the

Self Test Sequence and Software Download is given. Note that there are no operating instructions for the DTC. Once it is switched ON and working correctly, then it is effectively transparent to the operator and does not need to be "operated".

Chapter 5 *Functional Description* - This chapter gives a functional description of the DTC. The electronic hardware is described to block diagram level with a brief description of the major card components.

Chapter 6 *Troubleshooting and Diagnostics* - This chapter gives a detailed fault finding procedure and explains how to use the Self Test error codes and Diagnostic programs.

Chapter 7 *Removal and Replacement Procedures* - This chapters describes how to remove and replace defective parts (as identified in Chapter 6).

Chapter 8 *Replaceable Parts* - This chapter lists the Field Replaceable Parts and their Part Numbers, together with information on available options applicable to the DTC.

Appendix A. Upgrading the DTC - You must read this appendix if you have a DTC with date codes less than 2851 and want to upgrade for synchronous communications capabilities.

Appendix B. Describes the ASCII character set.

Appendix C. Lists the Documentation References.

Appendix D. Details the pin out of the RS 422, V.35 and V.36 Loopback Hoods

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1

Introduction

This manual, intended for the use of the Hewlett-Packard Customer Engineer (HPCE), describes how to perform the following tasks:

- Install the DTC into a 19 inch rack.
- Identify and connect cables to supported devices.
- Switch On and recognise the start up sequence.
- Identify and rectify faults using the error codes.
- Remove and replace modules within the DTC.

Overview

The HP2345A Datacomm and Terminal Controller (DTC) has been designed to provide a means of connecting the HP3000 series 900 computer to multiple terminals, serial printers and private/public Packet Switching Networks (PSNs) via a single connection point on a IEEE 802.3 or Ethernet Local Area Network (LAN).

The DTC can operate in two different modes depending on the DTC software and hardware installed. The two modes can be defined as:

- Host-Based Management Mode
- PC Based Management Mode

In the Host Based Management Mode the DTC is dedicated to a predefined HP3000 Series 900 Host. The DTC Configuration Software for the DTC is held by the Host and is downloaded to the DTC on receipt of a software download request. With this particular software and hardware installed the DTC can handle up to a maximum of 48 links to asynchronous terminals and printers.

In the PC-Based Managment Mode, the DTC is able to access multiple Hosts and has a Wide Area Network (WAN) capability using synchronous communication protocols. The DTC Configuration software is installed on a PC Workstation (referred to throughout this manual as the OpenView Workstation). The OpenView Workstation allows the Network Ad-

ministrator to configure, control and troubleshoot the DTCs connected to the LAN.

In the PC -Based Management Mode, the HP2345A can handle synchronous communication links to supported PSNs,synchronous Modems and remote DTCs. In this case the HP2345A will contain synchronous communication cards, referred to throughout this manual as the Synchronous Network Processor - Control Unit cards (SNP-CUs) and Synchronous Network Processor -Line Adaptor (SNP-LA) cards. At present the DTC can accommodate a maximum of 3 SNP-CU/SNP-LA cards. The HP2345A can handle both modes of communication simultaneously.

Note

Throughout this manual the term DTC Configuration software refers to the operating software for the DTC. It can be held on either a pre-defined Host or the OpenView Workstation, depending on the mode of operation. When troubleshooting you must ascertain the where the DTC configuration software is held.

General Description

Front Panel Description

At the front of the DTC is a 2 digit and dot Display, used to indicate the operating status and error codes.

The front panel can be removed to expose an internal metal plate to protect the power supply and front card cage. Behind the front card cage lies the Backplane and the rear card cage.

Rear Panel Description

At the rear of the DTC is the ON/OFF switch, fuse holder,the BNC socket for the Thin LAN connection and the 15 -pin D connector for the Thick LAN. These components are common to all DTCs. Above these you will find the rear panels of the Connector and SNP-LA communication cards and their connector ports for terminals, printers, modems and PSNs..

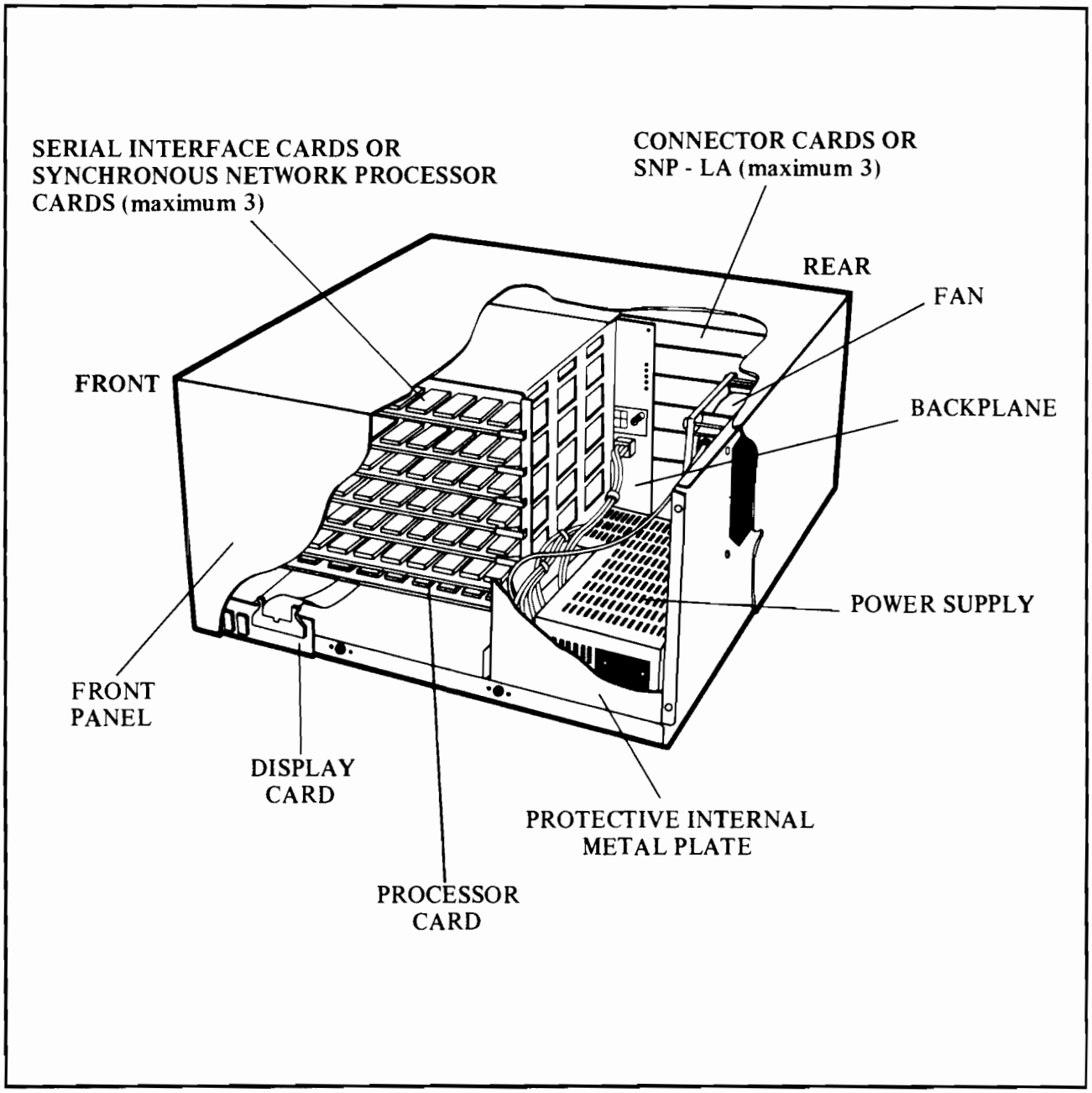


Figure 1-1 Cut away view of the DTC

Internal Description

Every DTC contains a Power supply/fan assembly,Display Card, Backplane and Processor Card. The mode of communications, i.e asynchronous or synchronous, is determined by the type of communication cards connected to the Backplane.

The communication cards can be either the asynchronous or synchronous communication cards . As mentioned previously, the Serial Interface Card (SIC) and the Connector Card (CC) are used for asychronous communications. For synchronous communications, the Serial Network Processor - Control Unit (SNP-CU) and the Serial Network Processor - Line Adaptor (SNP-LA) are used.

2

Site Requirements

Introduction

The aim of this chapter is to provide you with information relating to the environmental, physical and electrical specifications of the HP2345A.

The chapter is organised as follows:

- Physical Specifications
- Environmental Specifications
- Electrical Specifications
- Standards
- Positioning the DTC
- Rack Installation

Before attempting to install the DTC, make a note of all the specifications listed in the Tables and compare them with the specifications of the proposed installation site. If there are any noticeable differences between the DTC specifications and the site, contact your regional support engineer for information.

Physical Specifications

The physical specifications of the DTC are as shown in table 2-1. Before siting the DTC make a note of the weight and physical dimensions to ensure that the proposed installation site can accommodate the DTC.

Table 2-1 DTC Physical Specifications

PARAMETER	CONDITION	SPECIFICATION
Weight	**Minimum** **Maximum** **Typical (after packing - all slots occupied**	**16 kg** **20 kg** **24.5 kg**
Height	**Standard**	**21.9.5 mm/ 8.64 inches**
Length	**Standard**	**455 mm/ 17.91 inches**
Width	**Standard**	**425mm/ 16.73 inches**

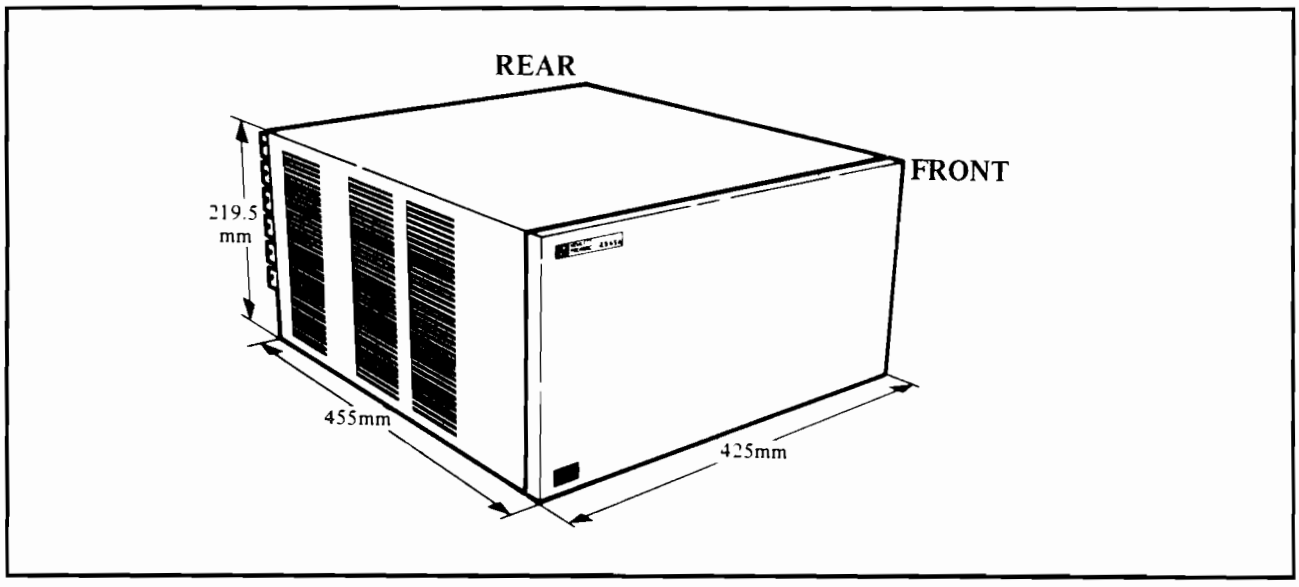


Figure 2-1 Side View of DTC (Physical Dimensions)

Environmental Specifications

Ther HP2345A has been designed for operation in light industrial and commercial environments. The DTC can withstand moderately high and low temperatures, wide humidity variations, occasional minor shocks and moderate vibration during operation. Note the environmental specifications carefully before siting the DTC to ensure that the environment is suitable.

Table 2-2 DTC Environmental Specifications

PARAMETER	CONDITION	SPECIFICATION
Temperature (ambient conditions)	Operating Non-operating	0 to +55 degs C -40 to +75 degs C
Relative Humidity	Operating Non-operating	5% to 95% at +40 degs C 90% at 65 degs C
Altitude	Operating	4000m
Static Discharge	Operating Non-operating	15kV-no data errors/loss 25kV - no damage

Electrical Specifications

Before installing the DTC ensure that the power available on site meets the specifications of the DTC. The electrical specifications for the DTC are shown in table 2-3.

Table 2-3 DTC Power Specifications

PARAMETER	CONDITION	SPECIFICATION
Power Consumption	**Typical (full load)**	**1..21 A (115V config.)** **0.7A (230V config.)**
	Maximum	**1.8A (115V config.)** **0.9A (230V config.)**
Line Frequency	**Minimum**	**47.5 Hz**
	Typical	**50/60 Hz**
	Maximum	**66 Hz**
AC Input Voltage	**Minimum**	**90V (115V config.)** **180V (230V config.)**
	Typical	**115V (115V config.)** **230V (230V config.)**
	Maximum	**135V (115V config.)** **275V (230V config.)**

Standards

The DTC has been passed and approved by the following safety agencies:

- UL (Underwriter's Laboratories) under Standard UL 478 (5th Edition)
- CSA (Canadian Standards Association) under Standard C22.2 (220 - M1983)
- IEC (International Electrotechnical Commission) under Standard IEC 380 (3rd Edition) and under Standard IEC 435 (2nd Edition).
- FEI (Finnish Electrical Inspectorate) - Voluntary safety inspection
- SASO (Saudi Arabain Standards Organisation)
- British Telecomm under BS6301

The DTC adheres to the following EMC (Electro-Magnetic Compatiblity) and EMI (Electro-Magnetic Interference) Standards.

- FTZ (Fernmeldetechnischen Zentarlamt) 1046/84.
- FCC (Federal Communications Commission) Part 15 class A.
- EN55022

The DTC has also obtained the Data Communications Certification for secondary attachment (via modems) in Belgium, Australia,Germany, U.K.; Norway, Sweden, Finland and Japan.

Note The DTC Acoustic Noise Level is less than 50dBA.

Positioning the DTC

The DTC can either be positioned as a "Stand-alone" unit, for example on a table. It may also be mounted within a 19 inch rack supplied by Hewlett-Packard or a non Hewlett-Packard rack. Full details of the Hewlett-Packard rack installation are given in the next section (see Rack Mounting Specifications) and in Chapter 3.

Whichever installation is chosen, the installation site must be prepared in advance to meet the following requirements:

- **A "stand-alone" Installation**

  The DTC must be mounted on a clean, dry, flat, horizontal table, of sufficient strength to physically support the DTC. The table surface must be large enough to allow clearance of at least 10cm on the two sides of the DTC so that the internal fan can work properly. A clearance of at least 60cm at the front and rear to allow for front panel and cable access. Figure 2-2 illustrates the recommended site clearance distances.

- **Electrical power cabling**

  Ensure that a power socket is no more than 2 metres from the rear of the DTC. All site power cabling must conform to the local safety regulations.

- **Communications cabling**

  All cabling for the LAN, terminals and printers is to be installed by the Customer. Terminals, printers and modem cables are not supplied with the DTC, and must be ordered seperately. Chapter 3 of this manual lists the appropriate cables.

The LAN cable installation for Thick LAN and Thin LAN is carried out by the Customer. The Customer is also responsible for installing the taps, terminators, MAUs,AUIs (for the Thick LAN), BNC T connectors and terminators (for Thin LAN).

The following manuals provide useful information regarding the LAN installation:

-Local Area Network Cabling and Installation Guide (part no 30242-90004)

-LAN Cable and Accessories Installation Manual, (part no 5955-7680)

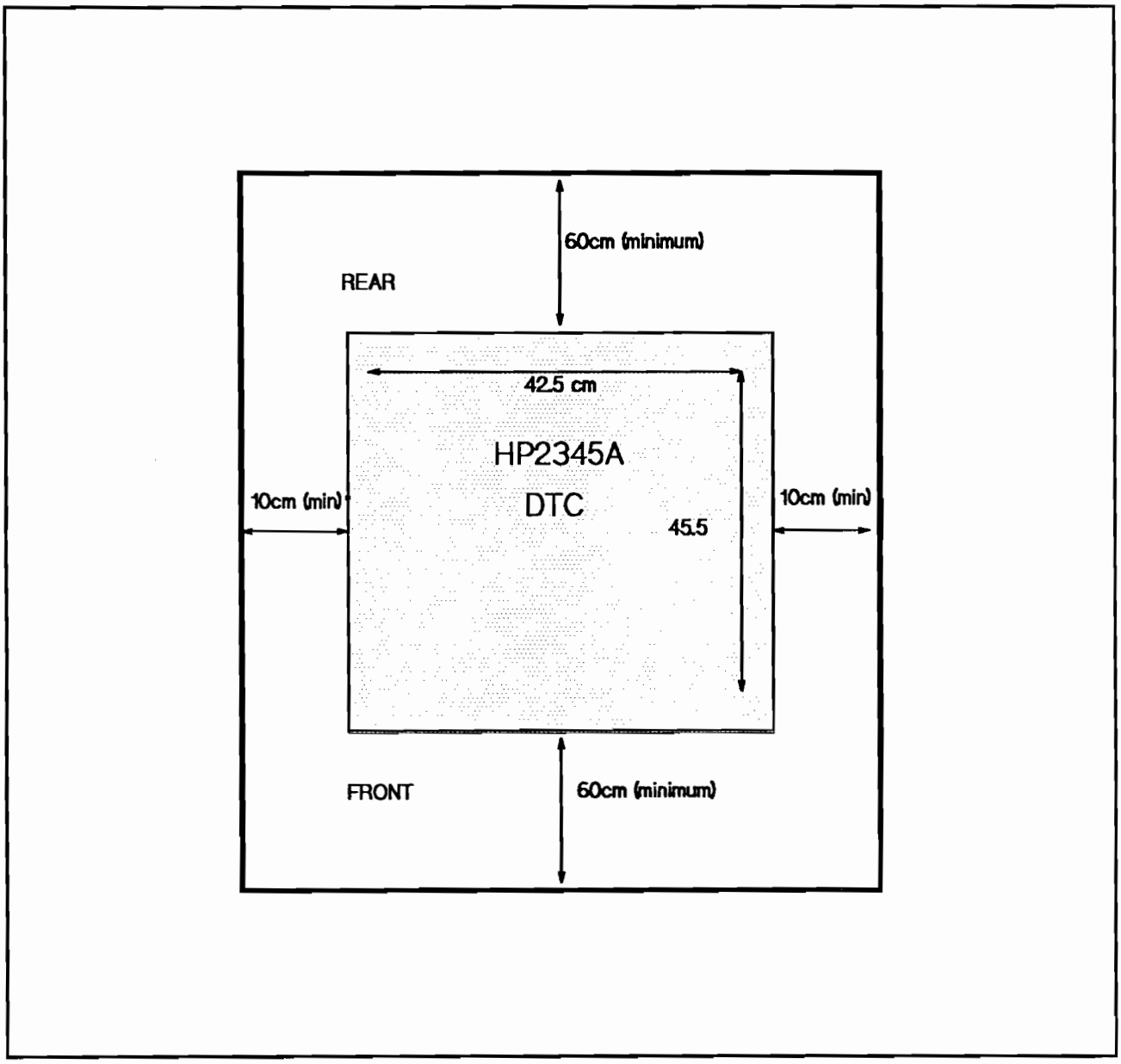


Figure 2-2 DTC Standalone Site Positioning (Top View)

Rack Mounting Specifications

The HP2345A DTC may be mounted in either a Hewlett-Packard 19 inch rack (see Chapter 3) or a non Hewlett-Packard supplied rack providing it conforms to the following specifications:

For Non Hewlett-Packard racks

- The rack must provide good accessibility to the DTC.
- The front panel hexadecimal display must be clearly visible.
- The front panel of the DTC can easily be removed.
- The rack must be correctly cooled and ventilated.
- The rack must be of robust construction and provide good electrical,thermal and mechanical protection for the DTC.
- The rack must conform to the local country codes and Standards applicable to cabinets containing electrical equipment.

When mounted in a non Hewlett-Packard rack, the DTC must be securely mounted on a shelf provided by the rack manufacturer. If the rack is to be moved frequently, the installation procedures should be as simple as possible. In all cases consult the rack manufacturer's documentation before attempting to install the DTC.

3

Installation Procedures

Introduction

This chapter describes how to install the HP2345A DTC into a HP or non HP 19 inch rack and connect the appropriate cables.

Caution The DTC should only be installed by qualified Hewlett Packard Personnel.

The DTC hardware installation procedure can be summarized as follows:

- Ensure that the installation site conforms to the specifications given in Chapter 2.
- Unpack and inspect for signs of damage.
- Check the identification label and options.
- Check that the correct internal power supply and AC fuse are installed.
- Mount in a HP 19 inch rack or as a stand alone unit
- Connect the LAN, terminal/printer and modem cables to the DTC.

Note that the LAN cables must be installed on site by the Customer.

- Connect to the AC supply.

Do not switch on until you are certain that the DTC has been correctly installed and that all connections are in their correct postions. Full details of the switch on and self test procedure are given in chapter 4 of this manual.

Storage and Unpacking

This section describes the precautions to be observed when storing the DTC and when unpacking it at the delivery site.

Storage

The DTC must be stored in an environment which conforms to the specifications as detailed in chapter 2, table 2-2.

Caution

The DTC contains delicate electronic components which can be irrevocabably damaged if handled improperly. Care must taken when carrying and transporting the DTC.

Unpacking.

Upon receipt of the DTC, carefully remove the packing material ensuring that all components and options have been packed with the DTC. Check against the delivery advice that the carton contains all the components and options ordered, if anything is missing contact the shippers and nearest Hewlett Packard office.

Closely examine the carton for signs of damage, if there is damage, remove the DTC and examine it for scratches, dents, broken parts etc.

If the DTC has suffered damage during packing and transit do not attempt to install it. Notify the carrier and nearest Hewlett Packard office immediately. Retain the shipping carton and packing material for inspection by the carrier.

In any correspondance, refer to the DTC by its model number (HP2345A) and quote the full serial number as detailed on the DTC identification label (see Figure 3-1).

The DTC Identification Label

The DTC identification label is located on the chassis inside the front of the DTC box. The label gives a full description of the product and is used to check that all the options ordered are included with the DTC. The following information is included on the label:

- Equipment Certification
- Product Identification
- Options Identification
- Power Requirements
- LAN Address
- Multicast Address

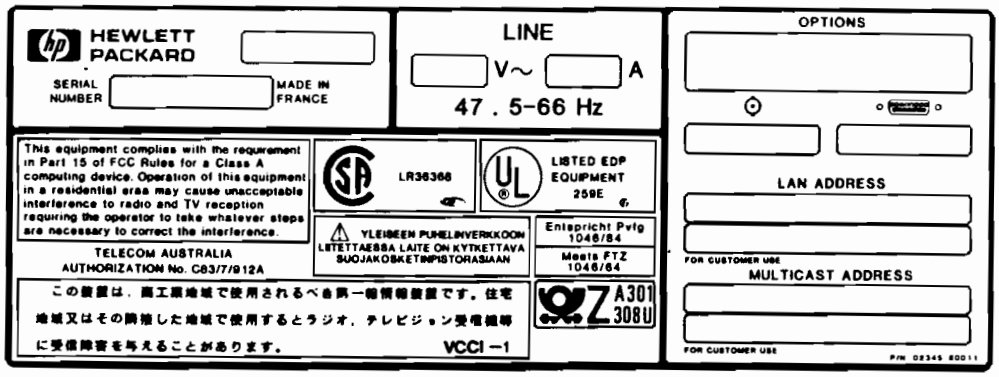


Figure 3-1 The DTC Identification Label

Equipment Certification

This section of the label certifies the compliance of the equipment with the FCC and other official requirements.

Product Identification

The DTC is identified by the HP model number (HP2345A) and a ten digit serial number (e.g.12345-12345).

Options Identification

The options delivered with the DTC are listed here along with the a visual representation of the appropriate LAN cable connector. All accessories ordered later (such as rack mounting equipment or add on cards) are delivered seperately and the customer must write these in later.

Power Requirements

The DTC voltage setting and power requirements are listed in this section.

LAN Address

The factory configured "Nodal" address for the DTC is printed in the top row of this section. If the customer changes the "Nodal" address for any reason , then the bottom row of this section should be filled in.

Multicast Address

The factory configured LAN "Multicast" Address is printed in the top row of this section. If the customer changes this for any reason, the bottom row of the section must be filled in.

Line Voltage and AC Fuse Checking

Before attempting to install the DTC it is important that you check the line voltage and the AC fuse rating indicated on the identification label.

If the voltage requirements stated on the label does not conform to the existing site voltage , DO NOT attempt to install the DTC. It is necessary to change the voltage setting within the power supply of the DTC, refer to *Chapter 7 - Removal and Replacement of Modules*.

If the voltage indicated on the label conforms to site AC voltage supply, then check that the AC fuse is of the correct rating.

Table 3-1 Fuse Ratings

AC INPUT VOLTAGE	CURRENT RATING	PART NUMBER
115 V	4A (Slow Blow)	2110-0055
230V	2A (Slow Blow)	2110 - 0002

Checking the AC Supply Fuse

The procedure to remove and check the AC fuse is shown in figure 3-2, and is described as follows:

1. Ensure that the DTC is disconnected from the mains supply.

2. Using a small flat bladed screwdriver, lift the plastic fuse box cover to expose the fuse holder.

3. Using the screwdriver blade, press the white plastic lip at the left of the fuse holder. The fuse holder, complete with fuse, will spring out.

4. Pull out the fuse holder and examine the fuse. Check that the fuse is intact and correctly rated for the DTC operating voltage.

5. If the fuse is not correct or has blown, replace it with the appropriate fuse type and rating, see Table 3-1.

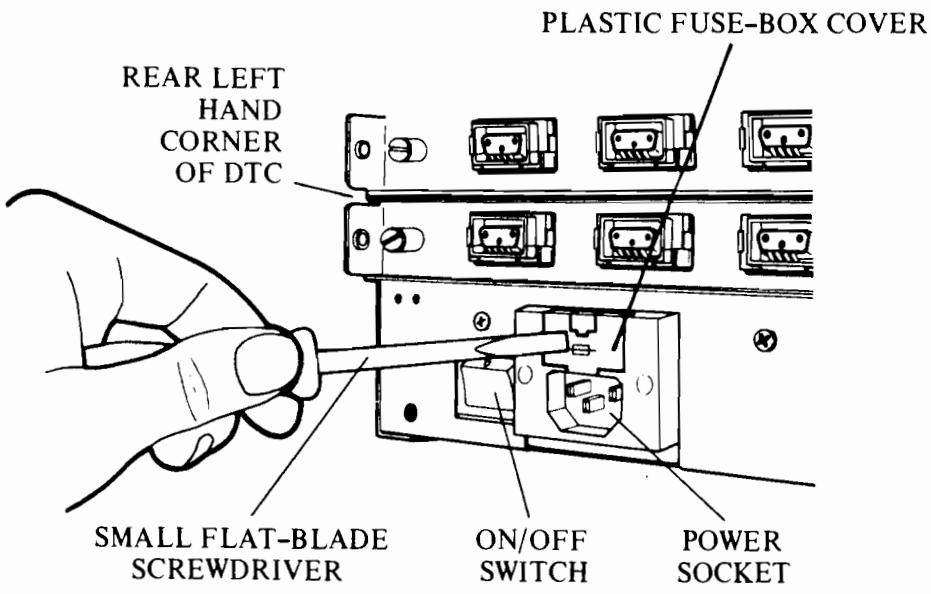


Figure 3-2 DTC Power Socket and AC Fuse Location

Note

For more information on fuses, see Chapter 7 of this manual,"Removal and Replacement of Modules".

Rack Mounted Installation

The DTC can be mounted within specially designed equipment racks supplied by Hewlett Packard, these are the 720mm rack (HP 46298A) which can house up to two DTCs, the 1000mm rack (HP 46298B) which can house up to three DTCs and the 1600mm rack (HP46298C) houses up to five DTCs.

With either rack installation it is necessary to have available the Rack Mounting kit (HP A1052A) for each DTC.

Before installing the DTC you must attach the DTC support rails into the equipment rack. The DTC can then be slid into position and secured by two L clamps which are supplied as part of the rack mounting kit. The following tools are required:

- Millimetric rule.
- Cross-headed screwdriver

Refer to figure 3-3 and follow the outlined procedure to fix the support rails into the 1000mm rack:

1. Remove the top cover of the HP46298 Rack by removing the rear two cross-slotted screws.

2. Lift the top cover of the Rack at the rear, push forward and remove.

3. Remove the two cross-slotted screws inside the top of the rack sidecover, remove by lifting up and out.

4. Remove the rack mounting kit from the delivery carton and identify each component.

5. Attach the cable guide to the support rails using the 2 M4x0.7 machine screws,these are through bolted to the L clamp which secures the DTC in position. Fasten a cable guide to the other support rail in a similar manner

6. Position the lower support rails either side of the rack, 13 holes up from the base, use a M5x0.8 machine screw to secure the support rail to the upright assembly,front and rear.

7. The second pair of support rails are to be located 28 holes up from the base.

8. The third pair of support rails are to be located 43 holes up from the base.

9. When the support rails are firmly fixed in position, slide the DTC into position then fasten to the L clamps using a M4x0.7 machine screw.

Note

This procedure is applicable for all rack installations, the distances for the HP 42698 A/ B / C racks are shown in figure 3-3

When the DTC is mounted in a Hewlett Packard rack, the cables remain the same as a for a stand alone unit.

All the cables leading into the DTC i.e the Thin or Thick LAN, Terminal/printer/X.25 cables must be carefully tied together using cable ties. The cables are routed downwards on the outward side of the cable guides.

The terminal/printer and modem cables should be tied together neatly, and fed horizontally along each Connector Card to one side of the DTC box, then routed downwards. The cables are held in position by cable tie assemblies which consist of a mount, a screw and a cable tie. These assemblies are fixed together on the back of the Connector Card, on either side, and the cables passed through them). This arrangement allows better access to the Connector Cards and the Processor Card. Six cable tie assemblies are supplied with the DTC.

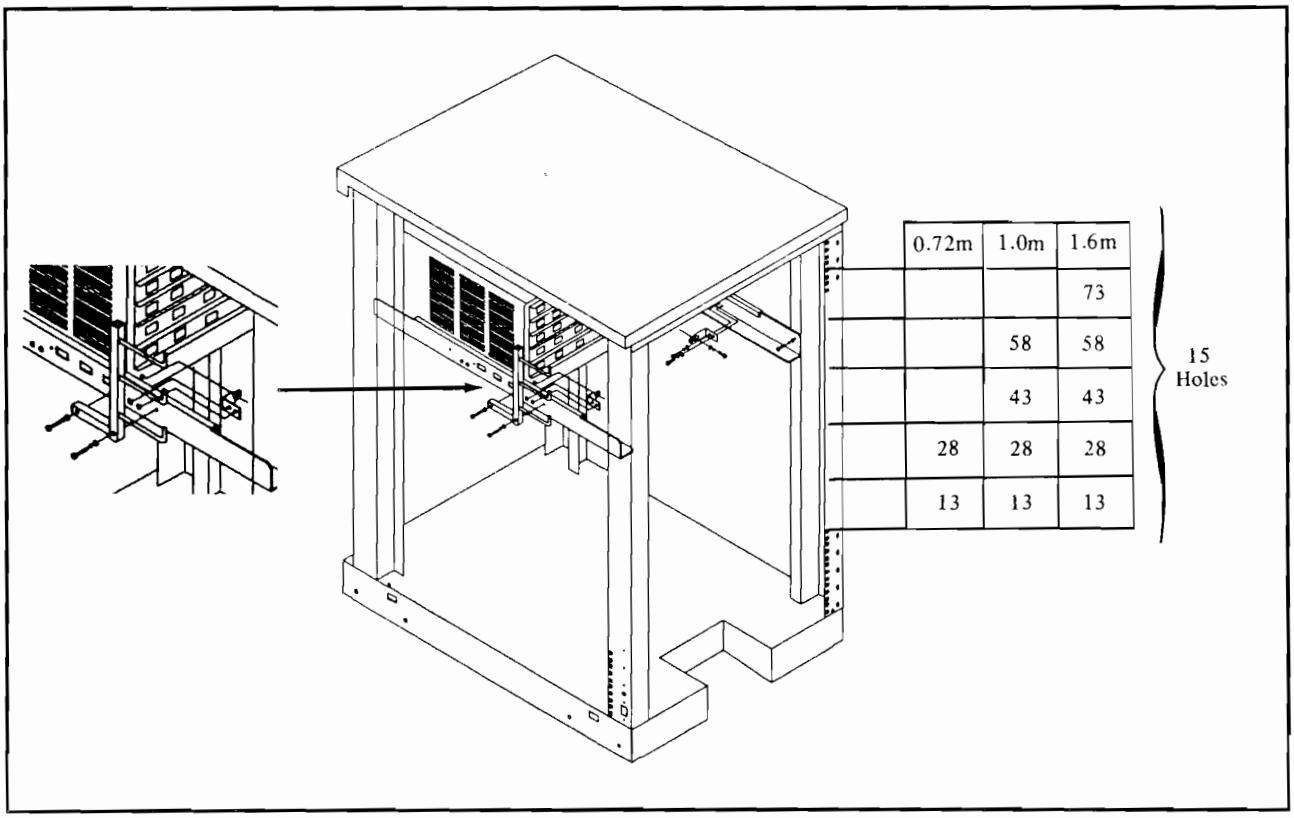


Figure 3-3 The DTC Rack Installation

Caution

After DTC units have been installed in the equipment rack, the rack may be moved short distances on its castors for proper positioning. Do not, however, move a loaded rack long distances over rough surfaces or down an incline. If the rack is to moved long distance, the DTC units will have to be de-installed.

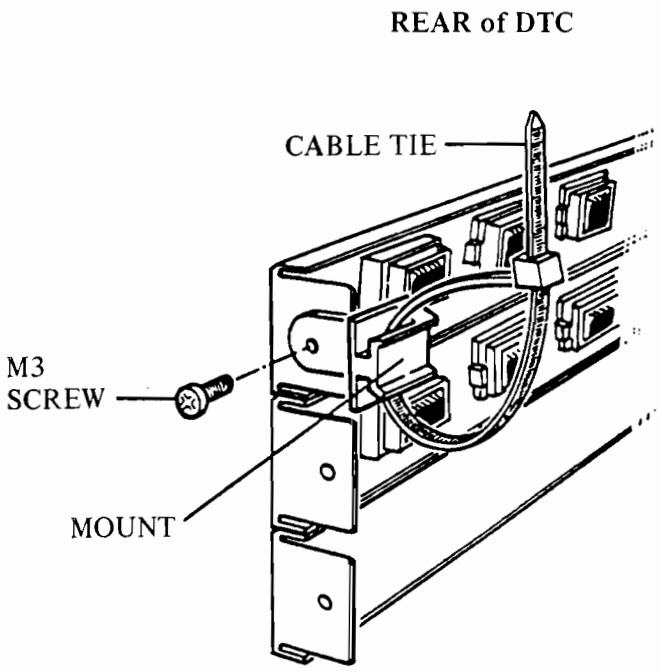


Figure 3-4 Cable Tie Assembly

Cable Identification and Installation

This section lists all the cables that are used with the DTC. The section is divided into two parts:

1. Asynchronous Communications

There are three asynchronous communication interfaces:

- RS-232-C Direct Connect
- RS-232-C Modem Connect
- RS-422 Direct Connect

2. Synchronous Communications

There are four synchronous communication interfaces:

- RS-232-D
- RS-422
- V.35
- V.36

Asynchronous Communications Installation

There are three different groups of communication cables connected to the DTC. They are the DTC to LAN cables, the DTC to terminal/printer cables, and the DTC to modem cables. All of these cables are ordered and installed by the customer and should be in position on-site before the DTC is installed. The HPCE merely needs to connect the cables into the correct connection ports on the DTC. Figure 3-5 shows the rear view of the DTC (asynchronous communications only), with all possible connection ports for the cables.

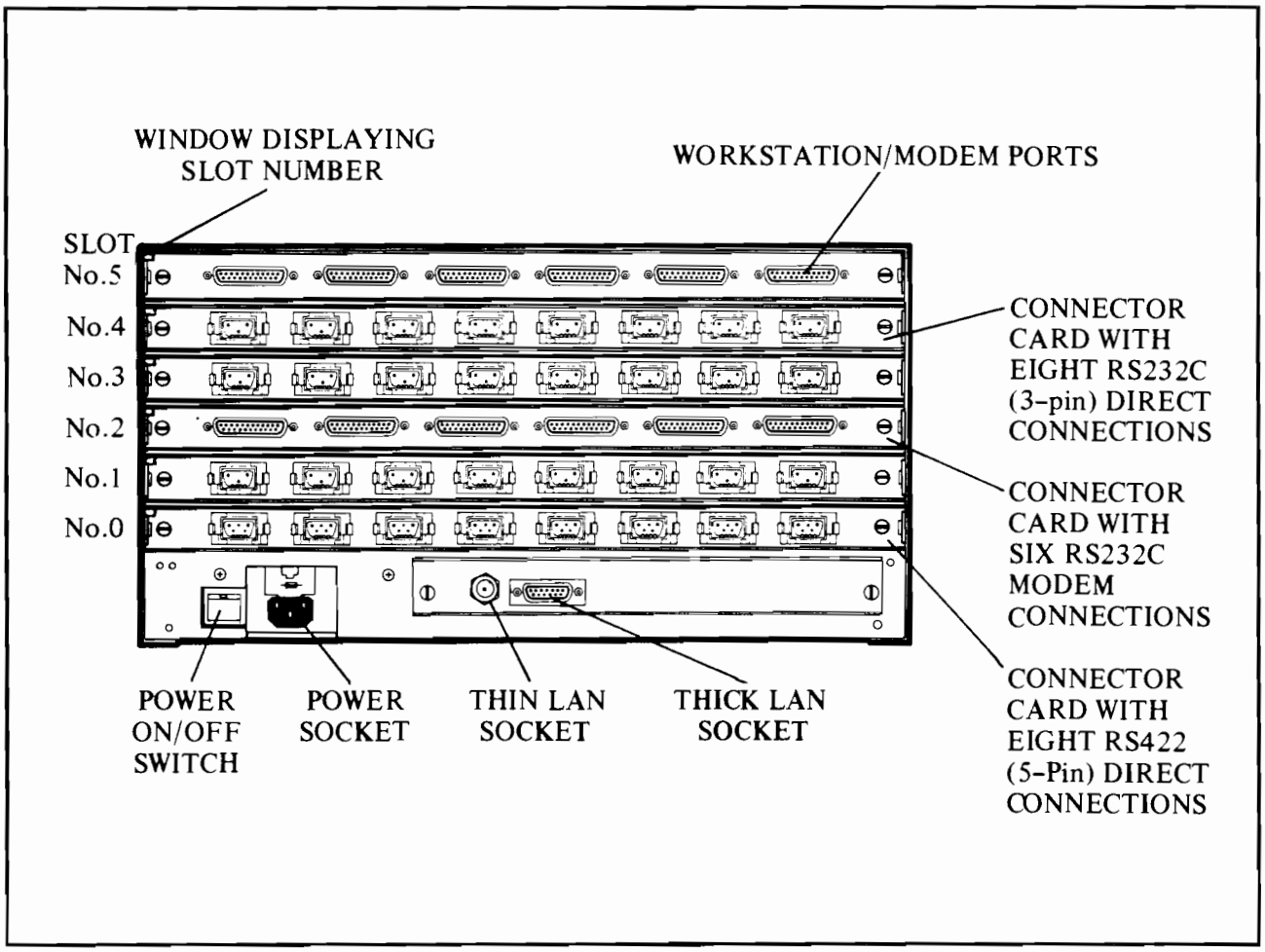


Figure 3-5 Rear View of the DTC

DTC to LAN Cabling

The LAN cable, complete with "taps" and "terminators" MAU (Medium Attachment Unit if Thick LAN) and AUI (Attachment Unit Interface if Thick LAN) and must be ordered and installed on site by the customer. There are three product options applicable to the LAN :

- Option 240 for the Thick LAN connection. This includes a 6 metre AUI and MAU. The DTC is internally configured for Thick LAN.
- Option 241 configure the DTC for Thick LAN operation. No MAU or AUI cable is provided.
- Option 242 for the Thin LAN connection. This includes a BNC 'T' connector and the DTC internally configured for Thin LAN. Has an inbuilt MAU.

There are two LAN sockets on the rear panel of the DTC as shown in figure 3-5.

To connect the DTC to the Thick LAN simply plug the AUI cable into the 15-pin DTC Thick LAN socket and slide the connector clip into place. It is necessary to remove the protective plastic cover from the Thick LAN socket. Coil up the surplus amounts of cable.

To connect the DTC to the Thin LAN, remove first the protective cover from the Thin LAN socket, then plug the BNC "T" connector into this socket. Next plug the LAN cable into each side of the "T" connector, and clip the plastic "boot" protective cover over the top of the BNC "T" junction.

Note

Data transfers can still take place on the LAN while the DTC is being installed (except in the case of Thin LAN when the BNC "T" connector is connected to the LAN cable - this opens the LAN).

If you need to change the LAN configuration *see "Modifying the LAN Configuration"* section, in order to switch the DTC configuration from Thick LAN to Thin LAN and vice versa.

DTC to Terminal,Printer and Modems

Asynchronous communications to supported terminals, printers and modems is via the Connector Card ports at the rear of the DTC.

When the DTC is configured for asynchronous communications only, a maximum of six connector cards can be installed into the card cage at the rear of the DTC. There are three different types of connector card as previously mentioned, these are as follows:

- RS-232-C -8 x 3 pin RS232-C direct connect ports card.
- RS-422 - 8 x 5 pin RS-422 direct connect ports card.
- RS-232-C -6 x 25 pin RS232-C modem connect ports card.

As shown in figure 3-5, the slot position of each Connector card in the DTC is identified by a number 0 to 5 labelled on the rear of the DTC. On the left of each slot and visible through a small window in the Connector Card. The top slot is number 5 and the bottom, number 0. Each communication port is identified by a number running from 0 to 5, left to right for Modem connections, and 0 to 7 for Direct Connections.

To connect the terminals/printers and modems to the DTC, plug the cable connector into the relevant Connector Card port. The 3-pin and the 5-pin connectors simply clip into place by pressing the catch on either side of the connector. The 25-pin connector is secured by tightening the locking screws on either side of the connector.

Each Connector Card connection is identified by an appropriate ID label.

Forty-eight labels are supplied with each DTC on a perforated sheet. Each label is detached from the sheet and affixed to each connector. The number of the DTC should be marked on the label, preferably using a marker pen.

Cables for RS-232-C Direct Connect

Direct connnections between the DTC and supported terminals and printers, via the RS-232-C direct connect interface are made using the cables shown in figure 3-6. The identification numbers marked on these cables are listed in table 3-2.

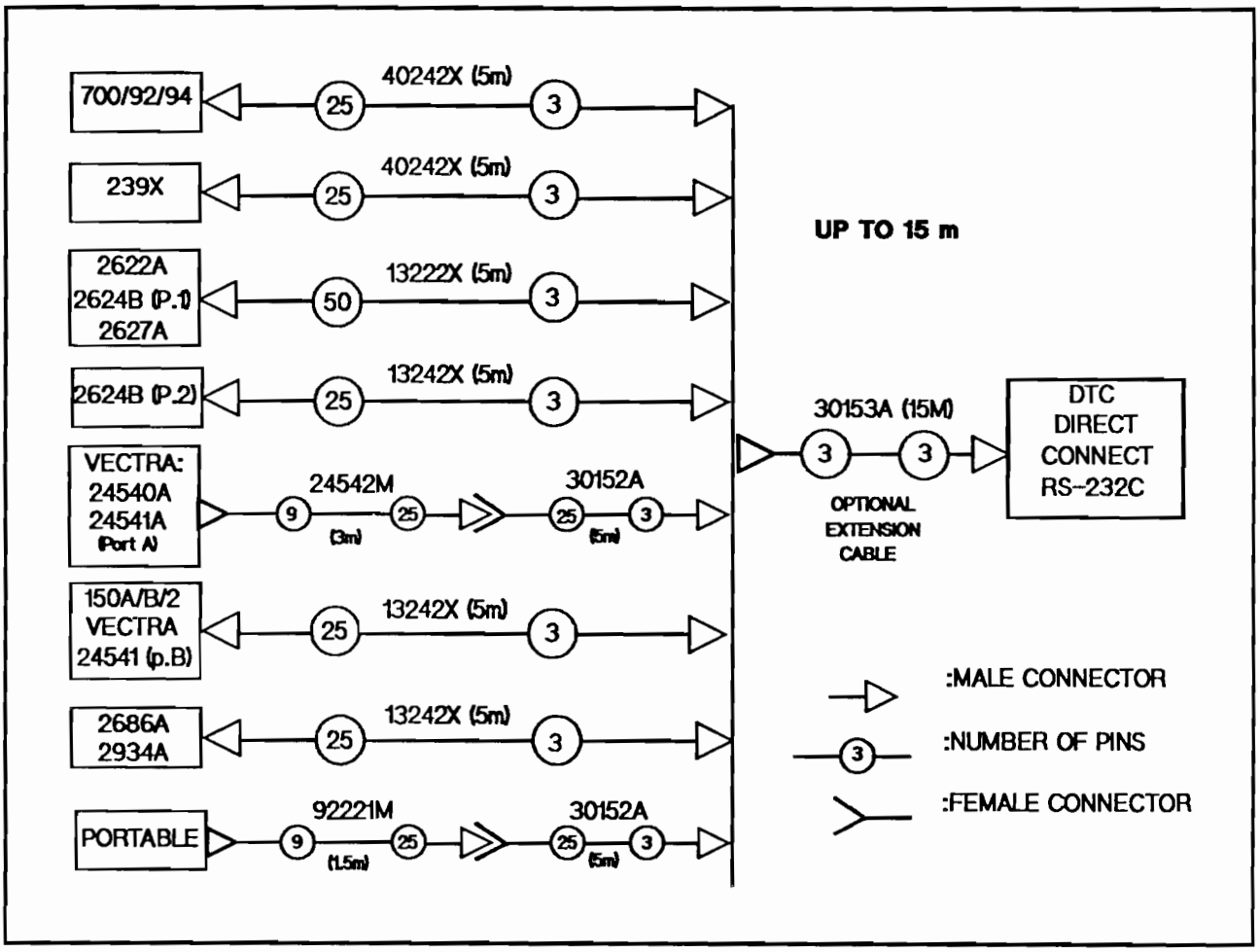


Figure 3-6 Direct Connections to RS-232-C

Note

The RS-232-C cables are supported for up to 15m (50ft) in length. Cables in excess of 15m will cause data degradation and corruption due to RF Interference and stray capacitance.. RS422 cables are supported for up to 1220m (4000ft) in length.

Cables for RS-422 Direct Connection

Direct connections between the DTC and supported terminal/printers via RS-422 Direct connect ports are made using the cables shown in figure 3-7. The identification numbers marked on these cables are listed in Table 3-2.

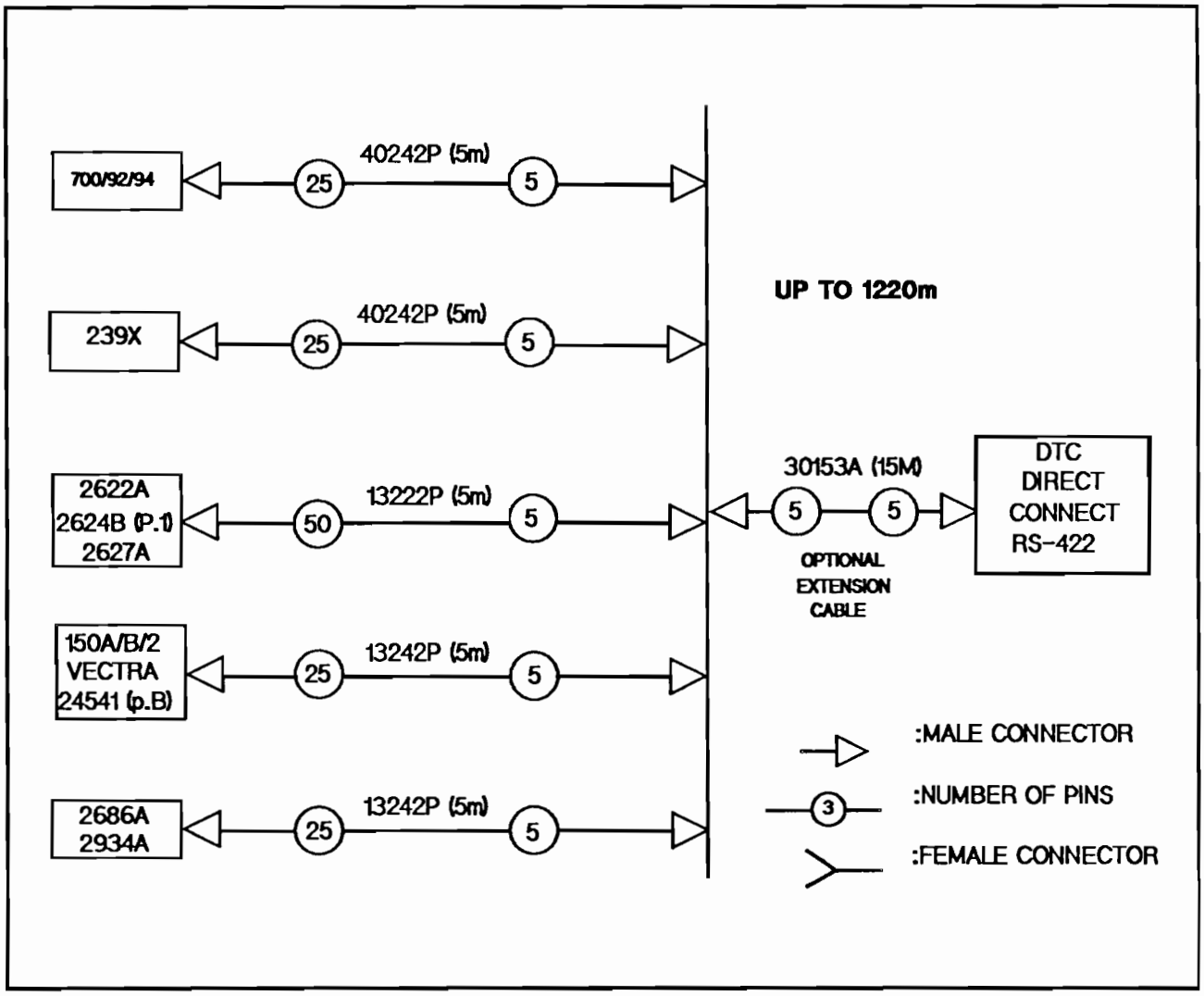


Figure 3-7 Direct Connections to RS-422

Warning

RS-422 Cable Installation

The RS422 interface allows a ground difference of up to 300V DC (210V AC) between the DTC and a directly connected terminals. This removes the need for a "ground bonding jumper" between the grounds of each power source in the event that a building has multiple power sources. Figure 3-8 shows the grounding arrangements. In the case of multiple power sources not having this "ground bonding jumper" installed, hazardous voltages can be present on the RS-422 to terminal cable. These voltages can cause injury to persons coming into contact with the cable.

In all cases dealing with grounding and power, the permanent authority is the local authority or electrical code. If Hewlett-Packard's recommendations differ from the local codes, the local codes take precedence. If you have any questions regarding electrical grounding consult an electrician or contact your local HP Sales and Support Office for advice.

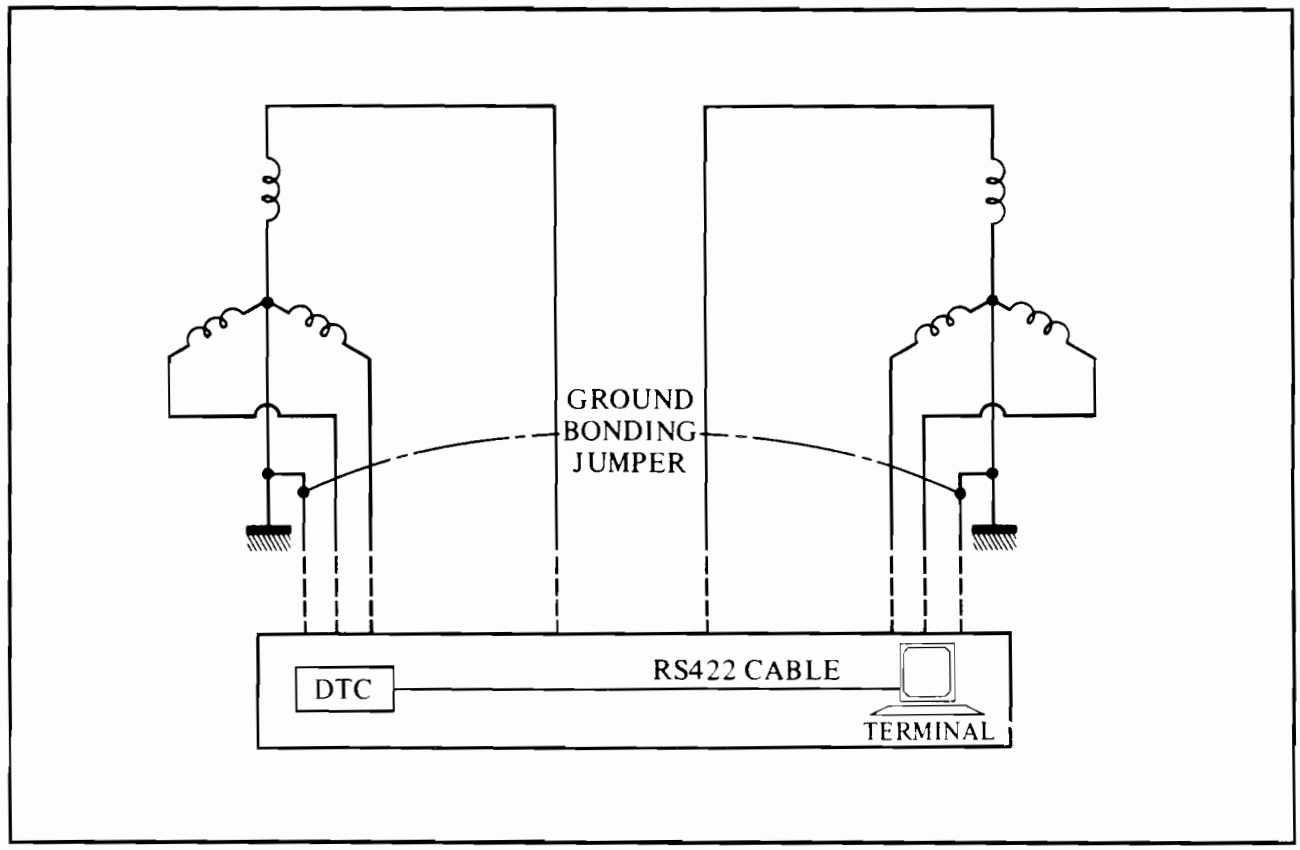


Figure 3-8 RS-422 Ground Bonding Arrangements

Cables for RS-232-C Modem Connection

DTC to supported terminals/printers via the RS-232-C Modem connect port are made using the the cables shown in figure 3-9a . The identification numbers marked on these cables are listed in Table 3-2

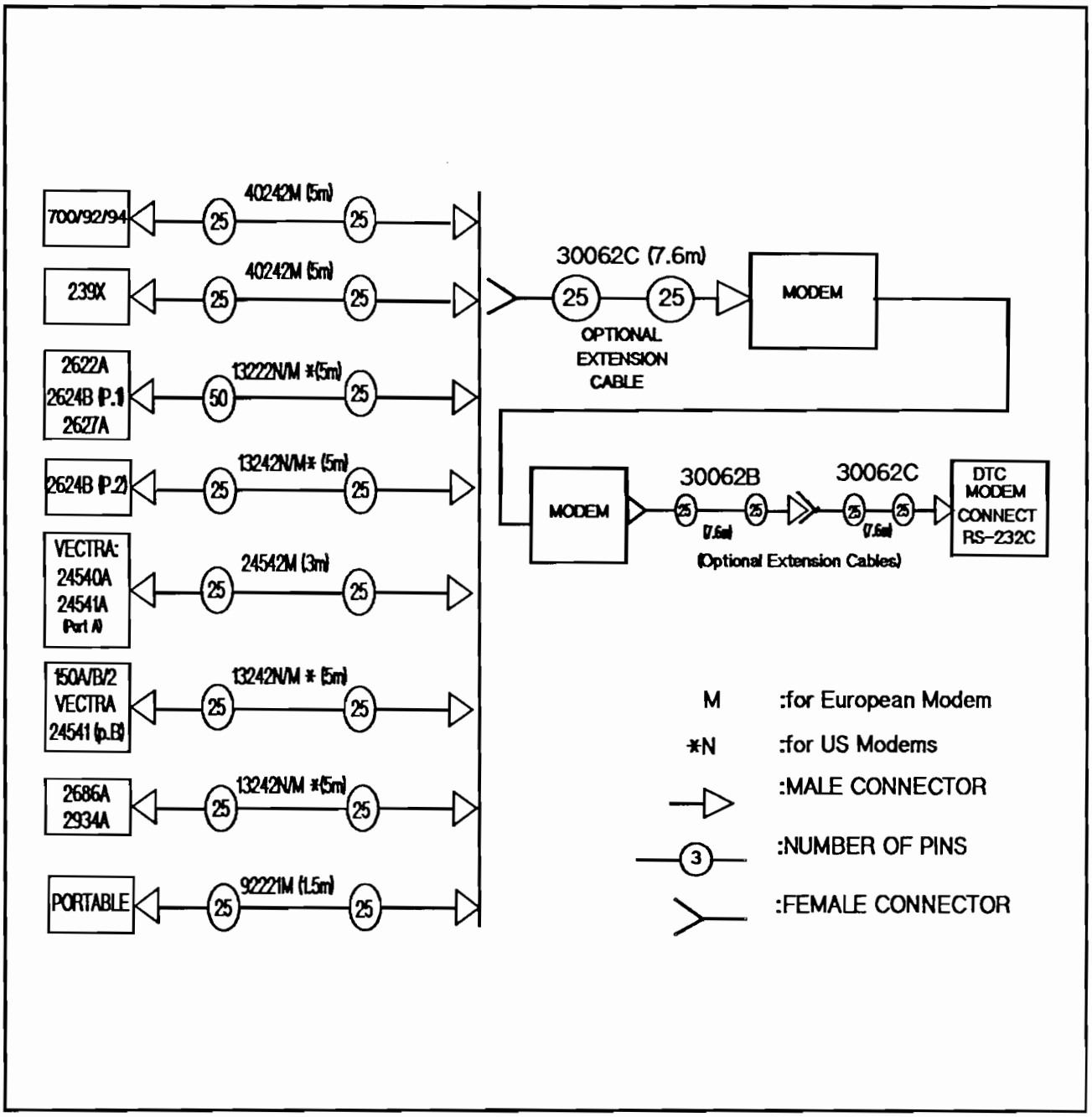


Figure 3-9a Modem Connections to RS 232-C Modem Ports

Direct Connections to RS-232-C Modem Port

The identification numbers are marked on these cables are listed in Table 3-2 and are as shown in figure 3-9b.

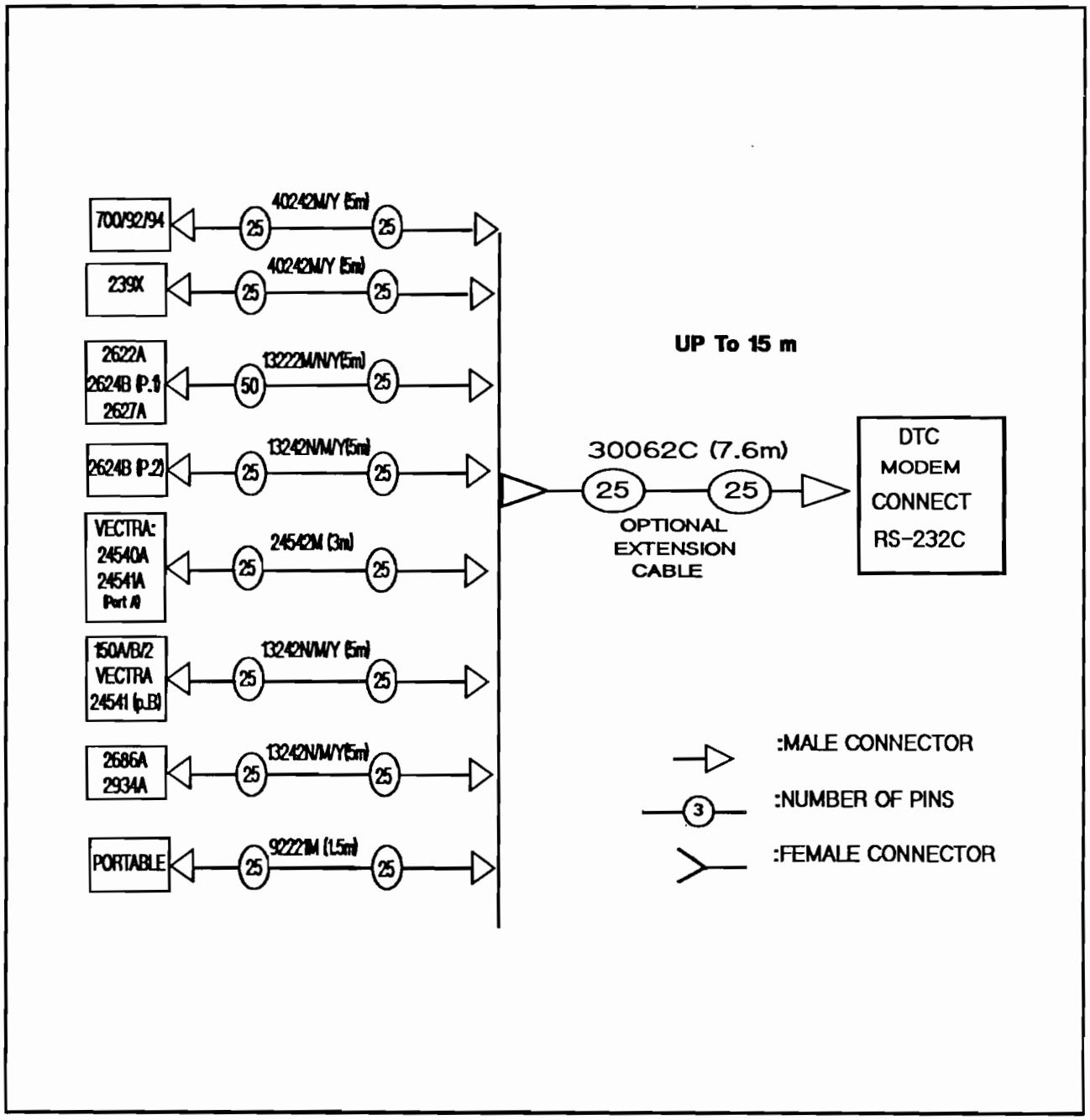


Figure 3-9b Direct Connections to RS-232-C Modem Ports

RS-232-C Modem port to PAD

Supported PADs

HP2334A (Version 3.1 or later), HP2334A Plus and HP2335A.

By connecting the asynchronous ports of the PAD to the asynchronous RS-232-C Modem port of the DTC, the PAD effectively emulates an asynchronous terminal for the Host and provides the X.25 interface for the synchronous network. Further details on PAD connections can be found in the *HP 2335A User's Guide (HP part number 02335-90002)*.

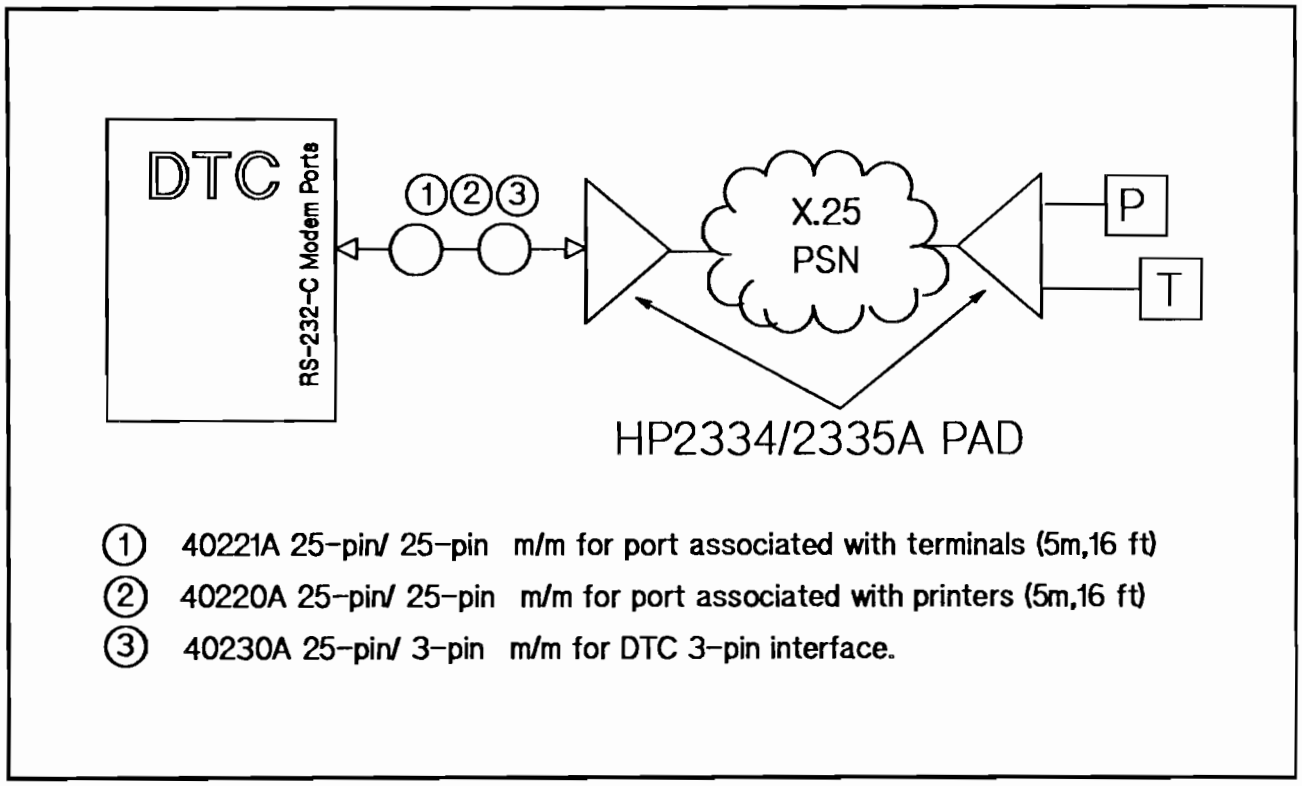


Figure 3-10 RS-232-C Modem Port to PAD

Table 3-2 Cable Identification Numbers

PRODUCT NUMBER	PART NUMBER	CONNEXIONS
13222M	13222-60002	RS-232C Modem to 2622A/2642B (P1)/2627
13222N	13222-60001	RS-232C Modem to 2622A/2642B (P1)/2627
13222P	13222-60009	RS-422C Direct to 2622A/2624B (P1)/2627A
13222X	13222-60005	RS-232C Direct to 2622A/2624B (P1)/2627
13242M	13242-60002	RS-232C Modem to 2624B (P2)
13242N	13242-60001	RS-232C Modem to 150A/B/2 Vectra/2686A/2934A
13242P	13242-90013	RS-422 Direct to 150A/B/2, Vectra, 24541 (p.B)
13242Y	13242-60005	RS-232C Modem to 2686A/2934A/2627A/239X
13242X	13242-60019	RS-232C Direct to 2622A/2627A/2624B(P2)
24542M	24542M	RS-232C Modem to 239X
30152A	30152-60001	RS-232C Direct to Vectra:24510A/24541A (Port A)
30153A	30153-60001	RS-422 Direct, Extension Cable
30062B	30062-60022	RS-232 Modem port to Modem (7.62m)
30062B (opt 001)	30062-60023	RS-232 Modem port to Modem (15,2m)
30062C	30062-60024	Extension Modem cable (7.6m)
30062C (opt 001)	30062-60025	Extension Modem cable (15m)
40242M	13242-60004	RS-232C Modem to 239X
40242P	40242-60007	RS-422 Direct to 239X,700/92/94
40242X	40242-60005	RS-232C Direct to 239X, 700/92/94
40242Y	40242-60010	RS-232C Modem to 239X,700/92/94
92221M	92221M	RS-232C Modem/Direct to Portable
5061-4958	5061-4958	RS-232D (SNP port) to Synch Modem; also use 24466-60001 extension cable to HP PPN 70/80.
30224B	30224B	RS-422 (SNP port) to HP3000/39/70; also use 30224L
30224C	30224C	RS-422 (SNP port) to HP 3000/37
30224L	30224L	RS-422 (SNP port) to HP3000/37;also use 30224C.
24400-60203	24400-60203	RS-422 (SNP port) to remote DTC; also use 30224L.
24466-60003	24466-60004	V.35 (SNP port) to HP PPN 70/80
40221A	40221-60001	RS-232-C Modem port to PAD (HP2335A)-
40220A	40220-60001	RS-232-C Modem port PAD (HP2335A)-

MPE/V System Access

Overview

Asynchronous data communications can be established between terminals connected to the DTC and MPE/V systems. There are three possible configurations that can be implemented:

- BACK -to-BACK ACCESS configuration in which two DTCs are in communication with each other, asynchronously, via the LAN.
- Local Switching within the DTC that enables terminals and PCs to communicate to the MPE/V computer system via the asynchronous ports on the same DTC.
- HP TS8 connection in which printers and terminals connected to the asynchronous ports of the DTC can communicate with a MPE/V system via a HP TS8 connected to the same LAN.

Back to Back Access

This configuration, as shown in figure 3-11, enables two DTCs to communicate with each other, asynchronously, via the LAN. Connections can be initiated from either the MPE/V system side or terminals connected to the DTC in order to access supported printers and plotters as well as terminals and PCs operating in terminal emulation mode.

Hardware requirements

For MPE/V access, the following hardware is required:

On the DTC side

- 2 DTCs (Processor Card, Serial Interface Card and the Connector Card)
- AUI
- MAU

On the System side

- ATP MUX Interface, ATP/M
- Cable 30062B

Note

Refer to the ATP Installation Manual for full details on the ATP installation.

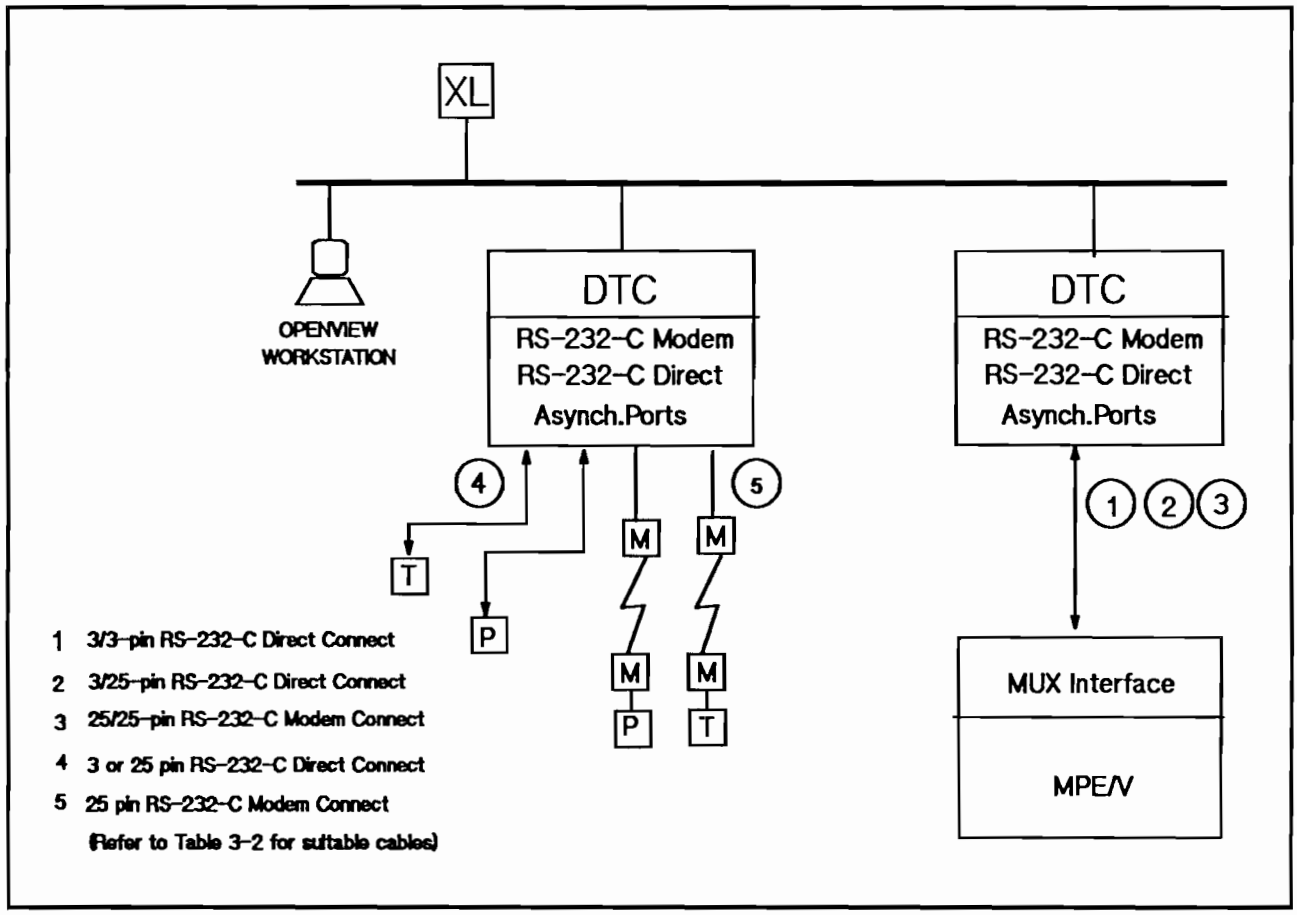


Figure 3-11 DTC to MPE/V Back to Back Connection

Local Switching

An alternative method of accessing the MPE/V computer system is by using the Local Switching facilities of the DTC. In this configuration the MPE/V computer with a MUX Interface is connected direct to the asynchronous ports of the same DTC as the terminals and PCs. Figure 3-12 illustrates the system topography.

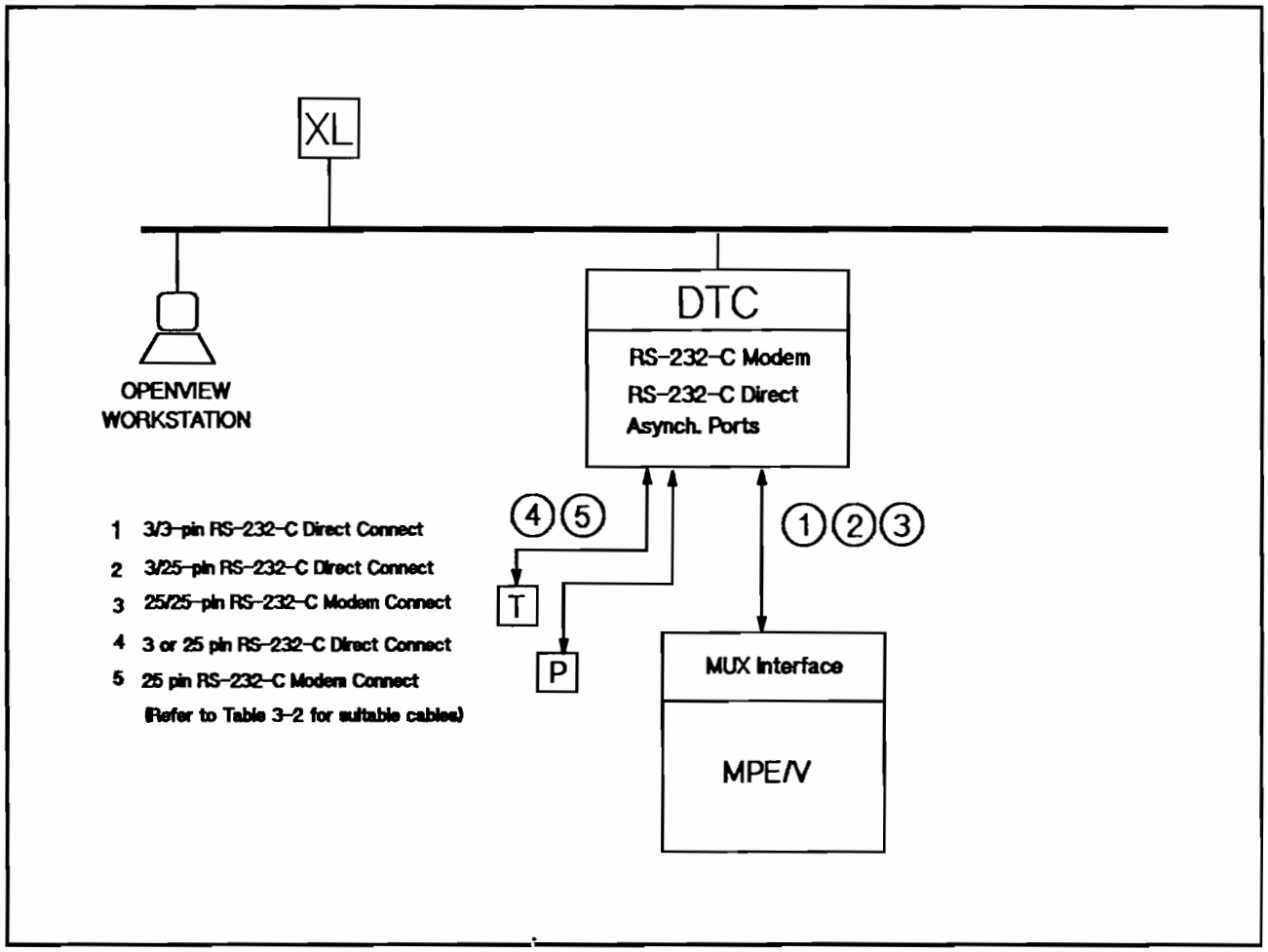


Figure 3-12 DTC to MPE/V using Local Switching

TS8 Connection

To access the MPE/V using a HP TS8 LAN Server:

Hardware Requirements.

On the MPE/V System side

- ATP MUX interface, ATP/M

TS8 - HP2342A LAN Server

- TS8
- AUI cable and MAU

On the DTC side

- DTC with Processor Card, SIC and CC cards

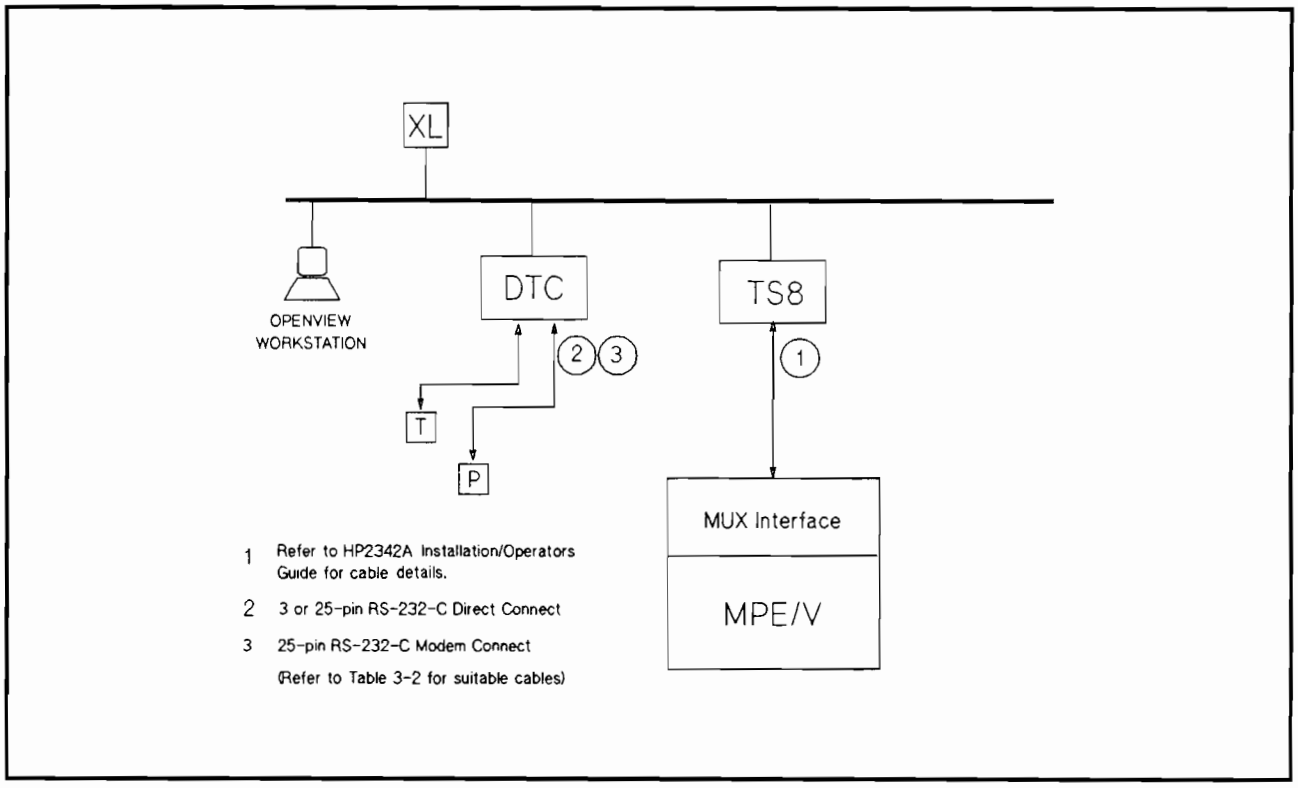


Figure 3-13 DTC to MPE/V via HP TS8 LAN Server

Synchronous Communications Installation

The DTC can be configured to support the physical interface standards RS-232-D, V.35, V.36 and RS-422 in order to provide a synchronous communications access to private or public Packet Switching Networks.This is achieved by upgrading the ROMs (HP part numbers 02345-80154 and 02345-80164 or after) on the Central Processing card and the addition of Synchronous Network Processor Cards.

These two cards are identified as the Serial Network Processor -Control Unit (SNP-CU) and the Serial Network Processor - Line Adaptor (SNP-LA).

There are two different types of the Synchronous Network Processor - Line Adaptor Cards applicable to the DTC. These are identified as follows:

- SNP-LA/RS232-D
- SNP-LA Multi-standard card

The SNP-LA Multi-standard Card (SNP-LA MS)

The SNP-LA Multi-standard card offers three different communication interfaces depending on the type of cable used and internal connections, these are identified as follows:

- SNP-LA/V.35 (HP product 2346E))
- SNP-LA/V.36 (HP product 2346F)
- SNP-LA RS-422 (HP product 2346G)

The Synchronous Network Processor - Line Adaptor card has two ports on the rear panel. Currently only one port (port 0) is supported. The second port is identical but at the moment is not supported. You should contact the nearest Hewlett-Packard, Sales and Support centre for more information when the second port is to be supported.

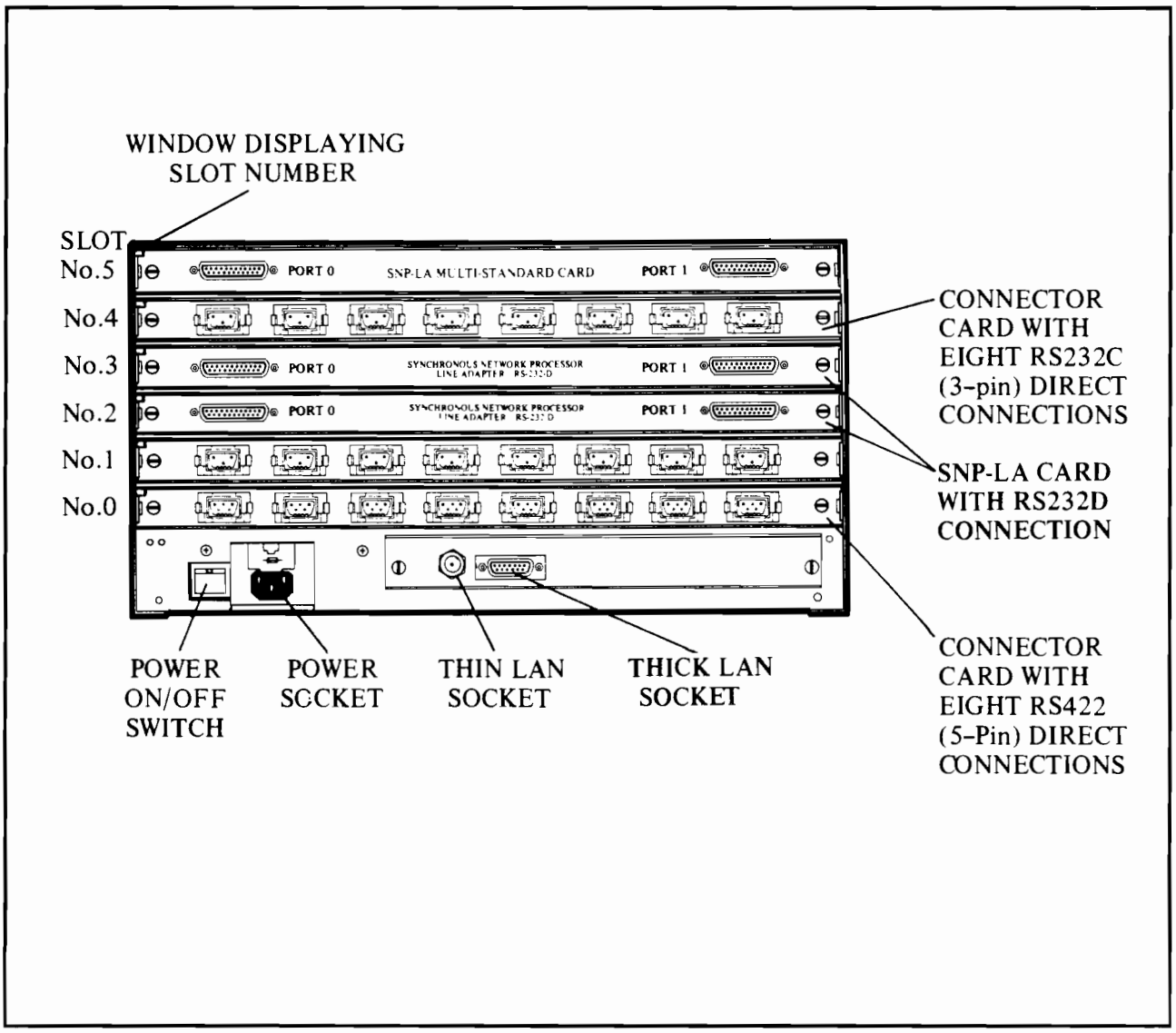


Figure 3-14 Rear view of DTC with SNP Cards Installed

Note

Slot 0 must always contain an asynchronous communications card for the diagnostics facility.

Empty slots must always be covered by a blank panel to prevent RF Interference affecting the operation of the DTC. .

SNP RS232-D Cabling Installation

The RS232-D port on the SNP-LA/RS232-D card provides the interface between the DTC Synchronous Network Processor Card and the following public or private Packet Switching Networks:

- HP-PPN 60/70/80 and Public Switching Networks

  Use cable 5061-4958 with extension cable 24466-60001

- Modem Connection

  Use cable 5061-4958

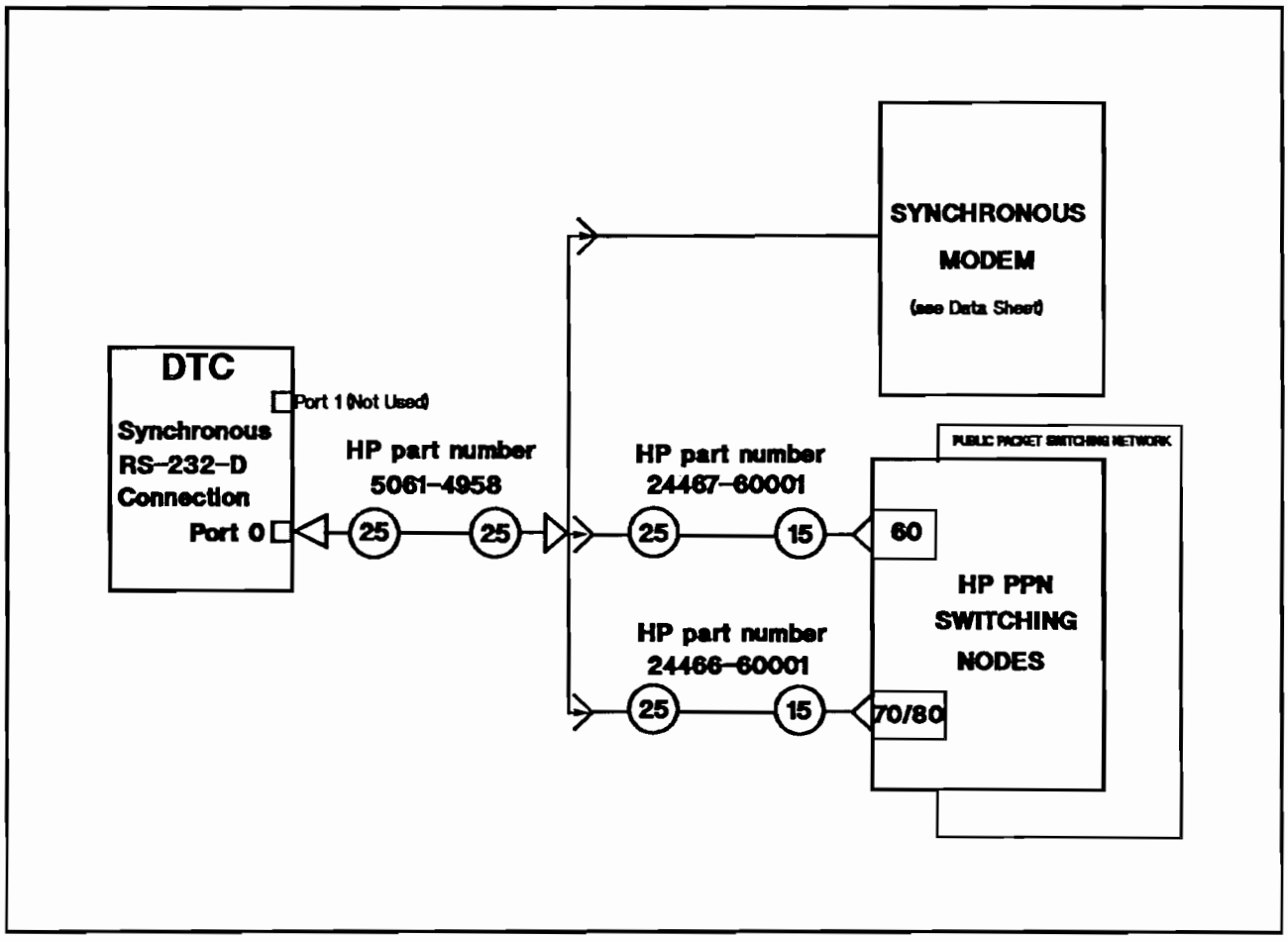


Figure 3-15 SNP-LA RS-232-D Connections

SNP RS-232-D Connector Pin-out

The signals, in and out of the 25-pin RS232-D cable connector are shown in figure 3-16.

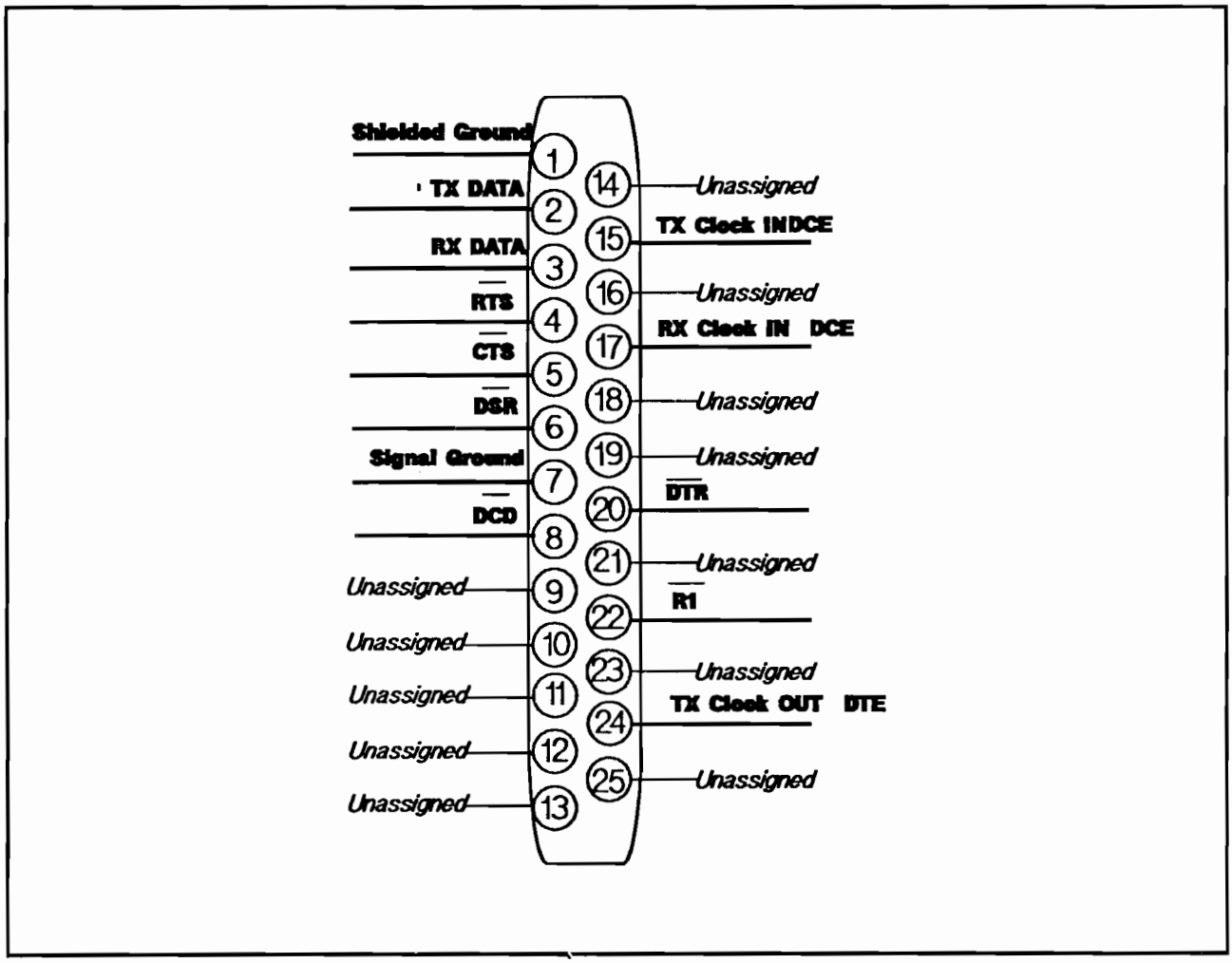


Figure 3-16 RS-232-D Pin Out

The SNP RS422 Cabling Installation

When the SNP-LA/Multi-standard card with RS-422 interface cable is installed,the DTC can communicate with the following systems:

- HP 3000/37 series computers
- HP 3000/39/70 series computers
- via the RS422 port of another SNP DTC

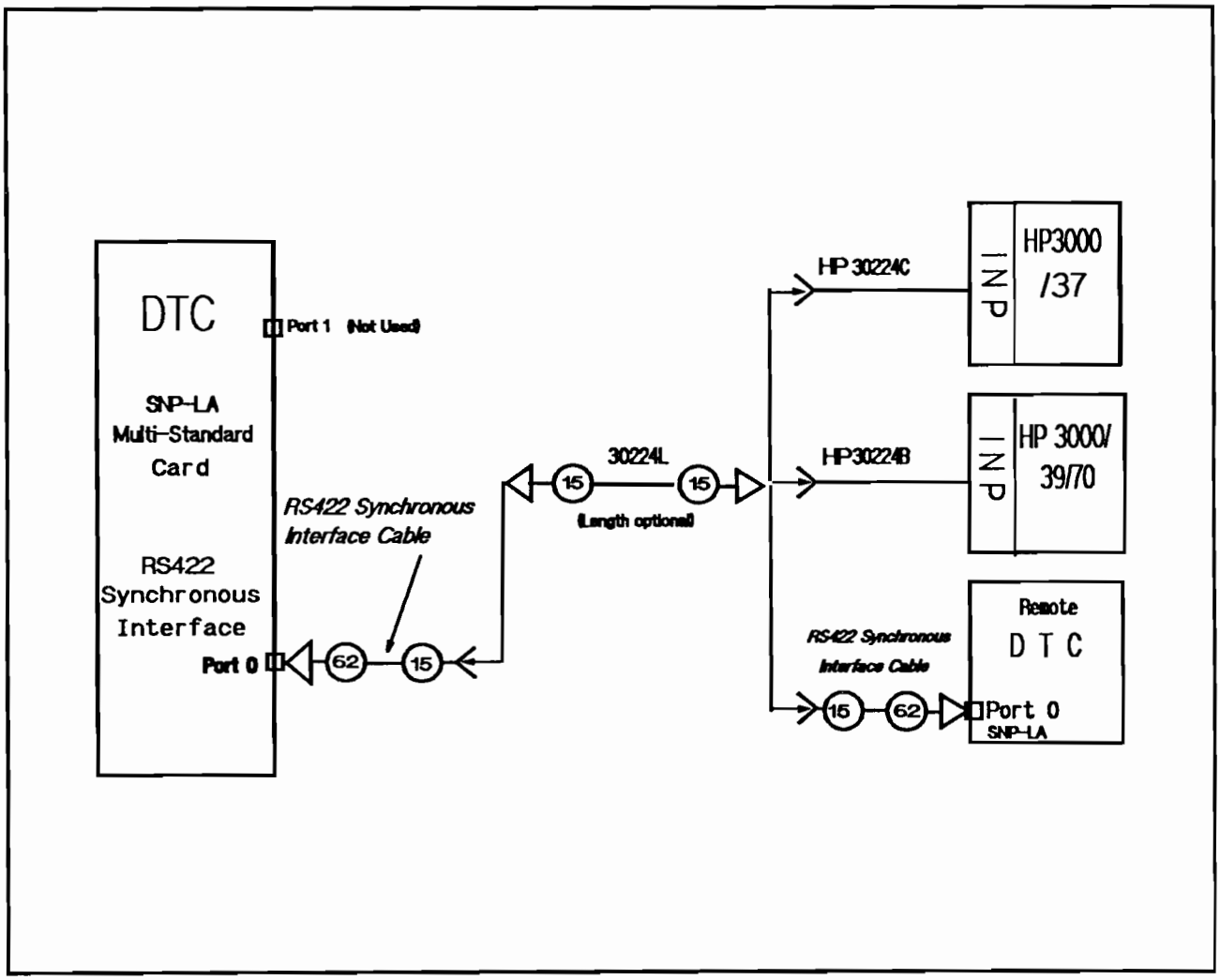


Figure 3-17 SNP RS-422 Connections

Note

The maximum cable length supported by the RS422 interface is 1220m (4000ft), cables in excess of 1220m will cause data degradation and corruption.

SNP RS422 Connector Pin-out

Figure 3-18 shows the signals, in and out of the RS 422 cable :

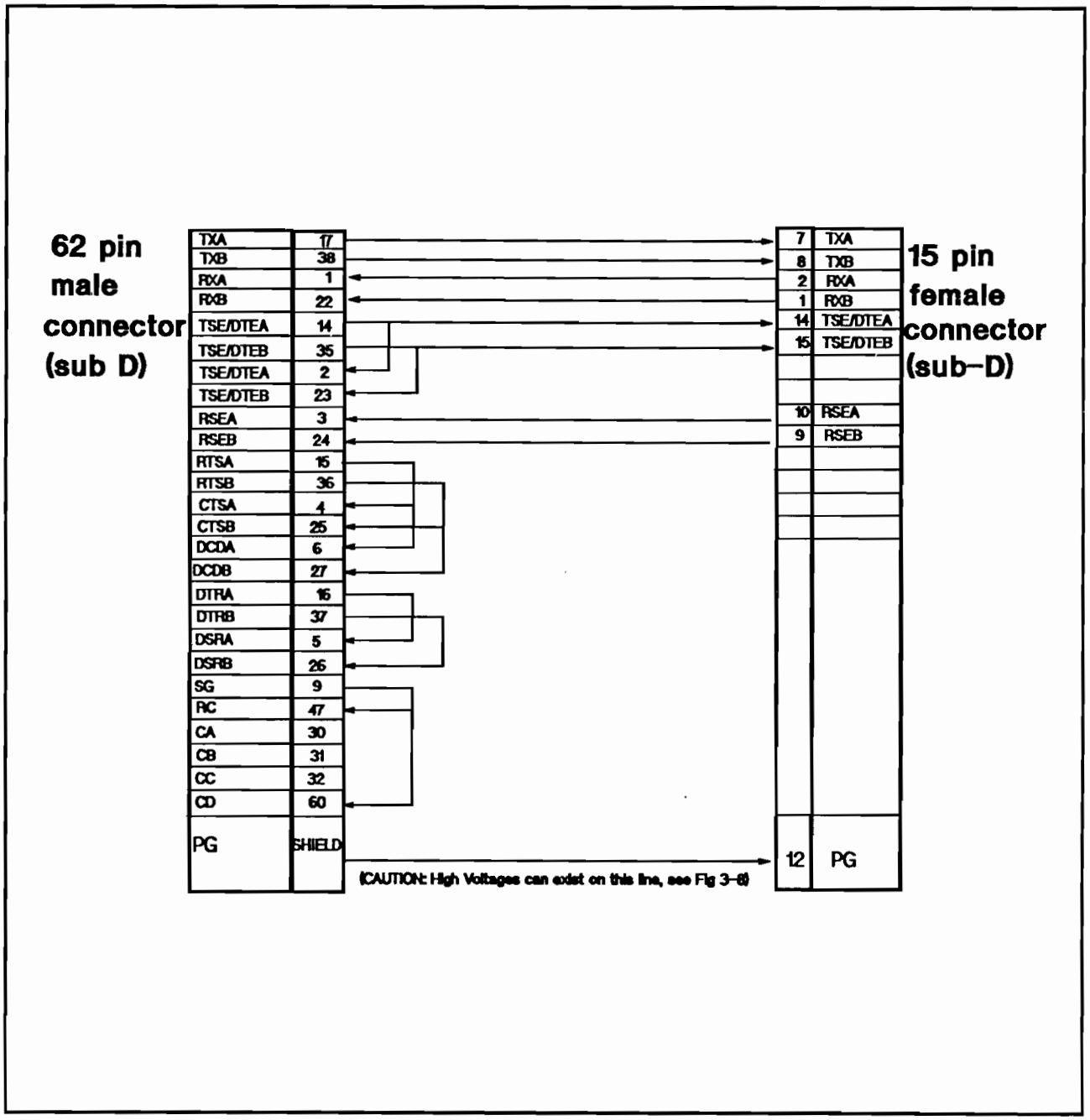


Figure 3-18 SNP RS-422 Pin Out

SNP V.35 Cabling Installation

When the SNP-LA/Multi-standard card with the V.35 interface cable is installed, data communications can be established between the Host computer system and remote computer systems via a supported synchronous modem and X.25 Packet Switching Network, or by direct connection to the switching node of the HP PPN 70/80. The cables and connections to be used are shown in figure 3-19, and can be summarised as follows:

- DTC to Synchronous Modem

  Use cable - HP part number 24400-60201

- DTC to HP PPN/70/80

  Use cable HP part number 24400-60201 with connecting cable HP part number 24466-60003

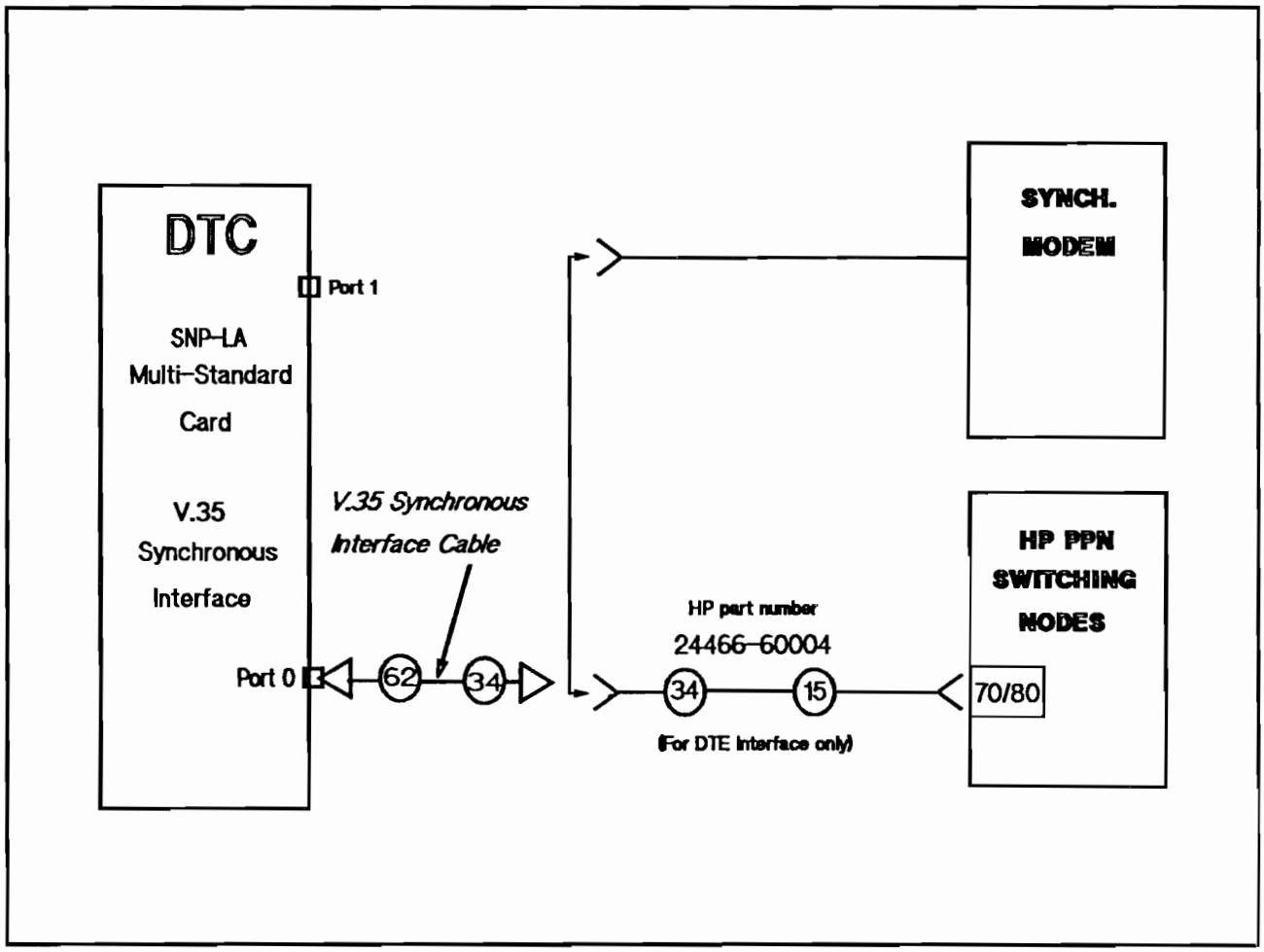


Figure 3-19 SNP V.35 Connections

SNP V.35 Connector Pin-out

Figure 3-20 shows the signals in and out of the V.35 cable: :

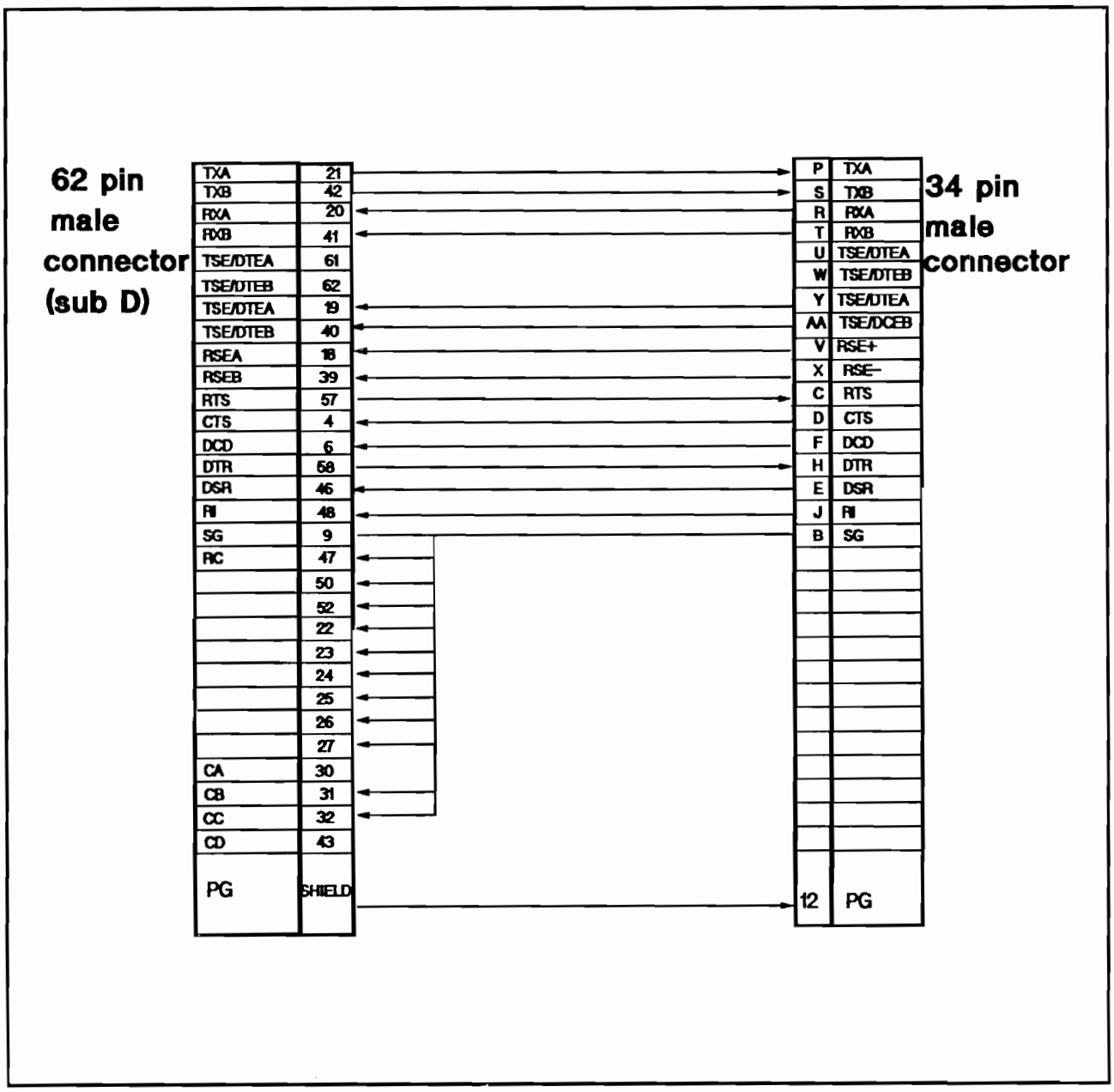


Figure 3-20 SNP V.35 Pin out

SNP V.36 Cabling Installation

When the SNP-LA/Multi-standard card with V.36 interface cable is installed, data communications can be established between the Host computer system and remote computer systems via a supported synchronous modem (see Data Sheet) and X.25 Packet Switching Network. The cables and connections to be used are shown in figure 3-21, and can be summarised as follows:

- DTC to Modem Connection

  Use cable HP part number 24400-60202

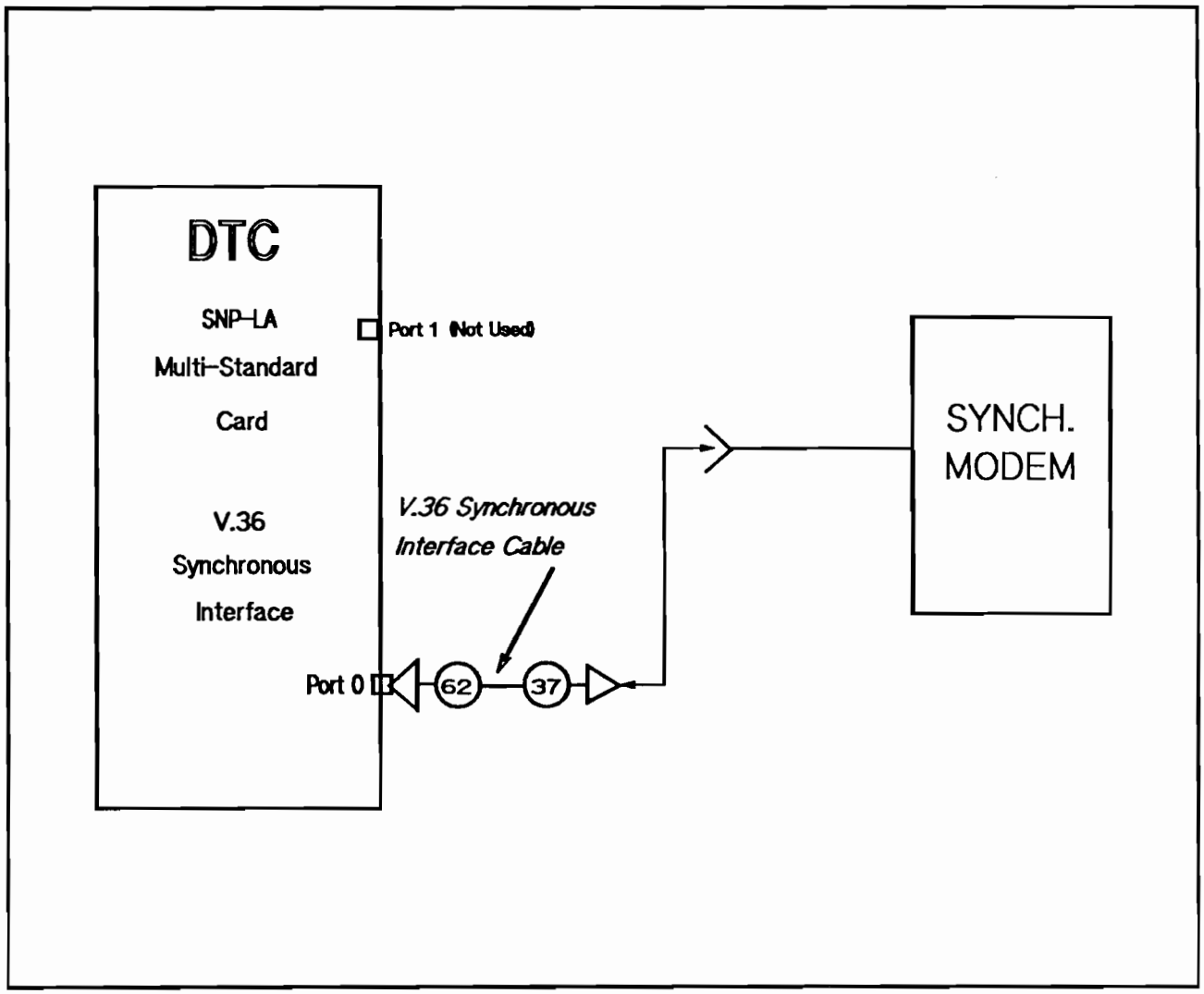


Figure 3-21 SNP V.36 Connections

SNP V.36 Connector Pin-out

Figure 3-22 shows the signals, in and out of the V.36 cable :

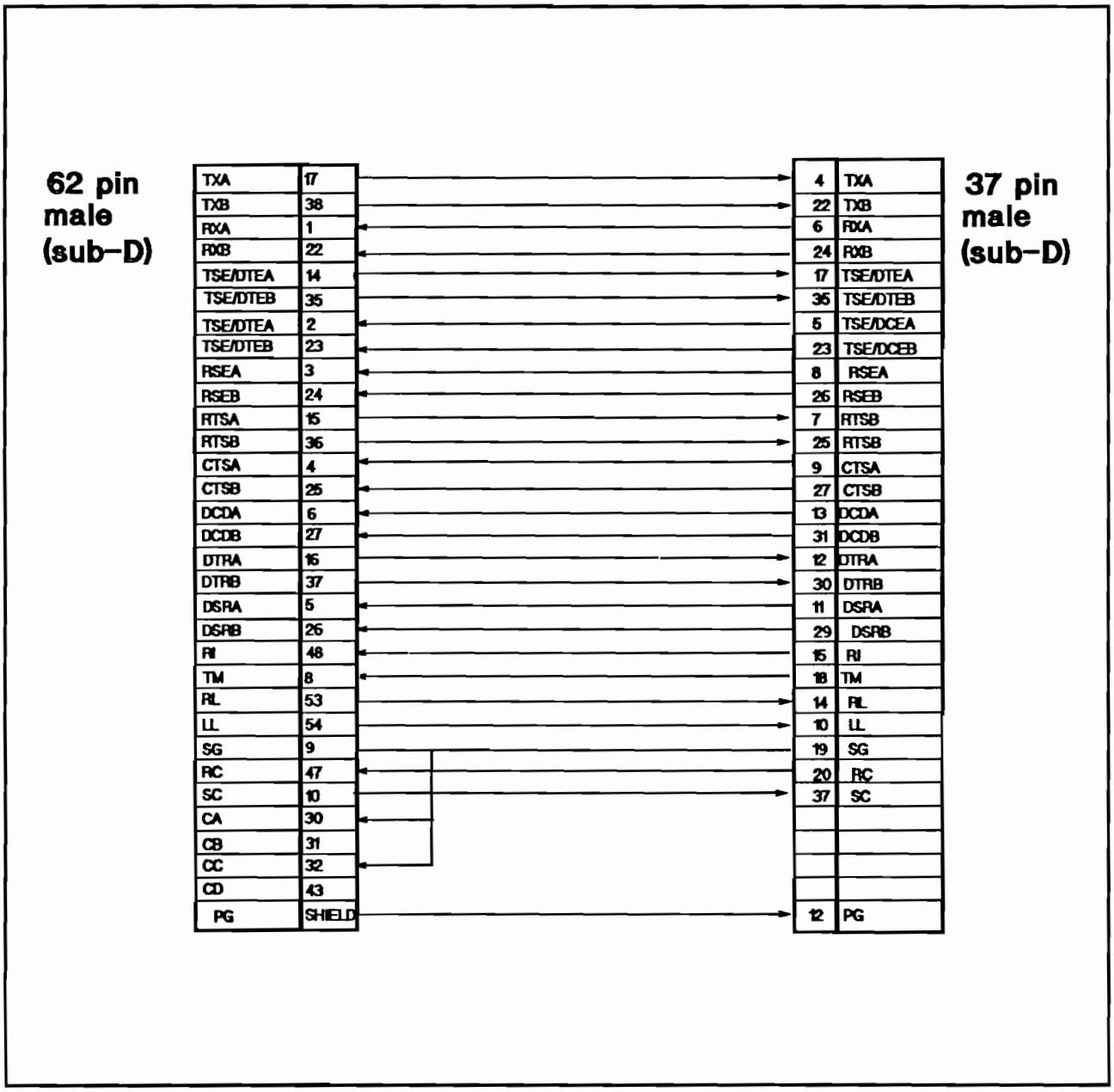


Figure 3-22 SNP V.36 Pin Out

AC Power Connection

The DTC power cable is 2m long, and is supplied with each DTC. It should be connected at one end to the site AC power outlet, and at the other end plugged into the AC socket on the DTC (located at the bottom rear of the box.)

Before the DTC is switched on it is advisable to make a final check to ensure that all cables are correctly installed, neatly coiled and placed in a position which does not create an obstruction or hazard.

For full details on the Power Up and Self test Sequence, refer to Chapter 4.

4

Power-Up and Self Test Sequence

Introduction

This chapter describes the power up and Self tests sequence of the HP2345A DTC.

A full description of the Self test and applicable error codes is provided plus a description of the software and configuration file download.

The Self Test error codes provide a basic fault diagnostic and status facility. These enables the HPCE to determine a fault to board level, however, further indepth diagnostic facilities are available to the HPCE via the Diagnostic screens which are described in detail in *Chapter 6 - Troubleshooting and Diagnostics.*

The DTC HP2345A in asynchronous communications mode can receive its operating and configuration codes from a predefined HP3000 series 900 Host computer or from the OpenView Workstation when the switching for multiple Host acccess is required.

The DTC HP2345A with a synchronous communication capability installed (SNP hardware and PC Management software) receives the operating and configuration codes from the Open View Workstation. This software is downloaded to the DTC by the OpenView Workstation at the completion of a successful DTC Self Test sequence. Full details of the Configuration procedure is given in the Using the *Openview DTC Manager* in the section *Configuring the DTC.*

Power Up Procedure

After connection to the site AC voltage supply, the DTC is switched ON via the power switch on the rear left hand corner of the DTC (see figure 3-2).

Once switched on the DTC automatically follows a specific power up sequence which is shown in flow-chart form in figure 4-1.

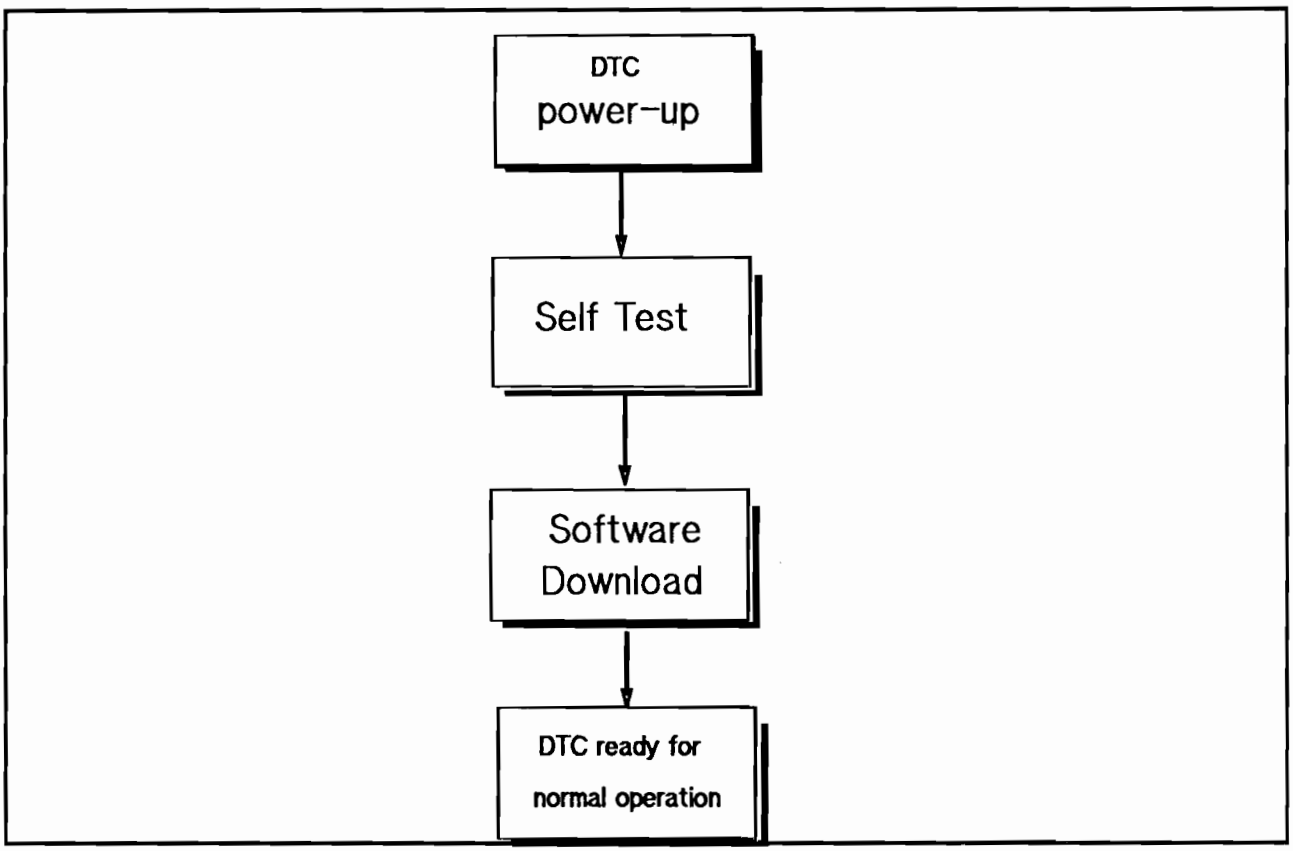


Figure 4-1 The DTC Start Up Sequence

DTC Self Tests

As soon as the DTC is switched on, the Self Test sequence is automatically started.

The Self Test routine is stored within the firmware of the DTC and checks the functional operation of the major DTC hardware components, including the LAN connection. A flow chart, shown in figure 4-2, illustrates the Self Test sequence and the hardware tested.

The status of the test is displayed in a hexadecimal format on a 2 digit Display in the front panel of the DTC. The progress of the tests can also be checked by removing the front cover of the DTC and observing the status of the green LEDs on each SNP-CU card or SIC card.

When the SIC card in slot 0 starts its self tests, the green LED flashes ON and OFF intermittently. The LED remains ON after completion of the tests providing no errors are detected. When a SNP Card or SIC in slot 1 executes the first part of its self tests, the green LED on the card is turned ON intermittently. It is turned ON again during the second part of the self test. It remains ON once the self tests are complete. The sequence is repeated for all slots until the Self-tests are complete. On completion of the Self Tests, all LEDs should be ON.

The execution of the tests can take a few minutes depending upon the number of boards installed. Typical times are:

- 50 seconds for the SIC/CC Card in slot 0.
- 72 seconds for the SIC/CC and one set SNP CU/SNP LA
- 93 seconds- all slots occupied

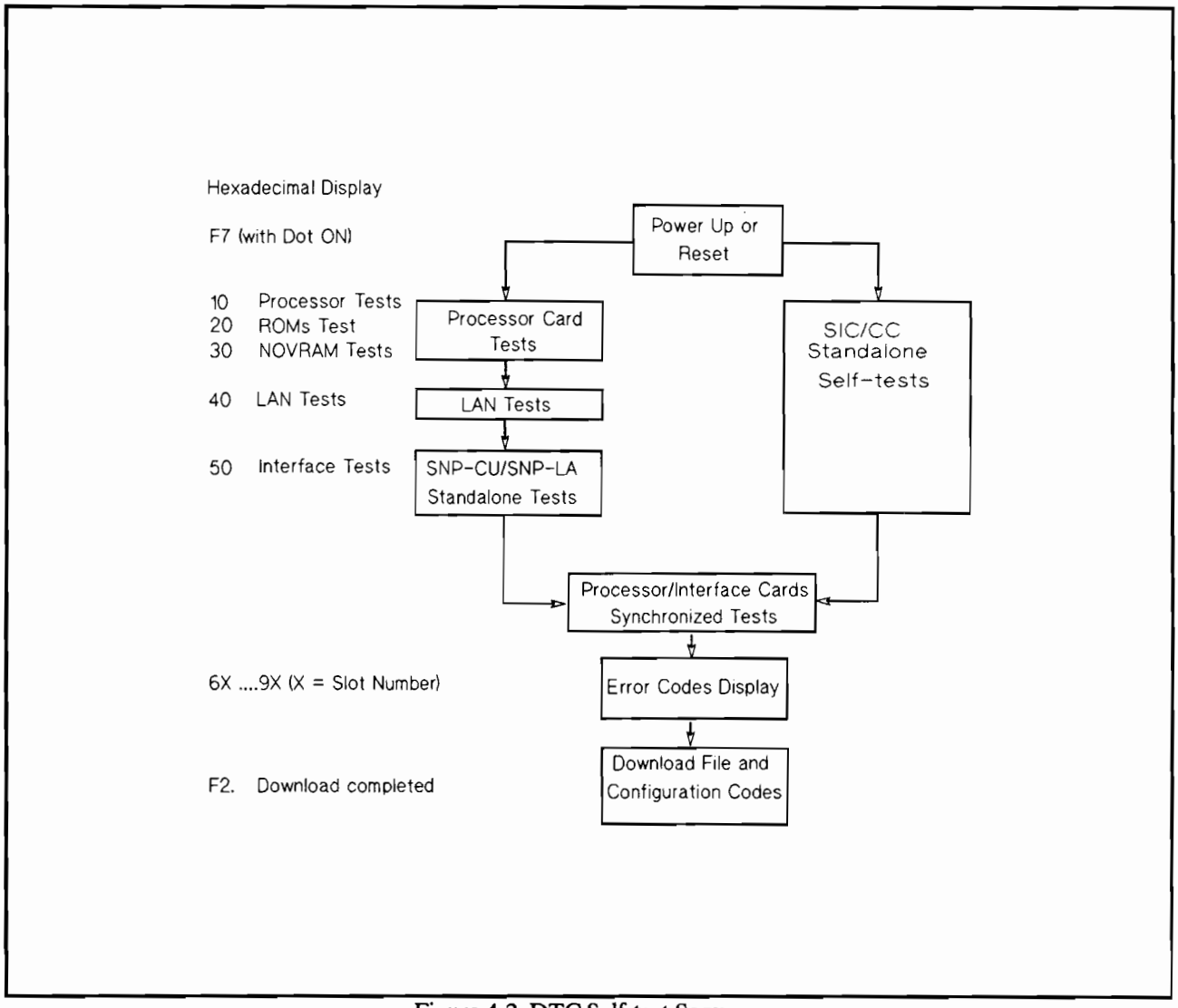


Figure 4-2 DTC Self-test Sequence

Self Test Display

As previously mentioned the status of the self-test is displayed on a two digit, hexadecimal display. During normal operation two digit codes and a dot are displayed. The codes applicable are defined as follows:

- 10 : Processor card, Self-tests are in progress
- 20 : Processor card ROM Self-tests are in progress
- 30 : NOVRAM Self-tests are in progress
- 40 : LAN Connection tests are in progress. (Not normally displayed))
- 50 : SIC or SNP-CU cards, Self-tests in progress
- 6X : No card present or communication failure
- 7X : SIC or SNP-CU card defective
- 8X : SIC or SNP-CU ROM defective
- 90 : Port 0/Slot 0 defective, No Diagnostics
- AX : SIC -Some ports down: SNP-LA No fatal error
- BX : SIC -All ports failed: SNP-LA Fatal error.
- DX : SNP DTC External cable or peripheral failure
- F1 : File error codes OK, Configuration file error
- F2. : Download successfully completed.....

Note

X indicates the respective slot number i.e the slots are numbered 0 to 5 where number 0 corresponds to the bottom slot and number 5 to the top slot

The status of the dot at the bottom right of the display is used to represent the current state of the DTC:

- Dot OFF - Self Test is being executed.
- Dot ON - Signifies that the software download is complete. The DTC is ready for normal operation.
- Dot Blinking - The software download is in progress.

The Self Test sequence and error codes are summarised on a label which is fixed to the internal metal plate, behind the front panel of the DTC. Figure 4-3 shows the label.

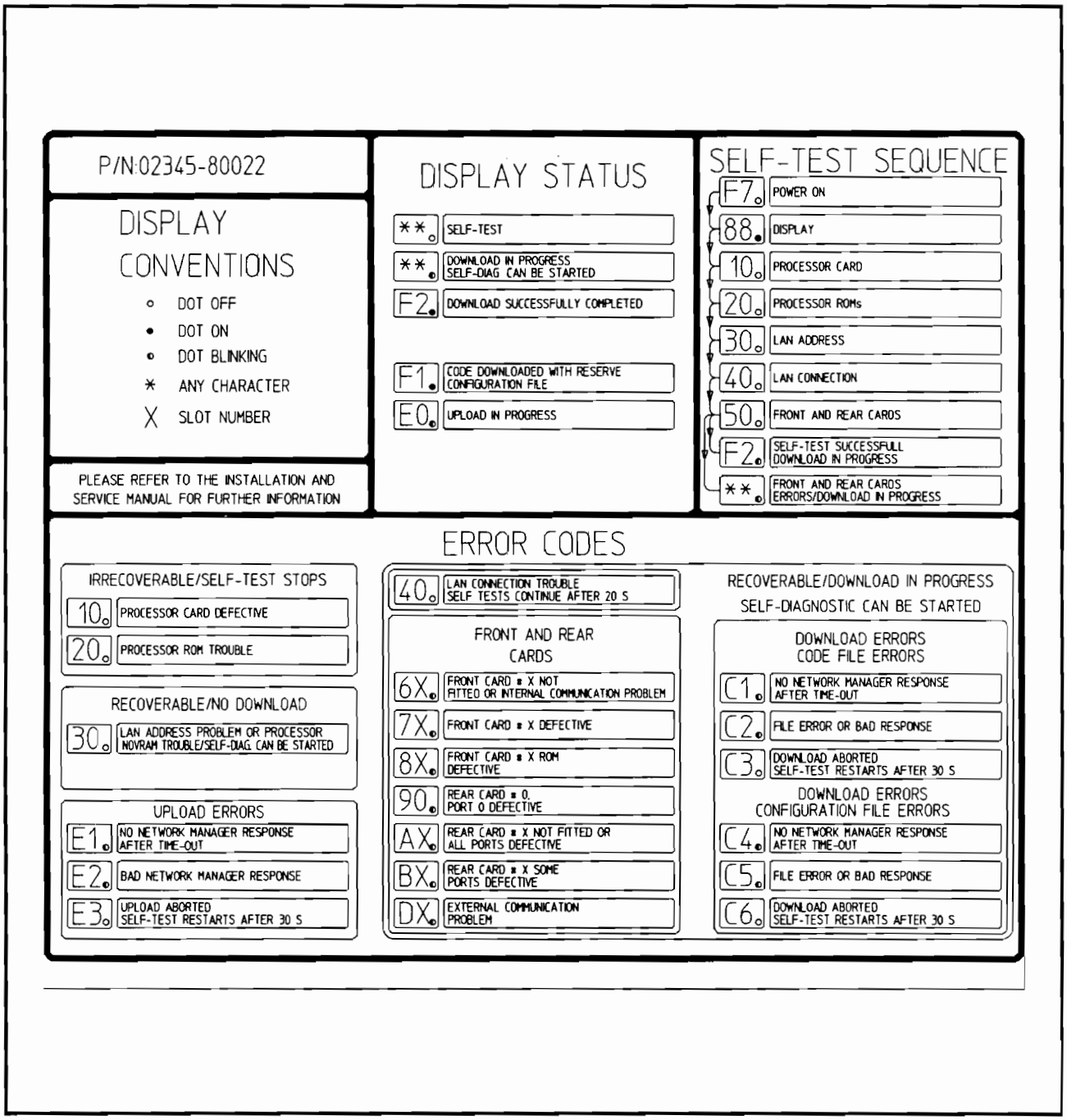


Figure 4-3 Self Tests and Error Code Label

The Self Tests Sequence

The test consists of the following steps, shown in figure 4.2 and is described as follows:

1. The tests starts by displaying a random code,**,(often F7 with the dot OFF), signifying "Power On"

2. The Display card is the first to be tested, code "88" with the dot ON is displayed, to show that all of the dots of the display are working. This test only lasts for a second. The Self-Test never stops on this test, as the test program cannot detect if all the display dots are ON. The installer must visually check that all the Hex characters are illuminated..

3. Next the Central Processor card is tested, and the code "10" with the dot OFF is displayed. Here, the processor chip, RAM, LANCE chip, internal LANCE loopback, and timer are tested. If there are problems then the Self Test stops on the code "10" with the dot OFF.

4. Next the Processor EPROMS are checksum tested. If there are problems then the Self Test stops on the code "20" with the dot OFF.

5. Next the LAN Address test is performed, which checks the NOVRAM content. This test only verifies the NOVRAM checksum, it does not verify the validity of the addresses according to 802.3 or HP rules. The code "30" with the dot OFF is displayed during the test, and the Self-test stops here if there is a problem.

6. Next the LAN connection test (external loopback) is performed, which exercises the loopback capabilities from the LANCE chip (on the Processor card) the LAN cable. In this way, the full DTC LAN connection (i.e the LANCE chip, the SIA chip, Thin LAN. In the case of Thick LAN connection, AUI, MAU, and LAN cable are tested. The code "40" with the dot OFF is not normally displayed during the test. If a problem with the LAN exists error code 40 will be displayed for a few seconds before continuing with the Self Test.

7. Next the SIC and CC cards are tested, which include the processor chip, RAM, SIO,PIO,CTC, EPROM Checksum and internal loopback tests. The code "50" with the dot OFF is displayed during the test. If there are problems the Self test continues with the software Downlaod..

During the SIC and CC tests, all the input/output ports are individually tested by internal loopback. The internal loopback is performed on the CC card just before the line driver/receiver chips, and therefore, these chips are not tested during the Self test. It is necessary to run the Self Diagnostic program (*see Chapter 6*) to test the line drivers/receivers. Once the SIC/CC tests are finished, the results (i.e error codes) are displayed cyclically for 15 seconds.

When the SNP-CU /SNP-LA Cards are installed the test remains basically similiar, however, the following components are tested on the boards: RAM, Serial Communications Controller (SCC) DMA Controller, PIA, Internal Loopback and the gate array ICs.

8. On completion of the Self Tests the code "F2" (with dot OFF) is displayed for 15 seconds. The dot then blinks to signify that the Download process has started, *see section "Download Routine"*

If during the Self tests an error is detected the error code is shown on the Display.

Fatal error codes are:

- 10 : Central Processing board has failed
- 20 : EPROM on Central Processing board has failed.

Under these circumstances the Diagnostics facility is unavailable. The HPCE should refer to *Chapter 6 -Troubleshooting and Diagnostics.*

Non fatal errors are:

- 30 : LAN Address has failed.
- 40 : LAN connection has failed

These errors are recoverable by accessing the Diagnostics Program, see *Chapter 6* section *The Diagnostics Program*.

Download Procedure

If no failure has been detected during the self tests routine, the download sequence begins. The DTC sends a " Boot Request" packet to the HP LAN Boot Multicast Address. This is recognised and acknowledged by the Host (Host Based Mode) or OpenView Workstation (PC Based Mode) which sends a Boot Reply packet telling the DTC that it is ready to download its LAN address. The DTC receives the Boot Reply and begins to read the Code File and configuration codes EXCEPT the synchronous communications protocol. These are held by the Openview Workstation and are downloaded when a X.25 Start command is issued at the OpenView Workstation.

As mentioned previously, the DTC Configuration for asynchronous communications protocols must have been completed prior to switching on the DTC. Full details of the Configuration procedure is given in the *Using the OpenView DTC Manager*

The X.25 protocol configurations are downloaded when the X.25 protocol start i.e at X.25 Level 1,2 and 3 Start and PAD Support Start commands are issued at the OpenView Workstation

During the Download process, F2 will be displayed on the hexadecimal display, the dot will be blinking to signify that the download process is taking place.

Note

During the Download process the SIC and CC error codes are displayed if errors are detected otherwise F2 is displayed.

If the Download has been successful the code "F2" with the dot ON will be displayed. It indicates that no problems have occurred, and that communication with the Host (Host Based Management)) or the OpenView Workstation (PC Based Management) has been established.

Download File Error Codes

File error codes which can be displayed during the Download process are listed as follows:

- C1 : Timeout: No response from the Host or Openview Workstation to a DTC download request.
- C2 : Operating code file error or bad response to the DTC request.
- C3 : Download aborted, serious hardware/software error, Self-test repeated in 30 seconds.

Download Configuration Files Errors

Configuration file error codes which can be displayed during the Download process are listed as follows:

- C4 : Timeout: The Host or Openview Workstation has not responded to a DTC Configuration Download.
- C5 : Configuration file error or a bad response to a DTC request.
- C6 : Download aborted, serious hardware/software error, Self-test repeated in 30 seconds.

Upload Errors

An "Upload" of RAM memory will be performed *in the event* of a serious internal error, or an OpenView Workstation/Host based Manager request .The "Upload" process consists of dumping the contents of the DTC RAM memory including shared RAM into a OpenView Workstation or Host file and takes place via the LAN. The program code actually resides in ROM where it is always available. The "Upload" code stops all processes running on the DTC by controlling the CPU and LAN. The code resets the LAN controller and drives the LAN without using the 802.3 LAN driver. Once the "Upload" is completed it is not possible to return the LAN Controller to the DTC 802.3 Driver, therefore, it is necessary for the DTC to reboot after completing the dump. The reboot is performed automatically.

The indication "upload in progress" is shown on the Display by the code "E0" with the dot blinking. The errors which can occur during the Upload process can be represented as follows:

- E1 : Timeout: The Host or OpenView Workstation has not responded to the DTC Upload request.
- E2 : Bad response from the Host or OpenView Workstation to the DTC request.
- E3 : Upload has been aborted, Self-test repeats after 30 seconds.

All the errors associated with the Download and Upload processes are explained in greater detail in Chapter 6 - Trouble Shooting and Diagnostics.

With the download successfully completed the DTC is ready for operation.

Technical Description

This chapter describes the hardware architecture of the DTC. It is limited in its scope to card description, major card components and their functions. It does not attempt to provide a fully detailed circuit description to component level since troubleshooting other than card and ROM changes is beyond that which the HPCE can perform on site.

The DTC Hardware architecture comprises of the following major functional blocks:

- The DTC Processor card
- The Backplane
- The DIO Bus
- The Asynchronous Interface cards (SIC/CC)
- The Synchronous Interface cards (SNP-CU/SNP-LA)

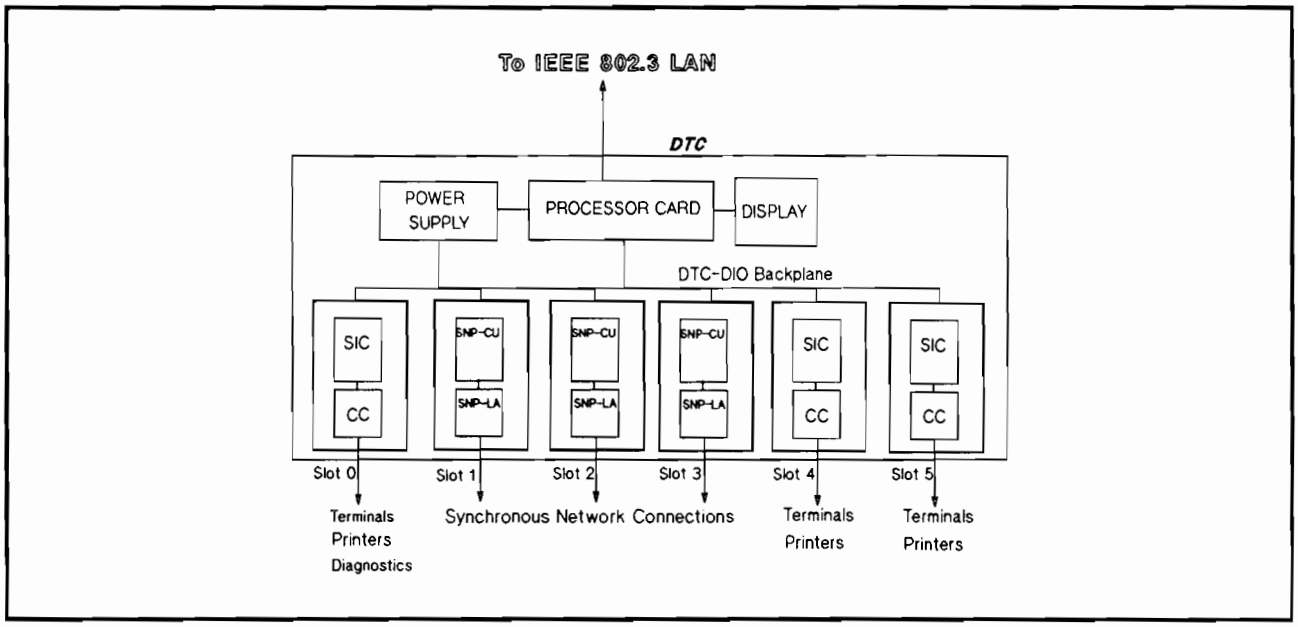


Figure 5-1 Example of DTC Card Layout

Note

Only three SNP-CU/SNP-LA cards are shown as this is the maximum that the software will support. Later versions of the DTC will support five SNP-CU/SNP-LA. The other cards are SIC and CC which can be either RS-232-C (Direct connect),RS-232-C (modem connect) and RS-422 (direct connect)

The DTC Processor Card (CPU)

The Processor card manages the overall operations of the DTC, interfaces with the LAN, and disassembles the LAN data for further processing by the SIC/CC cards or SNP-CU/SNP-LA cards.

The Processor card comprises of the following major components:

- 68000 Microprocessor
- RAM (512K bytes)
- EPROM (64K byte)
- Network Interface
- Timers
- DIO Driver Circuitry

The simplified functional schematic of the Processor card is shown in figure 5-2.

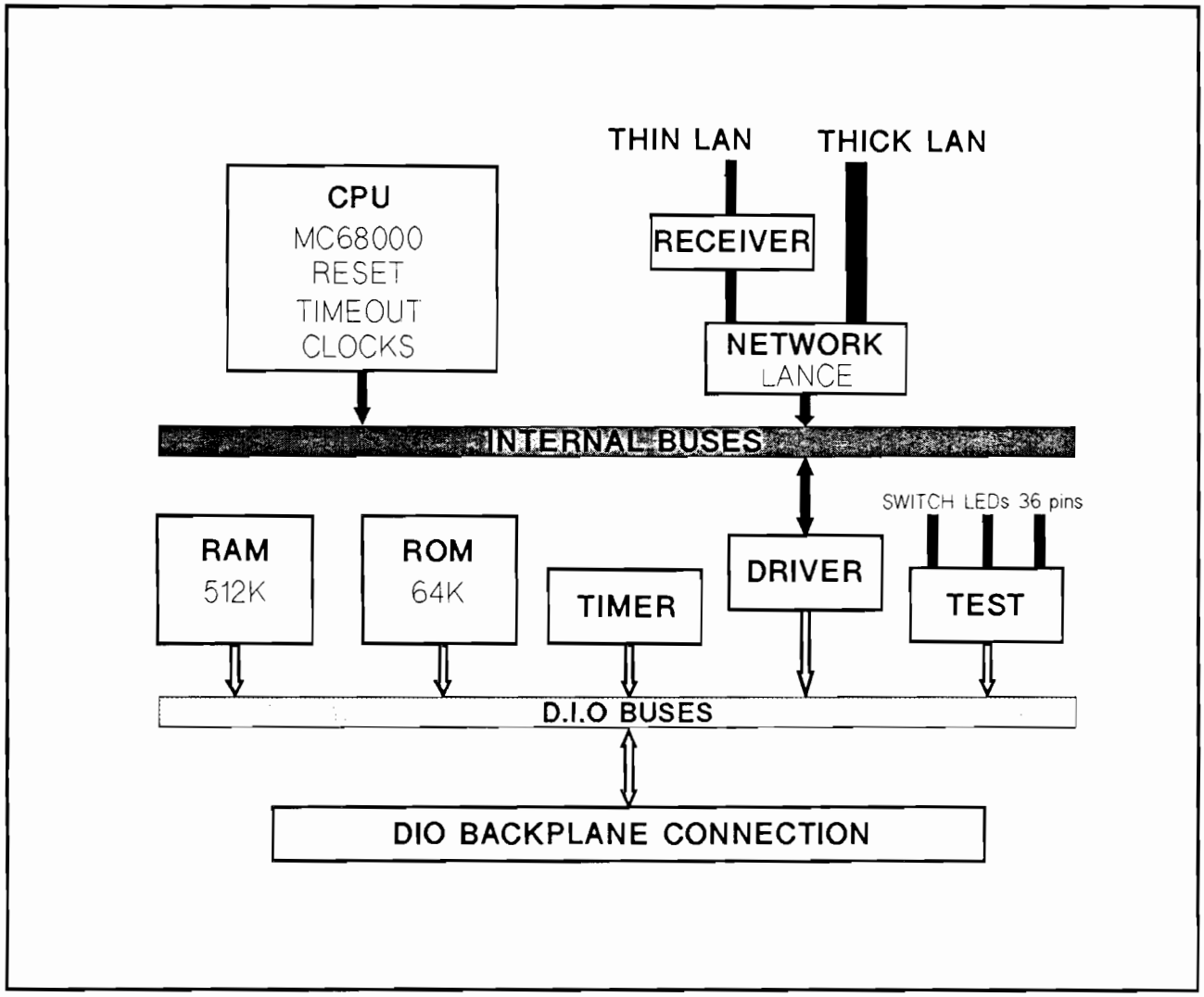


Figure 5-2 Block Diagram of Processor Card

68000 Microprocessor

The Processor Card uses a 68000 Microprocessor operating at 8MHz,it addresses memory and I/O functions on a 16 bit DIO bus. It has 7 levels of interrupt, and provides "time-outs" and clock signals.

RAM and EPROM

During the initial software download from the Host or OpenView Workstation , the DTC software is downloaded into RAM on the Processor board,(see Chapter 4- Download Procedure).

The control code for the download process and for the Upload is contained in EPROM which also contains the DTC -Self Test and Diagnostic routines.

The NOVRAM on the Processor card stores and saves the DTC LAN Multi-cast and Nodal Addresses. These addresses are the only data stored in the DTC in the event of a complete power failure. After a power failure a new software download to the DTC is needed. The NOVRAM is an EAPROM (Electrically Alterable PROM) and RAM integrated onto the same chip.

Network Interface

The Network Interface is the Processor card's primary communication path to other machines. It can be configured to the Thick LAN or Thin LAN standards (only one is active at any one time). It allows many different applications to be connected to a high-speed data link. It consists of a LANCE Network Controller chip, an SIA (Serial Interface chip) and has a built in Thin LAN transceiver.

Timers

Two simple Timers are used on the Processor card to assist in time-keeping, they provide a reference for the software timers and clocks. Two ticks are provided, a 10 millisecond fast tick for Timers, and a 1 second slow tick for a real time clock. Each tick generates an interrupt for the 68000 microprocessor.

The DIO driver Circuitry

The Processor Card communicates with the Asynchronous and Synchronous Interface cards via the Backplane, using the DIO bus. It also sends signals down this bus to the Display card, which is used to show the status of the DTC during normal operation, the Self-test, the software Download and the Upload.

The Serial Interface Card

The Serial Interface card provides the interface for the RS-232-C or RS-422 asynchronous devices to the Backplane of the DTC. The devices can operate simultaneously at speeds up to 19.2 Kbps without loss of characters. The card,as shown in figure 5.3, comprises of the following major functional components:

- Z80B Microprocessor.
- 16K byte (or 8K byte) boot EPROM
- 32K byte RAM
- 8K byte fast RAM
- 3, Z80B-CTC Counter/Timers for internal timing and baud rate generation.
- 4, dual channel Z80B-SIO USARTs.

- LZ-80B-PIO parallel I/O Controller for modem signal handling.
- Arbitration circuitry between Z80 and 68000
- Miscellaneous interface circuitry.

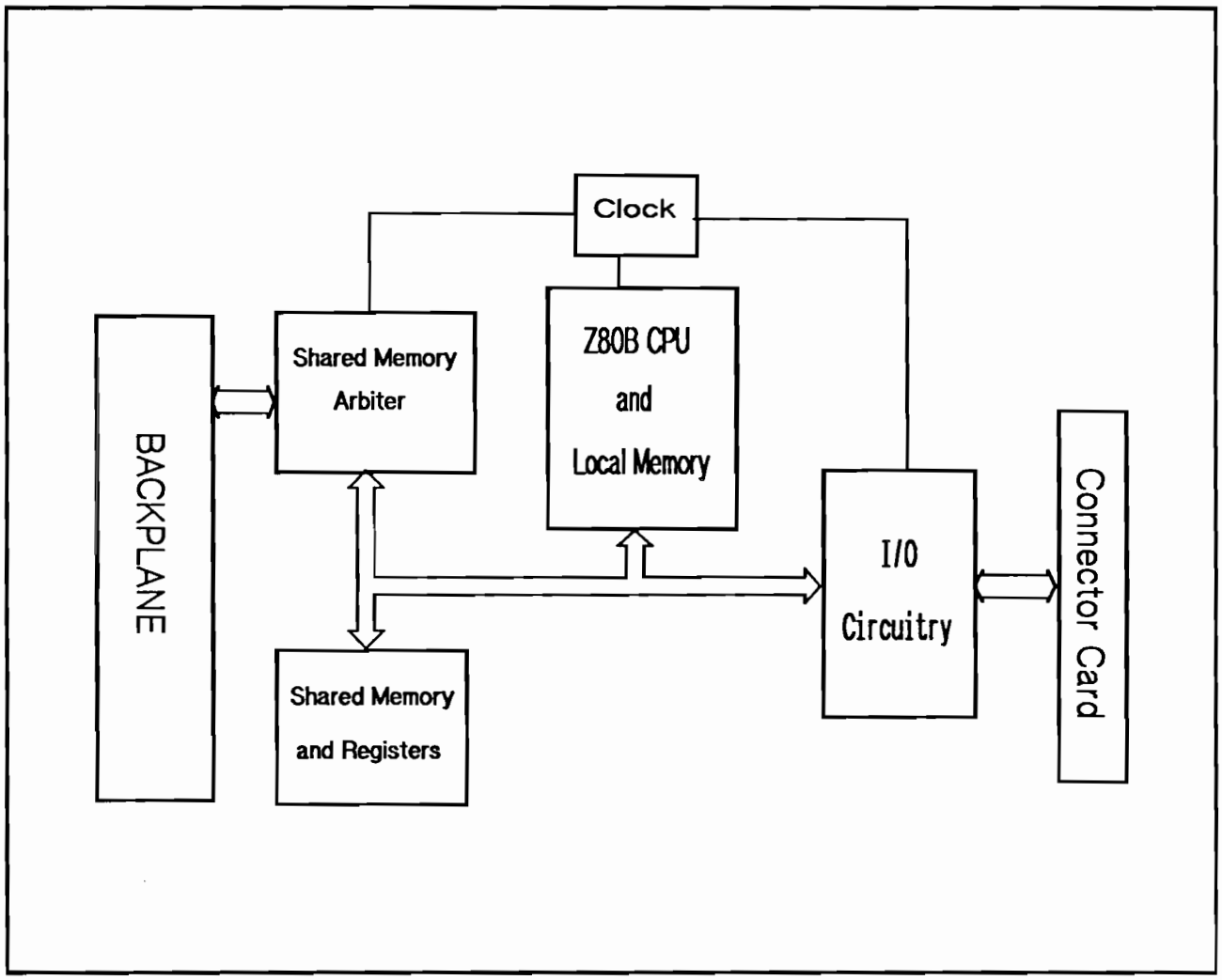


Figure 5-3 Block Diagram of SIC

Z80B Microprocessor

The Z80B microprocessor serves to process the asynchronous data stream between the CC and the Processor Card. It operates at a clock speed of 5.5Mhz determined by the clock generator circuitry.

EPROM

The 16K EPROM contains the boot code, the Self-Test and Diagnostic routines.

RAM

The DTC software from the Host or OpenView Workstation is downloaded into RAM on the Processor card, the code applicable to the SIC is transferred from this RAM area. The SIC RAM consists of 32K RAM (shared RAM accessible by the 68000CPU and the Z80B) and 8K fast RAM accessible only by the Z80.

Although the 68000 CPU and Z80B both have access to the 32K RAM, they are prevented from accessing the RAM at the same time by the use of the Memory Arbiter.

Z80B Counter/Timers

The clock generation circuitry can generate three different clock frequencies:

- 11MHz - used for shared memory Arbiter synchronisation
- 5.5MHz - the Z80B system clock and Arbiter sequencing.
- 2.75MHz - the datacomm basic clock, from which the receive and transmit codes are derived.

Z80B-SIO USART

There are four dual-channel Z80B-SIO USARTs, sending data to and receiving it from the Connector Cards.

PIO

This parallel interface is used to control the modem signals and the internal-loopback circuitry.

The Serial Connector Card

All asynchronous communications are via the Serial Connector cards of which there are three types. These provide the following communication interfaces:

- RS-232-C Direct Connect (8 connectors)
- RS-232-C Modem Connect (6 connectors)
- RS-422 Direct Connect (8 connectors)

Transmission rates between the CCs and supported terminals or printers can be set at either 300, 1200, 2400, 4800, 9600 and 19,200 bps.

Each type of card has an identification code which is set by a resistor pack on the card. This enables the SIC to determine which type of Connector card is connected, see Table 5.1.

Table 5-1 Connection Identification Code

BIT PATTERN	CONNECTION TYPE
0 0 0	RS -232- C Direct Connect
0 0 1	RS-232- C Modem connect
0 1 0	RS 422 Direct Connect

RS-232- C Direct Connect

The card is responsible for converting the RS-232-C voltage levels to TTL levels which are required by the SIO's on the SIC card.

The card comprises of the following major components:

- 8 loopback latches to allow individual testing of all I/O ports.
- 2 PAL (Nand gate arrays) for data line loopback.
- Line Drivers and Line driver protection circuitry made up of fuses, diodes, transzorbs resistors, capacitors and ferrites (RFI).

A block schematic of the RS232-C Direct Connect card is shown in figure 5-4.

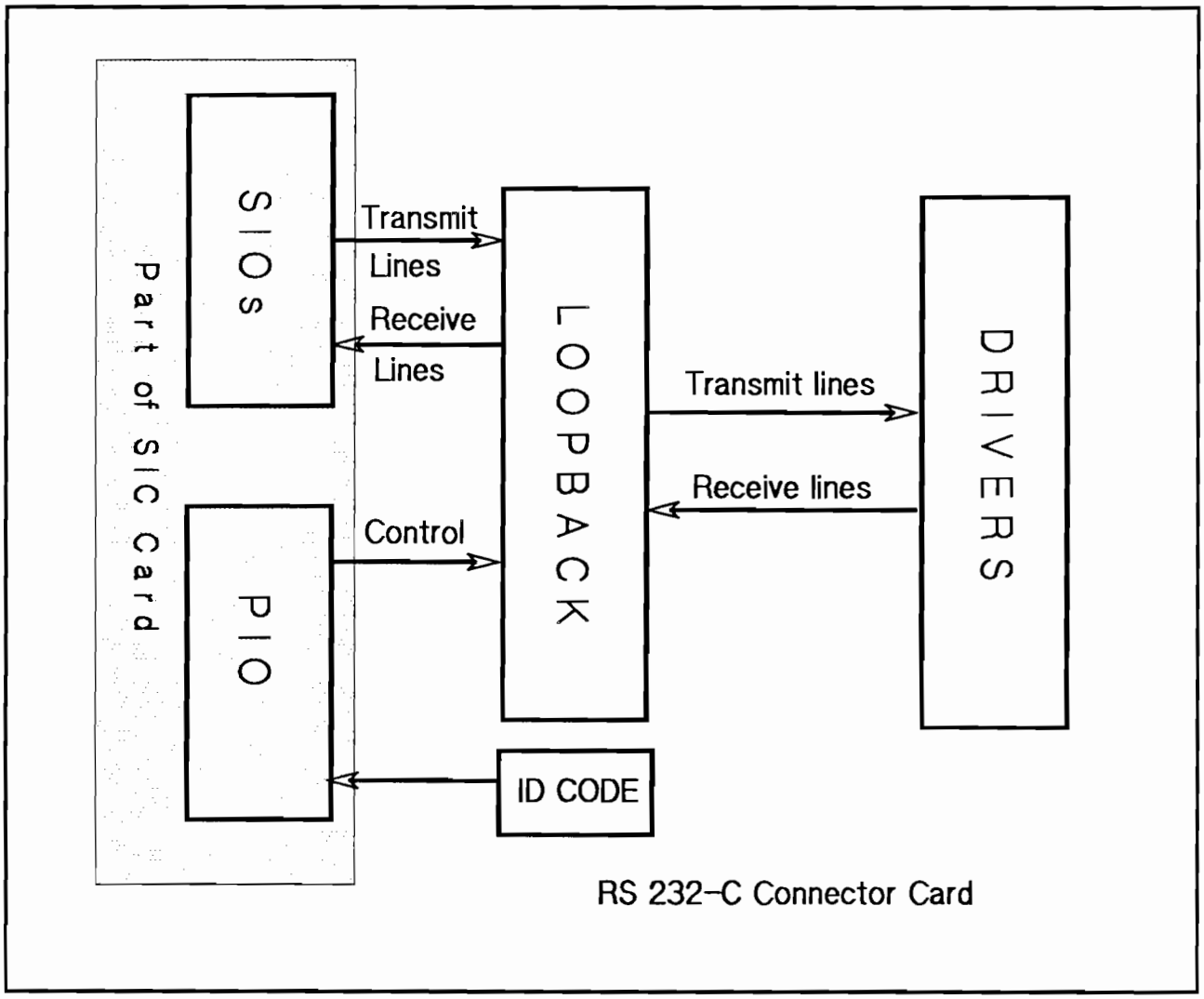


Figure 5-4 DTC RS-232-C Direct Connect Card

RS-232-C Modem Connect

The card provides connection for 6 terminals or printers to the SIC. The card comprises of the following major functional components:

- 6 loopback latches to allow individual testing of each I/O port.
- Loopback circuitry, made with PALs for data lines, and multiplexers for modem control lines.
- Modem signal, multiplexing and de-multiplexing.
- Line drivers and line driver protection circuitry.

A block schematic of the RS232-C Modem Connect card is shown in figure 5-5.

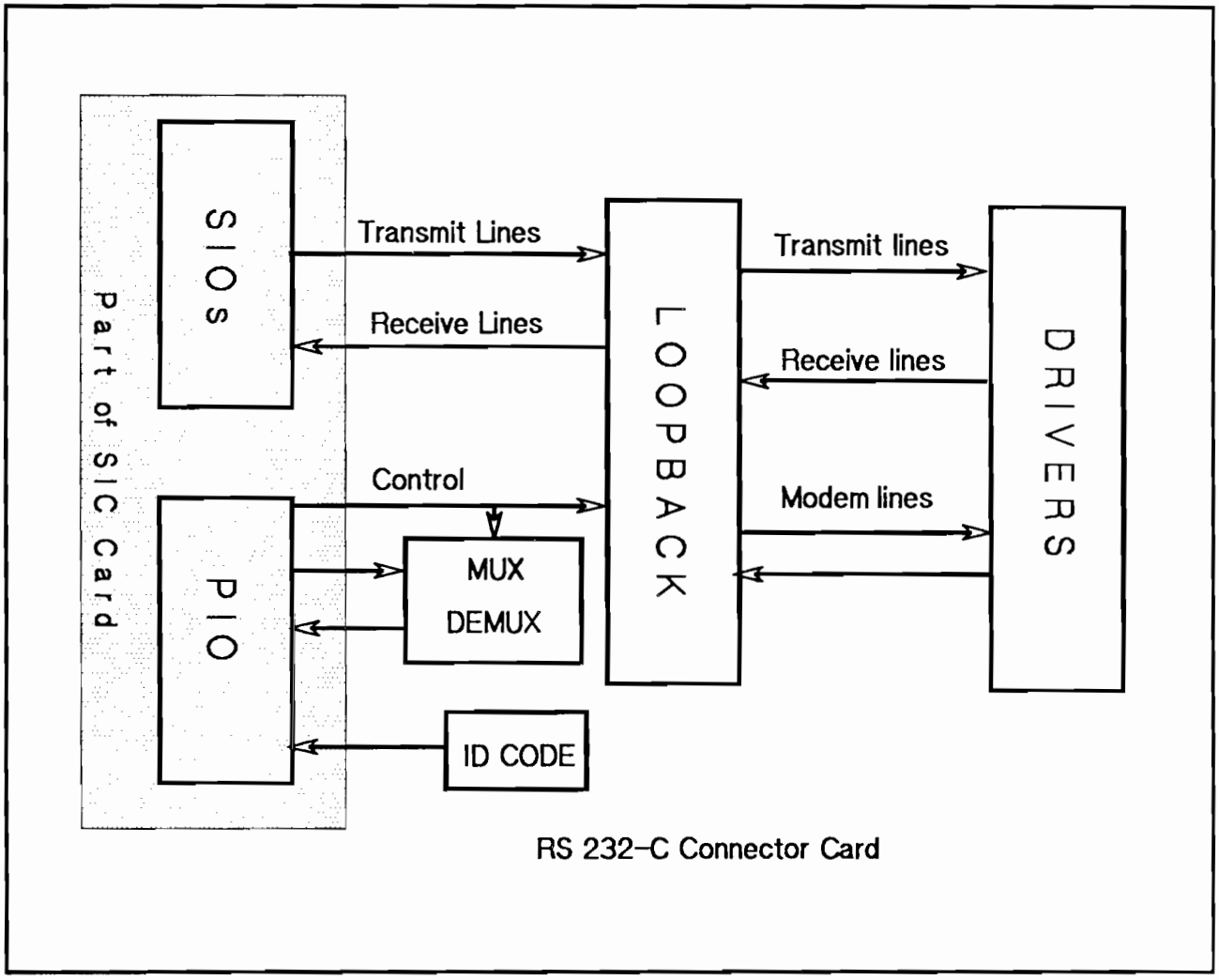


Figure 5-5 DTC RS-232-C Modem Connect

RS-422 Direction Connection

The card provide connection for up to 8 terminals or printers to the SIC. It comprises of the following major functional components:

- 8 loopback latches, to allow individual testing of all I/O ports.
- Loopback circuitry made up of PALs
- Line Drivers and line driver protection circuitry.
- 8 individual 5 volt power supplies.
- 16 opto-couplers.

A simplified function schematic of the RS-422 Direct Connect is shown in figure 5-6.

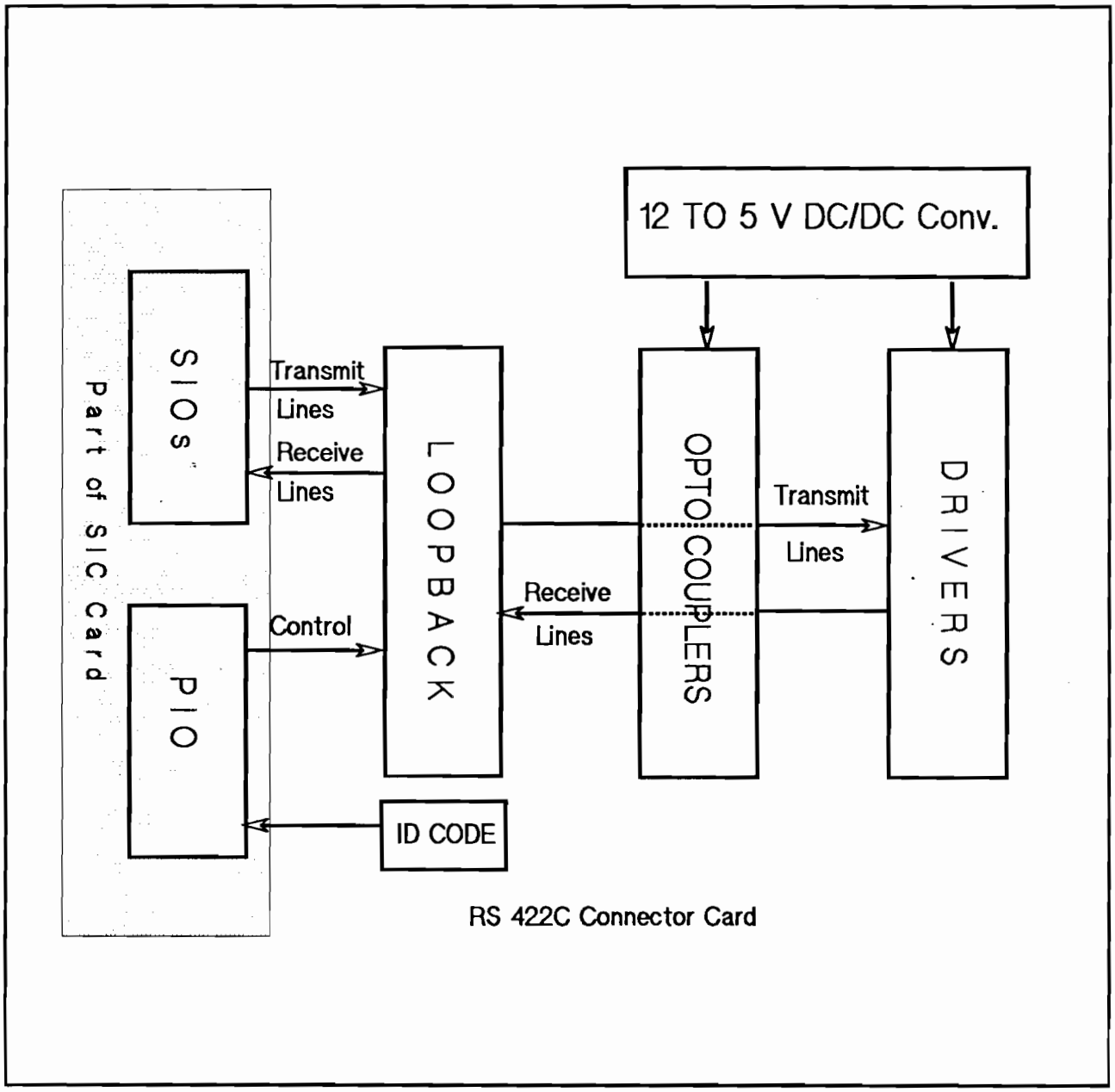


Figure 5-6 RS-422 Direct Connect

Note

The 5V supplies and opto-couplers allow the RS-422 ports to be isolated from each other and from the DTC mainframe ground. Transmission rates of up to 19.2Kbps, with up to 300V ground common mode voltage between terminals and the DTC are supported on this card, instead of 7V on a standard RS-422 interface.

SNP-CU

The SNP-CU provides the DTC with a synchronous communications capability.

The SNP-CU card serves to act as an processor/interface between the Processor card and the SNP-LA cards (i.e RS-232-D and multi-standard-V.36, V.35, RS-422 interface).

The card is based around a 68010 local microprocessor operating at a clock frequency of 8MHz. It can access 1.5Mbytes of shared DRAM which stores part of the synchronous communication protocol code.

The card comprises of the following major components:

- 68010 Microprocessor - 8MHz version
- 63450 DMAC, 4 channel DMA Controller
- 8530 Serial Communications Controller (SCC)
- 2 Custom Gate Arrays
- DTC Dedicated EPROM
- Dual Port 1.5Mbyte DRAM Shared Memory

A block schematic is shown in figure 5-7.

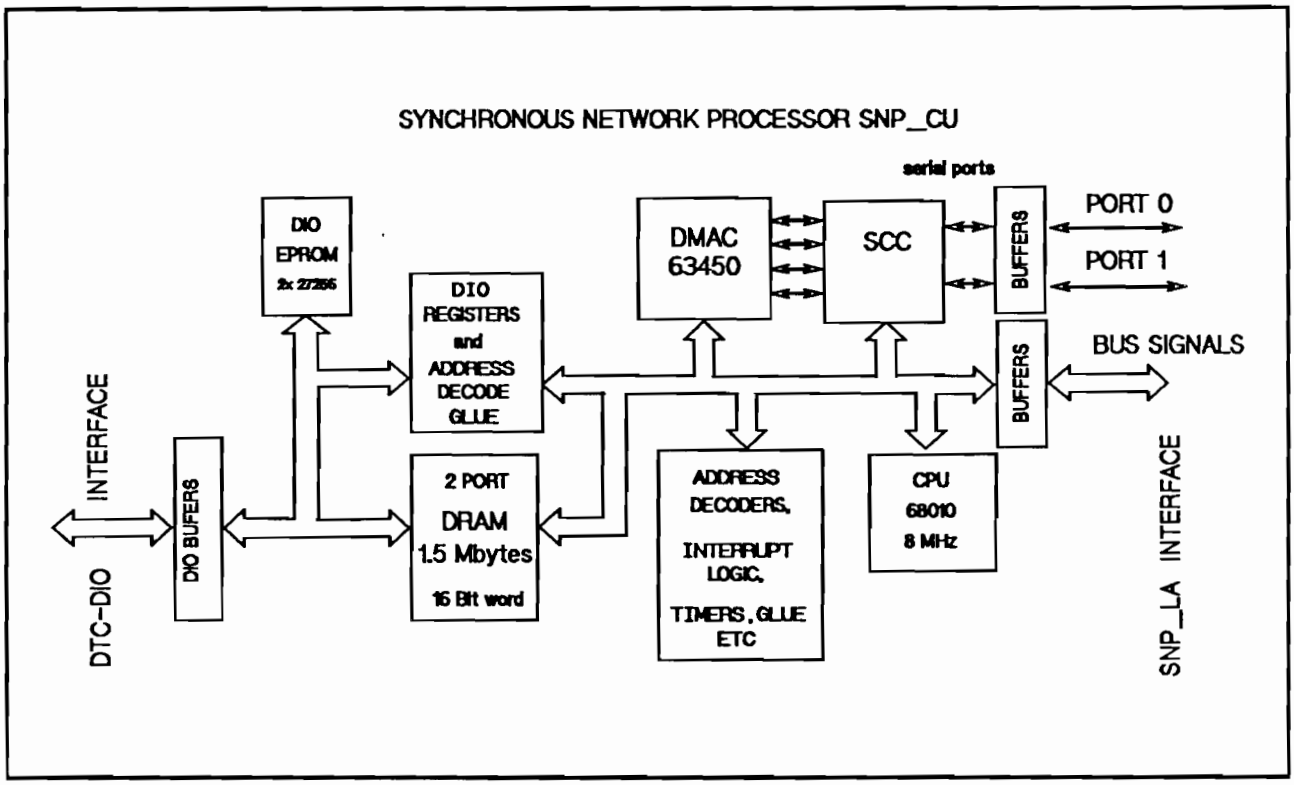


Figure 5-7 Block Diagram of SNP-CU

The 68010 Microprocessor

The 68010 microprocessor has been selected to provide compatibility with the 68000 microprocessor on the Processor card. Each processor has 68000 type time cycles and operate at the same clock rate i.e.8MHz. There are 7 levels of interrupt to service the SNP-LA card, DIO Bus, DMAC, CC, DIO soft reset and the DUART debug port (not available to CE).

The 63450 DMA Controller

Data transfers are under the control of the DMA Controller. This chip, in effect, controls the flow of data between the DTC Processor card and the SNP-LA cards. Data to be transmitted from the DTC Processor card is placed in the shared DRAM buffers by the Processor card CPU. The DMA Controller has direct memory access to the DRAM. It reads the contents of the shared DRAM buffers and places the contents onto the SNP-CU Local Bus. The DMAC is at this time the Bus Master. The Serial Communications Controller reads the data on the Bus which is then processed for transmission to the SNP-LA. For received data, the DMAC transfers data from the SCC to the shared DRAM.

8530 SCC

The Z8530 SCC is a dual channel (port A and port B),multi-protocol, data communications controller. The SCC is programmed to convert parallel data into a synchronous serial data stream. The SCC is under the control of the DMAC to provide data reception or transmission. When receiving data a level 6 interrupt is generated to interrupt the local CPU when the first character of the packet is received. The DMA then transfers the packet to shared DRAM. The SCC then issues an "end of frame" interrupt so that the local CPU can check the status of the received packet.

Custom Gate Arrays

Two custom built Gate Arrays exist on the card which provide DIO Decoding, Local Bus address decoding. glue logic functions and diagnostic loopback testing.

Shared DRAM memory.

The dual port memory is seen by both SNP-CU and the Processor card microprocessors as being its own memory but by using a 2 bus structure, CPU access conflicts are reduced to a minimum. As mentioned previously, data transmission between the Processor and SNP-CU cards takes place through the DRAM. A Refresh signal is derived from the RAM memory controller to refresh the dynamic RAM memory.

The DIO Eprom

The DIO Eprom is memory on the SNP-CU that is only available to the CPU on the Processor card and is for diagnostics only.

SNP-LA

The SNP-LA enables the DTC to be connected to the following DTE physical interface standards:

- RS232-D
- V.35
- V.36
- RS-422C

There are two types of Line Adaptor card available:

- **The SNP-LA/RS232-D card**
- **The SNP-LA Multi-standard card (V.35,V.36,RS-422).**

Note

The Interface standard V.35,V.36 or RS422 is selected by the use of specially hardwired external cables

SNP-LA/RS-232-D

This card enables the DTC to communicate via the synchronous RS-232-D interface to either the HP PPN 60/70/80 or a direct modem connection.

The card comprises of the following major components:

- PIA Peripheral Interface Adaptor
- Interface Identification Code Circuitry
- DUART
- Loopback and Interface Circuits
- Line Protection Circuitry

A block schematic of the card is shown in figure 5-8.

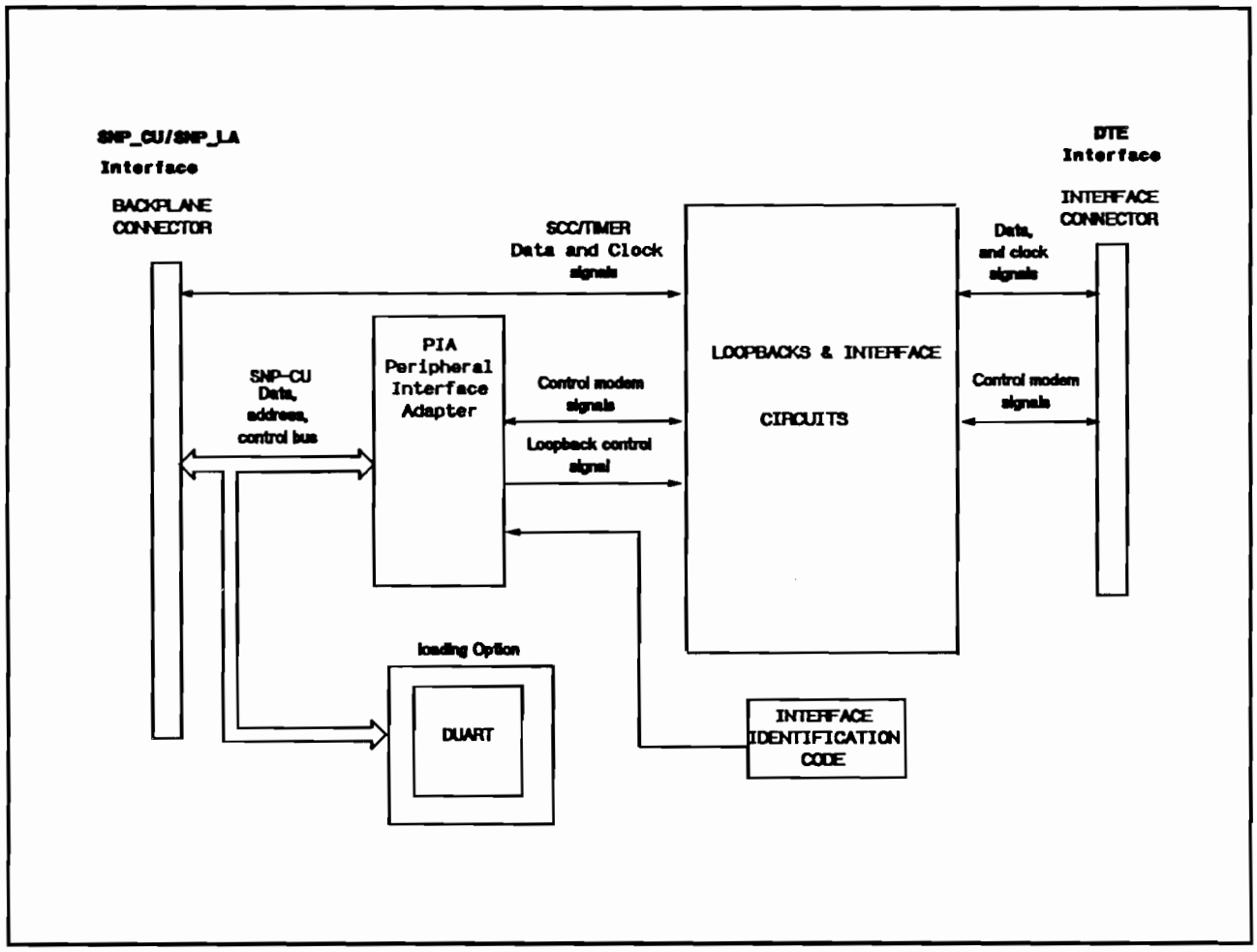


Figure 5-8 Block Diagram of SNP-LA/RS-232-D

PIA

This chip provides the means of interfacing the external peripheral equipment to the 68000 family of microprocessors. Two unidirectional ports are available which are programmed to act as either inputs or outputs for modem control signals

Interface identification Code Circuitry

The circuitry provides the recognition code to enable the SNP-CU to determine which Line Adaptor card it is connected to. The identification code is obtained by the use of hard-wired links on the PIA chip. Table 5-2 shows the bit pattern applicable to the RS-232-D interface.

DUART

This chip is used for debug purposes only, it has no function during the operation of the DTC.

Loopback and Interface Circuits

This circuitry comprises of a custom built Quadriloop chip which contains the RS-232-D Line Drivers, and circuitry to enable loopback tests to be performed up to the RS 232-D output connections. The results of the loopback tests are analysed by the Diagnostics program and displayed on the Diagnostics Results Screen. This is fully explained in Chapter 6- Diagnostics and Troubleshooting.

Table 5-2 SNP-LA Bit Recognition Codes

BIT PATTERN				CABLE DESCRIPTION
CD	CC	CB	CA	
0	0	0	0	25 Pin RS-232-D
0	1	0	1	SNP loopback hood
0	1	1	0	SNP Loopback cable
0	1	1	1	RS 422 Direct Connect
1	0	0	0	PSI Loopback Hood
1	0	0	1	V.35
1	0	1	0	V.36
1	0	1	1	X.21 (Later Release)
1	1	1	1	NO Cable

Line Protection Circuitry

As the Line Adaptor card can be effected by temporary random transient voltages, protection circuitry is built into the RS-232-D input lines. This takes the form of line inductors and transzorbs.

SNP-LA Multi-standard card

This card provides the following interface standards:

- V.35
- V.36
- RS422

The card has a maximum operating speed of 64k bps. Essentially, the card's architecture is the same for the three interfaces, however, an external cable determines the DTE physical interface. The relevant cables are fully described in Chapter 3 - Installation Procedures.

The card architecture comprises of the following major components:

- PIA - Peripheral Interface Adaptor
- Interface Identification Code Circuitry.
- Loopback Circuitry
- DUART
- Line Drivers and Receivers

A block schematic of the SNP-LA Multi-standard card is shown in figure 5-9.

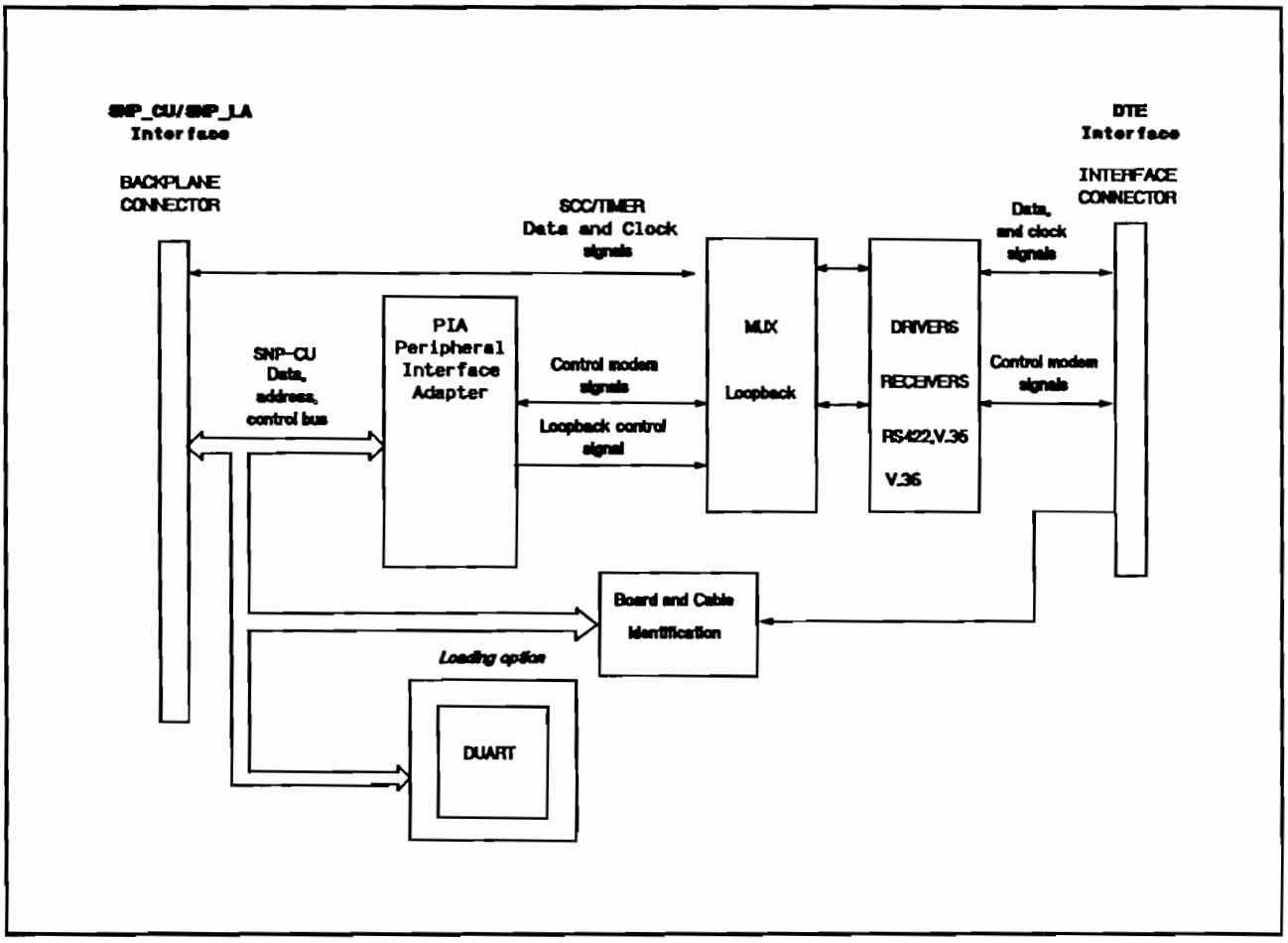


Figure 5-9 SNP-LA Multi-standard Card

PIA

This chip provides the means of interfacing the external peripheral equipment to the 68000 family of microprocessors. Two unidirectional ports are available which are programmed to act as either inputs or outputs for modem control signals.

Interface identification Code Circuitry

The circuitry provides the recognition code to enable the SNP-CU to determine which Line Adaptor card it is connected to. The identification code is obtained by the use of hard-wired links on the PIA chip. Table 5-2 shows the bit pattern applicable to the RS422/V.35/V.36 Interface.

DUART

This chip is used for debug purposes only, it has no function during the operation of the DTC.

6

Troubleshooting and Diagnostics

Introduction

The aim of this chapter is to provide the HP CE with information and some recommended hardware troubleshooting techniques to diagnose and rectify possible hardware faults on the DTC.

The diagnostics described in this chapter are specific to the DTC when the Self Tests and software download are in progress. If the software download has been successful, system diagnostics can be run on the DTC OpenView Workstation or Host; these Diagnostics facilities are described in detail in Using the OpenView DTC Manager.

There are a variety of diagnostics tools and methods available to the HP CE to faultfing on the DTC hardware and communication ports.

Diagnostics Tools

There are three types of Diagnostic tools available to diagnose and rectify faults on the DTC, these are:

- Internal Diagnostics tests

These are DTC Self Test error codes. A 2 digit hexadecimal display on the front panel of the DTC shows the current operating status and any encountered errors. The possible error codes are described in detail in section Faultfinding using the Selt Test of this chapter.

- The Diagnostics Program

Enables the HPCE to perform Loopback tests, check the DTC LAN Address and examine the results of the Self Tests. The Program can be accessed by connecting a terminal to port 0 of slot 0 and pressing Ctrl P whilst the Selt Tests are in progress. See section The Diagnostics Program of this chapter.

- Test Equipment

This includes some "standard" HP CE test equipment such as loopback connectors and a digital voltmeter.

Other tools available include TermDSM and LANDAD. TermDSM is a Host based diagnostic facility (Not to be used with OpenView Workstation); refer to the TermDSM Users Manual (HP part number 32022-90004) LANDAD is used to check the LAN connections, see the On-line Diagnostics Subsystem Utilities Manual (HP part number 09740-64006)

Test Equipment

For effective hardware fault finding on the DTC, the HP CE should have available the following standard test equipment:

- Voltmeter to check DC voltages throughout DTC
- Loopback Connectors are used in conjunction with the Diagnostics Program. Available Loopback connectors are shown in Table 6-1.

Table 6-1 Loopback Connectors

CONNECTOR	HP PART NUMBER
3- pin Loopback Connector - Asynchronous RS-232-C Direct Connect	30148-60002
5-pin Loopback Connector- Asynchronous RS-422 Direct Connect	30147-60002
25-pin Loopback Connector - Asynchronous RS-232-C Modem Connect	02345-60010
62-pin Loopback Connector - Synchronous	24400-60216
62-pin Loopback Connector - Synchronous V.35 Interface	24400-60211
62-pin Loopback Connector - Synchronous V.36 Interface	24400-60212
62-pin Loopback Connector - Synchronous RS-422 Interface	24400-60213

Troubleshooting Stages

The troubleshooting procedures follows the same sequence as the DTC internal Self tests i.e it follows the sequence "Power On" to "Self-test" to "Download". After the Self Test has been sucessfully completed and during the "Download" sequence the Diagnostics Program may be invoked. On a successful "Download" the Diagnostics facility is suppressed.

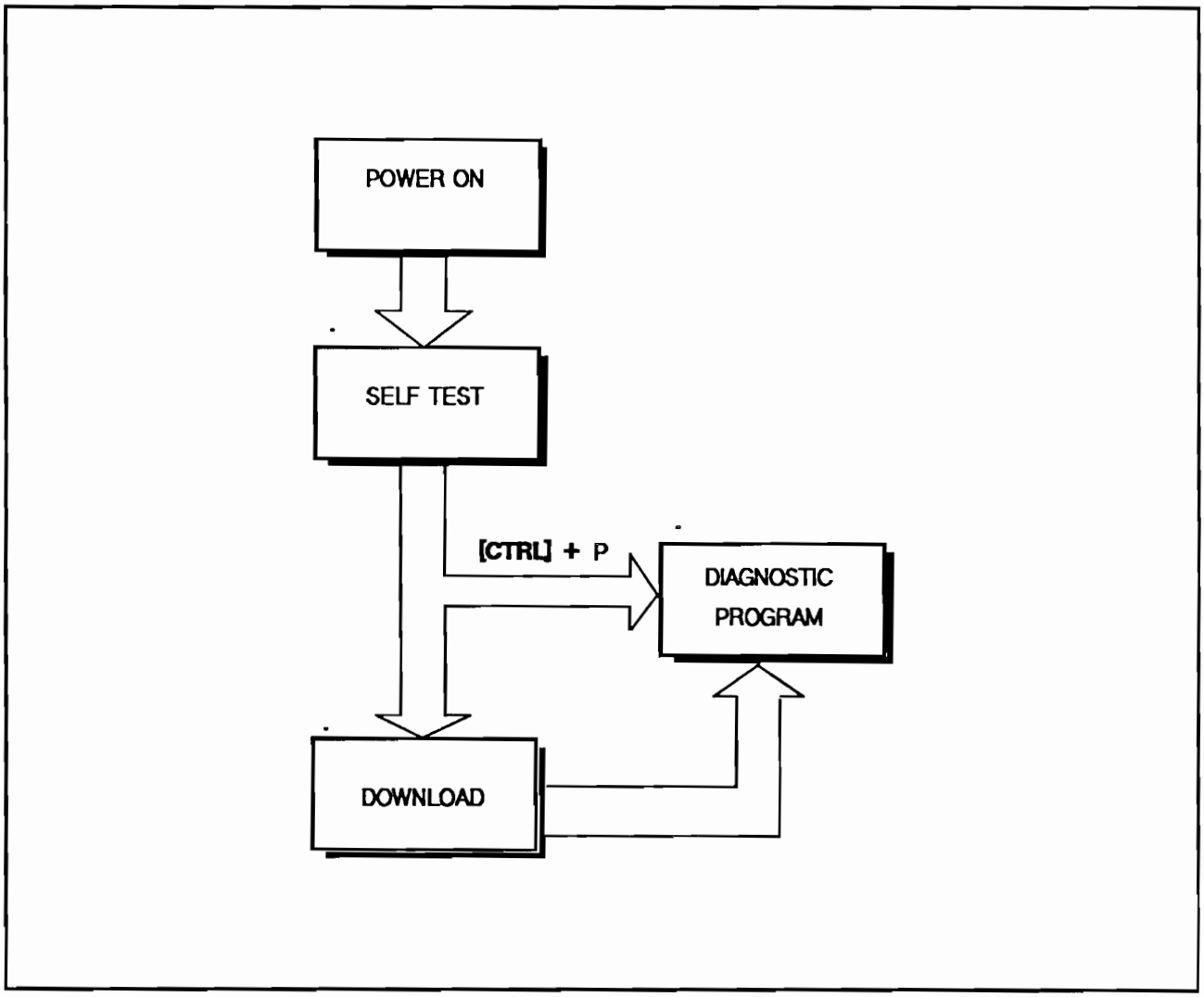


Figure 6-1 Troublshooting Stages

Warning

Before attempting to remove or replace any components or assemblies, including, circuit cards,ALWAYS switch OFF the DTC.

Static Sensitive Devices

When handling or servicing equipment that contains static sensitive devices, adequate precautions must be taken to prevent damage or destruction. Some of the semi-conductor devices used in the DTC can be irreparably damaged by static discharge.

Power-On Troubleshooting

Fault finding on the Power supply unit should ONLY be undertaken when the HP CE thinks there is a power supply problem when the DTC is switched ON. Finding faults associated with the power supply involves taking voltage measurements within the DTC. The voltages presest,test points and any replaceable fuses are summarised in the following schematic.

The voltages of interest are summarised in table 6-2 together with their tolerances. The tolerances given here are those needed by the DTC cards to work properly

Caution

The Power Supply is protected against over-current on all DTC power outputs, against +5V over-voltage, and against over-temperature. In the event of any of these, the Power Supply is automatically switched OFF.

The over-current protection is auto-recoverable, and the Power Supply restarts as soon as the over-current has stopped. The over-voltage and over-temperature protections are reset by a power OFF/power OFF cycle.

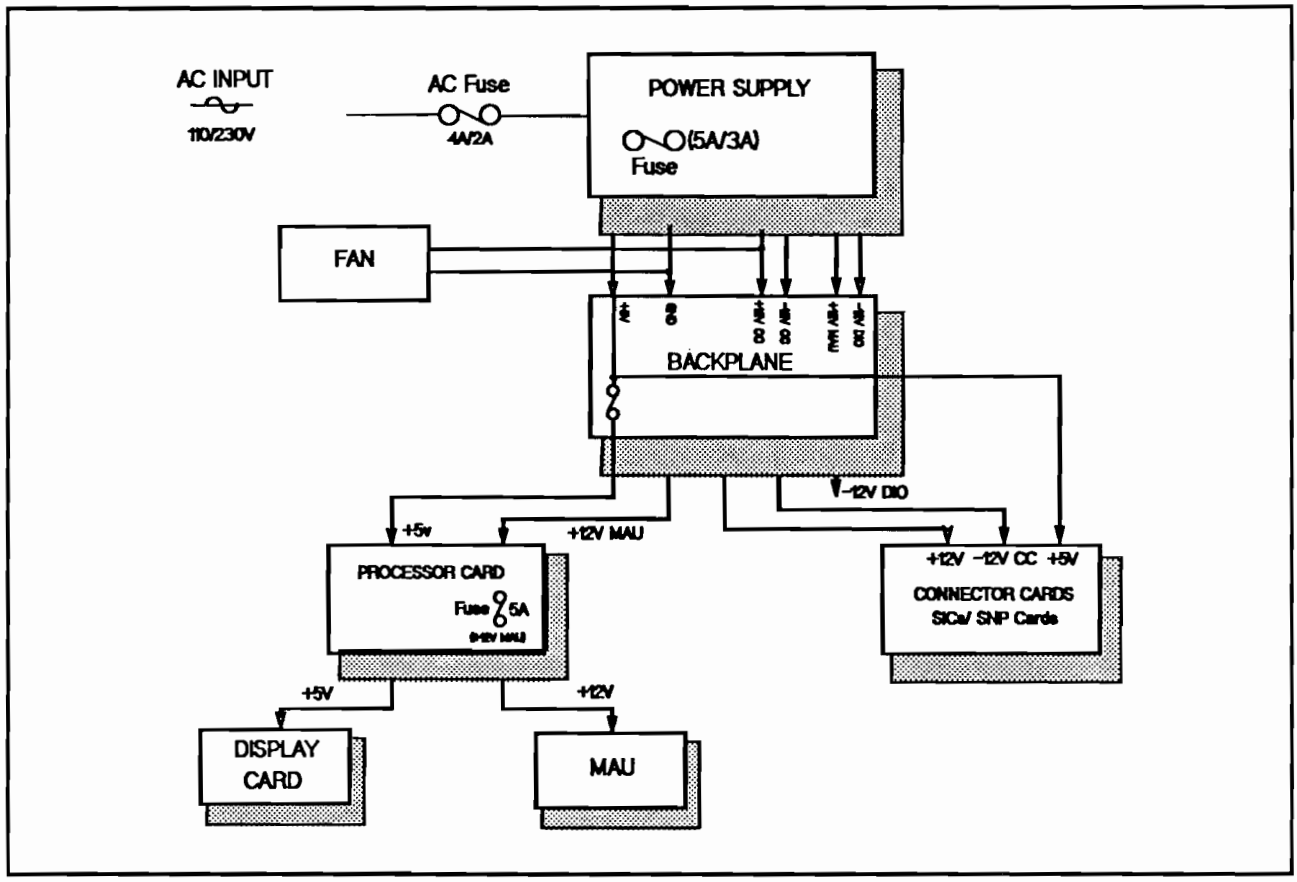


Figure 6-2 DTC Voltage Distribution

Table 6-2 DTC Voltage Tolerances

VOLTAGE	LOCATION WITHIN DTC	TOLERANCE
+ 5V	Throughout	+ 4.75 V to + 5.75V
+ 12 V	Throughout	+ 11V to + 13V
-12 V	Throughout	-11V to -13V
+ 12V	Throughout	+ 11.5 to 15V

Fault-Finding Flowchart

The recommended troubleshooting procedure is summarised in the following flow chart,figure 6-3. The numbers marked by each step indicate the action the HP CE should take, this is described in the text accompanying the flow chart.

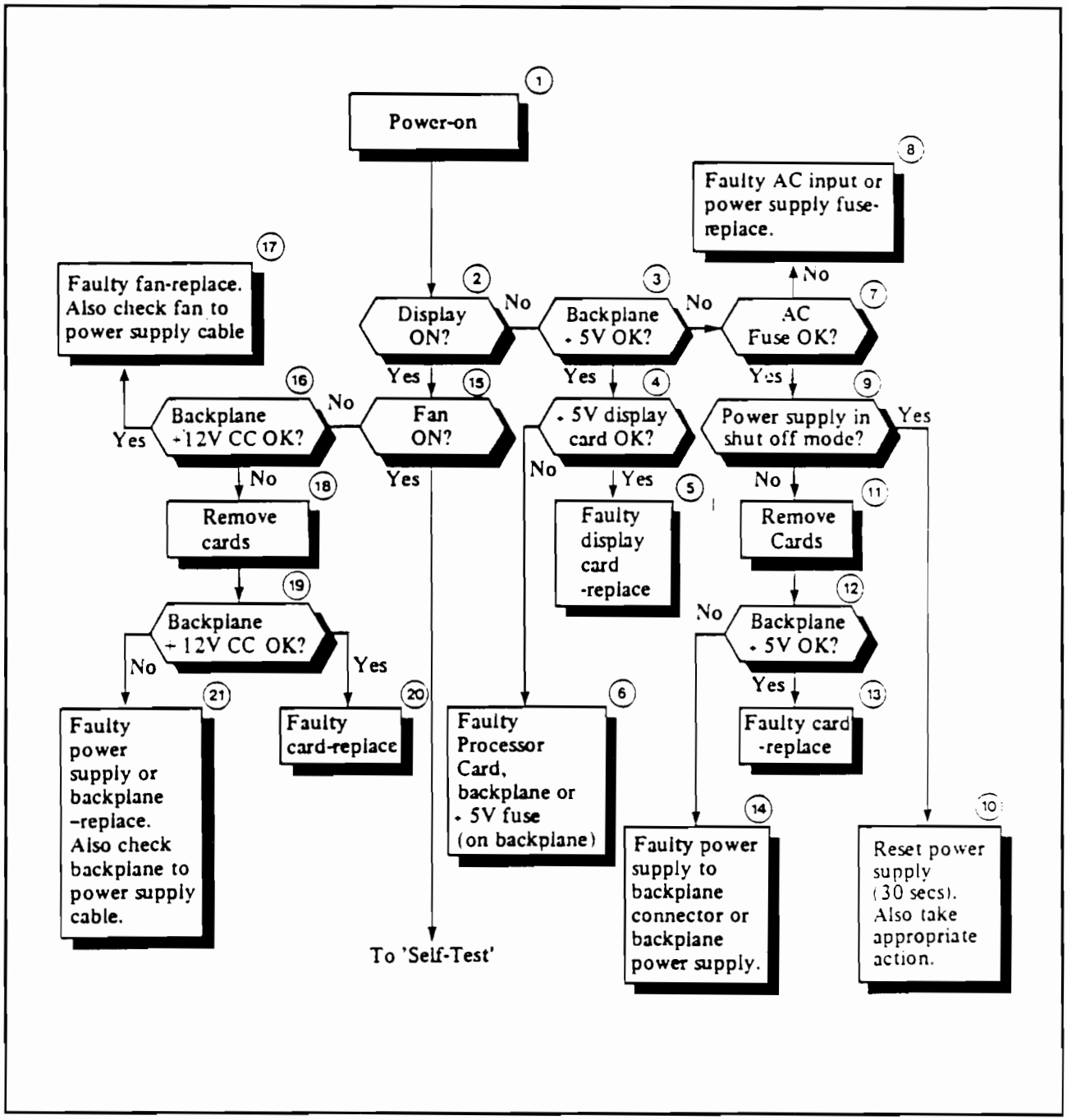


Figure 6-3 Power Supply Troubleshooting

Procedure

1. Switch ON the DTC.

2. Check that the front panel Display is ON, if illuminated proceed to step 15; if NOT illuminated proceed step 3.

3. Check that +5V is present on test point on the Backplane, see figure 6-4, which shows a section of the Backplane and a view of the relevant test points and the +5V fuse.If +5V is not present, check +5V fuse and proceed to step 7; if +5V present proceed to step 4.

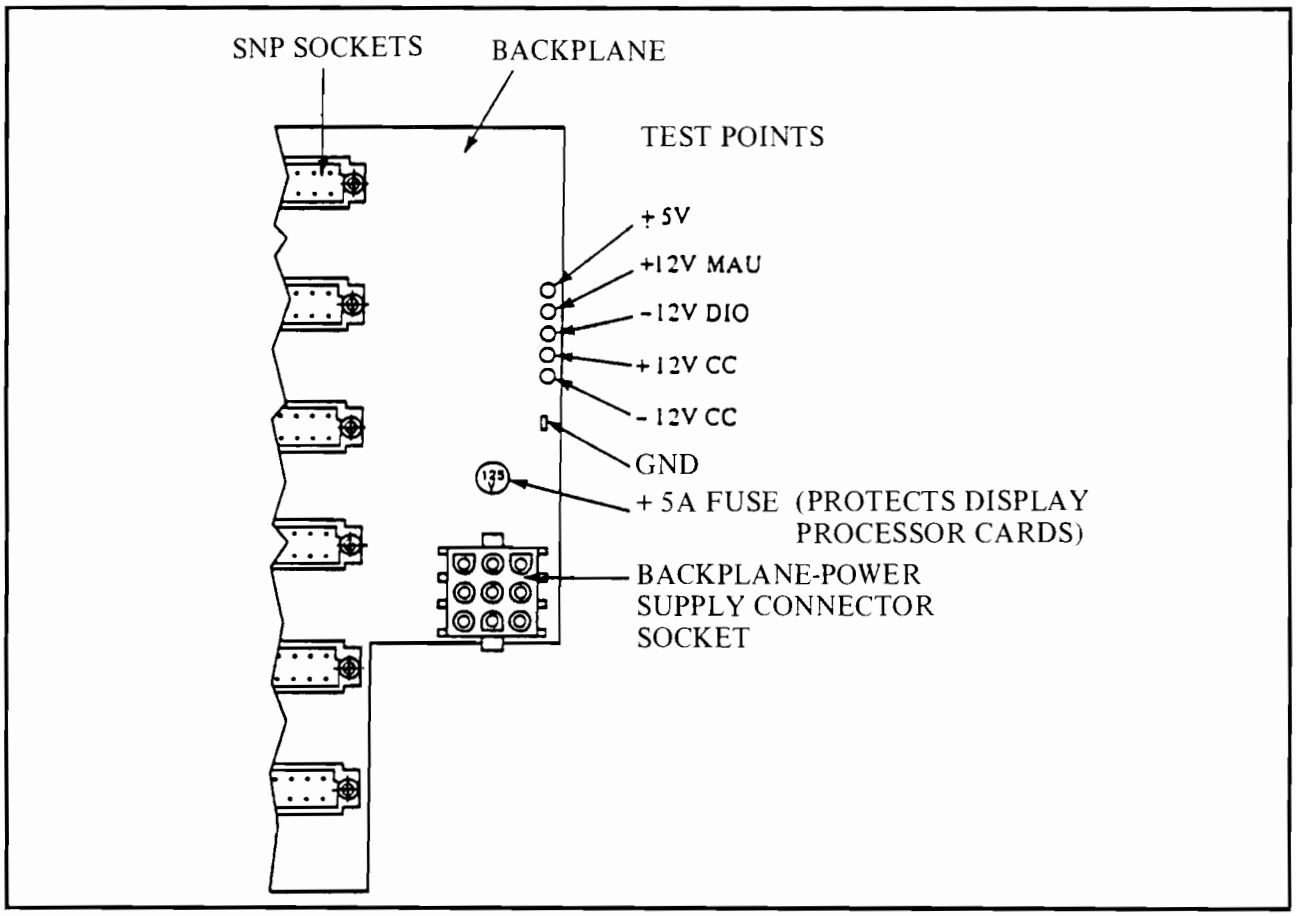


Figure 6-4 Test Point on Backplane

Note

The Display card can be accessed by removing the DTC front panel, and the Backplane by removing the protective metal plate. Viewed from the front of the DTC, the Backplane test points are on the right hand side.

4. Check that +5V is present on the Display card,if it is not present, proceed to step 6; if present, then replace the Display card, proceed to step 6. Figure 6-5 shows the location of the +5V test point on the Display card.

5. Replace the Display card by unscrewing the two screws on the front of the Display card.

6. If +5V on the Display card test point is not present or outside tolerance, then suspect either a fault on the Processor card or on the Backplane. Examine the +5V fuse on the Backplane and replace if necessary.

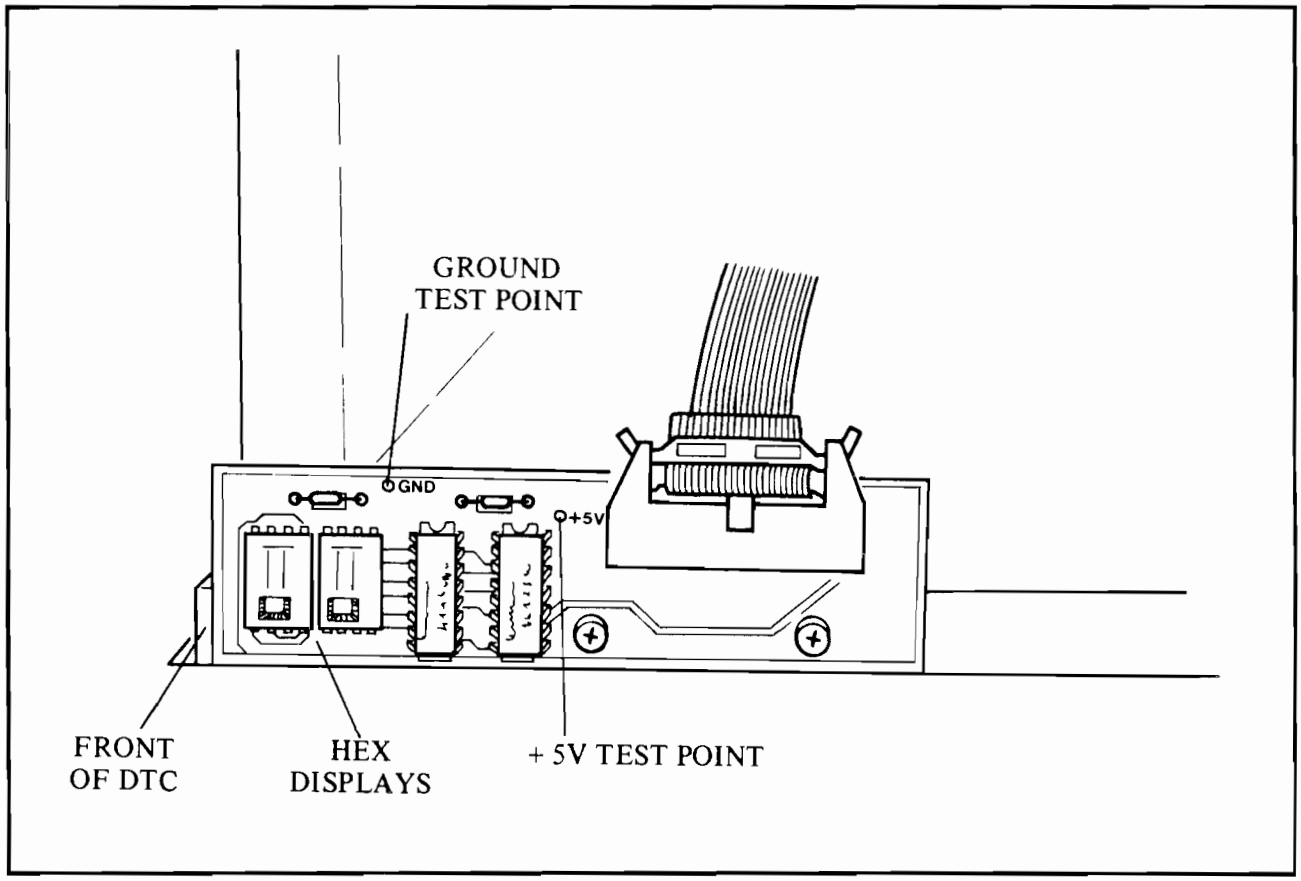


Figure 6-5 Test Points on Display Card

Note

The Processor card and Backplane are replaced according to the instructions given in Chapter 7.

7. If +5V not present on Backplane, check the AC supply and fuse, if OK proceed to step 9; if AC supply or fuse are unsatisfactory proceed step 8.

8. Check the AC supply fuse and replace if faulty. If the AC Supply input is not present but the plug fuse is OK, then do not attempt to troubleshoot further, instead,call the appropriate Electrical Installers to check the AC supply.

Note

The part numbers for fuses are given in Chapter 8. It should be noted that the part numbers for each fuse are different depending on whether a 115V or 230V power supply is used.

9. Check that the Power Supply is not in Shut OFF mode which can occur if over-voltage or over-temperature conditions exist, proceed to 10; if Power Supply is not in Shut-OFF mode then proceed to 11.

10. In the Shut OFF mode the Power Supply is automatically switched OFF and the LED inside the Power Supply is illuminated. If this is the case, wait 30 seconds with the power OFF before switching ON again.

11. If the Power Supply is not in Shut OFF mode, then the problem may be due to a faulty SIC/CC or SNP-CU/SNP-LA, proceeed to step 12.

12. Remove each SIC/CC or SNP-CU/SNP-LA card in turn, following the removal procedures in chapter 7. With the DVM on the +5V test point on the Backplane check that +5 V is present, if so proceed to step 14; if not proceed to step 13.

13. If a SIC/ CC or SNP-CU/SNP-LA has a fault i.e has a short circuit on the power line, then the +5V supply at the Backplane test point will be low. Replace the faulty interface card.

14. If +5V is still not present on the Backplane test point despite removing all Interface boards, then check the power supply to the Backplane connector. Ensure that it is plugged in correctly, then measure the voltage on the +5V pin, it should read +5V, if not, the fault lies either in the Power Supply or Backplane. These are replaced in accordance with the instructions in Chapter 7.

15. If the DTC front panel light is ON, then check the fan, if it is OK the Self Test is intiated, if not proceed to 16.

16. If fan is not ON, check the +12V CC on the Backplane, (see figure 6-10), if +12V is present proceed to 17; if not proceed to 18.

17. Check the cables to the fan, if it is OK, then the fan is faulty and should be replaced.

18. If the test point does not measure +12V then the SIC/CC and/or SNP-CU/SNP-LA should be removed in turn to establish if a short circuit exists on an interface board.Proceed to 19.

19. With the probe of the DVM connected to the +12V test point. If +12V is still not present after changing cards then proceed to 21; if the +12V line recovers when a Interface card is removed proceed 20.

20. With a Interface card removed and the +12V line recovers, then a possible short circuit exist on the card's power lines. Replace the faulty card in accordance with the instructions given in Chapter 7.

21. If the +12V still does not exist on the test point despite removing all the cards, then either Power Supply is faulty or the Backplane to Power Supply cable. If found faulty they can be replaced in accordance with the instructions given in Chapter 7.

This concludes the section on Power Supply troubleshooting, the next proceeding sections examine possible faults that are diagnosed by the Self tests or the Diagnostics program.

Troubleshooting using the Self Test

The Self test has already been described in Chapter 4 of this manual, Power-Up and Set-Up Procedures. However, the Self-test is a very important fault finding tool and in this context it is described here, with particular emphasis on the troubleshooting aspects.

The DTC may contain the SNP Synchronous communication cards, in which case, an additional set of Self test codes are displayed, these are explained in detail in this section. The troubleshooting flow charts and accompanying text described in this section apply when both the asynchronous and synchronous communication cards are installed. Wherever applicable, the extra codes specific to the SNP, i.e code Dx, will be described in detail.

The Self test starts immediately (and automatically) after "Power -On". If the Display card and fan are working satisfactorily, then there is no necessity to perform the initial troubleshooting as described in the preceding sections. Figure 4-1 and 4-2 summarise the Self test sequence, and list the error codes.

The results of the Self Test are displayed on the front panel Display. This can display two digits/characters and a dot in the right hand corner. The display shows the current state of the Self test using hexadecimal codes and the dot.

The status of the Self Test is also displayed on a green LED at the front of each SIC or SNP-CU Card. The LEDs can only be seen by removing the front panel of the DTC. If the Self Test is OK, then the LED is turned

ON. If there is a failure, then the LED is OFF, signifying that at least one port is not working.

Note For troubleshooting purposes only the hexadecimal display codes are used.

The execution of the Self Tests can take a few minutes depending on the number of cards installed. Typical times are about 63 seconds for one set of SIC or SNP -CU Cards installed to around 93 seconds with all slots occupied. However there will be a significant increase in time taken if an error is detected.Once the Self Test has finished, providing it has not detected an error and stopped, then the Download request is sent to the Openview Workstation or Host and the download begins.

The recommended faultfinding procedure is summarised in the following flow chart,figure 6-4. The numbers marked by each step indicate the action the HP CE should take, this is descibed in the text accompanying the flow chart. As can be seen from the flow chart the numbering sequence follows on from the Power-Up faultfinding steps.

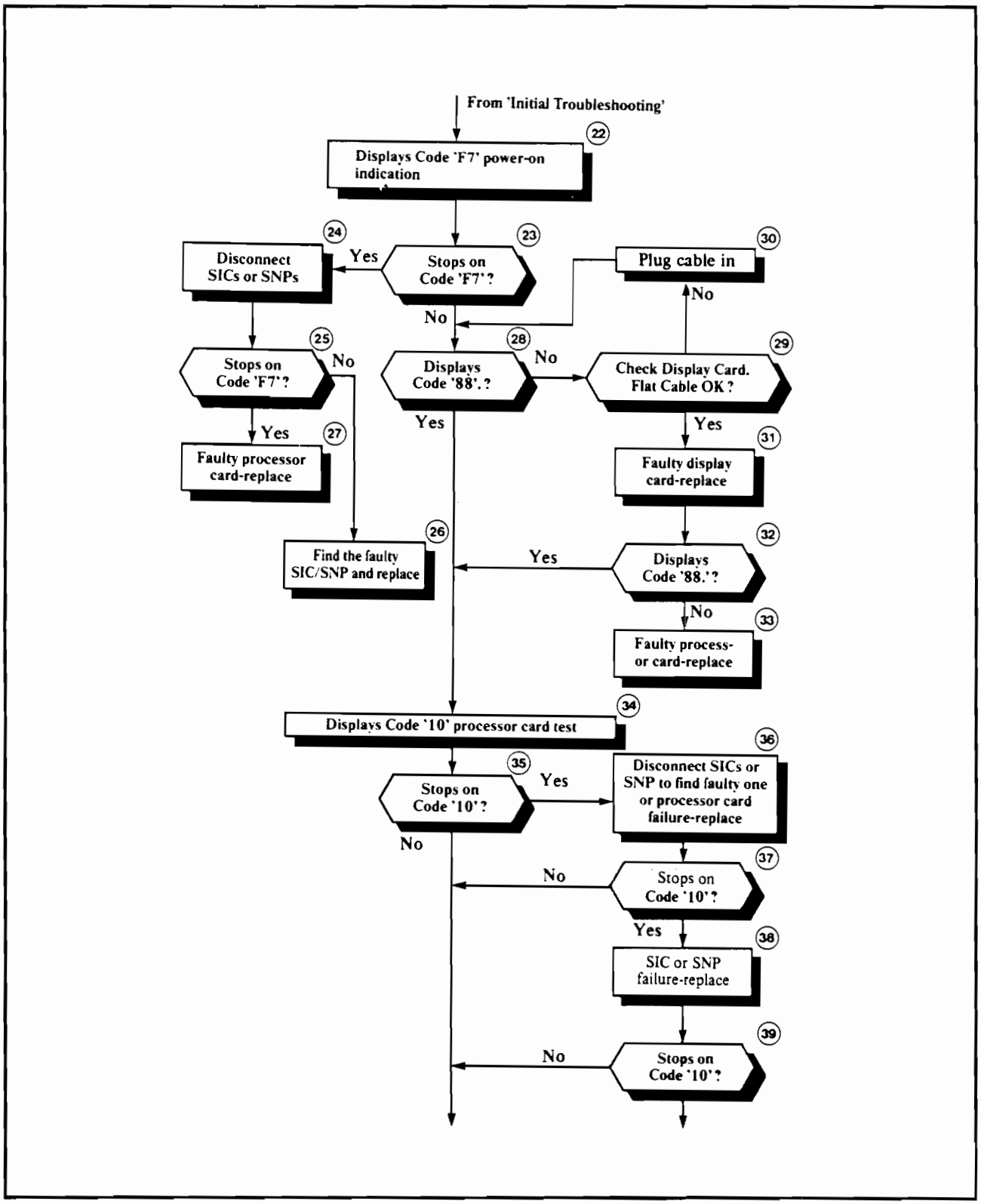


Figure 6-6(i) Fault Finding Flowchart

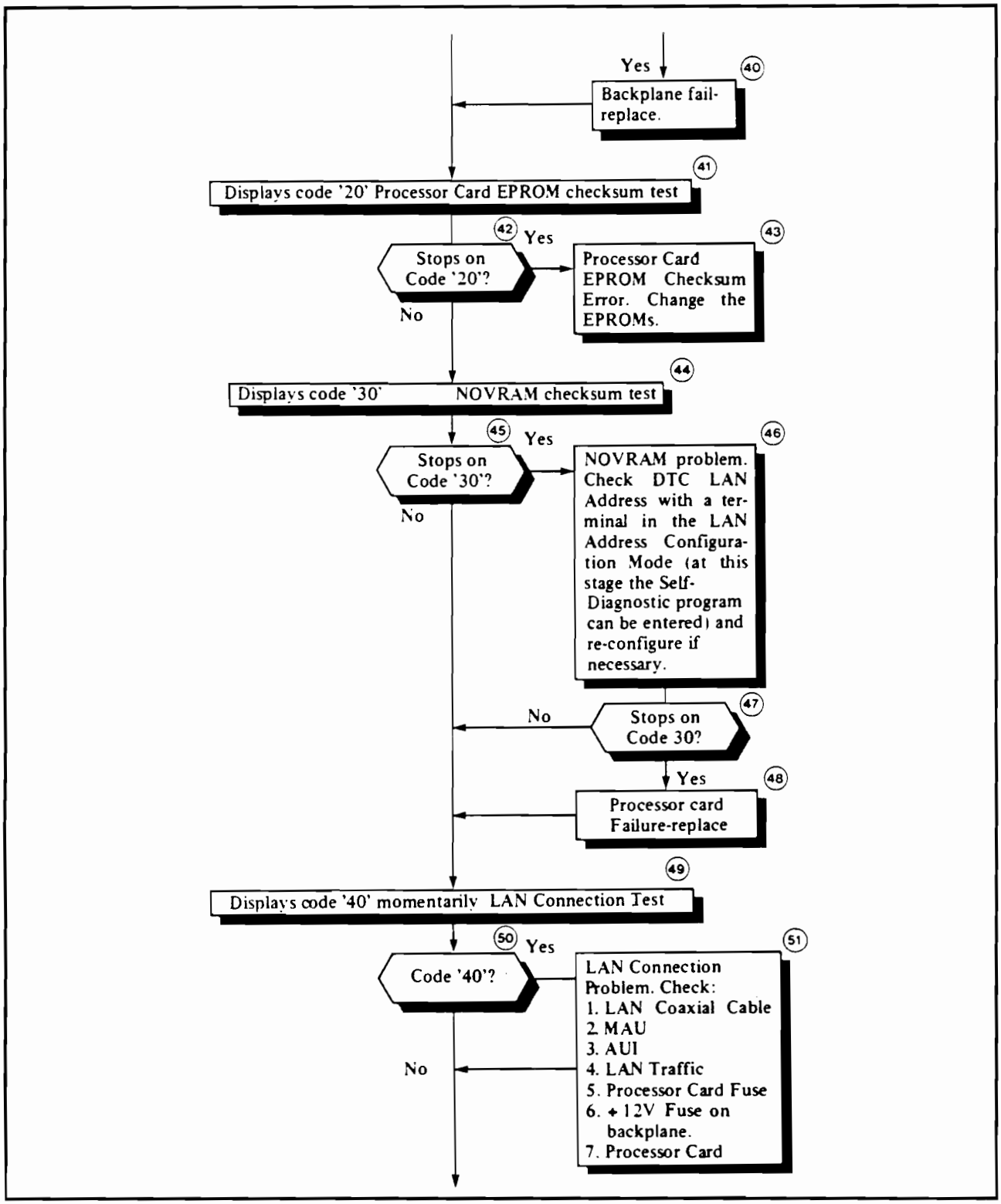


Figure 6-6 (ii) Fault Finding Flow chart

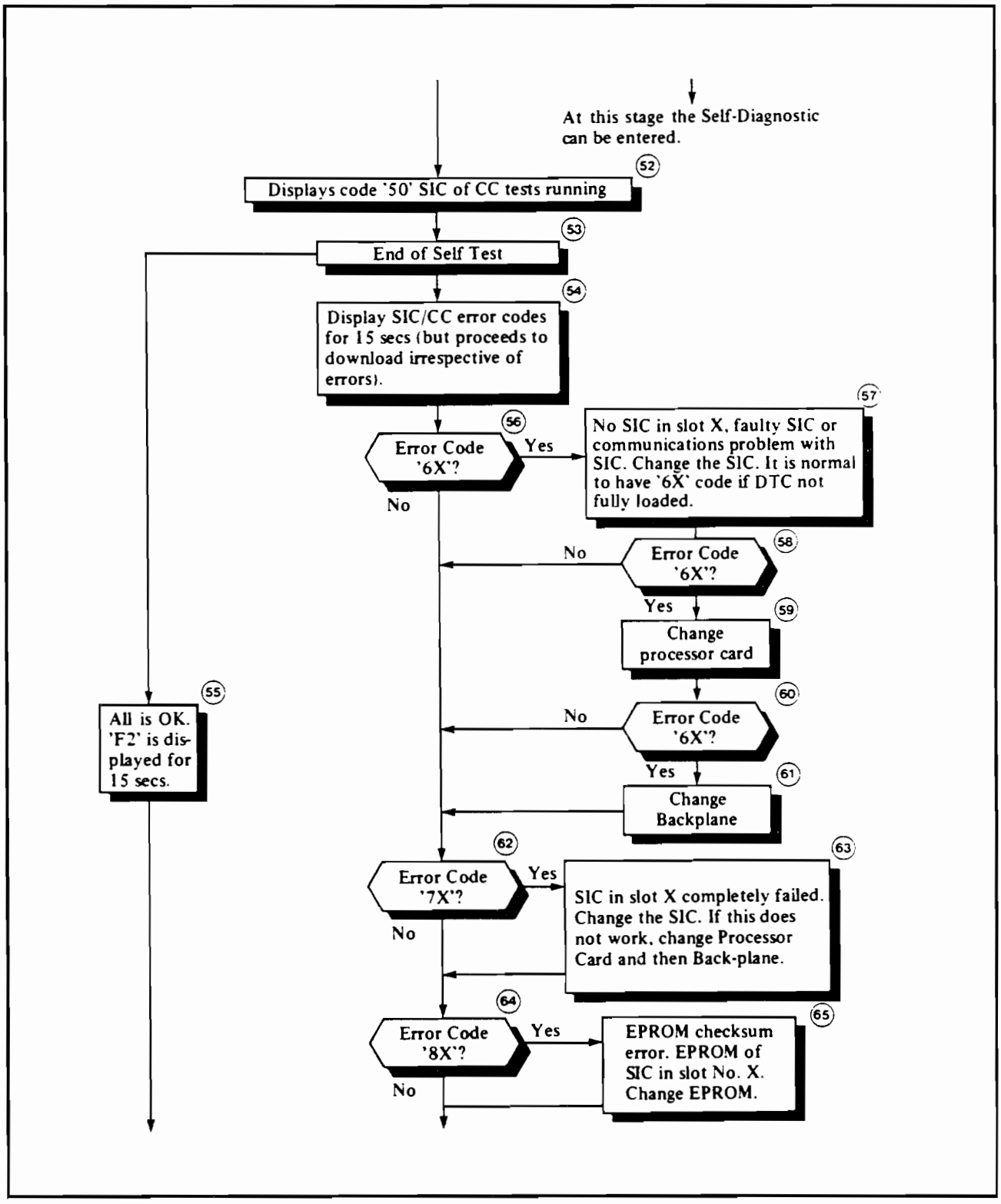


Figure 6-6 (iii) Fault Finding Flowchart

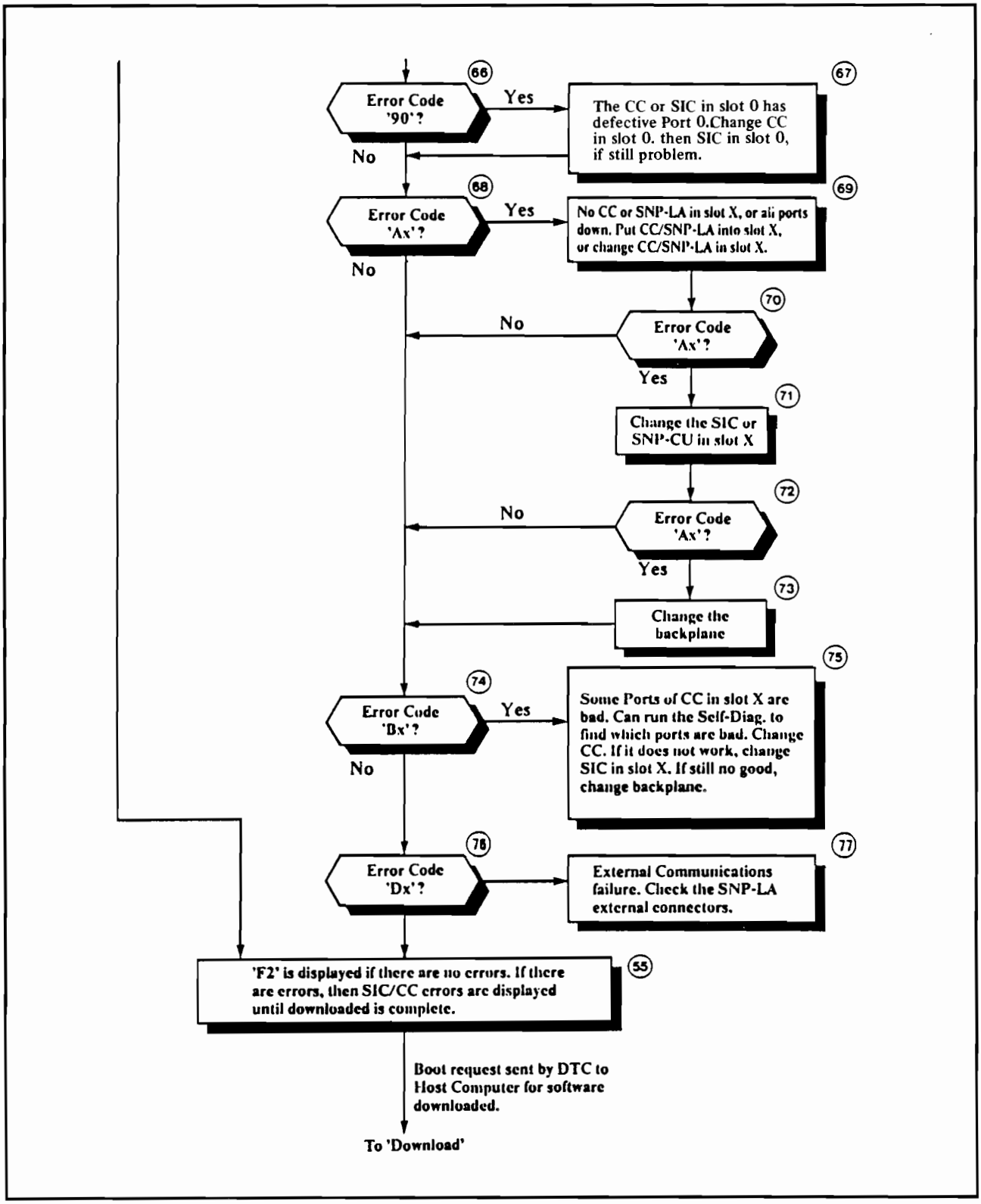


Figure 6-6 (iv) Faultfinding Flowchart

Procedure

22. Self Test starts by displaying a random code (often F7 with the dot OFF) this signifies "Power-ON". Providing no problems are encountered the code is displayed only momentarily and proceeds to the next stage, proceed to 28; if a fault is encountered proceed to 23.

23. Code F7 is displayed continually.

24. Remove all the Interface cards (SIC/CC, SNP-CU/LA) from the Backplane. If a change in the error code occurs this signifies a fault associated with a Interface card, proceed to 26.

25. If F7 is continually displayed with the Interface cards removed, then the fault exists within the Processor card, proceed 27.

26. Return each Interface card in turn to the Backplane, noting the status of the Display. When the Interface card stops on F7, the Interface card is probably faulty. Replace with a new card.

27. With the Interface cards removed, F7 is displayed. Replace the Processor card in accordance with the instructions given in chapter 7.

28. Code 88 with the DOT ON signifies that the Display card is functioning correctly. The HPCE must ensure that all segments of the Display are illuminated; if OK proceed to step 34; if not proceed to step 29.

29. Code 88 illuminated incorrectly, check that the flat cable to Display card is correctly plugged in.

30. Remove the cable, check the plug connections and assembly to ensure all in order, repair if necessary.

Reinsert the cable, if cable is OK, proceed to 31.

31. If the segments of the Display are still incomplete, change the Display Card.

32. With the Self test restarted,and code 88 still not displayed then a fault lies in the Processor Card.

33. Replace the Processor Card in accordance with the instructions given in chapter 7. This time when the Self test restarts, code 88 with the dot ON should be displayed.

34. Next the Processor Card is tested. If a fault associated with the Processor Card exists, the error code 10 (with the dot OFF) is continually displayed proceed to 35; Self test sequence continues , see 41.

35. Error code 10 continually displayed signifies a fault on the Processor card or possibly associated with the DIO bus or SIC/SNP-CU Cards, proceed to 36.

36. Remove the SIC/CC, SNP-CU/LA cards from the Backplane, restart the Self test. If error code 10 is still continually displayed, change the Processor card in accordance with the instructions given in chapter 7..

37. If the Processor Card is OK the Self test sequence continues and error code 10 displayed momentarily, proceed to 41,however, with a Processor card known to be OK, the error code 10 is still displayed continually, the fault exists in either the DIO/SIC/SNP-CU Cards or backplane.

38. To find the faulty card substitute each card in turn until the error code 10 changes and the Self Test sequence continues, proceed to 41:if not see 39.

39. If error code 10 still continually displayed and all SIC/SNP-CU Cards are known to be OK, the fault exists on the Backplane, proceed to 40.

40. Examine and replace the Backplane in accordance with the instructions given chapter 7. With a new Backplane installed the Self Test sequence should continue and error code 10 changes to 20.

41. Error code 20 signifies that an EPROM checksum is being performed on the Processor Card, if this has been successful, the Self Test sequence continues to the NOVRAM checksum, see 44; if error code 20 displayed continually, see 42.

42. If error code 20 continually displayed ,it signifies that an error has been encountered during the EPROM Checksum, proceed to 43.

43. There are two EPROMs on the Processor Card. The EPROMs are situated as shown in figure 6.7, if defective,they should be replaced.

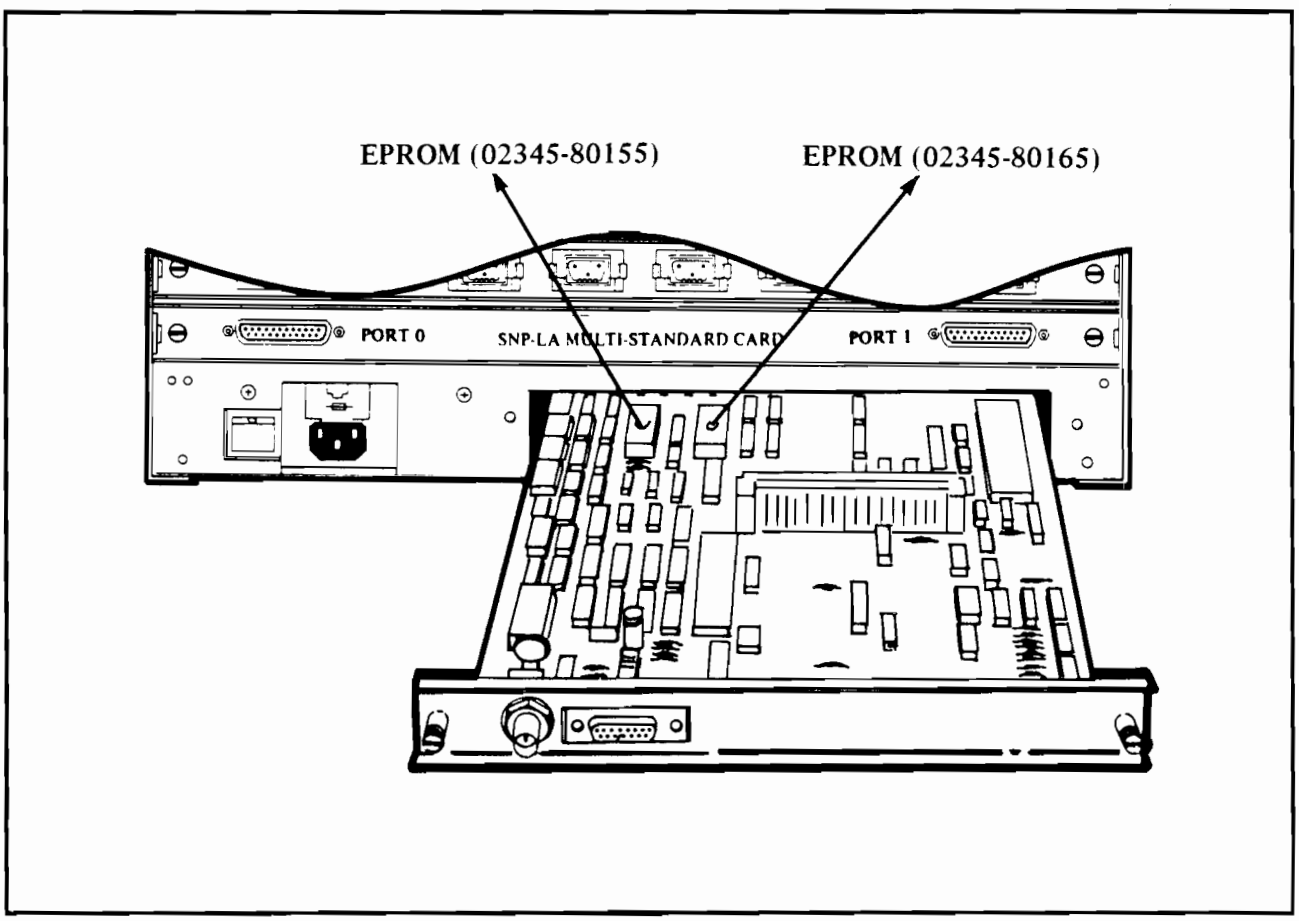


Figure 6-7 Eprom and Fuse Location - Processor Card

44. Error Code 30; the NOVRAM Checksum which also tests the LAN address. The test verifies the NOVRAM Checksum but does not verify the validity of addresses according to IEEE.802.3 or HP rules. If the error code 30 is displayed continually, proceed 45; if it changes, proceed to 49.

45. Error code 30 continually displayed signifies that an error has been encountered during the NOVRAM Checksum which also means that the LAN Address may be incorrect, proceed to 46.

46. At this stage during the Self Test Sequence it is possible to access the Diagnostics program. This is essential if the LAN Address is to be checked and reconfigured. The LAN Address reconfiguration is described in detail in the section " Diagnostics Program". Using this function it is possible to review and, if necessary, modify the LAN addresses (nodal and multicast) of the DTC. The two addresses are labelled on the bottom of the card cage,near the front panel. After performing any modifications and exiting the Diagnostics program, the Self test should continue , see 49: if not proceed to 47.

47. Error code 30 still displayed after checking the LAN Address could signify an error exists in the Processor Card.

48. Replace the Processor Card with a known working card in accordance with the instructions given in chapter 7

49. Error code 40 is not normally displayed (less 50msecs), however, when displayed for a period of 20 seconds it signifies a fault associated with the LAN.

50. Error code 40 displayed for a period not exceeding 20 seconds, see 51.

51. The error code 40 signifies an fault exists on the LAN or a LAN connection, it will be necessary for the HP CE to check the assemblies that are shown in step 51 in the fault finding chart.

Note

This manual does not attempt to explain how to troubleshoot faults on the LAN hardware. The HP CE should refer to LAN Link Hardware Troubleshooting Manual (part number 5955-7681) for more information.

52. Error code 50, when displayed for a few seconds, signifies that self tests are being performed on the SIC/CC Cards and the SNP-CU/SNP-LA Cards. This tests the processor chip,the RAM, SIO, PIO and EPROMs on the SIC/CC and tests the processor chips, DRAM, HP Custom built gate arrays, DMAC and the CC on the SNP-CU/LA Cards. Note that the Self Test will never stop on this code and the Download will commence once the test is complete irrespective of any errors that may exist on the I/O cards, proceed to 55.

53. At this stage the Self tests of the Processor Board and DIO bus are complete and the Download of code can take place, see 55.

54. During the 15 second period that the Download is taking place error codes are displayed associated with the SIC/CC or SNP-CU/LA Cards and their respective external connectors, these error codes are defined as follows:

- 6X: No card present of communications failure
- 7X: SIC or SNP-CU Card defective
- 8X: SIC or SNP-CU ROM defective
- 90: Port 0, slot 0 defective
- AX: CC- Some ports defective:SNP-LA No Fatal Error
- BX: CC- All ports down:SNP-LA Fatal Error.

- DX: Synchronous DTC external cable or peripheral error.

Note

X indicates the respective slot number i.e the slots are numbered 0 to 5 where slot 0 corresponds to the bottom slot and number 5, the top slot. Port 0 is always the left hand port looking at rear of the DTC.

55. If the Download of code is successful the code F2 will be displayed for 15 seconds with the dot blinking. On completion of the Download, code F2 with the dot ON will be displayed. Full details of the download errors are given in section " Download Troubleshooting".

56. Error code 6X displayed,if yes see 57, if not step to 62.

57. Error code 6X when displayed, signifies that either the SIC or SNP-CU in slot X is not installed properly. No Card is installed in slot X or that there is a communications failure between the SIC / SNP-CU and the Processor card. Ensure that the SIC or SNP-CU Card is fitted correctly. If error code 6X is displayed and the Card is correctly fitted in the slot then change the Card.

58. Error code 6X is still displayed even though the SIC or SNP - CU Card has been changed.

59. Change the Processor Card in accordance with the instructions given in chapter 7.

60. Error code 6X still displayed even though the Processor Card has been changed.

61. Change the Backplane in accordance with the instructions given in chapter 7.

62. Error code 7X (slot number) when displayed, signifies that either the SIC or SNP-CU Card is defective i.e has failed Self test, if so see 63.

63. Change the SIC or SNP -CU, if this does not clear the error code, change the Processor Card and if not successful, the Backplane.

64. Error code 8X (slot number) when displayed, signifies EPROM check-sum error on the SIC or SNP-CU Card.

65. Change the EPROM, if this is not successful, change the Processor Card and again, if unsuccessful, change the Backplane.

66. Error code 90 signifies that Slot 0, port 0 is defective. This port is reserved for Diagnostics access.

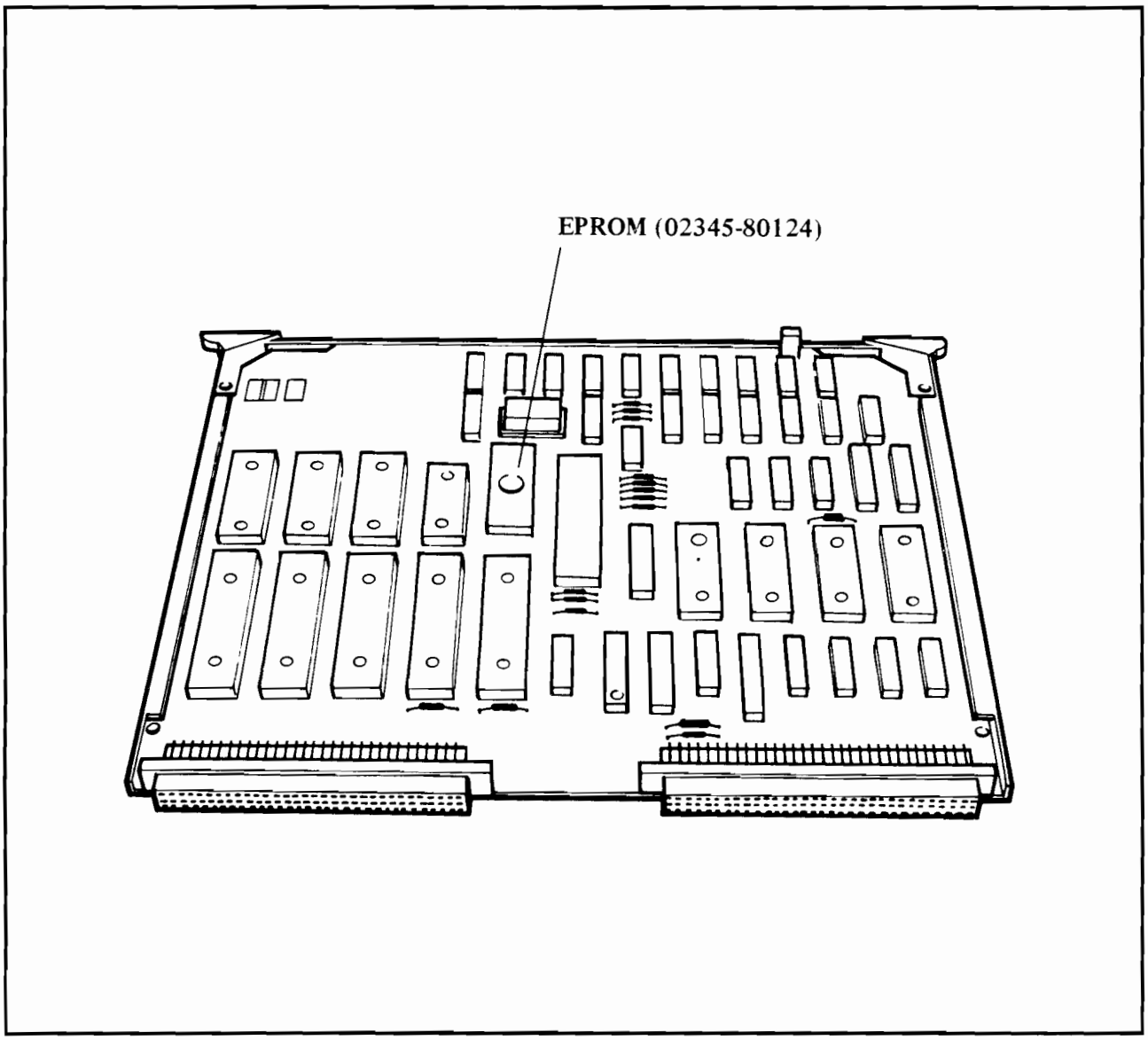


Figure 6-8 EPROM Location on SIC

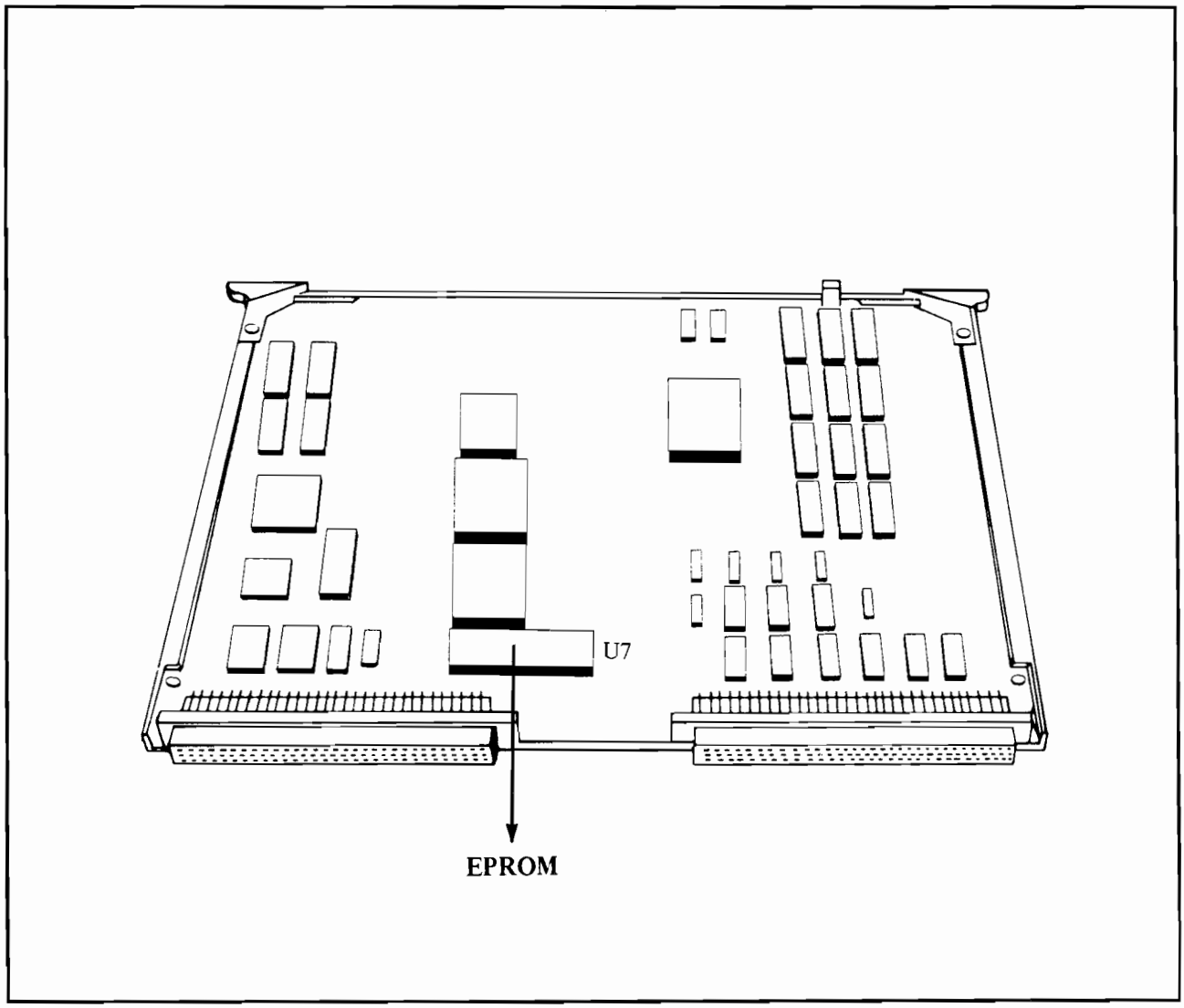


Figure 6-9 EPROM Location on SNP-CU

67. The CC in slot 0 is defective, change the CC Card, if the code is still displayed, change the SIC Card.

68. Error code AX (slot number) when displayed, signifies that either the CC Card or SNP-LA card in slot number X has all of its ports defective or there is actually no Card installed in slotX.

69. Install or replace the CC Card or a SNP-LA Card into slot X.

70. If a CC or SNP-LA Card is installed in slot X and error code AX is still displayed.

71. Replace the SIC or SNP-CU Card in accordance with the instructions given in chapter 7.

72. Error code AX still displayed after replacing the Cards.

73. Replace the Backplace in accordance with the instructions given in chapter 7.

74. Error code BX (slot number) when displayed, signifies that some of the ports are defective.

75. It is possible at this stage to run the Diagnostics program to determine the which of the ports are defective. Detailed information on how to use the Diagnostics program is given in section "Diagnostics program" later in this chapter.

76. Error code DX (slot number) when displayed, signifies an external communication failure, this can be either the cable connector or peripheral device.

Note

Error code DX only applies to the SNP-LA Cards and does not apply to the SIC/CC.

77. Check the external cable and connector to ensure that it is correctly plugged in and that all connections are intact.

This concludes the list of Self Test error codes that can be displayed. At this stage the Download is taking place, see 55 . Information associated with the Download can be found in the next section.

Download Troubleshooting

On the successful completion of the Self Tests a Boot Request is sent to the Openview Workstation or Host. The status of the Download is displayed on the front panel Display in the form of hexadecimal codes. By using the faultfinding flow chart shown in figure 6-10 and a knowledge of the error codes associated with the Download, you should be able to determine in which area the problem lies.

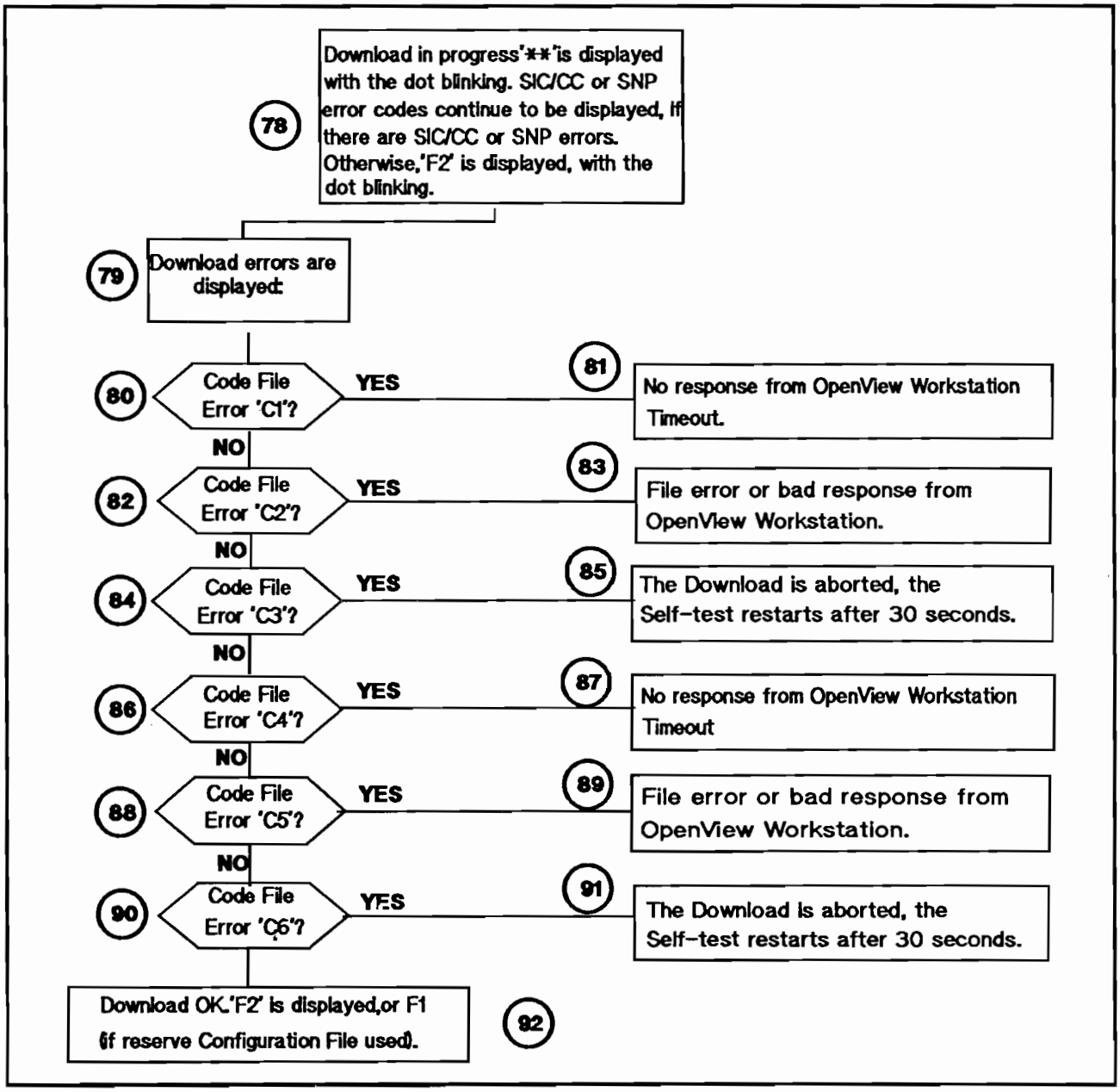


Figure 6-10 Troubleshooting at Download

78. The Download in progress,'**' is displayed with the dot blinking, On sucessful completion of the Download, F2 with the dot blinking is displayed.

79. If there are errors during the Download they will be displayed upon the Display. The error codes associated with the Download can be defined as follows:

- C1: No response from the Host or Openview Workstation.
- C2: Operating code file error.
- C3: Download aborted, H/W or S/W error.
- C4: Configuration file error.
- C5: Configuration file error.
- C6: Download aborted, H/W or S/W error.

Note

The Download and Configuration file errors are described in chapter 4- Power-Up and Set-Up Procedures.

80. Error code C1 signifies that the Host or Openview Workstation has not responded to a Download Request from the DTC. .The DTC stops on this Code File error 'C1' until the problem has been resolved. The DTC keeps on asking for the operating code file every 30 seconds, and when at last the Host or OpenView Workstation responds, then the Download takes place.

81. If error code C1 displayed, there are several possible causes:

- The Host or OpenView Workstation has not yet completed its Power-Up sequence.
- Communications failure between the Host or OpenView Workstation and LAN.
- The DTC has not been configured into the Host or OpenView Workstation
- The DTC "Nodal Address" is incorrect or misconfigured. Run the Diagnostics program to check the address.
- The DTC Boot Multicast Address is incorrect. Run the Diagnostics Program to check that the default address is 090009000004 (hex).

82. Error code C2 signifies that possibly the wrong operating code is being downl oaded from the Host or OpenView Workstation to the DTC. The protocol in use in the DTC and the one in use in the Host or OpenVIew W'orkstation are not matched or are desynchronized.

83. If error code C2 displayed, check that the operating code file in the Host or OpenView Workstation has not been corrupted, or that the code file is not a DTC file (maybe in a different format, or different software.

84. Error Code C3 signifies that a serious internal error (hardware or software) has occurred.

85. The Download is aborted and the Self Test sequence restarts. Check the Self Test error codes to determine the faulty area.

86. Error Code C4 signifies that there has been no response, after 30 seconds from the Host or OpenView Workstation to a Configuration-Download Request from the DTC.

87. If error code C4 displayed, the probable causes are similiar to those for 'C1' except C4 relates to the DTC Configuration file information rather than to the code file.

- The Host or OpenView Workstaion failed after loading the operating code.
- The LAN connection has just failed or is busy.

88. Error Code C5 signifies that there is a Configuration file error, or a bad response to the DTC Request.

89. If Error Code C5 displayed, there are several reasons for the error:

- The Host or Openview Workstation software is incompatible with the downloaded DTC operating code.
- The Host or OpenView Workstation has difficulty in reading the Configuration file.

90. Error Code C6 signifies that there is a serious hardware or software fault.

91. The Download of the Configuration files will be aborted and the Self Test restarts after 30seconds.

92. On completion of a successful Download code F2 will be displayed with the dot ON.

Upload Errors

Other errors which are displayed on the Display are those errors associated with the Upload of memory from the DTC to the Host or OpenView Workstation via the LAN. An Upload is automatically started by the DTC when it senses that there is a serious fault and it acts before all the contents of the memory are lost. Alternatively the Upload can be started by a command issued by the DTC Manager or TermDSM,see *Using the OpenView DTC Manager.*

The flow chart shown in figure 6.11 provides the HP CE with a step by step guide to solving problems during the Upload and the steps are futher explained in the accompanying text.

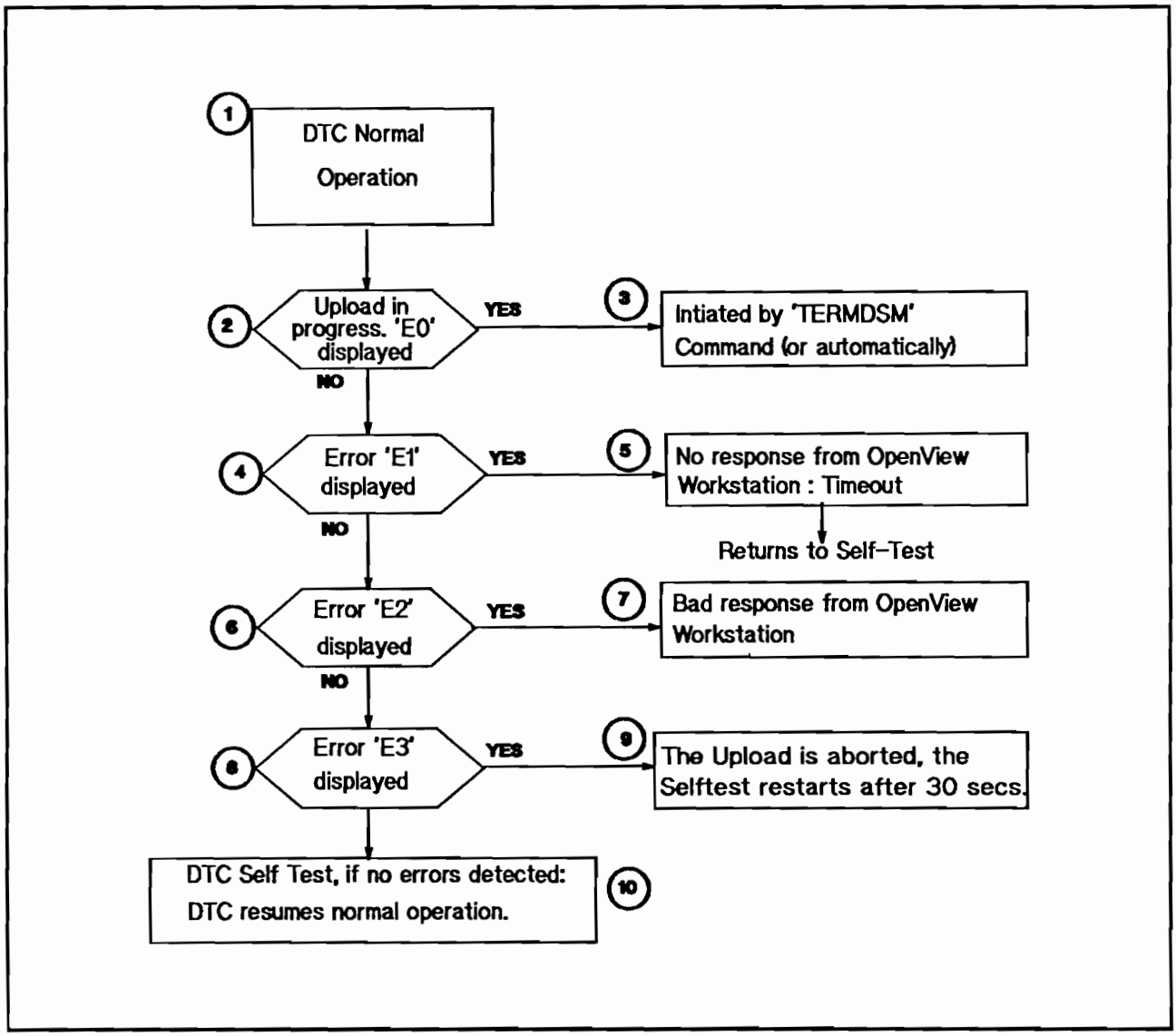


Figure 6-11 Flowchart depicting the Upload

1. DTC normal operation, either F2 or F1 displayed.

2. Error code E0 with the dot blinking, signifies that the Upload is in progress. The dot continues blinking until the Upload is complete,then it is extinguished. If problems are encountered during the Upload, then error messages are displayed on the Display, these are defined below:

- E1: No Host or OpenView Workstation response to the DTC Upload Request.
- E2: Bad response from the Host or OpenView Workstation.
- E3: Upload has been aborted, Self Test repeated.

3. The Upload can be started by the TermDSM Command file on the Host Computer or the OpenView Workstation; it can also be started automatically on error detection.

4. Error code E1 signifies that there is no Host or OpenView Workstation response to the DTC Upload Request or a DTC Write Request after a wait period of 30 seconds.

5. This error is similiar to the error C1 (see 81) and is caused by the same faults as those described for C1.

The DTC keeps on asking for an Upload for 30 seconds then the DTC returns to the Self Test. A possible reason for this is that the Host or OpenView Workstation has had difficulty in writing the Upload file into its memory, or there are protocols problems.

6. Error code E2 signifies that there has been a bad response from the Host or Openview Workstation to the DTC Upload Request. It means that a problem has occurred with the Host or Openview Workstation during the Upload and the Upload has been aborted.

7. The OpenView Workstation has had difficulty writing the Upload file into its memory, or protocol problems exists. The DTC waits for a short while to see if the Host or OpenView Workstation will respond. If the response is still bad then it returns to the Self Test.

8. Error Code E3 signifies that the Upload has been aborted. A serious hardware or software error has been detected.

9. The Upload is aborted and the Self Test is restarted.

This concludes the section on Error Codes, the alternative method of fault location is the Diagnostics Program.

The Diagnostics Program

The Diagnostics program is a fault diagnosis facility which is present in the firmware of the DTC which enables the HP CE to perform the following tasks:

- To identify and localise faults on the principal circuit cards i.e Processor card, SIC/CC, SNP-CU/LA and external cable connections.
- To allow the DTC's LAN Nodal/Multicast addresses to be read, edited and up-dated.

Note

One part of the Diagnostics program is used to test the connection from the DTC to a terminal/printer. This is known as the Terminal Loopback Test. You can also check the cables between the DTC and terminals without running the Diagnostics program. This is done during the Diagnostics execution: all the characters typed on the keyboards of terminals connected to the DTC are echoed by the DTC during the Self Test. The terminal can be configured at any speed; it only needs to be in the 'remote' mode. If the characters typed on the keyboard are well echoed by the DTC then this shows that the cables connected to the terminal are satisfactory.

There are two versions of the Diagnostics program stored in the firmware of the DTC:

- Asynchronous version, this is run when the DTC only contains the aysnchronous communications cards (SIC/CC), or if it contains a single synchronous card which has failed.
- Synchronous version, this is run when the DTC contains at least one synchronous card which is functioning correctly.

When to access the Diagnostics Program

The Diagnostics program can only be accessed when the following conditions exist:

- When an error has been detected during the Self Test and it stops at 30.
- During the SIC/CC or SNP-CU/LA error code cycling sequence i.e (at the end of the Self test).
- During the Download.

The Diagnostics can be run whenever the dot is blinking on the Display; once the Download is complete it is NOT possible to run the Diagnostics program.

How to Access the Diagnostics Program

The Diagnostics program is controlled via a terminal connected directly to the DTC, operating temporarily as a local console. The terminal must be connected to port 0 of the asynchronous card installed in slot 0. The asynchronous Connector Card can be any one of the three different Connector types which can be installed in the DTC, i.e RS-232-C Direct Connect, RS-232-C Modem Connect or the RS-422 Direct Connect.

Note

The modem control signals are not managed by the Diagnostics program (only the Transmit Data, Receive Data and the Signal Ground are used). It is not possible to connect the local console to the DTC via modems, even if a RS-232-C Modem Connect is plugged into slot 0. If a RS-232-C Modem Connect card is plugged into slot 0 then it is possible to connect the local console directly into port 0 of this CC, via the standard modem terminal cable for the particular terminal (see chapter 3 of this manual for cabling details)

To access the Diagnostics program the following procedure must be performed:

1. Connect the local terminal to port 0, slot 0.

2. Switch ON the terminal and set the configuration as follows:

- BAUD RATE: 9600 baud
- DATA BITS: 8
- PARITY : None
- HANDSHAKE: Disabled
- STOP BIT : 1
- FULL DUPLEX
- CHARACTER MODE (BLOCK mode OFF)
- AUTOMATIC LINE FEED :Disabled
- REMOTE FEED

3. Press CTRL and P keys simultaneously.

At this stage either the asynchronous communications or the synchronous communications Diagnostics program is displayed depending whether SNP-CU/SNP-LA cards are installed in the DTC. The Diagnostics screens applicable to the Synchronous DTC are described in section Synchronous Diagnostics Program.

Asynchronous Communications Diagnostics Program

The screen displays menus applicable to DTC when only the asynchronous communications facility is available.

On completion of the Diagnostics access procedure shown above, the screen as shown in figure 6-12, is displayed.

```
                    DTC 2345 LOCAL CONTROL MODE

PROCESSOR CARD ROM 1 : P/N 02345-80155   ROM VERSION A.00.02.001

PROCESSOR CARD ROM 2: P/N 02345-80165

SER. INT. CARD   ROM 0 : P/N 02345-80123   ROM VERSION A.00.01.016
SER. INT. CARD   ROM 1 : P/N 02345-80123   ROM VERSION A.00.01.016
SER. INT. CARD   ROM 2 : P/N 02345-80123   ROM VERSION A.00.01.016
SER. INT. CARD   ROM 3 : P/N 02345-80123   ROM VERSION A.00.01.016
SER. INT. CARD   ROM 4 : P/N 02345-80123   ROM VERSION A.00.01.016
SER. INT. CARD   ROM 5 : P/N 02345-80123   ROM VERSION A.00.01.016

    FOR SELF DIAGNOSTIC                 type D
    FOR LAN ADDRESS CONFIGURATION       type L
    FOR RESET                           type R
    please enter your command and press return
```

Figure 6-12 DTC Local Console Mode - Menu Screen

Note

The menu screen displays the HP part number (P/N) and ROM firmware version number for each of the SICs and Processor Card ROMs installed. This is the only way to find out the version number of the firmware installed in the DTC. (note:only the part number is physically displayed on the ROMS).

The DTC Local Control Mode Menu

This menu give you the choice of three functions:

```
FOR  SELF DIAGNOSTIC     type D
```

This test provides a comprehensive report of the results of the Self Test, and allows you to conduct external loop-back tests on the asynchronous ports of the DTC.

```
FOR  LAN ADDRESS CONFIGURATION  type L
```

This function allows you to review and, if necessary, to modify the LAN Nodal and multicast addresses of the DTC configured in the factory.

```
FOR  RESET   type R
```

Allows you to exit from the Self Diagnostics program, and restart the Self Test.

To select a function, press the appropriate letter followed by carriage return (Enter).

Note

Only upper case letters are permitted.

Self Diagnostics

The Self Diagnostics Test gives a full report of all the CC and SIC errors which have been encountered during the Self Test. It also provides an external loopback testing facility using the loop back connector or a terminal connected to any port of the DTC. This tests the full connection from the Processor Card to the port including the driver/receiver chips on the CCs. Note that during the Self Diagnostic Test, the SIC, LEDs and the Display activities are not important.

For the test to function properly it is essential that the CC in slot 0 is functioning properly in order to establish connection with the local console.

Procedure

To access the Self Diagnostics test, press:

D ↵

Note that ' ↵ ' represents the carriage return (Cr) character generated by pressing the terminal's Enter or Return key.

The local console screen displays a full report of the results of the SIC and CC Self Tests, in the following format, as shown in figure 6-13.

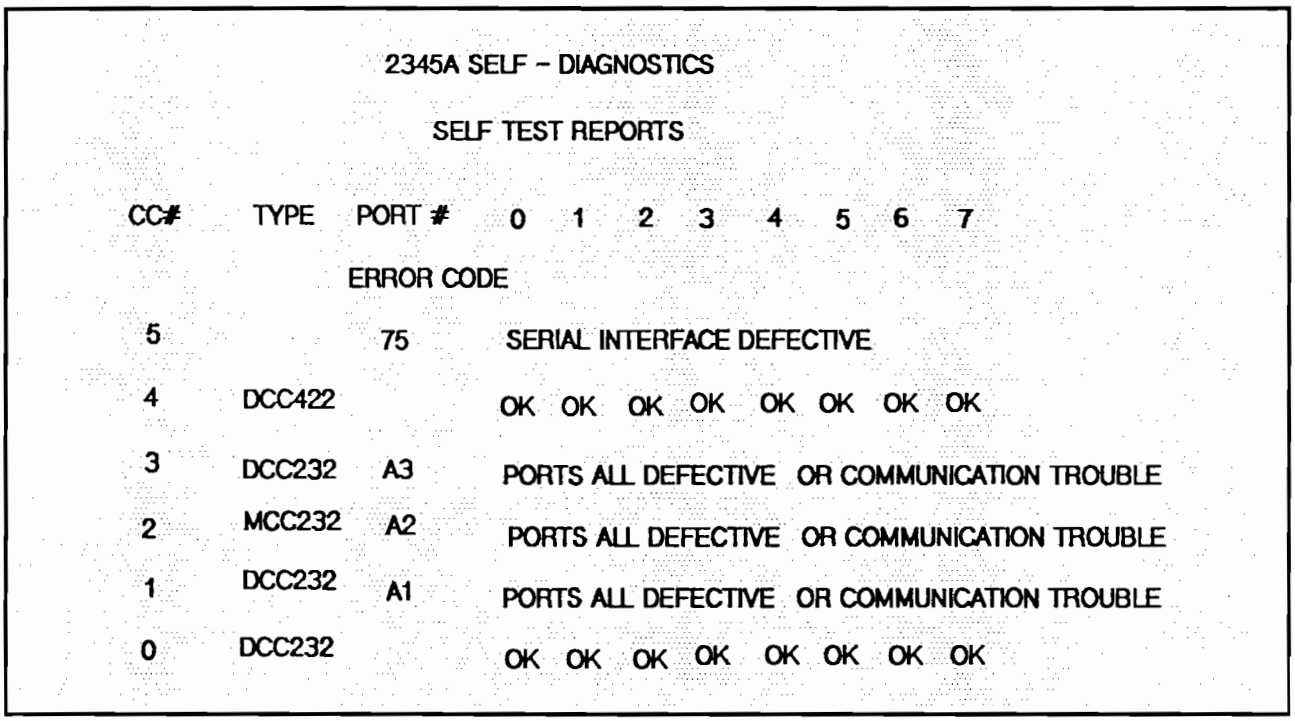


Figure 6-13 Self Diagnostics Report Screen

This screen displays the following information:

- The CC number identifying the slot tested (0 to 5).
- The TYPE of the CC (either RS-232 Direct Conect, RS-422 Direct Connect or RS-232-C Modem Connect).
- The ERROR CODES encountered during the previous test.
- The status for each PORT NUMBER (0 to 7) on the CC, during the internal loopback test. If the port is functioning correctly then it is described as 'OK', and if not, then described as BAD.
- If a SIC is defective, then error message:

  SERIAL INTERFACE DEFECTIVE

  is displayed.

The Self-Diagnostics program then prompts you for specific information. Each reply must be followed by a carriage return " ↵ ", mistakes can be rectified by using the BACKSPACE key.

Screen prompt:

```
ENTER THE CONNECTOR CARD # TO BE TESTED

ESC TO EXIT
```

In the response to the prompt you must enter a number between 0 to 5 , corresponding to the location in the DTC , followed by " ↵ ".

If the number is out of range, or it corresponds to a CC or SIC which is absent, then the message:

```
ERROR
```

flashes on the screen and the prompt is repeated until a valid number is entered.

Note

It is not possible to test ports on a CC which has the Self Test error codes '6X', '7X', '8X' or 'AX'.

When a number has been entered, the screen displays the results of the loopback test, the screen is as shown in figure 6-14

```
LOOPBACK TEST          CONNECTOR PORT # 0

PORTS                  0   1   2   3   4   5   6   7

SELF TEST              OK  OK  OK  OK  OK  OK  OK  OK

SELF DIAG

LOOP #
```

Figure 6-14 Loopback Connector Test Screen

The information displayed represents the results of the Self Test i.e OK or BAD, for each of the ports (0 to 7) on the CC under test. Below the information the following prompt is displayed:

```
ENTER THE TEST I.D (L=LOOPBACK T=TERMINAL

 ESC TO EXIT
```

Press 'L' or 'T' followed by " ↵ ".

The Self Diagnostics proceeds either to the Loopback or Terminal Mode. The Loopback Mode tests the port using a loopback connector installed, while the Terminal Mode sends data to a terminal connected to the port to be tested, and reads the data sent back.

The Loopback Connector Test

This tests the CC ports using a loopback connector. These are described earlier in this chapter and simply plug directly into the appropriate port at the rear of the DTC.

Before the test begins you are prompted to plug the loopback connector into place.

The loopback test is performed at all Baud rates (300,1200,2400,4800, 9600 and 19200 bps). For Modem ports , the 'Transmit Data','Receive Data', and all the control lines are tested. The Modem loopback connector connects the following signals together: 'TX data' to 'RX data' (pin 3 to pin 2), 'Data Signal Rate Selector' to 'Ring Indicator' (pin 23 to pin 9', 'Data Terminal Ready' to 'Data Carrier Detect' (pin 6 to pin 5) and 'Request' to 'Send' to 'Data Set Ready' and to 'Clear To Send' (pin 8 to pins 20 and 22). The RS-232-C Direct Connect and RS-422 Direct Connect loopback connectors connect together the 'Tx Data' and 'Rx Data' signals.

To start the Loopback Test:

Press L followed by " ↵ ".

Then press either A for ALL, or the CC port number followed by " ↵ " in reponse to the screen message:

```
ENTER THE PORT#TO BE TESTED (A=ALL, 0...7)

ESC TO EXIT
```

For example to test all ports:

Press A followed by " ↵ "

The following prompt is displayed:

```
NUMBER OF TIMES 0 TO 32767,
0 for infinite loop, default=1,
ESC TO EXIT
```

Enter the number of times that the ports are to be tested followed by " ↵ ".

The following message is displayed:

```
PLUG IN THE LOOPBACK CONNECTOR,
P/N XXXXX XXXXX, RETURN when done,
ESC TO EXIT
```

The appropriate loopback connector should now be plugged into the port(s) to be tested. The loopback connector part numbers are as follows:

- HP part number 30148-60002 for the RS-232- Direct Connect.
- HP part number 30147-60002 for the RS-422 Direct Connect.
- HP part number 02345-60010 for the RS-232-C Modem Connect.

The test begins as soon as the " ↵ " key is pressed.

During the tests the cursor flashes up on the screen under the port number which is currently being tested. The loop counter (LOOP #) at the bottom of the screen is incremented after each loop of the test. The cursor continues to indicate the port being tested until the end of testing when the screen displays the status i.e OK or BAD for that port. The User is then prompted for another port to test. If a port is defective and only one port is being tested, then the testing for that port halts after the first bad loop test, the screen displays the message 'BAD' for that port, and the User is prompted for another port number to test.

When more than one port is being tested then the test continues to test every port, even if one port is defective. It only stops testing when it finds all ports are defective.

When one port, or several ports, are being tested then the test is stopped (aborted) when the 'S' key is pressed.

The following screen message is displayed on the screen during the loopback test:

```
PRESS S TO ABORT THE LOOP ON TEST
```

When the testing is finished, press the "ESC" key to return to the Self Test Report screen, (see figure 6-13)

This information represents the results of the Self Tests i.e OK or BAD for each of the ports (0 to 7) on the CC under test. Below this information the following prompted is displayed :

```
ENTER THE TEST I.D  L=LOOPBACK T=TERMINAL

ESC TO EXIT)
```

Terminal Loopback Test

This test sends all ASCII printable characters to, and reads this data back from a terminal connected to any port on the DTC. The character sequence is displayed as follows:

```
!"#$&'()*+,-.0123456789:;?@ABCDEF

GHIJKLMNOPQRSTUVWXYZ[\]_

abcdefghijklmnopqrstuvwxyz{|}~
```

Only the 'Transmit Data' and 'Receive Data' signals are tested. In the case of modern connectors, no Handshake is performed with the control signals, and the terminal must be connected directly by its modem cable (see Chapter 3 of this manual for cabling details) to the port to be tested.

Press 'T' at the prompt for the Test I.D, and then pressing " ↵ " selects this test. The screen then displays the test information in the format shown in figure 6-15.

The information represents the results of the Self Test, i.e OK or BAD, for each of the ports (0 to 7) on the CC to be tested.

Below this screen information is the following:

```
ENTER THE PORT TO BE TESTED

(A=ALL, 0...7,ESC TO EXIT).
```

To test one port on the CC, then press the number of that port and press " ↵ ".

To test all the ports on the CC,

press 'A' then " ↵ "

The following prompt is displayed:

```
NUMBER OF TIMES  0 to 32767,
0 for infinite loop,default=1
ESC TO EXIT).
```

Enter the number of times that the selected port(s) should be tested and press " ↵ ".

The following message appears on the screen:

```
CONNECT A TERMINAL (9600 baud,8 bits,
RETURN when done,  ESC to EXIT).
```

Terminals must be configured to the appropriate port(s) and the terminal configuration modified accordingly (i.e 9600 baud, 8 bits and 1 stop bit). The supported terminals are shown in chapter 3.

Testing starts as soon as the " ↵ " **key is pressed. During testing the cursor flashes up on the screen under the port number which is being tested. The loop counter (LOOP #) at the bottom of the screen is incremented after each pass of the test. The cursor continues to indicate the port being tested until the end of testing, the screen then displays the status (OK or BAD), for that port, and the User is prompted for another port number to test. If a port is defective and only one port is being tested, testing halts after the first loop, the screen displays the message BAD for that port and the User is prompted for another port number to test. When more than one port is being tested, then the Test continues to examine every port (even if one port is found to be bad). It only stops testing when all of the ports are bad.**

The following message is displayed on the screen during the Terminal Loopback test:

```
PRESS S TO ABORT THE LOOP ON TEST
```

This means that the test can be aborted at any time by pressing the 'S' key. When the testing is finished, then press ESC to return to the Self test Report screen as shown in figure 6-13.

LAN Address Reconfiguration

This function allows you to review and, if necessary, to modify the LAN addresses of the DTC configured in the factory.

The DTC has two LAN addresses, the 'Nodal Address' and the 'Multicast Address, each are 48 bits long and are stored in non-volatile RAM on the Processor card. These addresses are defined at the factory and labelled on the internal metal plate at the front of the DTC box.

The Nodal Address is used by the Host computer to identify the DTC as a Node in the network. The factory pre-defines a specific address for each DTC, which is different from all other LAN address used on the IEEE 802.3 networks. If the Processor Card is replaced, then the Nodal Address of the 'old' Processor card must be configured on the 'new' Processor Card.

The Multicast Address is used by the DTC for the Download of operating code and configuration files. All DTCs use the same Multicast Address, which is 090009000004 (in hex). The Multicast Address will only need to be modified if this address is used by non-HP equipment, and if this equipment is connected on the same LAN.

Press '1' followed by " ↵ ", at the Local Mode Console Menu (see figure 6-12) selects the LAN Address Reconfiguration function. The screen displays both Nodal and Multicast Addresses and prompts you for a password to continue the program, as shown in figure 6-15

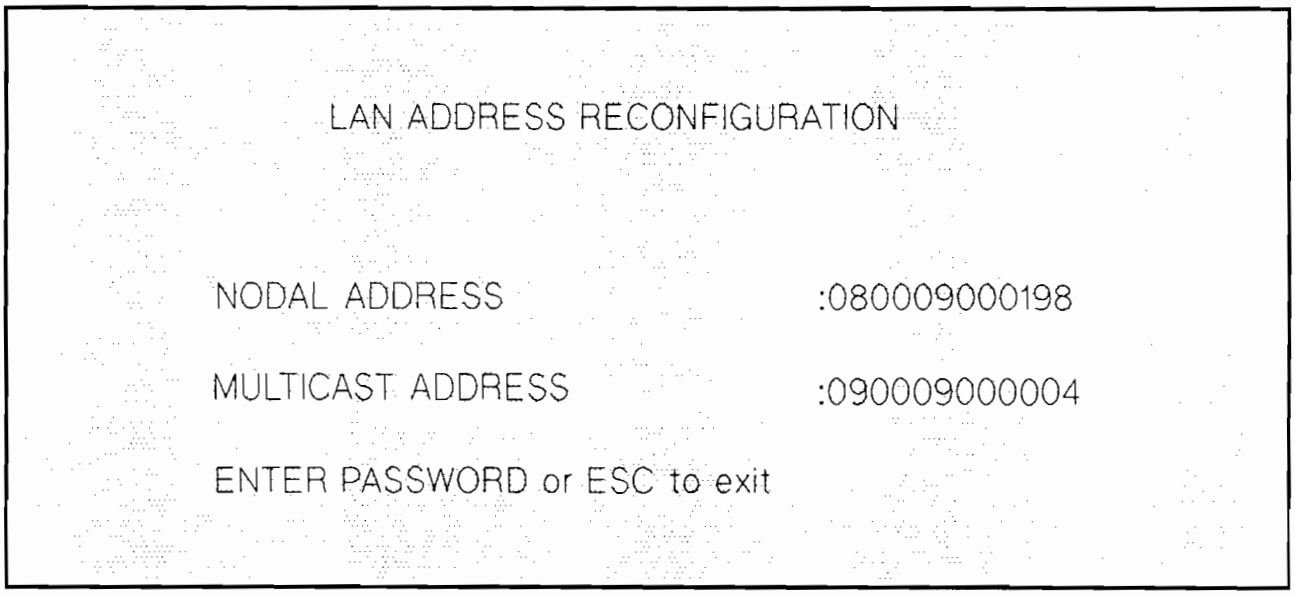


Figure 6-15 Example LAN Address Reconfiguration

Note The password is 'AVESTA'.

To continue with the LAN Reconfiguration, type AVESTA. and " ↵ ".

To correct a password mistake, use the BACKSPACE key.

If the password is valid, then the following message appears on the screen:

```
Enter new NODAL ADDRESS or

ESC for no change:
```

To enter a new Nodal Address, you must observe the following rules, (if these are not observed, the Address is always rejected):

- The address must consist of 12 hexadecimal digits (6 bytes)
- Digits must be in the range 0,9 or A,F.
- The least significant bit of the second hexadecimal digit of a Nodal Address must be 0 (the first byte must be even).
- A Nodal Address must NOT be FF FF FF FF FF FF (H).

Use the BACKSPACE key to correct mistakes when typing the address. Press " ↵ " to enter the new address.

If the new Nodal Address has been entered correctly, the following prompt is displayed:

```
Enter new MULTICAST ADDRESS or

ESC for no change:
```

To enter a new Multicast Address, the User must observe the following rules (otherwise the address is rejected):

- The Address must consist of 12 hexadecimal digits (6 bytes).
- Digits must be in the range 0,9 or A,F.
- The least significant bit of the second hexadecimal digit must be '1' (i.e. the first byte must be odd).
- Must NOT be FF FF FF FF FF FF (Hex).

Use the BACKSPACE key to correct mistakes when typing the address. Press ' ↵ " **to enter the new address.**

If the new Multicast Address has been entered correctly, then the following prompt is displayed:

```
The new addresses are
```

```
NODAL ADDRESS: yyyyyyyyyyy

MULTICAST ADDRESS: zzzzzzzzz

ENTER M(odify) or S(ave) or ESC for exit.
```

Press 'M' to modify again the addresses,'S' to store the new addresses in the NOVRAM or ESC for exiting without modifying anything. If the 'S' key is pressed, the following message is displayed:

```
ADDRESSED STORED
```

Turn the power OFF then ON and re-enter the Diagnostics program Check the LAN ADDRESS again.

Press any KEY to exit.

You are advised to turn the power OFF and then back ON again to verify that the new addresses have been stored and can be read again without any error.

If the storing process is unsucccessful the screen displays the error message:

```
NOVRAM FAILED..CHANGE THE PROCESSOR CARD
```

The User may press any key to exit and return to the 'Local Console Mode Menu" screen (Figure 6-13)

Reset

When the 'Local Console Mode' menu is displayed it is possible to restart the Self Test by pressing 'R, followed by " ↵ ". This has the same effect as a power-ON/power-OFF cycle, and it is the way to exit from the Self Diagnostics program.

Synchronous Communications Diagnostics Program

When the DTC contains the synchronous communication cards a different version of the Diagnostics program is available. It enables the HP CE to identify and locate faults on either the synchronous or asynchronous communication cards.

Synchronous Diagnostics Program Access

The Diagnostics Program can only be accessed when the following conditions exist:

- When an error has been detected during the Self test and it stops at 30.
- During the error code cycling i.e after 6X.
- During the Download.

The Diagnostics can NOT be accessed once the Download is complete.

A terminal must be connected to port 0, slot 0, which must be an asynchronous communications card. Details of the installation and setting up the terminal are given in section Diagnostics Program Access .

```
                    D.T.C 2345A CONFIGURATION

SLOT  FRONT CARD   REAR CARD    EXTERNAL DEVICES

 0     SIC         MCC232
 1     SIC         DCC232
 2     SIC         DCC422
 3     SNP CU      SNP LA/MS
 4     SNP CU      SNP LA/MS    CABLES:PORT # 0 = V.36
 5     SNP CU      SNP LA/MS    CABLES:PORT # 0 = RS422


   For FIRMWARE and HARDWARE VERSION          -press V
   For SELF-TESTS RESULTS and DIAGNOSTICS     -press D
   For LAN ADDRESS CONFIGURATION              -press L
   For RESET                                  -press R
```

Figure 6-16 Example of the DTC Configuration Display

When the Diagnostics program is accessed the screen, as shown in figure 6-16,is displayed.

The screen displays the current configuration of the DTC and provides you with the following information:

- Slot shows the slot number..
- Front Card indicates the type of Interface card occupying slot X, either the SIC or SNP-CU.
- Rear Card indicates the type of Connector Card occupying slot X, either the CC, SNP-LA/RS-232-D or SNP-LA/MS
- External Device indicates the external cable, either the V.35, V.36, RS- 232-D or RS 422.

The accompanying menu presents you with a choice of four functions:

- Firmware and Hardware Version indicates the Firmware version and ROM part number.
- Diagnostics provides a comprehensive report of the Self Tests results, and allows you to conduct external Loopback tests on the ports of the DTC.
- LAN Address Configuration allows you to view and, if necessary, to modify the LAN Nodal and Multicast Addresses.
- Reset enables you to exit the Diagnostics program, and to restart the Self Tests.

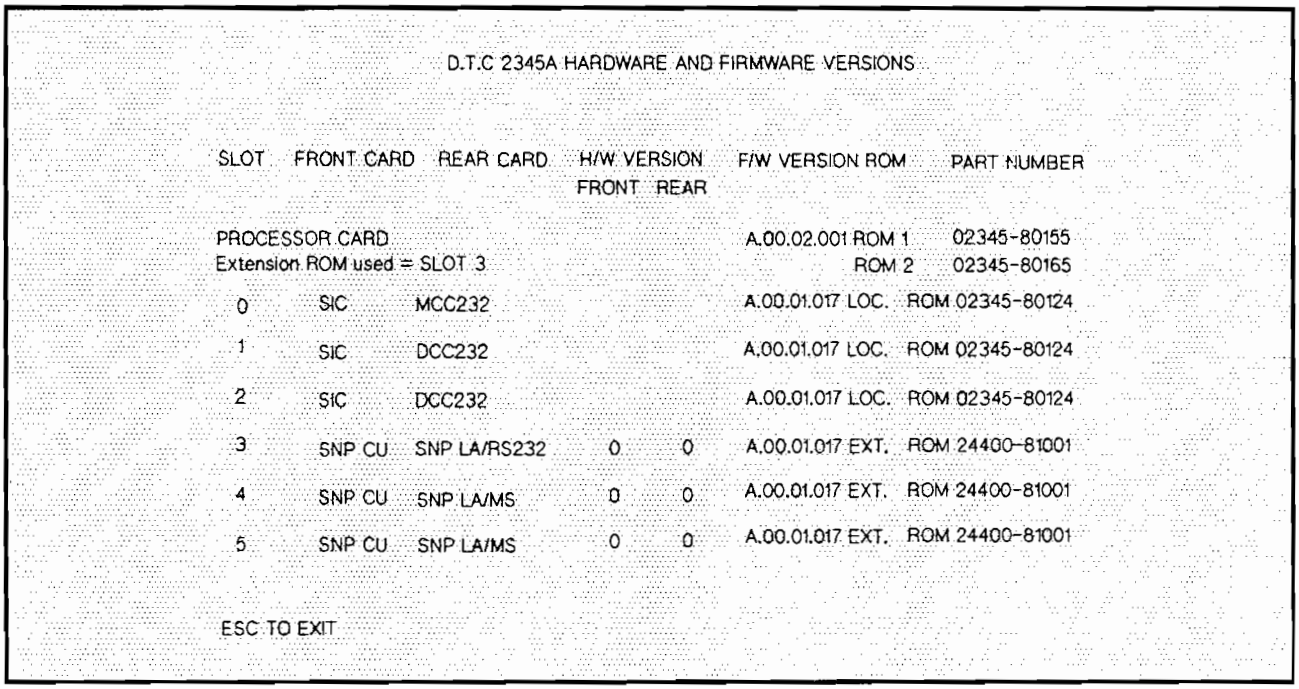
Hardware and Firmware Version

This screen displays the hardware version, the part number of the ROM and the ROM firmware version for the Processor Card and for each of the SIC or SNP-CU Cards. This screen provides the only means of identifying the firmware version installed in the DTC and allows you to check whether the firmware and hardware are compatible.

The screen is selected by pressing option 'V' from the DTC Configuration display.

A full list of the Firmware and ROM part numbers applicable to the DTC are given in Chapter 8.

When a slot is unoccupied a series of X characters are displayed, in all other cases when a SNP-CU or SIC Card is installed, 00 is displayed.



D.T.C 2345A HARDWARE AND FIRMWARE VERSIONS

SLOT	FRONT CARD	REAR CARD	H/W VERSION FRONT	H/W VERSION REAR	F/W VERSION ROM	PART NUMBER
PROCESSOR CARD					A.00.02.001 ROM 1	02345-80155
Extension ROM used = SLOT 3					ROM 2	02345-80165
0	SIC	MCC232			A.00.01.017 LOC. ROM	02345-80124
1	SIC	DCC232			A.00.01.017 LOC. ROM	02345-80124
2	SIC	DCC232			A.00.01.017 LOC. ROM	02345-80124
3	SNP CU	SNP LA/RS232	0	0	A.00.01.017 EXT. ROM	24400-81001
4	SNP CU	SNP LA/MS	0	0	A.00.01.017 EXT. ROM	24400-81001
5	SNP CU	SNP LA/MS	0	0	A.00.01.017 EXT. ROM	24400-81001

ESC TO EXIT

Figure 6-17 Example of Hardware and Firmware Version Screen

To exit from this screen and return to the DTC Configuration:

Press 'ESC' followed by " ↵ ".

Diagnostics - You can access the Diagnostics by pressing key 'D' when the DTC Configuration screen and menu is displayed.

The Diagnostics screen, as shown in figure 6-18, provides a full report of the Self Tests results. It displays the type of Interface cards i.e SIC, SNP-CU and CC or SNP LA occupying slot number X, its Identification Code (see NOTE), the detected error code and its description.I also allows you to perform loopback tests on the CC and/or the SNP LA/RS-232-D/SNP LA/MS cards. To perform these tests you must have available the loopback connectors as shown in Table 6-1.

Note

The identification codes displayed are:

0117 (Hexa) = Synchronous Network Processor Card

0025 (Hexa) = Serial Interface Card (SIC)

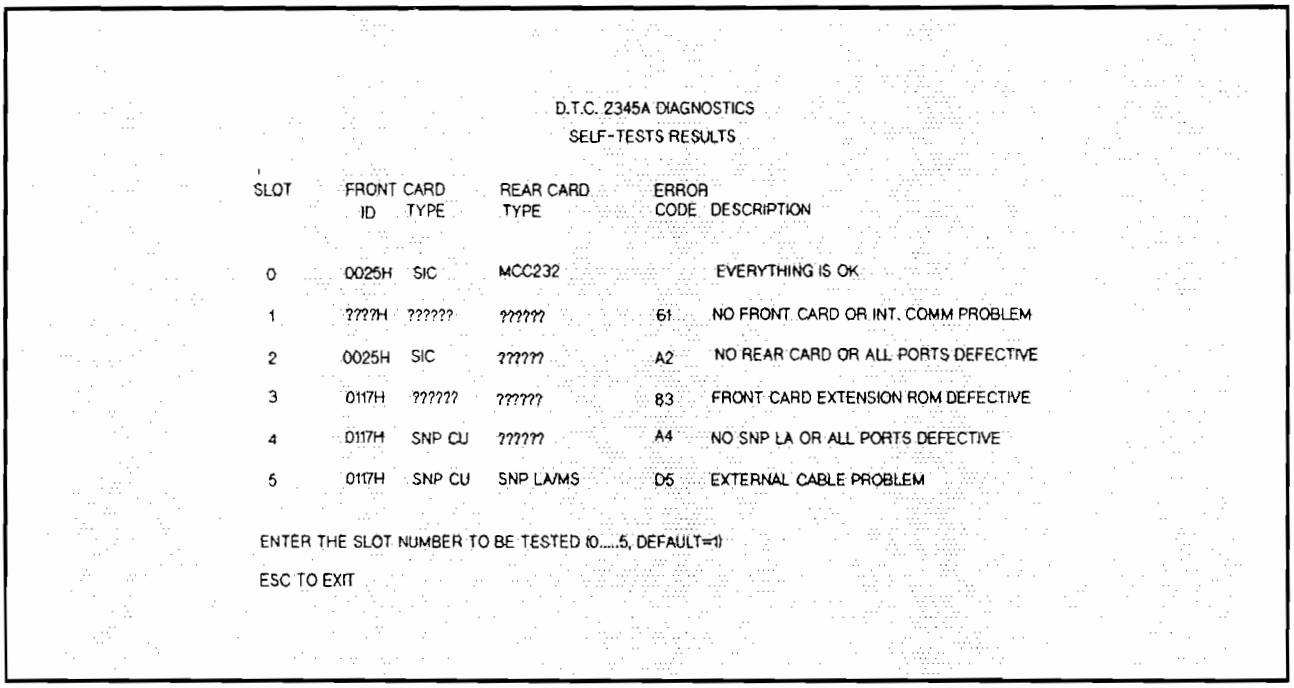


Figure 6-18 Example of Self Tests Results Screen

The error codes which are displayed on the screen are described in detail in section *Faultfinding Using the Self Test* of this chapter

Note

FRONT CARD can be either a SIC or SNP CU card. They are installed in the front card cage assembly.

REAR CARD can either be one of the Connector Card types for asynchronous communications and/or one of the SNP LA synchronous communications

A screen prompt in the lower portion of the screen allows you to perform loopback tests on the cards in a specific slot or to exit the Self Tests Results and return to the DTC Configuration Screen

Screen prompt:

```
ENTER THE SLOT NUMBER TO BE TESTED
(0....5, DEFAULT = 0 ):
```

ESC TO EXIT

To select a slot to be tested:

Enter the slot number (x) followed by " ↵ ".

Note

If the slot number entered is not correct (out of the permitted range, no I/O card present or error codes 7X (H), 8X (H), AX (H)), the message 'ERROR' flashes up on the screen , and the prompt is repeated until a valid number is entered.

Loopback Tests

The Diagnostics screen provides you with information related to the external loopback tests. The screen displays information in three distinct areas:

- The upper portion of screen displays the selected slot, the hardware configuration, the error code detected during the Self tests and its description.
- The middle portion of the screen displays the ports to be tested and the results of the Loopback tests, i.e either a Pass or Fail result.
- The lower portion of the screen contains a menu that enables you to select the number of tests to be performed, this can either be a single loop, a specified number or an infinite number of loops.

To start the Loopback Tests

To start the loopback tests, simply follow the screen prompts displayed in the lower portion of the screen. These prompts are self-explanatory, however,should you have difficulty you can refer to the section Asychronous Communications Diagnostics which gives a step by step guide to using the program. It is essentially similiar to the Asynchronous Diagnostics Program.

If the chosen slot contains the asychronous communications cards (SIC/CC) the Diagnostic screen as shown in figure 6-19 will be displayed. As there are three possible CC cards you will need to have the following loopback connectors available:

- RS-232-C Direct Connect = Loopback Connector 30148-60002
- RS-232-C Modem Connect = Loopback Connector 02345-60010
- RS-422 Direct Connect = Loopback Connector 30147-60002

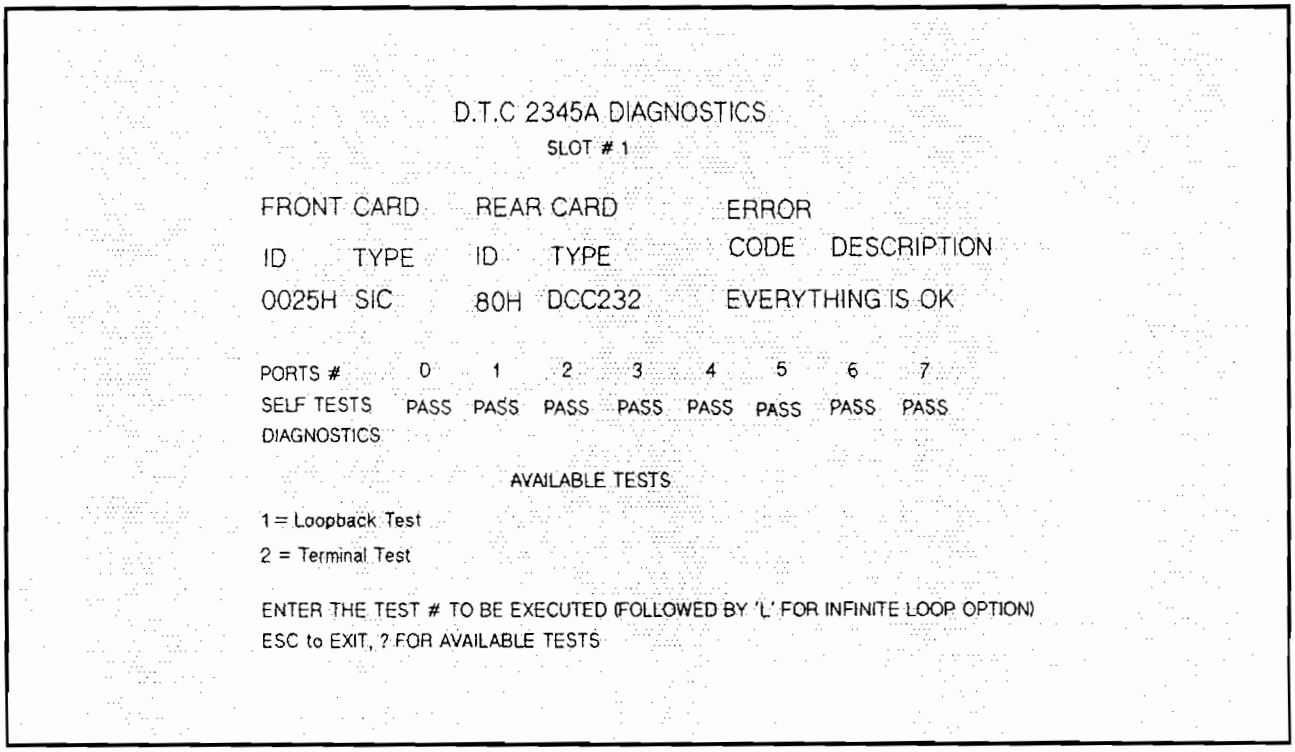


Figure 6-19 Example of Diagnostics Screen

RS-232-D Diagnostic tests

If the slot chosen contains the SNP LA/RS-232-D card you have the choice of two Diagnostic tests, these are:

- SNP Complete Self Test
- SNP LA/RS-232 Internal Loopback Test

The SNP LA Complete Self Test give you the results of the full Self test sequence plus an additional test of the shared RAM. The entire test takes five to six minutes to perform. Either a PASS or FAIL will be displayed on the screen under the tested port.

The SNP LA/RS-232 Internal Loopback Test uses the Quadriloop chip on the RS-232-D card. Either a PASS or FAIL result will be displayed on the screen.

Figure 6-20 shows an example layout of the RS-232-D Diagnostics screen.

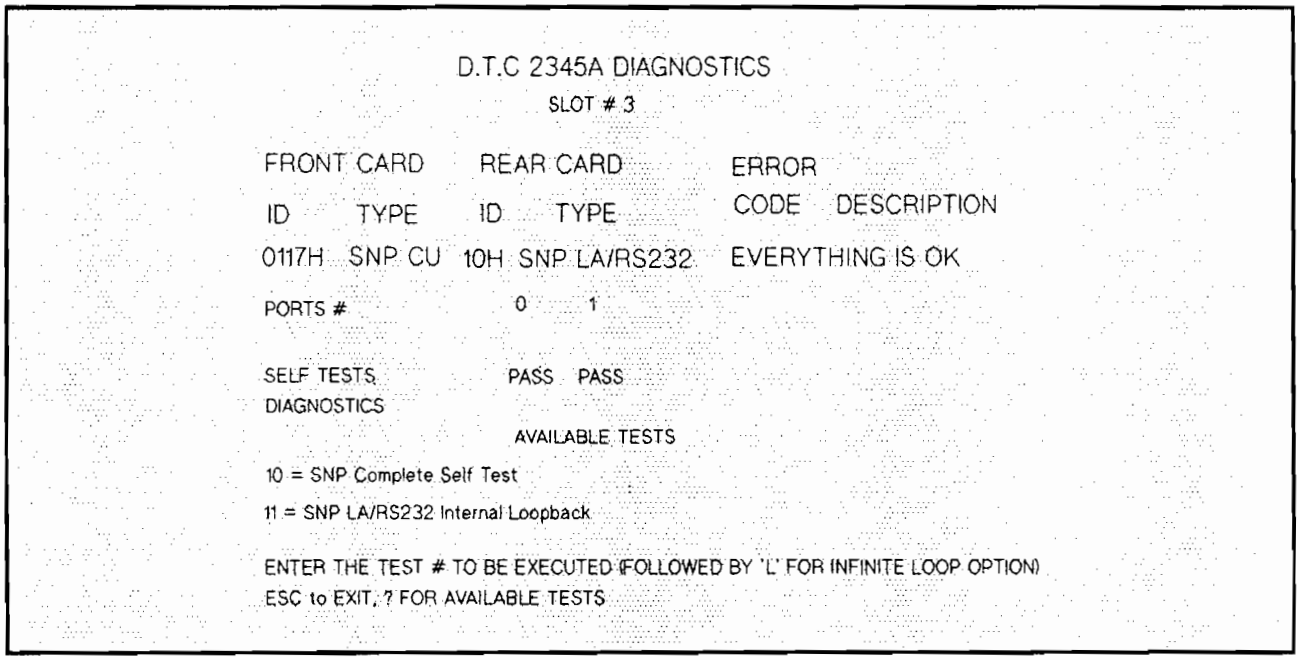


Figure 6-20 Example of the RS-232-D Diagnostic Screen

SNP LA/MS Diagnostic Tests

If the chosen slot contains the SNP LA/MS card you will have the choice of six available tests, four of these depend on the interface standard in use. The tests available are:

- SNP Complete Self Test, type 10 followed by "
- SNP LA/MS Hood Loopback, type 13 followed by "
- SNP LA/MS V.35 Cable Loopback, type 14 followed by "
- SNP LA/MS V.36 Cable Loopback, type 15 followed by "
- SNP LA/MS X.21 Cable Loopback, type 16 followed by "
- SNP LA/MS RS-422 Cable Loopback, type 17 followed by "

The SNP Complete Self Test gives you the full Self Test sequence plus an additional test of the shared RAM. Either a PASS or FAIL result will be displayed on the screen.

The SNP LA/MS allows you to test the SNP LA card irrespective of the interface standard in use. You must have available the Loopback Hood, HP part number 24400-60216. Simply connect the Loopback Hood to the port to be tested and follow the instructions given in the screen prompts. Either a PASS or FAIL result will be displayed on the screen.

The SNP LA/MS V.35 Cable Loopback test allows you to test the V.35 interface cable. You will need to havve available the V.35 interface cable, HP part number 28606-63003 and the V.35 Loopback Hood connector, HP part number 24400-60211. Follow the instructions displayed in the screen prompt when connecting the cable and Hood to the port to be test. Either a PASS or FAIL result will be displayed on the screen.

The SNP LA/MS V.36 Cable Loopback test allows you to test the V.36 interface cable. You will need to have available the V.36 interface cable, HP part number 24400-60202 and the Loopback Hood connector, HP part number 24400-60212. Follow the instructions displayed in the screen prompt when connecting the cable and Hood to the port to be tested. Either a PASS or FAIL result will be displayed on the screen.

The SNP LA/MS X.21 is not currently supported.

The SNP LA/MS RS-422 Cable Loopback allows you to test the RS-422 interface cable. You will need to have available the RS-422 interface cable, HP part number 24400-60203 and the Loopback Hood connector, HP part number 24400-60213. Follow the instructions displayed in the screen prompts when connecting the cable and Hood to the port to be tested. Either a PASS or FAIL result will be displayed on the screen.

Figure 6-21 shows an example of the SNP LA/MS screen with a V.36 Interface cable test.

```
                    D.T.C 2345A DIAGNOSTICS
                          SLOT # 4

FRONT CARD      REAR CARD          ERROR
ID     TYPE     ID    TYPE         CODE   DESCRIPTION

0117H  SNP CU   20H   SNP LA/MS    EVERYTHING IS OK

PORTS #                 0      1
EXTERNAL CABLES         V.36
ID                      5H
SELF TESTS              PASS   PASS
DIAGNOSTICS

                      AVAILABLE TESTS

10 = SNP Complete Self Test          13 = SNP LA/MS Hood Loopback
14 = SNP LA/MS V.35 Cable Loopback   15 = SNP LA/MS V.36 Cable Loopback
16 = SNP LA/MS X.21 Cable Loopback   17 = SNP LA/MS RS422 Cable Loopback

ENTER THE TEST # TO BE EXECUTED (FOLLOWED BY 'L' FOR INFINITE LOOP OPTION)
ESC to EXIT, ? FOR AVAILABLE TESTS
```

Figure 6-21 Example of the SNP LA/MS Diagnostics Screen

Quitting the Diagnostic Tests

When you want to quit the Diagnostic screens and return to the SELF TESTS RESULTS screen:

Press 'ESC', then to return to the DTC CONFIGURATION screen:

Press 'ESC'

LAN Address Reconfiguration

This function allows you to review, and if necessary, to modify the LAN addresses of the DTC configured in the factory.

To select the LAN ADDRESS RECONFIGURATION from the DTC CONFIGURATION screen and menu:

Press 'L' followed by " ↵ ".

The following procedures to change the LAN Addresses are identical to those described in section LAN Address Reconfiguration for the Asychronous communication cards. The HP CE should refer to this section (page 39) for the necessary information.

Reset

When the DTC CONFIGURATION screen and menu are displayed it is possible to reset and restart the DTC Self Test by the following method:

Press 'R' followed by " ↵ ".

The DTC will restart its Self Test sequence. It is possible to re-enter the Diagnostics program by pressing CTRL and P simultaneously if the Self Test stops on 30.

Note

The RESET option is the only way you can exit the Diagnostics program.

This concludes the Diagnostics and Troubleshooting.

7

Removal and Replacement Procedures

Introduction

In the case of failure, the DTC sub-assemblies can be replaced by qualified Hewlett-Packard personnel. The replacement of faulty parts is at sub-assembly level, and not at component level. Chapter 8 lists all the replacement parts together with their part numbers and ordering information This chapter provides the HP CE with the necessary information to replace the following sub-assemblies:

- The DTC cover.
- The CC Cards and/or SNP-LA Cards
- The SIC Cards and/or SNP-CU Cards
- The Backplane
- The Power Supply
- The Fan
- The Field Replaceable Fuses

Warning

The DTC must always be dismantled by qualified Hewlett-Packard personnel only.

Before starting to dismantle the DTC, make sure that the DTC is disconnected from the AC voltage supply by removing the power cable.

Anti-static handling procedures should be followed when removing or replacing any of the DTC cards.

DTC Cover Removal/Replacement

The cover of the DTC is removed by following the instructions listed below. Before attempting the dismantle the DTC, ensure that appropriate tools are available, these can be listed as follows:

- 5 mm flat-bladed screwdriver
- 8 mm flat-bladed screwdriver
- medium sized cross head screwdriver
- suitable long nosed pliers for working on electronic equipment

If the DTC is mounted within the HP 1000 mm rack (HP part number 46298B), HP 720mm rack (HP part number 46298A) or 1600mm rack (HP part number 46298C). You should refer to *Chapter 3- Installation Procedures, section Rack Mounted Installation* for details on how to remove the DTC from the rack

With the DTC mounted on a bench, the procedure to remove the cover and front panel is as follows:

1. The front panel is secured by means spring clips on fixed to base and top cover of DTC. To remove, simply grip the sides of the Front panel and firmly pull outwards.

2. The top cover is secured to the base by means of 6 slotted machine screws. Using the 5mm flat bladed screwdriver, remove each screw.

3. Pull the cover outwards at either side, and then push it backwards to remove it from the DTC.

4. To replace the cover, repeat the previous steps in reverse order.

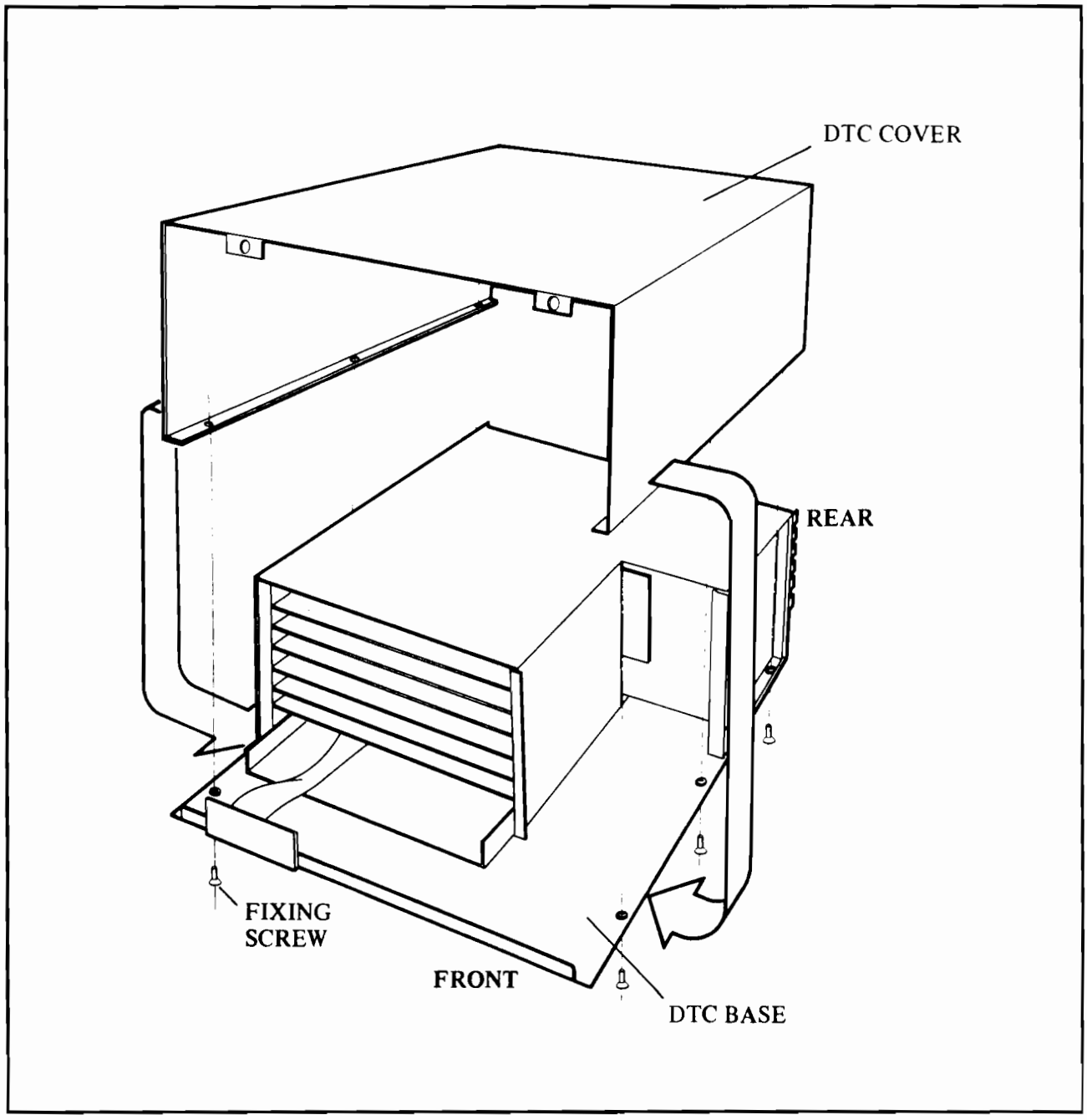


Figure 7-1 DTC Cover Removal/Replacement

Card Removal

Connector Cards (CC)

The procedure to remove the Connector Cards is as follows:

1. Remove all terminal/printer cables from the input /output ports of the card(s) to be removed.

2. To remove the card, simply release the captive screw on either side of the Card (using the 8mm flat-blade screwdriver). Grip the metal flanges either side of the card and then pull out the card. It slides out quite easily. The same procedure applies to all six cards, which can be installed in the DTC.

3. To replace the Connector card, simply slide the card back into the slot, and gently push the Card so that it mates correctly with the socket on the Backplane, do so carefully to avoid damage to the pins of the socket. Firmly secure the captive screws back in position so that there is a good connection between the CC and the Backplane.

Note

When replacing the CC, ensure that there is a SIC in the same slot number on the other side of the card cage.

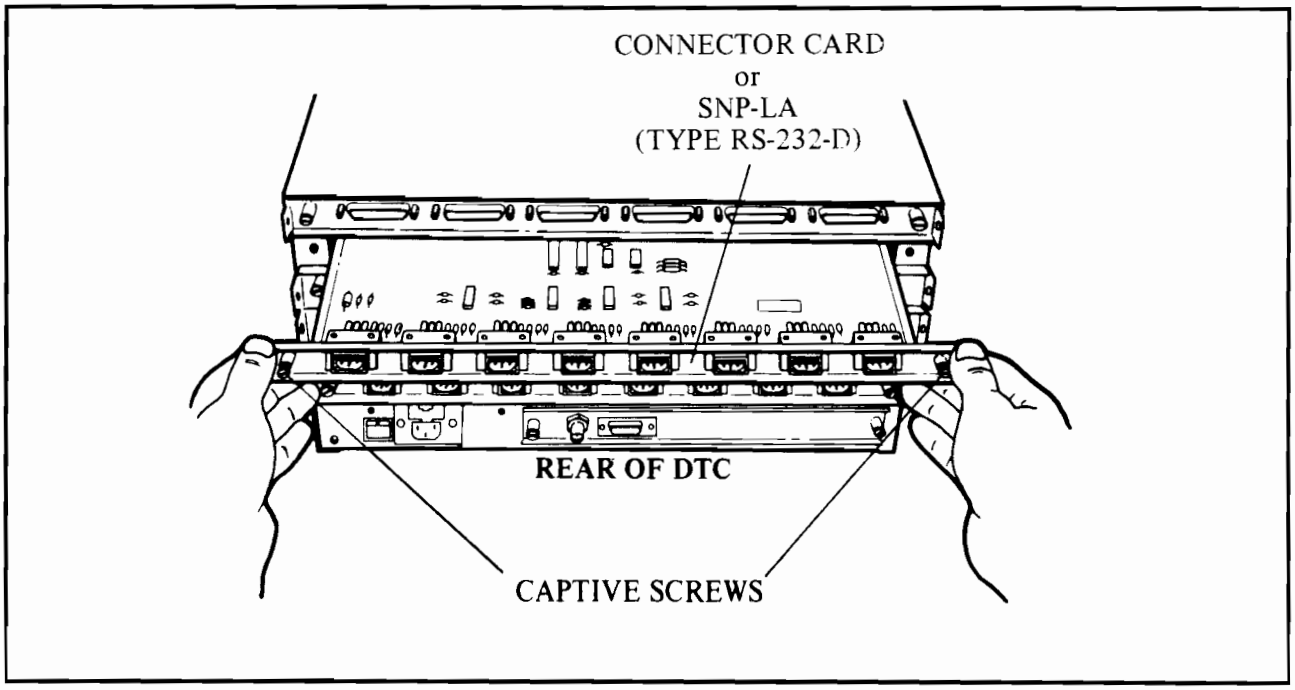


Figure 7-2 Connector and/or SNP-LA Card Removal

Serial Network Processor-Line Adaptor (SNP-LA)

The SNP-LA cards are contained in the rear card cage assembly. These are of the same physical size and construction as the CC Cards. They fit into the card cage in exactly the same manner as the CC and the procedure to replace the card(s) is identical to the CC Cards, see procedure for removing Connector Cards.

Processor Card

The Processor Card is fitted in the bottom rear of the DTC, the procedure to remove the Card is as follows:

1. Remove the LAN cable from one of the two connectors on the rear panel of the Processor Card.

2. With the front panel of the DTC removed, **disconnect the connector to the Display card** and ensure that the plug and cable can freely pass through the gap to the Processor Card.

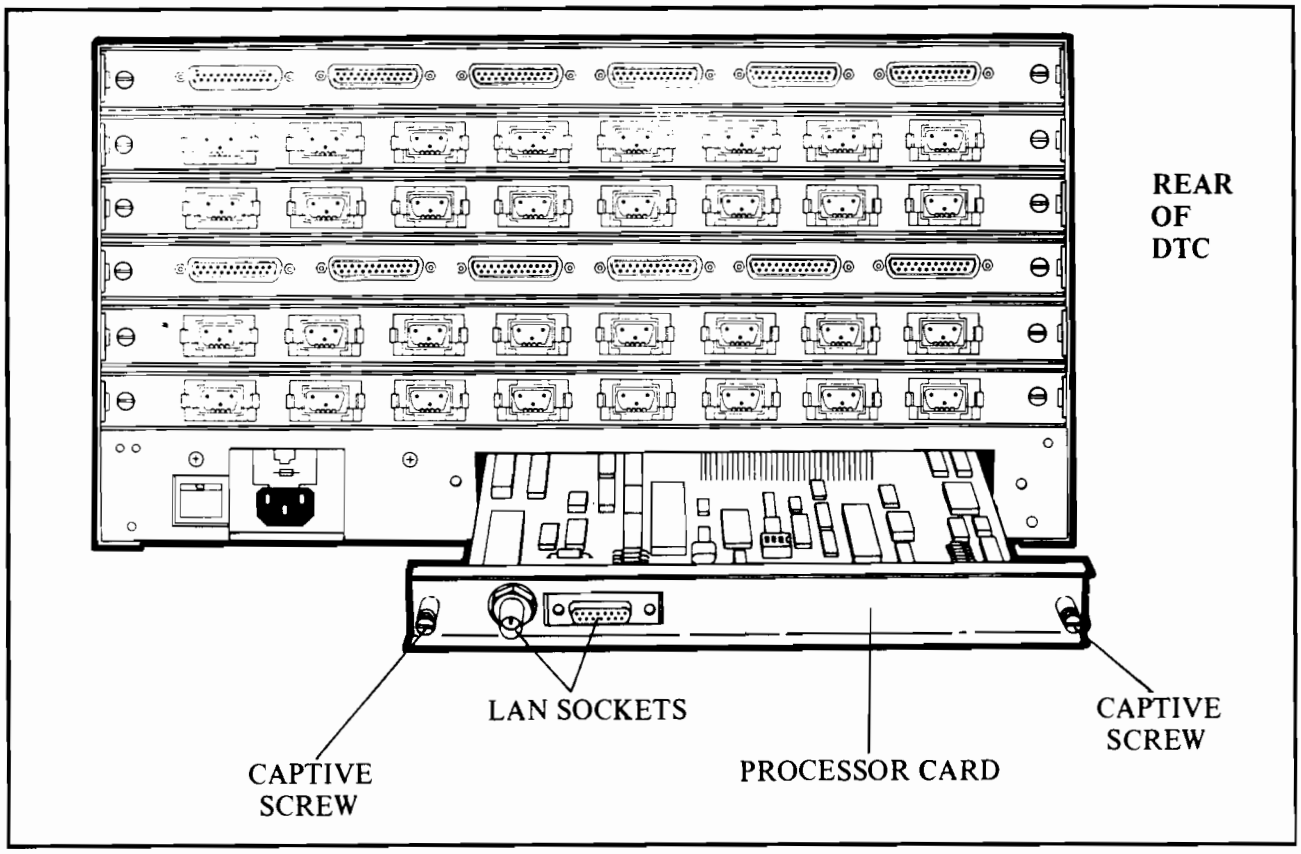


Figure 7-3 Processor Card Removal/Replacement

3. Release the captive screw either side of the Processor Card, grip the upper and lower metal flange of the Processor Card front panel and firmly pull the card out. Ensure that the Display Card cable does not become tangled up inside the DTC as the Processor Card is pulled out.

Caution

Ensure that the cable to the Display Card is disconnected at the Display Card.

4. To replace the Processor card, perform the previous steps in reverse. The Processor Card actually plugs into the Backplane. Do not use too much force when reinserting the Processor Card, also ensure that the ribbon cable to the Display Card is carefully fed through to the front of the DTC without being tangled. Ensure that the captive screw either side of the Processor Card are firmly in place to give a good Processor Card to Backplane connection.

5. If a new Processor Card has been installed, check the LAN Addresses and modify to match the old card. Reconfigure the Downloading device.. *See DTC LAN Address Reconfiguration*, chapter 6 (page 39) of this manual.

Display Card

The Display Card is fixed to the chassis at the front of the DTC by 2 cross headed screws. The procedure to remove the Card is as follows:

1. Carefully disconnect the ribbon cable connector.

2. Unscrew the 2 cross headed screws,on the front of the Card see figure 6.5.

3. To replace, follow the procedure in reverse sequence.

Serial Interface Cards

The Serial Interface cards are located behind the protective metal plate (with error code label) at the front of the DTC. In order to remove and replace a SIC Card, follow the outlined procedure:

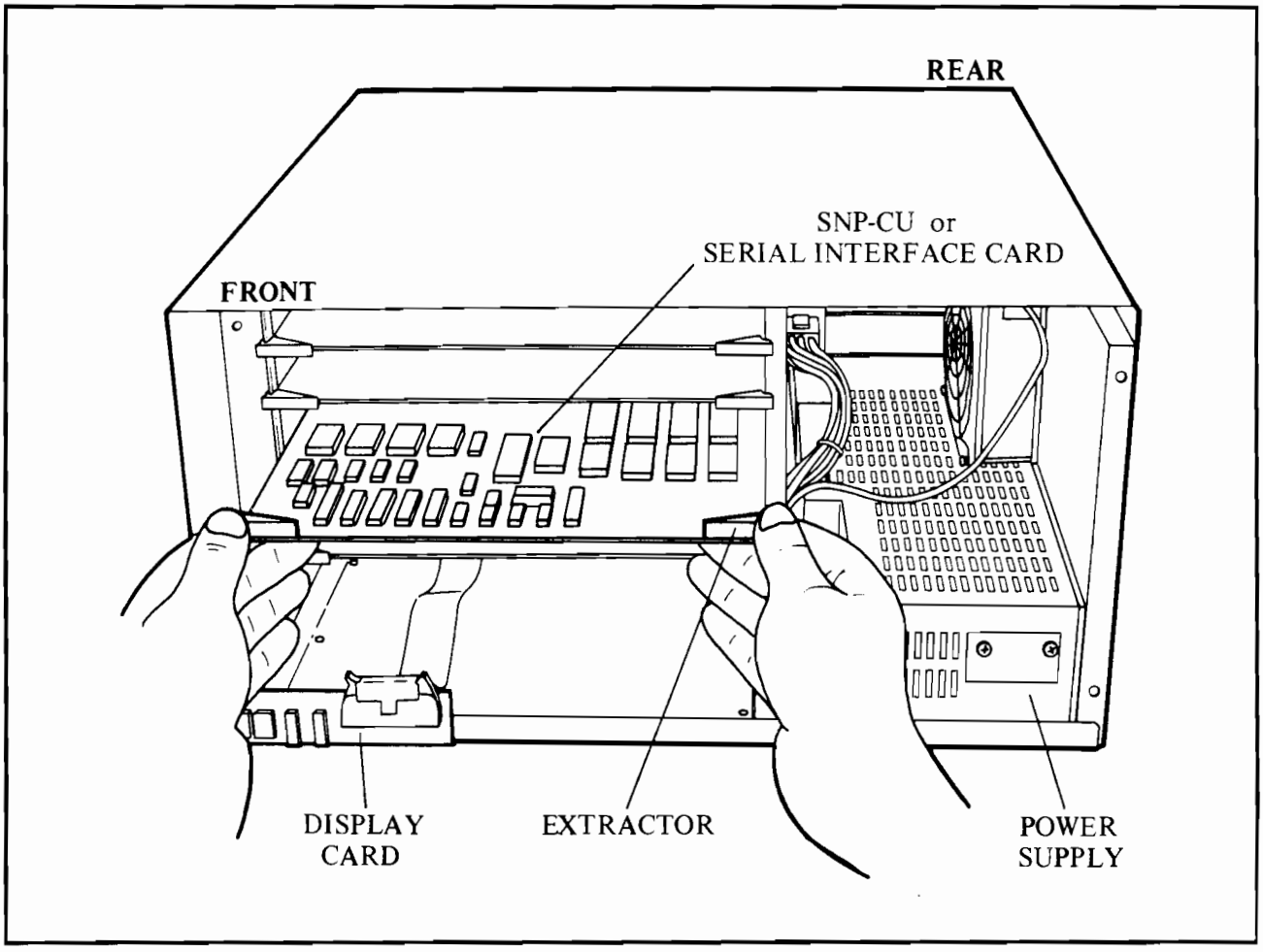


Figure 7-4 SIC/SNP-CU Removal/Replacement

1. With the front panel removed. Release the 4 captive screws securing the protective plate to the chassis,and lift it out carefully to avoid damage to the Display Card.

2. With the protective plate removed, the SICs in the front card cage can be easily removed. To remove, simply grip the extractor each side of the Card and gently pull out. The SIC should slide quite easily out of the Card cage.

3. To replace a SIC, simply perform the previous steps in the reverse sequence. When replacing a SIC Card, ensure that there is a CC card in the same slot number in the rear card cage.

Serial Network Processor - Control Unit

When the DTC contains the SNP-CU Cards in place of the SIC Cards. The Cards are of the same physical dimensions and construction. To install, remove or replace follow the same procedure as that for the SIC Cards.

Backplane Removal/Replacement

The Backplane is located almost centrally within the DTC. It is removed by following the outlined procedure:

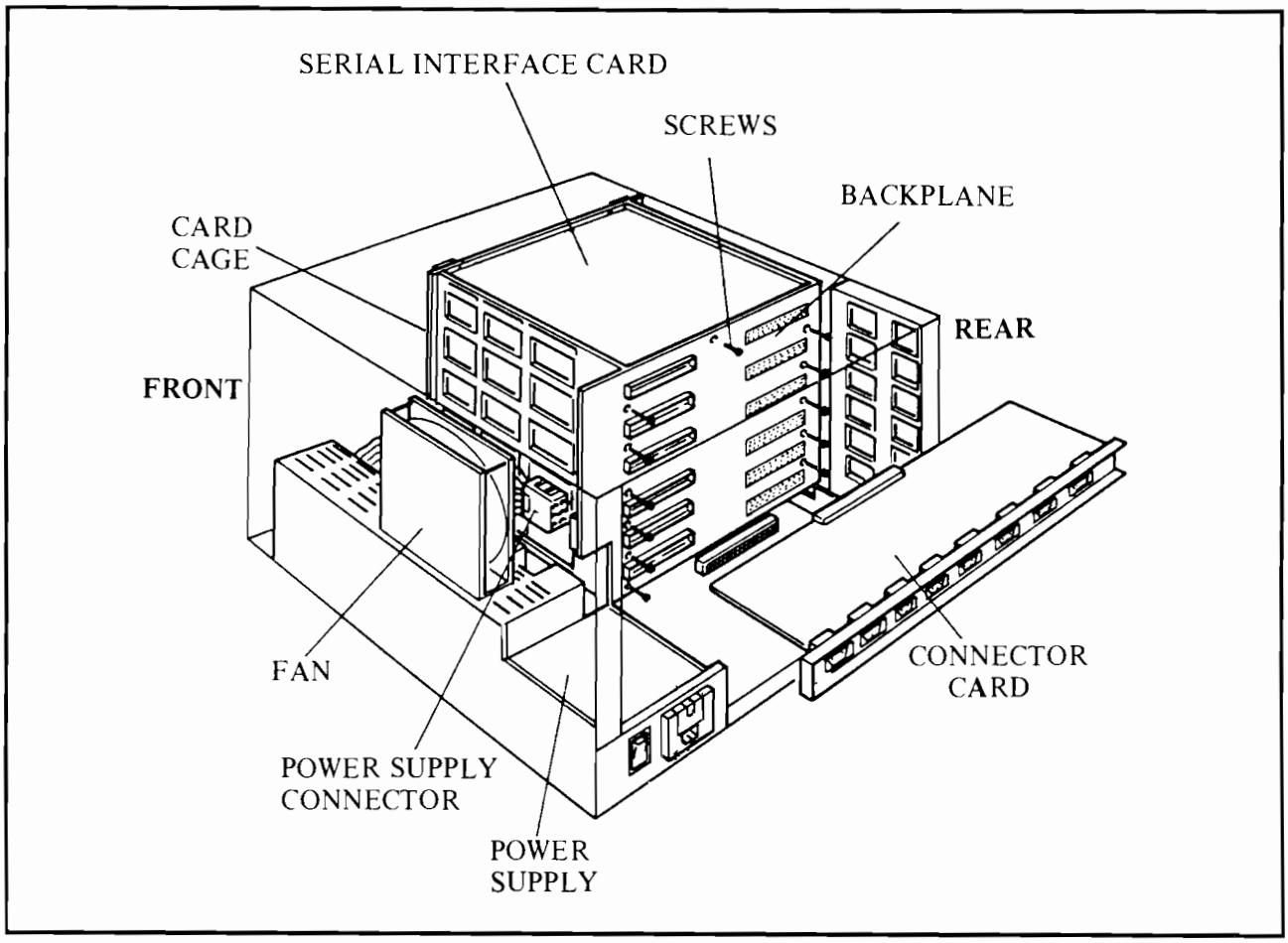


Figure 7-5 Backplane Removal/Replacement

1. With the Front panel and protective panel removed, pull out all the Cards installed in the front card cage, 2cm i.e. just disconnect them from the Backplane.

2. Disconnect the Display Card cable from the Display Card and ensure that it is not tangled.

3. Remove the Processor Card, as detailed in previous sections, and place on an anti-static mat.

3. Remove all the CC or SNP-LA Cards from the rear card cage, as detailed previously, and place them on an anti-static mat.

4. Disconnect the 9-pin internal Power Supply cable from the Backplane by squeezing the clip at the top and bottom of the connector, and then pulling the connector off.

5. The Backplane is secured by 13 cross head screws to the chassis, accessible from the rear of the DTC, once these are all removed the Backplane simply comes away from the card cage.

6. To replace the Backplane into the DTC simply follow the previous steps in reverse order. Note that the Power Supply connector plugs in one way only as only one orientation is possible. Ensure that the Backplane is correctly positioned before finally tightening the screws. Insert a Card in slot 0 and then tighten the screws above. Insert a Card in slot 1 and tighten the screws above. Repeat the process for the remaining cards.

Power Supply Removal/Replacement

The Power Supply is located to the right of the front card cage sub-assembly and secured in position by 4 screws to the chassis. To remove the Power Supply assembly follow the procedure outlined below:

1. With the Front and protective panel removed, previously described, the Power Supply is clearly visible.

2. Disconnect the 9-pin Power Supply connector from the Backplane.

3. Remove the 4 cross head screws which secure the Power Supply sub-assembly in position. Two of these screws are located at the front of the DTC, and the other two are at the rear, either side of the power switch and the power socket.

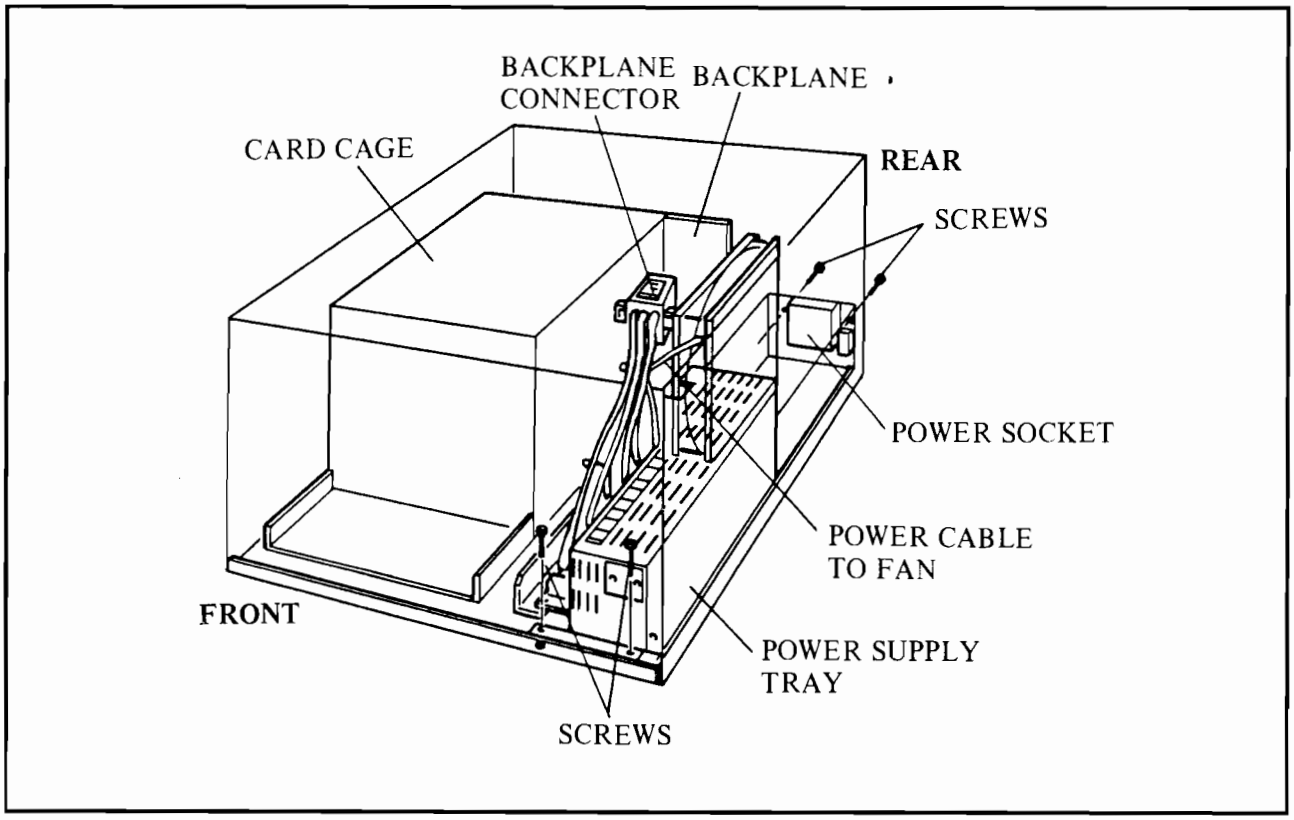


Figure 7-6 Power Supply Removal/Replacement

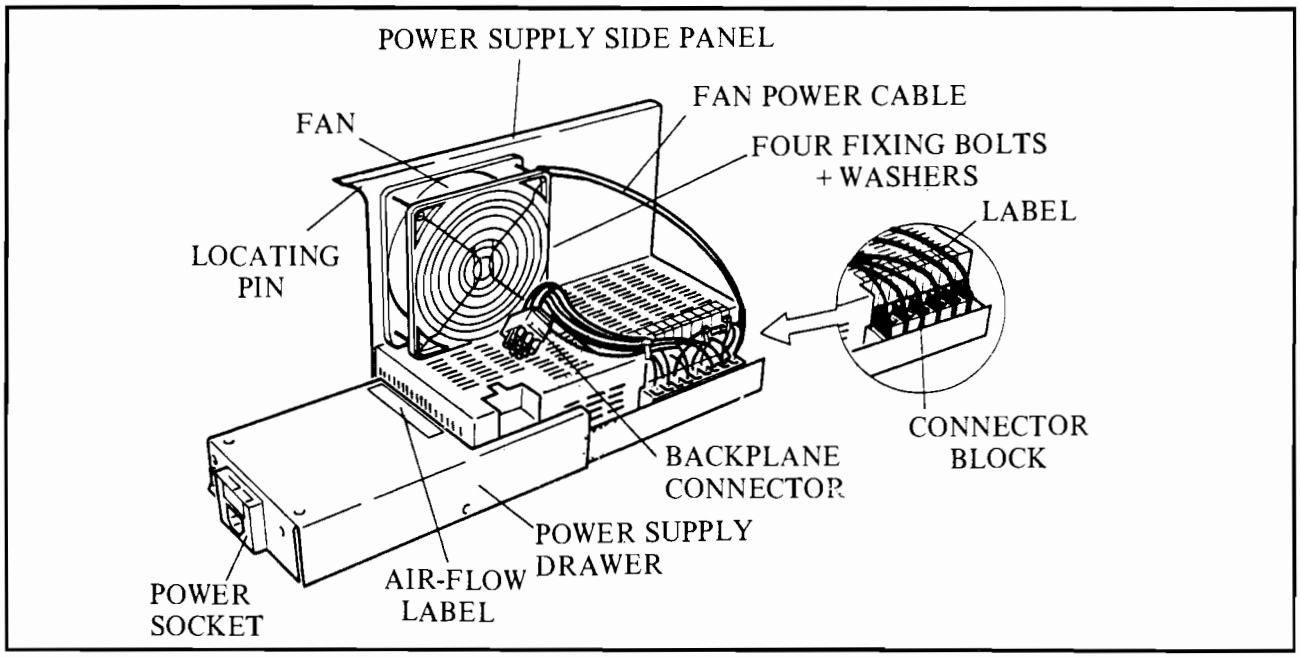


Figure 7-7 Fan Removal/Replacement

4. The entire assembly containing the power supply, fan and cabling is removed as a whole assembly. Lift out the power supply assembly by lifting it forwards, clear of the DTC chassis.

5. To replace the Power Supply assembly simply follow the previous steps in reverse.

Note

There are two Power Supply assemblies, HP part number 02345-60008 (for 115V) and HP part number 02345-60009 (for 230V). A label on each Power Supply specifies the voltage.

Be careful to properly position the "locating pin" (on the Power Supply assembly) in its card cage hole when the power supply assembly is installed. If the assembly is not inserted far enough it cannot be screwed into place.

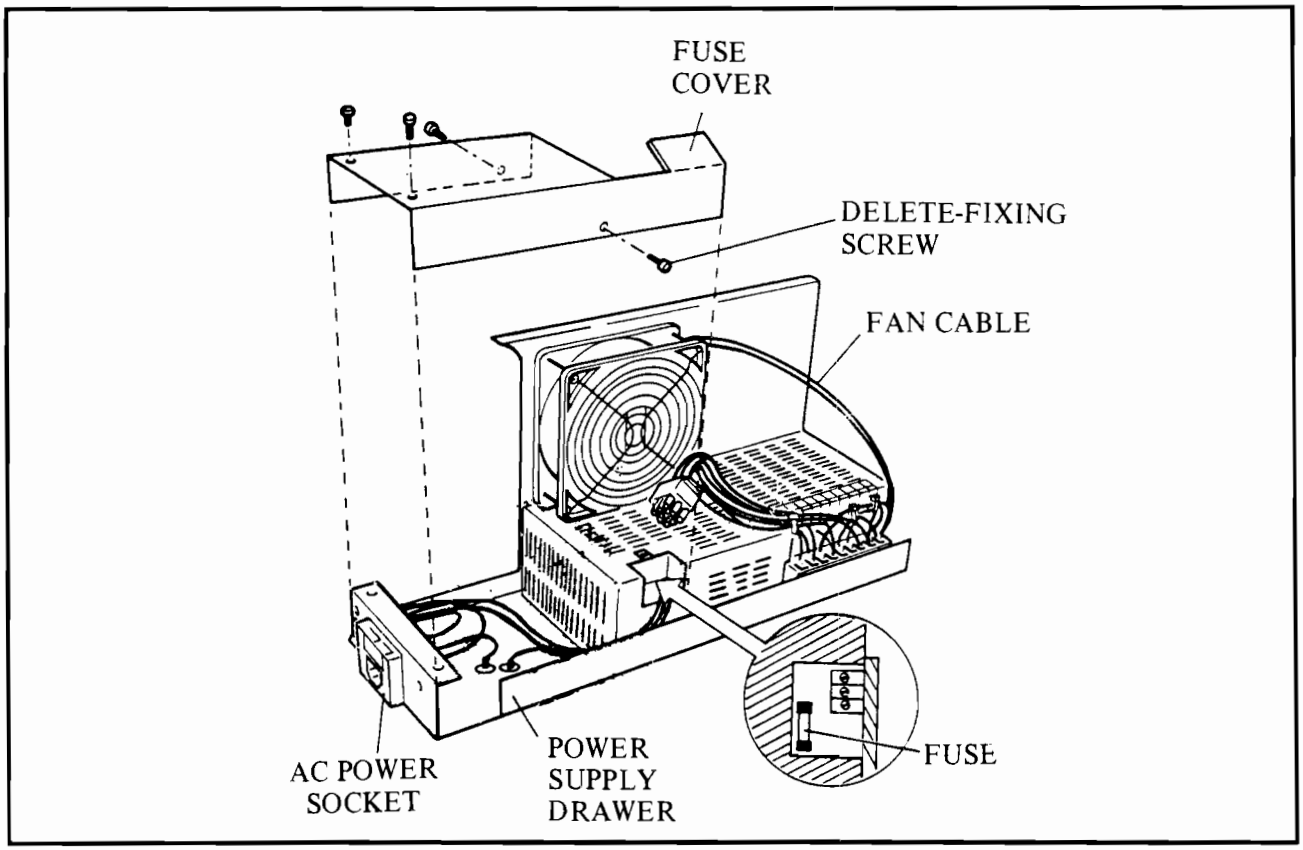


Figure 7-8 Power Supply Fuse Replacement

Fan Removal/Replacement

The fan is part of the Power Supply assembly and is secured in position by 4 bolts. The procedure to remove/replace the fan is outlined below:

1. With the Power Supply assembly removed, the fan can be replaced.

2. Unplug the fan cable cable from the side of the fan.

3. Unscrew the four fixing bolts located in each corner of the fan sub-assembly and remove the fan.

4. To replace the fan simply follow the previous steps in reverse order.

Note

The fan power cable must be orientated properly into the fan power socket. The "+" mark on the plug must align correctly with the "+" sign on the fan. The "+" and "-" signs are clearly marked on the fan.

Fuse Replacement

This section summarises the removal and replacement procedures for all the "Field Replaceable fuses" in the DTC.

AC Fuse

The replacement of this fuse is described in chapter 3.

Power Supply Fuse

To replace this fuse, remove the Power Supply assembly from the DTC. This is described in section, *Power Supply Removal/Replacement* of this chapter. Next, the fuse cover must be removed by unscrewing the four cross head screws that secure it to the chassis. Once removed the Power Supply fuse is clearly visible at the front opening on the Power Supply assembly. Carefully remove the fuse. The ratings of this fuse are as follows:

115V, 5A - HP part number 2110-0775
230V, 3A - HP part number 2110-0774

Processor Card

This fuse is found near the front of the Processor Card and is clearly marked F1 5A. To remove,if it has blown, simply pull out the fuse from its holder and replace with another of the same type, (125V,5A, HP part number 2110-0520).

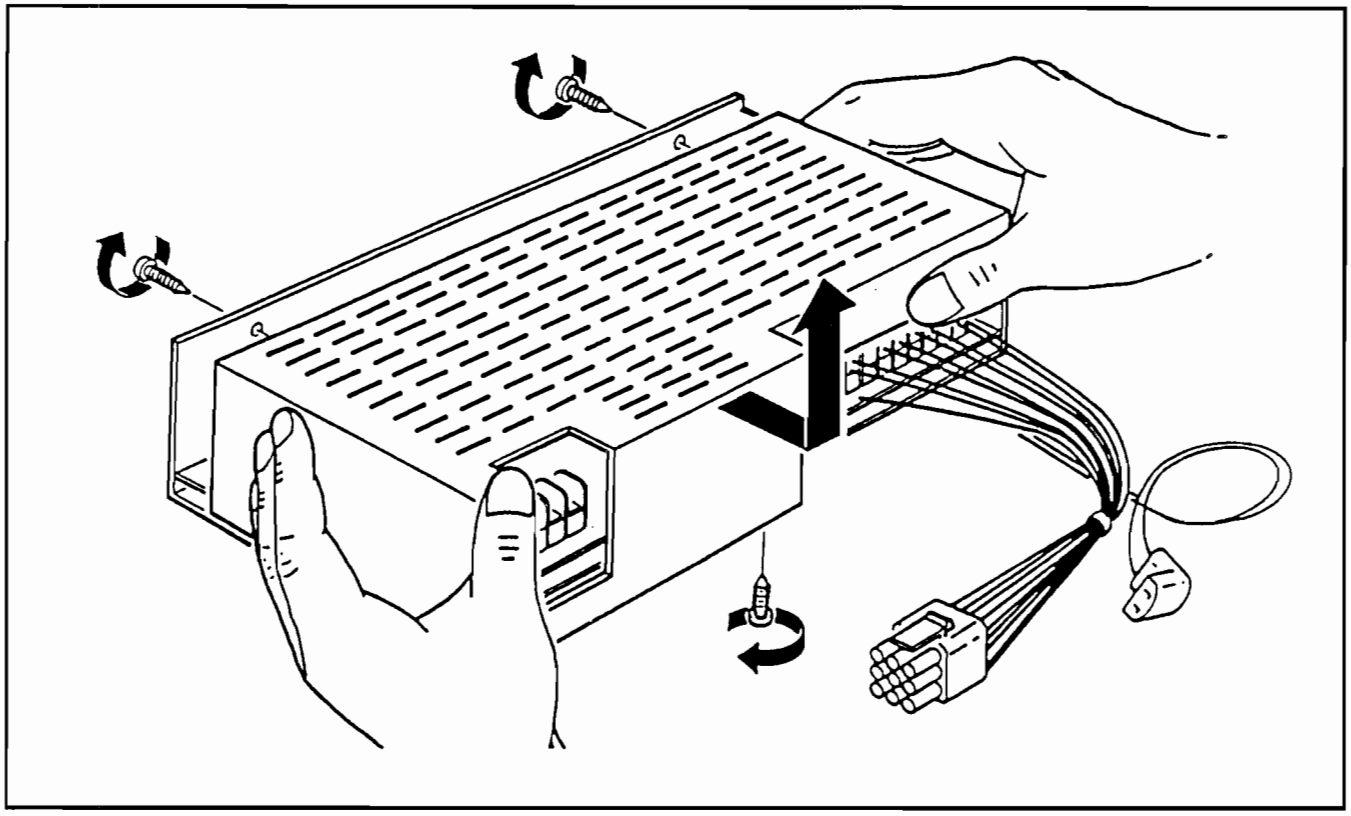


Figure 7-9 Power Supply Cover Removal

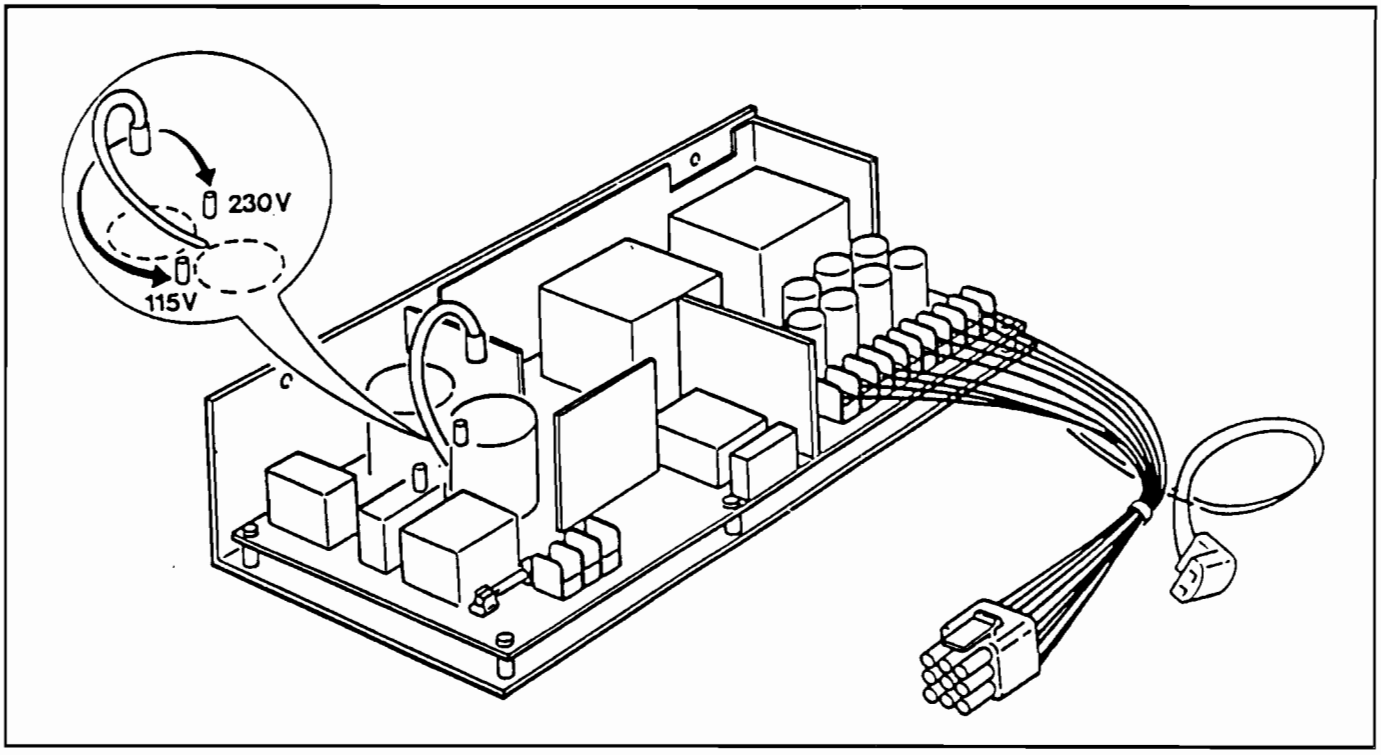


Figure 7-10 Power Supply Strap Cable

Backplane Fuse

This fuse is found just above the power supply cable to the Backplane. To remove, simply pull the fuse out from its holder and replace with another of the same type (if it has blown) (125V,5A HP part number 2110-0520)

DTC Voltage Change Procedure

The DTC is normally supplied to suit the installation mains supply, however, in some instances it may be necessary to change the DTC's power supply voltage to suit local power supplies, i.e to change the DTC from a 230V AC system to 115V Ac and vice versa. This section outlines the procedure to make the voltage change and is as follows:

1. Remove the Power Supply assembly in accordance with the instructions given in section *Power Supply Removal/Replacement.*

2. Replace the AC fuse with the required fuse for the new voltage as described in section *Fuse Removal/Replacement.*

3. Remove the fan from the Power Supply assembly as described in section *Fan Removal/Replacement*

4. Remove the 4 cross head screws which hold the fuse cover in place, see figure 7-8.

5. Unscrew the three screws (located in the power supply, see figure 7-8) sufficiently to allow removal of the three spade connectors.

6. Remove the six fixing screws which hold the power supply sub-assembly in place. Four of these are found on the underside of the power supply drawer and two are located on the back. Remove the power supply.

7. Remove three screws which hold the power supply cover. Remove the power supply cover, see figure 7-9.

8. Replace the power supply fuse with a new fuse corresponding to the required voltage. The part nnumbers of these fuses are as follows:

- 115V 5A HP part number 2110-0775
- 230V 3A HP part number 2110-0774

9. Remove one end of the strap cable which is located between the two large capacitors (C7 and C8) from its connector.(To remove the connector from the circuit board pin,place the finger under the cable loop and pull). When the strap cable has been removed the two connecting points can be clearly seen (marked 115V and 230V respectively). Note that this cable strap has just been removed from one of these points. This is illustrated in figure 7-10.

10. Reconnect the strap cable to the required voltage pin.

11. To re-mount the power supply, reassemble in the reverse sequence to the dismantling. When re-connecting the mains wires from the AC power socket to the power supply, note that the neutal wire has a black tracer.

12. Correct the voltage rating stickers on the underside of the power side, on the fuse cover and on the DTC box.

Modifying the Lan Configuration

If you have a Thin LAN and wish to change to Thick LAN or vice versa you will need to change the LAN switch settings on the Processor Card. To do this follow the procedure outlined below:

1. Remove the Processor Card from the DTC as described earlier in this chapter.

2. Figure 7-11 shows the Processor Card, and gives the location of the Thick/Thin jumper (J15). The jumper plugs directly into a 6 x 3 matrix of pins on the Processor Card as shown in the figure:

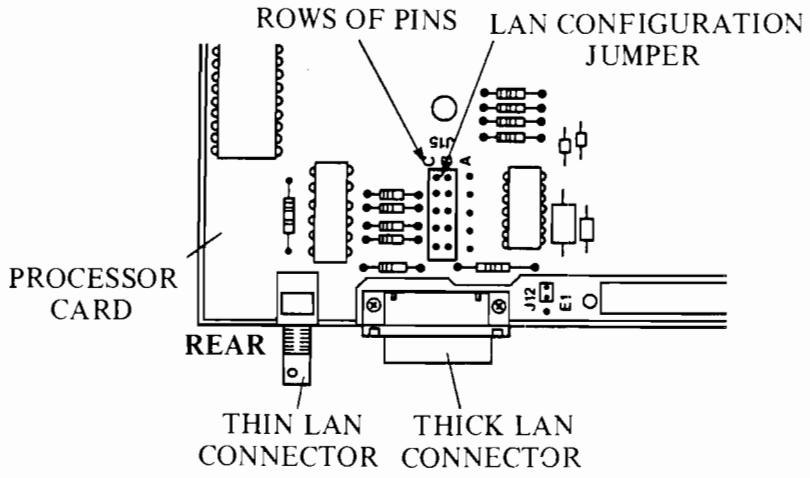


Figure 7-11 Thick/Thin LAN jumper location on Processor Card

The rows of (6) pins are labelled A, B and C. For Thin LAN configuration, the jumper should be placed on rows B and C, as shown in the figure. For ThickLAN configuration, the jumper should be placed on rows A and B. The jumper can be lifted off the pins using a pairs of tweezers or pliers. After the jumper has been moved, the LAN configuration modification is complete.

3. Replace the Processor Card into the DTC, as detailed previously. Connect the LAN cable connector to the appropriate LAN socket at the rear of the DTC, depending on whether Thick or Thin LAN is now installed. Then power-up the DTC as normal.

4. Once the DTC is running normally, mark the change to the DTC on the identification label.

This concludes the Chapter on the removal and replacement of the DTC assemblies and sub-assemblies. The following chapter provides a detailed inventory of replaceable parts.

Replacement Parts

Field replaceable assemblies are shown in Table 8-1. Exchange modules in Table 8-2. Troubleshooting items are shown in Table 8-2.

Table 8- 1 List of Field Replaceable Parts

DESCRIPTION OF PART	PART NUMBER
Processor Card	02345-60016
Upgrade ROM Kit	02345-60013
Serial Interface Card	02345-60001
Serial Interface Card ROM	02345-80123
Connector Card (Direct Connect RS-232-C)	02345- 60003
(Modem Connect RS-232-C)	02345-60004
(Direct Connect RS-422)	02345-60005
SNP -CU Card	24400-60001
SNP-CU ROM	24400-81001
SNP-LA (RS-232-D)	24000-60100
SNP-LA/MS	24400-60200
(V.35 Connector Cable)	28606-63003
(V.36 Connector Cable)	24400-60202
(RS-422 Connector cable)	24400-60203
Connector Labels	02345-90004
Backplane	02345-60002
Display Card	02345-60007
Fan	3160-0485
Fan Cable	8120-1478
Power Supply Assembly 115V	02345-60008
Power Supply Assembly 230V	02345-60009
Power Supply Primary cable	02345-60600
Power Supply Secondary cable	02345-60500

Table 8 - 1 Cont. List of Field Replaceable Parts

DESCRIPTION OF PART	PART NUMBER
Power inlet Socket	1252-1788
Power Switch	3101-0402
2A AC Fuse (Europe 230V)	2110-0002
4A AC Fuse (U.S 115V)	2110-0055
3A Power Supply Fuse (Europe)	2110-0774
5A Power Supply Fuse (U.S)	2110-0775
5A Backplane / CPU Fuse	2110-0520
Box (cover, front panel,and protective plate)	02345-60100
Cover	02345-00004
Front Panel	02345-00008
Blanking Panel	02345-00012
MAU and TAP	30241A
AUI Cable	92254A
BNC " T " Connector (Plus Plastic Cover)	92227N
DTC Installation and Service Manual	02345-90001

Table 8 - 2 DTC Field Replaceable Parts - Exchange Modules

DESCRIPTION OF PART	PART NUMBER
Processor Card	**02345-60016**
Serial Interface Card	**02345-60001**
Connector Card (RS232-C Direct Connect) **(RS232-C Modem Connect)** **(RS422 Direct Connect)**	**02345-60003** **02345-60004** **02345-60005**
Synchronous Network Processor -Control Unit	**24400-60001**

Table 8 - 3 List of Troubleshooting Items

DESCRIPTION OF PART	PART NUMBER
Asynchronous Loopback Connectors	
(RS422: 5-pin)	60147-60002
(RS232-C Direct: 3-pin)	30148-60002
(RS232-C Modem:25-pin)	02345-60010
Synchronous Loopback Connectors	
(V.35 Interface)	24400-60211
(V.36 Interface)	24400-60212
(RS422 Interface)	24400-60213
Thick LAN Connection Kit (*)	
Loopback Cable Kit	92257B
Tap (1)	
Section of Thick LAN cable	
Two terminators	30241A
MAU (1)	92254A
AUI (1)	
Thin LAN Connection Kit (*)	92227Q
BNC "T" Connector (1)	
Terminators (2)	
Note: * = these items are NOT supplied with the DTC. They must be ordered seperately.	

Upgrading the DTC

All models of the HP2345 Distributed Terminal Controller (DTC) supplied with date codes greater than 2851 are supplied with the asynchronous communications cards ONLY.

The HP2345 DTC can now be upgraded to give greater flexibility and connectivity by installing the Synchronous Network Processor Cards and replacing the ROMs on the Processor Card with ROMs containing synchronous communication protocols. The ROMS are delivered as part of the DTC Hardware Upgrade kit, option 001 of the products shown in Table A-1

Table A-1 Products with the Hardware Upgrade Kit

PRODUCT	OPTION	DESCRIPTION
2346D	001	SNP-CU and SNP-LA with RS-232-D Interface.
2346E	001	SNP-CU and SNP-LA Multi-standard V.35 Interface.
2346F	001	SNP-CU and SNP-LA Multi-standard with V.36 Interface.
2346G	001	SNP-CU and SNP-LA Multi-standard with RS-422 .

Changing the EPROMs

To replace the existing EPROMs on the Processor Card with EPROMS (HP part numbers 02345-80155 and 02345-80165) found in the DTC Hardware Upgrade Kit.

You will need to have the following tools available:

- 4mm flat bladed screwdriver
- Integrated Circuit (IC) extractor tool
- Integrated Circuit (IC) insertion tool
- Anti-static wrist strap correctly earthed

Procedure:

1. Ensure that the DTC is switched OFF and power lead disconnected.

2. Unplug the LAN cable from the LAN connector on the rear panel of Processor Card.

3. Remove front panel of DTC and unplug the connector to the Display Card, ensure that the connector and cable are free to pass through the gap to the Processor Card.

4. Release the captive screw on either side of the Processor Card. Grip the rear panel and firmly pull out the Card sufficiently to expose the two EPROMs at the rear of the card, see figure A-1.

5. Using the IC extractor tool, carefully remove the existing EPROMS and insert the EPROMs contained within the DTC Hardware Upgrade kit. Refer to figure A-1 to ensure that the appropriate EPROM is inserted into the correct slot.

Caution

The EPROMs are static sensitive devices and thus extra care must be exercised when handling these components. Always wear an anti-static wrist strap. The pins of the EPROM can be easily bent and damaged whilst inserting into the EPROM slot. Always use the IC insertion tool to insert an EPROM.

6. Carefully slide the Processor Card back into position, it must be correctly aligned with the Backplane connector before pressing the Card firmly into position and tightening the captive screws. Re-connect the cable and connector to the Display Card and attach the front panel.

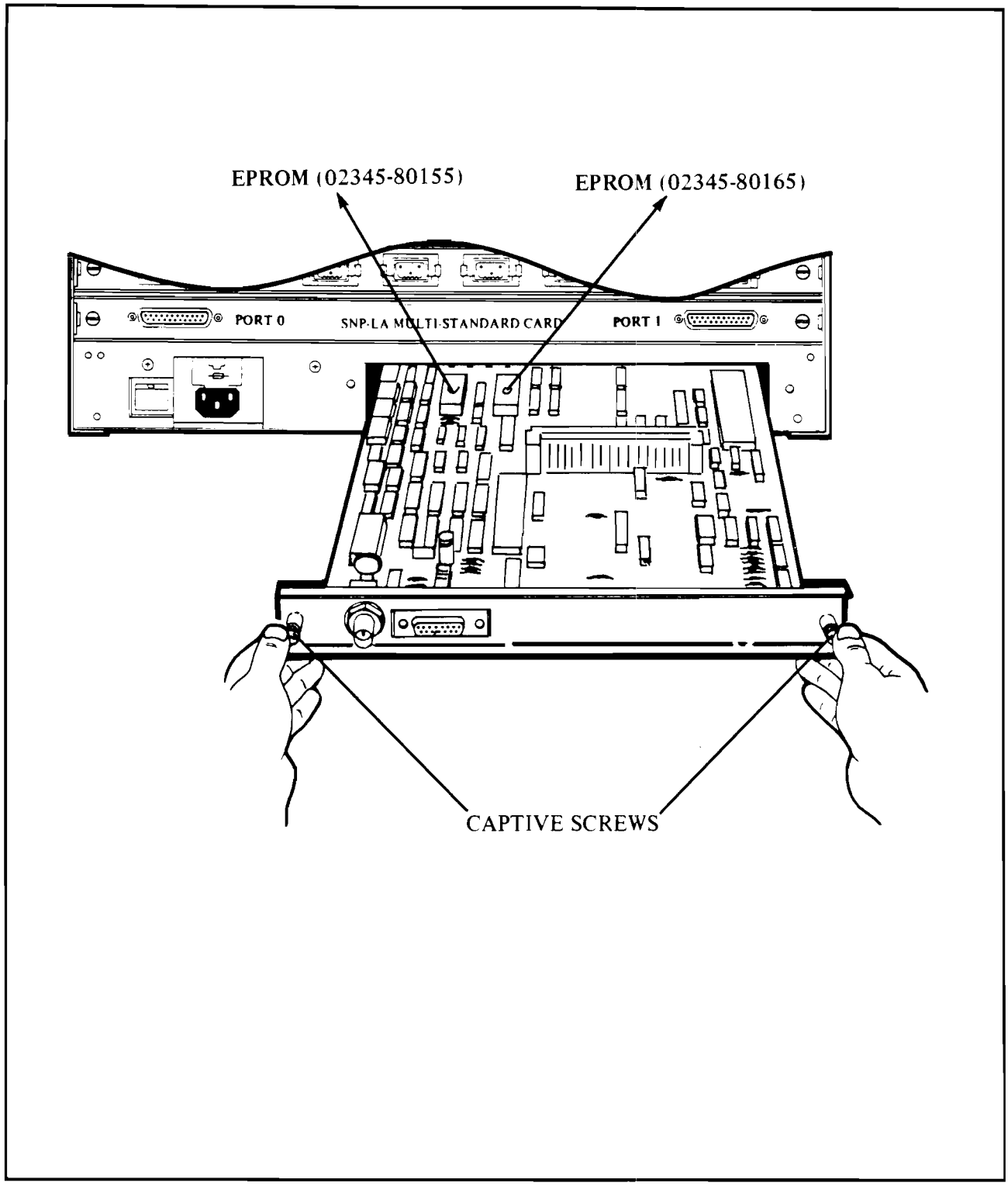


Figure A-1 Replacing the EPROM on the Processor Card

Installing the SNP Cards

The SNP Cards comprises of 2 cards:

- Synchronous Network Processor - Control Unit (SNP-CU)
- Synchronous Network Processor - Line Adapter (SNP-LA)

Intalling the SNP-CU Card

The SNP-CU card is installed in a slot at the front of the DTC. The slots are numbered 0 to 5, the bottom slot (0) is reserved solely for a Serial Interface Card.

To install a SNP-CU card into an unoccupied slot, the procedure is as follows:

Procedure

1. Remove the front panel of the DTC.

2. Remove the internal plate that protects the front card cage and power supply. It is attached to the chassis by four captive screws.

3. Select the unoccupied slot and ensure that the corresponding slot at the rear of the card cage is also empty.

4. Carefully remove the SNP-CU Card from its protective wrapping. The Card contains static sensitive devices which can be irrevocably damaged by static discharge if handled incorrectly.

5. Grip the Card by its side extractors. Place the Card within the side guides of the selected slot and firmly slide into position.

6. Replace the internal protective plate and fasten in position.

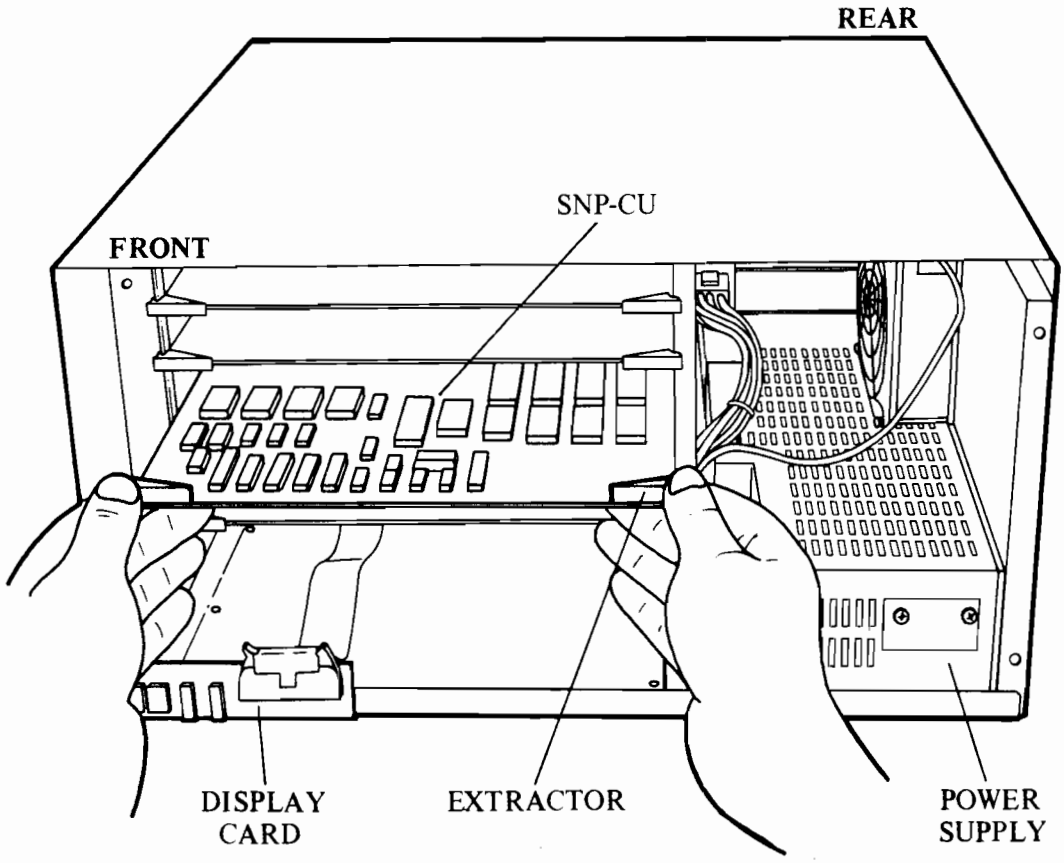


Figure A-2 Installing the SNP-CU Card

Installing the SNP-LA Card

The SNP-LA is installed in the rear slot, opposite the SNP-CU Card. The slots are numbered 0 to 5, the bottom slot (0) is reserved solely for an asynchronous card.

1. Identify the appropriate slot.

2. Remove the SNP-LA Card from its protective wrapping.

3. Grip the Card by the rear panel and insert into the side guides of the selected slot. Firmly press into position and then tighten the captive screws either side of the rear panel.

4. Connect the applicable cable according to the interface type i.e. RS-232-D, V.35, V.36 or RS-422 ; see Chapter 3 of the Manual supplied with the DTC Hardware Upgrade kit.

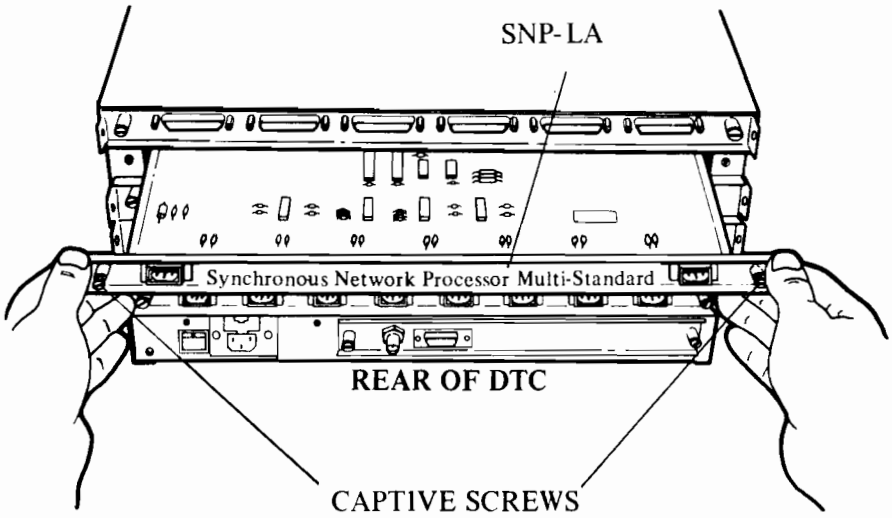


Figure A-1 Installing the SNP-LA Card

Fixing the new Label

The Label shipped with the DTC Hardware Upgrade kit lists the Self Test Error codes and their meanings. The Label is to replace the existing Label affixed internal protective plate.

To change, simply peel off the old label and affix the new then clip on the DTC front panel. The DTC hardware upgrade is now complete.

ASCII Character Set

Table B-1. ASCII Character Set/International Alphabet # 5

b7	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1
b4 b3 b2 b1	0	1	2	3	4	5	6	7
0 0 0 0 0	NUL	(TC7) DLE	SP	0	@	P	`	p
0 0 0 1 1	(TC1) SOH	DC1	!	1	A	Q	a	q
0 0 1 0 2	(TC2) STX	DC2	"	2	B	R	b	r
0 0 1 1 3	(TC3) ETX	DC3	#	3	C	S	c	s
0 1 0 0 4	(TC4) EOT	DC4	$	4	D	T	d	t
0 1 0 1 5	(TC5) ENQ	(TC8) NAK	%	5	E	U	e	u
0 1 1 0 6	(TC6) ACK	(TC9) SYN	&	6	F	V	f	v
0 1 1 1 7	BEL	(TC10) ETB	'	7	G	W	g	w
1 0 0 0 8	(FE0) BS	CAN	(	8	H	X	h	x
1 0 0 1 9	(FE1) HT	EM	)	9	I	Y	i	y
1 0 1 0 10	(FE2) LF	SUB	*	:	J	Z	j	z
1 0 1 1 11	(FE3) VT	ESC	+	;	K	[	k	{
1 1 0 0 12	(FE4) FF	FS	,	<	L	\	l	|
1 1 0 1 13	(FE5) CR	GS	-	=	M	]	m	}
1 1 1 0 14	SO	RS	.	>	N	^	n	~
1 1 1 1 15	SI	RS	/	?	O	_	o	DEL

C

Documentation References

Throughout the HP 2345A DTC Manual, reference is made to other documentation for relevant information.these are listed as follows:

For information on LAN cabling and connections, refer to the following manuals:

- *LAN Cable and Accessories Installation Manual* (P/N 5955-7680).
- *HP36921A LAN/3000 Series 900 LINK (LANIC) Installation and Reference Manual (HP part number 30621-90001).*
- *LAN Link Hardware Troubleshooting Manual (HP part numbe 5955-7681).*

For other information relating to the DTC, refer to the following manuals:

When the DTC is configured for asynchronous communications:

- *ASC Troubleshooting Manual (HP part number 32022-90004)*
- *ASC System Administrator's Manual (HP part number 32022-90001)*
- *ASC Programmer's Reference Manual (HP part number 32022-90002)*

When the DTC is configured for synchronous communications, the following manuals contain relevant information:

- *Using the OpenView DYC Manager*
- *OpenView Terminal User Guide*
- *HP2334A Plus X.25 Multiplexer Reference Documentation (HP part number* 02334-90013)
- *HP2335A X.25 Multiplexer Reference Manual (HP part number 02335-90001)*

Synchronous Loopback Connectors

This appendix details the internal connections of the loopback connector hoods which are used when Loopback tests are to be performed on the DTC configured for sychronous communications. The Loopback hood is connected to the end of the Interface cable which determines the communication interface standard, these are, for example, list as follows:

- SNP-LA/RS-422 Loopback Connector (HP part number 24400-60213)
- SNP-LA/V.35 Loopback Connector (HP part number 24400-60211)
- SNP-LA/V.36 Loopback Connector (HP part number 24400-60212

RS422 Loopback Internal Connections

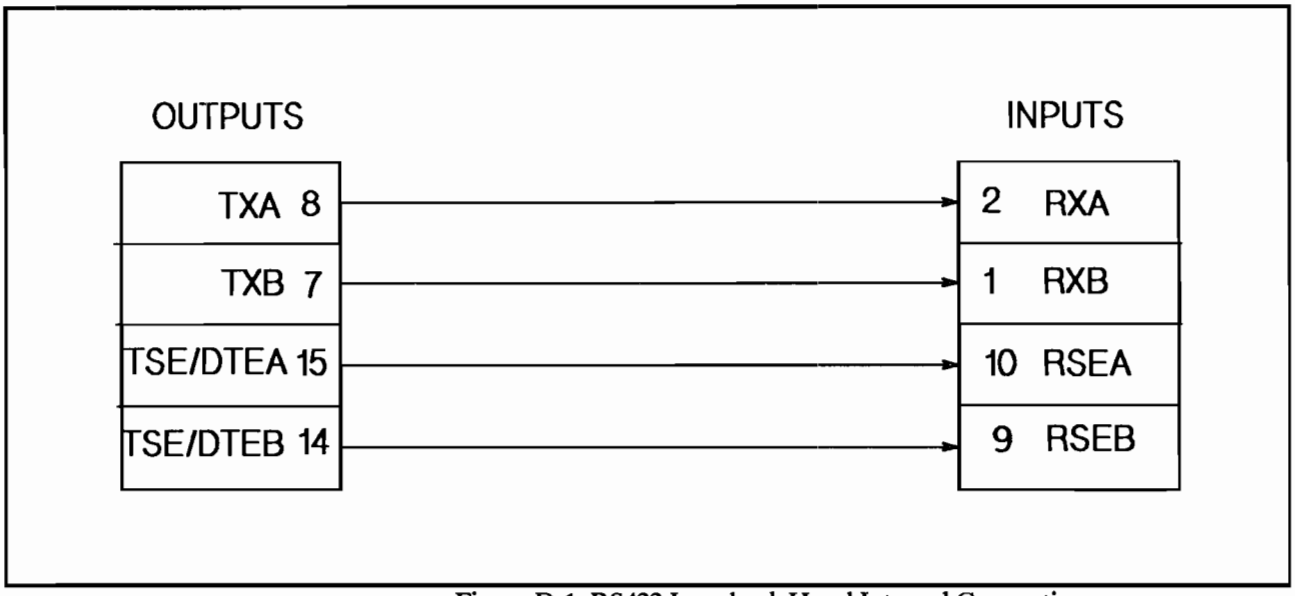


Figure D-1 RS422 Loopback Hood Internal Connections

V.35 Loopback Hood Internal Connections

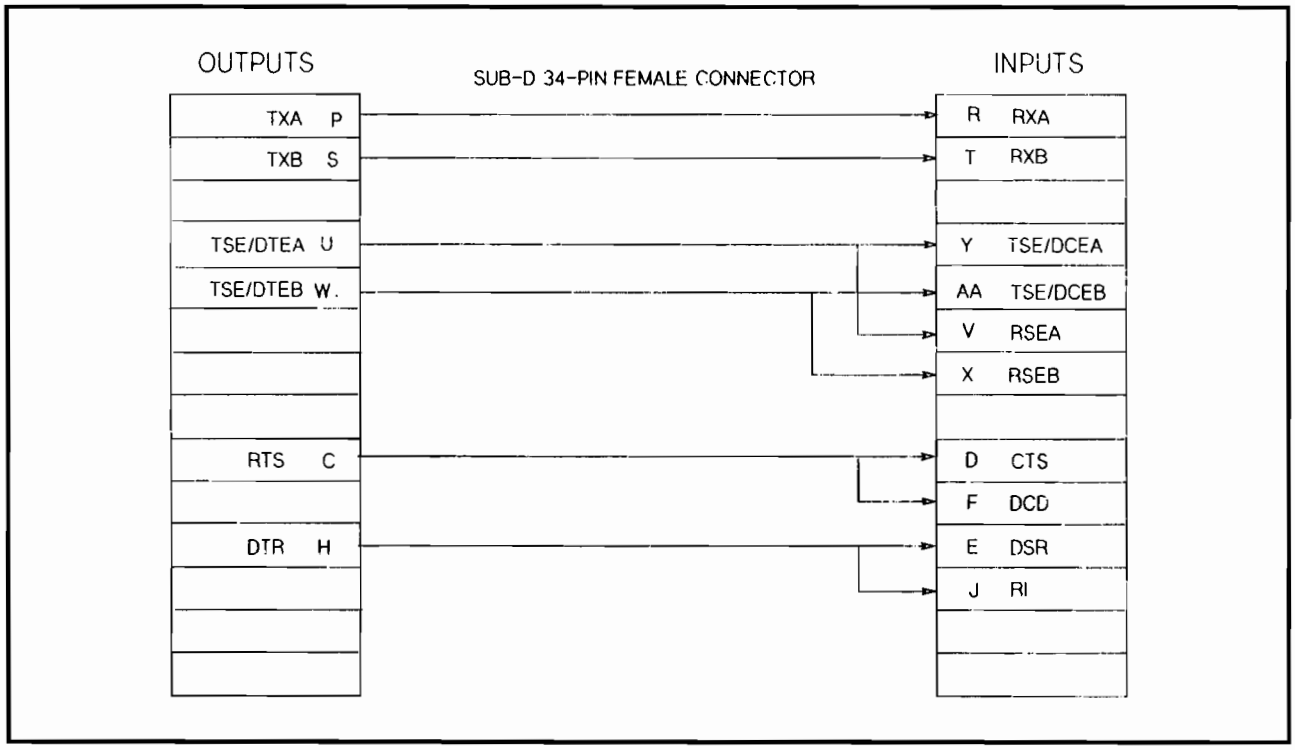


Figure D-2 V.35 Loopback Hood Internal Connections

V.36 Loopback Hood
Internal Connections

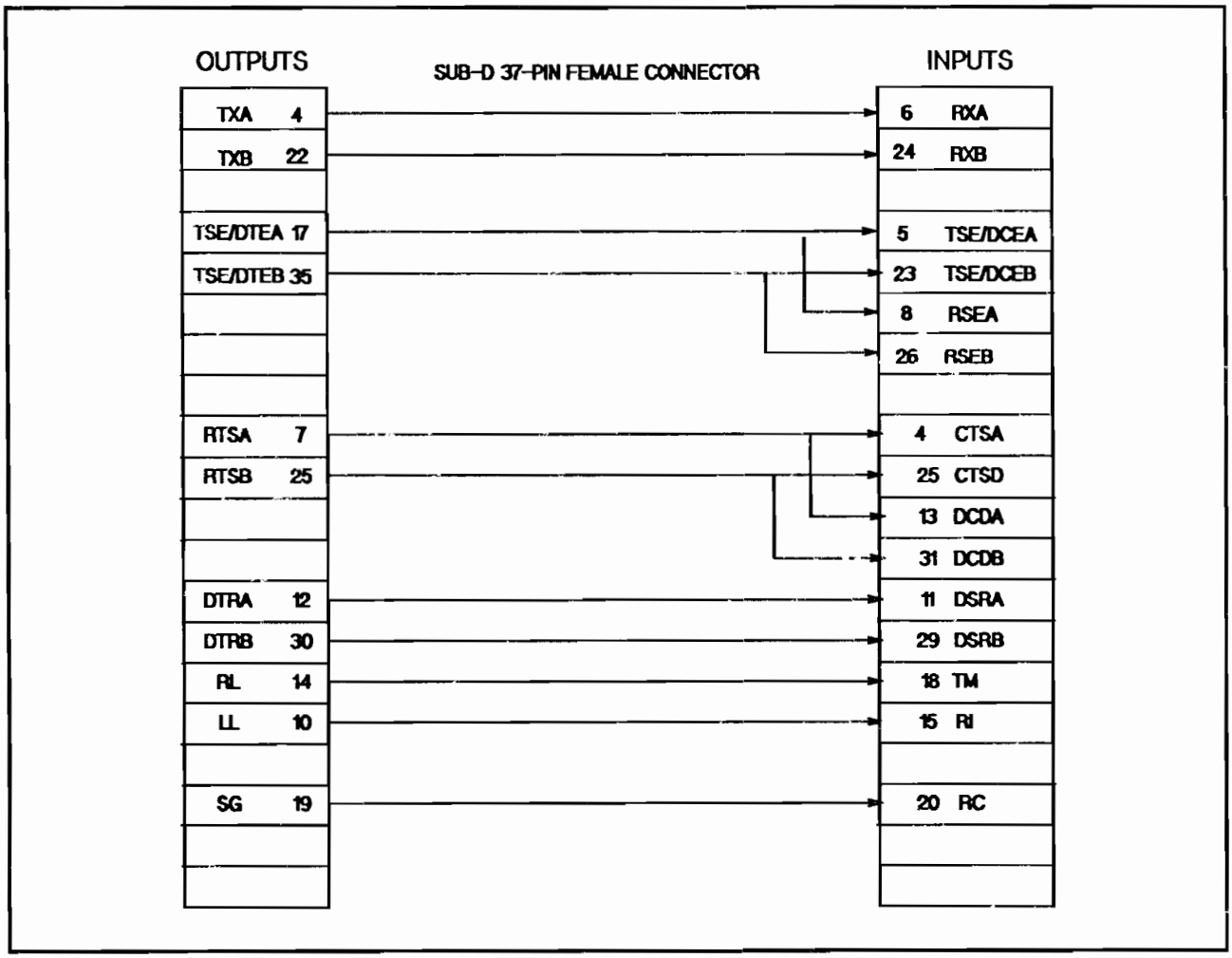


Figure D-3 V.36 Loopback Hood Internal Connections

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GLOSSARY

Access Port	An interface card for the HP3000 series 900
ASCII	American International Standard Code for Information Interchange
Asynchronous	Method of transmitting information data at a speed determined by circuit functions rather than timing signals, asynchronous transmission always contains start and stop bits to identify the beginning and end of each character.
AUI	Attachment Unit Interace: a cable assembly which interconnects the MAU and the DTC.
Backplane	Interface the Processor Card and the SICs, distributes the DC voltages throughout the assembly.
Backbone LAN	A thick LAN cable conforming to the IEEE802.3 Type 10 BASE 5 Standard.
BPS	Bits per second: the speed of data transmission over a communication channel.
CC	Connector Card: contains the communication ports for RS-232-C DCC, RS-232-C MCC and RS 422.
CCITT	Consultative Committee for International Telegraphy and Telephony (Europe)
HP CE	Hewlett Packard Customer Engineer.
CPU	Central Processing Unit: in the DTC the Processor Card is sometimes referred to as the CPU card.
CSA	Canadien Standard Association
CSMA/CD	Carrier Sense Multiple Access/Collision Detect.
DCC232	Direct Connector Card based on the RS-232-C standard
DCC422	Direct Connection Card based on the RS-422 standard.
DIO Bus	A standard Hewlett Packard I/O Backplane for the Interface cards
DTC	Datacomm and Terminal Controller.

DCE	Data Circuit-terminating Equipment:distinguishes the network side of a User/network interface.
EIA	Electronic Industries Association
EMC/EMI	Electro-Magnetic Compatibility/Electro-Magnetic Interference.
EPROM	Erasable Programmable Read Only Memory: a read-only memory in which data can be erased and re-programmed bit by bit.
Ethernet	A Local Area Network system that uses baseband tansmission at 10 Mbps over coaxial cable. Ethernet is a trademark of Xerox Corporation.
FCC	Federal Communications Commission
FEI	Finnish Electrical Inspectorate.
FOS	Fundamental Operating System: the main part of the MPE/XL operating system.
FTZ	Fermeldetechnisches Zentralamt
GND	Ground.
IEC	international Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers.
IEEE802.3	(i) The standard for a LAN utilising CSMA/CD as the access method:(ii) A LAN conforming to this standard.
IEEE802.3 Nodal Address.	A unique hexadecimal number that identifies a node on a IEEE802.3 LAN.
IEEE802.3 Multicast Address	A hexadecimal number that identifies a set of nodes, this address is used for multicast delivery.
ISO	International Standards Organisation.
LAN	Local Area Network: a data communications network of limited size (serving, for example a building or group of buildings), with a high data transmission rate, low delay and low error rate.
LANCE	Local Area Network Controller for Ethernet: an integrated circuit chip on the Processor Card.
LANIC	LAN Interface Card: for the HP3000 series 900 Host computer.

Loopback Test A test of the communication link performed by connecting the DTC output from one port to another configured for input and then testing the quality of the received signal.

MAU Medium Access Unit: an assembly which connects the AUI to the LAN cable.

MCC232 Modem Connector Card based on the RS-232-C standard.

Modem Modulator/Demodulator: a device for converting digital data into analog signals and vice versa; also called 'data-set'.

MPE/XL Operating system for the HP3000 series 900 computers.

MUX A Multiplexer: device used to divide a data channel into two or more independant fixed data channels of lower speed.

NOVRAM Non-volatile RAM.

OSI Open Systems Interconnection: a formal data communications heirarchy model containing seven levels of functional requirements,developed by the ISO.

Packet A block of data whose maximum length is fixed. The unit of information exchanged by X.25 at Level 3. There are DATA packets and various control packets. A packet type is identified by the encoding of its header.

PAD Packet Assembler/Disassembler: a CCITT facility, offered by many PSN administrations, essential for interfacing asynchronous character mode terminals (DTE-Cs) to a packet switching network.

PLA Programmable Logic Array: a logic array which allows flexible functional design.

Port An interface on the CC that is capable of having a modem attached for communication with a remote data terminal.

PPN The HP X.25 Private Packet Network is a private X.25 packet switching network that provides communications between computeers and User workstations that are geographically dispersed.

PSN Packet Switching Network: is any data communications network using packet switching techniques whereby data is broken up into packets at source interface and disassembled back into a data stream at the destination interface. A public PSN offers the service to any paying customer.

RAM Random Access Memory: a type ;of memory which allows direct access to any location without having to follow a sequence of storage locations.

ROM	Read Only Memory: a type of memory which can only be read and not written to or changed.
SIC	Serial Interface Card: is the interface card between the Processor Card and the DTC.
SIO-USART	Serial Input-Output Universal Synchronous/Asynchronous Receiver /Transmitter: a member of the Z80 family of integrated circuits.
SNP-CU	Synchronous Network Processor - Control Unit: is the Card in the DTC that provides multiplexing and processing of the synchronous data stream.
SNP-LA	Synchronous Network Processor - Line Adaptor: provides the connection interface for synchronous communications. There are two version; (i) version for RS-232-D; (ii) a multi-standard version for V.35,V.36, RS 422 and X.21.
"Start-Stop"	A serial data transmisssion method where each character or byte is transmitted as a self-contained piece of information, needing no additional synchronisation or timing information to be transmitted.
Synchronous	Transmission in which the sending and receiving instruments are operating continuously at the same frequency and in which the desired phase relationship may be maintained by means of correction.
TDR	Time Domain Reflector: an instrument used to troubleshoot the LAN.
TermDSM	Terminal Diagnostic System Manager: a utility which provides diagnostic services through a series of commands.
Thin LAN	A Thin LAN conforms to the IEEE802.3 type 10 BASE 2 standard LAN.
UL	Underwriter's Laboratories.
X.21	Defines the interface between a DTE and a DCE of a public data network where the access to the network is made over synchronous digital lines. Presently X.21 is usually applied to public data networks using circuit switching.
X.25	Defines the interface between a DTE and a DCE for packet mode operation on a Public Data Network