Series DCX
XBridge
Reference Manual

STATUTORY NOTICES

CE

Cray Communications Ltd declare that this product conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the member states relating to electromagnetic protection.

WARNING

The DCX 860 and 870 incorporate a panel in front of the plug-in modules. This panel may only be removed by suitably qualified personnel for installation or maintenance purposes, and must be replaced afterwards. Removal under any other circumstance would invalidate any RFI (Radio Frequency Interference) and Safety Type Approvals.

Published by Cray Communications Technical Publications Department

Preface

This manual provides comprehensive information for engineers and network managers to install, configure and monitor XBridge.

There are two versions of the X.25 bridge product, the Standard XBridge and the high speed HSXBridge. Whenever 'XBridge' appears in this manual it refers to both versions unless stated otherwise.

The manual is divided into sections which describe the product and provide instructions for configuring it, and appendices which contain useful reference material. The reader is recommended to make full use of the contents list for easy reference.

In addition, it may be necessary to refer to general DCX documentation, and particularly to the Reference Manual of the parent DCX 840, 850, 860 or 870, as relevant information is not duplicated here.

For an explanation of terms used in this manual, see the Pocket Books of Telecommunications and Computer Communications.

MORE STATUTORY NOTICES

APPROVALS

The Cray XBridge and HSXBridge are approved for connection to BT PSS and KiloStream (and similar services provided by Kingston-upon-Hull City Council) under numbers:

NS/1282/1/C/021762 DCX 840 systems (no barrier required)

NS/1282/1/C/021763 DCX 850 systems (no barrier required)

NS/1282/1/J/453041 DCX 860/870 systems (barrier is required)

LITHIUM BATTERY

The lithium used in the battery of this unit will react violently with water and most gases. Discharged batteries must not be crushed, incinerated or disposed of in the normal waste. Used batteries should be collected and disposed of in an approved land fill. The manufacturer and your local waste authority will provide more detailed information about their disposal.

Accidental charging and short circuiting of the battery may cause overheating and possible rupture.

Replace only with the same or equivalent type recommended by the equipment supplier.

Contents

Appendices

Figures

Tables

1 Introduction

1.1 The XBridge

The XBridge provides a no-data-loss X.25 bridging facility for the DCX 840/850/860/870 network multiplexer ranges. It enables up to 127 channels to be multiplexed on to one X.25 link, and supports multiple destinations simultaneously.

XBridge is fully operational over leased lines and public or private X.25 data networks. It can be integrated and combined with other Cray multiplexing and switching product ranges, and then passes their data and control information transparently over X.25, to give highly flexible and efficient networking performance.

Physically XBridge is a single card with ports for the X.25 link and an X.25 trace. Management of XBridge is via a VDU-based user-friendly menu system. In addition it can be managed by a Cray Network Management Centre, which provides the facilities to logon transparently, restart the device, and upload and download configurations.

1.2 Specification Summary

XBridge conforms to all the 1980 CCITT Recommendations of X.25 for communication with Public Packet Switched Networks, and X.121 for international network addressing.

XBridge is designed to be fully compatible with X.25 Public Packet Switched Networks such as:

Canada	-	Datapac
Denmark	-	Paxnet
France	-	Transpac
Germany	-	Datex-P
Japan	-	KDD
Netherlands	-	DN-1
Spain	-	IBERPAC
Britain	-	PSS or IPSS
USA	-	Telenet

Product Certification is required for attachment to Public Networks: contact your supplier for up-to-date information.

- **Asynchronous Interface**

  - No data loss
  - Up to 128 low speed ports on a single card mapped directly on to DCX channels
  - Up to 127 user channels
  - 1 manager channel
  - Up to 8 simultaneous transport connections (Standard XBridge)
  - Up to 64 simultaneous transport connections (HSXBridge)
  - Compatibility with DCX 840, 850, 860 or 870, giving direct connectivity to up to 256 nodes

- **Composite Link**

  - Single high speed channel conforming to 1980 CCITT Recommendation X.25:

  X.25 Physical Layer - Level 1

  - V.24 interface speed to 19200 bps (Standard and HSXBridge)
  - X.21interface speed to 128000 bps (HSXBridge only)
  - V.35 interface available (refer to Appendix C.3)
  - Clocking is configurable (Internal and External)

X.25 Data Link Layer - Level 2

- LAPB
- DTE and DCE emulation

X.25 Network Layer - Level 3

- SVC support
- DTE and DCE emulation
- Manager access
- Modulo 8 numbering
- Closed User Group support
- Optional Reverse Charge Request and Acceptance
- Packet size configurable as 128 and 256 data octets
- Calling address validation

Transport Level 4

- Proprietary protocol, enhancing performance and efficiency
- Class 3 functionality
- Establishment and maintenance of X.25 calls
- Retransmission of packets lost by the network (i.e. no data loss)

1.3 XBridge in Networks

Figure 1-1 presents a simplified example network showing XBridge interfacing DCX to an X.25 environment. The product automatically generates X.25 call requests as required, and a user need have no knowledge that XBridge is being used to access a remote DCX network over X.25. Of course the DCX network may be extensive, with XBridge able to provide X.25 transport to any terminal or host connection.

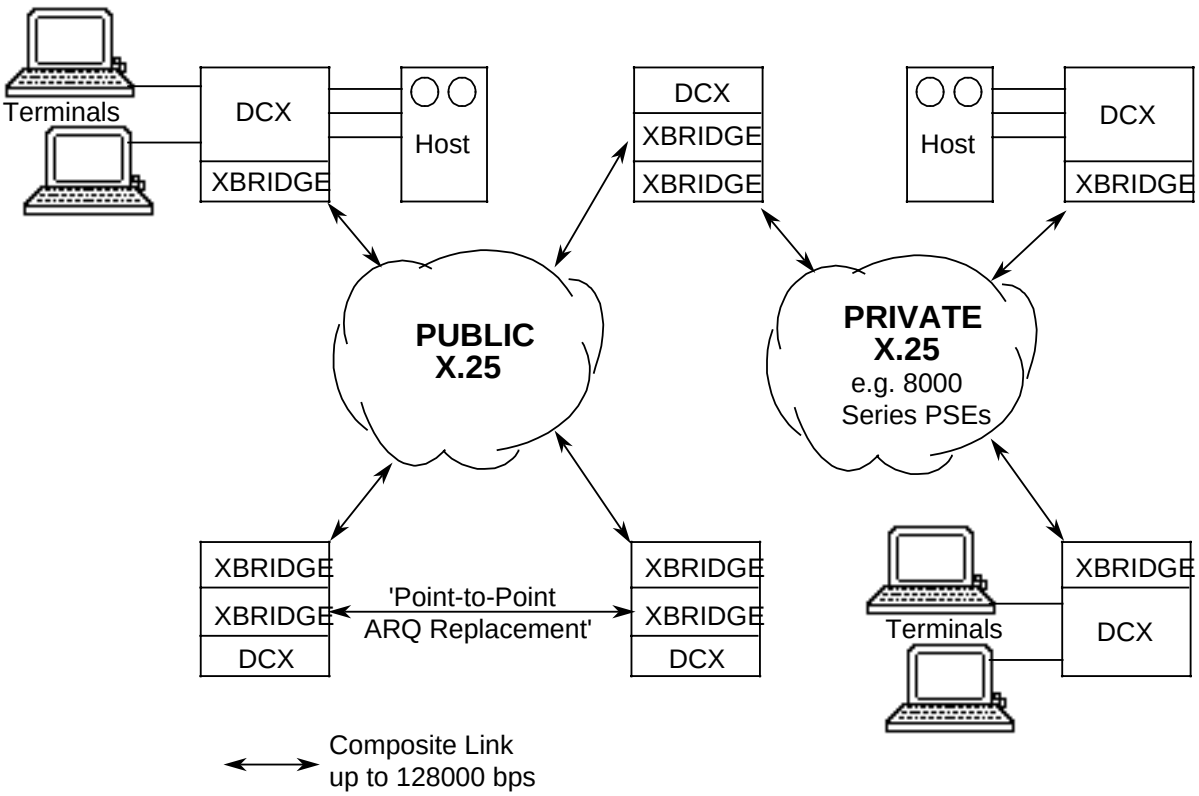


Figure 1-1 Example of XBridge in Networks

Regarding the point-to-point application shown, it should be noted that a DCX node incorporating XBridge will require bus timing. This can be supplied by a suitable ARQ or TAC card in the DCX.

1.4 Terms, Conventions and Abbreviations

The following terms, conventions and abbreviations are used throughout this manual.

The person configuring XBridge is referred to as the 'supervisor', to avoid confusion with the XBridge 'manager' software.

The word 'terminal' is used to describe an 'asynchronous DTE' which can be handled by a DCX LSC card. The terminal may be any device which supports data transmission, e.g. VDU, printer or computer port.

The 'supervisor terminal' is a terminal which a supervisor is using to contact the XBridge manager.

Conventions

Messages between XBridge and the supervisor screen are distinguished by being shown in '**modern font**'.

Non-literal entries are shown in angle brackets and in lower case, e.g. **<1 to 16 alphanumeric characters>** means enter from 1 to 16 alphanumeric characters, **<1-5>** means enter a number in the range 1 to 5 inclusive.

Entries from the keyboard of the carriage return and space characters are shown as **<CR>** and **<SP>** respectively.

General Abbreviations

ASCII	Americal Standard Code for Information Interchange
bps	Bits per second
BRAM	Battery-backed memory
ISO	International Standards Organisation
CCITT	International Telegraph and Telephone Consultative Committee
CPU	Central Processor Unit
DCE	Data Circuit-terminating Equipment
DNIC	Data Network Identity Code
DTE	Data Terminating Equipment
LED	Light Emitting Diode
NUA	Network User Address
NMC	Network Management Centre
OSI	Open Systems Interconnection
PAD	Packet Assembler/Disassembler
VDU	Visual Display Unit

X.25 Abbreviations

(An overview of the X.25 protocol is given in Appendix A).

CUG	Closed User Group
CUGOA	Closed User Group Outgoing Addresses
LAPB	Balanced Link Access Procedure (subset of HDLC protocol)
LCN	Logical Channel Number
LCGN	Logical Channel Group Number
NUA	Network User Address
PSN	Packet Switched Network
RPOA	Recognised Private Operating Agency
SVC	Switched Virtual Circuit

DCX Abbreviations

A-M-D	Addressed Mapped-address Data
ARQ	Automatic Repeat reQuest
BOP	Buffer Overflow Protection
BUF	Buffer card
DCX	Data Concentrating Exchange
DIL	Dual-In-line
LSC	Low Speed Channel
NCAM	Network Control and Management (DCX 860/870)
STC	System Test and Configuration card
TAC	Timing and Control module
TFC	Terminal Flow Control
USO	User Switching Option

2 Functional Description

This chapter provides an overview of the functionality offered by XBridge, explains its interworking with DCX, and details the main components of the card itself.

Information outlined in the specification summary is not repeated in this chapter. Details of the facilities which are configurable via the manager are described in Chapter 4.

2.1 Operational Overview

XBridge provides high speed transparent data transfer between DCX nodes. It uses X.25 as the carrier for its transport connection protocol. One XBridge communicates with another via a single connection. Each XBridge may support multiple connections, thus providing simultaneous data transfer between itself and other XBridges in the X.25 network.

A single X.25 call is established for each connection and is shared by all channels using that connection. In addition the data from several channels may be transported in a single X.25 packet. This efficient data compaction technique offers optimum performance as well as considerable savings on call charges over public networks.

XBridge is transparent to the DCX user. Its transport procedure automatically establishes and maintains the X.25 network connections. Retransmission of lost data packets ensures the integrity of DCX data from one DCX node to another.

Permanently mapped channels may be routed over any connection number to any destination channel number. Self-mapped channels may be used for USO connections, in which case the transport connection used is obtained from the XBridge USO routing table.

2.2 Hardware Overview

The XBridge card occupies a single slot in a DCX frame. It is a microprocessor-based card, which performs all the functions necessary to interface a DCX 840, 850, 860 or 870 multiplexer network to a Packet Network. Its interface with the other DCX modules is via the A-M-D bus and the buffer card as shown in Figure 2-1.

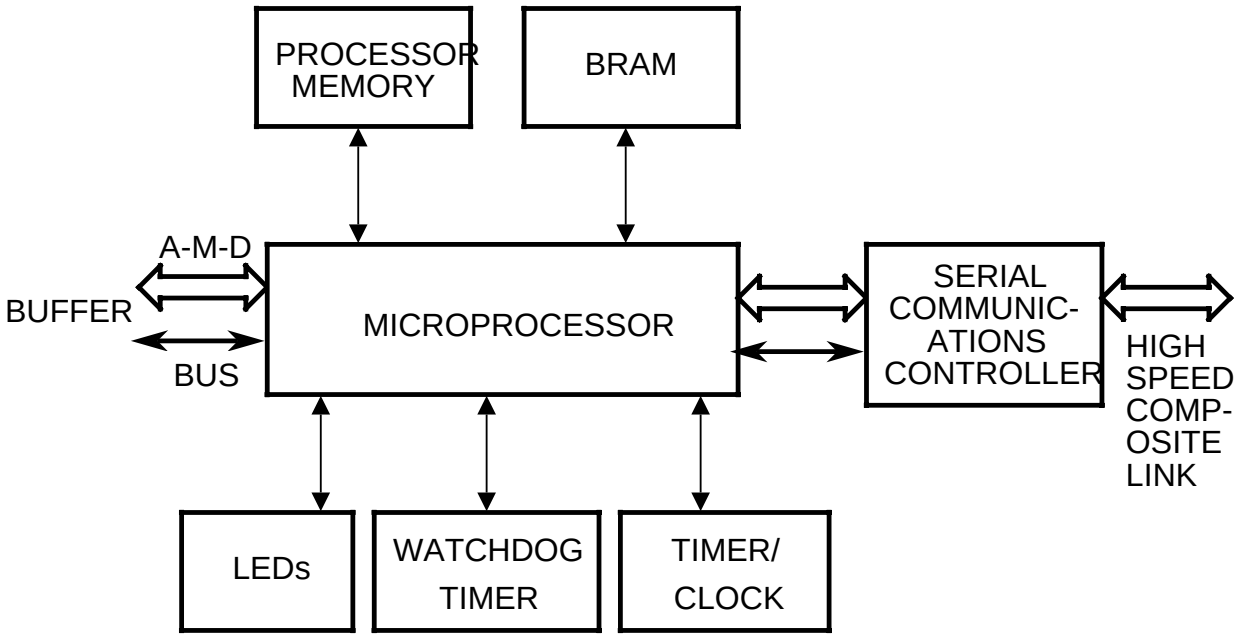


Figure 2-1 Simplified Block Diagram of the XBridge Card

2.2.1 Timer/Clock and Watchdog Timer

The timer/clock provides clock interrupts to the processor. The watchdog timer monitors the processor for malfunctions. (Contact your supplier if XBridge is warm started by the watchdog timer.)

2.2.2 BRAM

The BRAM is a special area of memory used to hold the configuration data. It is powered by a Lithium type battery. The size of this memory is 16 kbytes for the Standard XBridge and 32 kbytes for HSXBridge. If fully charged, the BRAM should keep its contents intact for up to five years in the event of a mains power failure.

2.2.3 Serial Communications Controller

The serial communications controller provides the interface to the high speed composite link to the X.25 packet switched network.

2.3 Indicators

Both the Standard XBridge and HSXBridge have nine LED indicators as shown in Figure 2-2. The **OK** indicator is green, all the others are red.

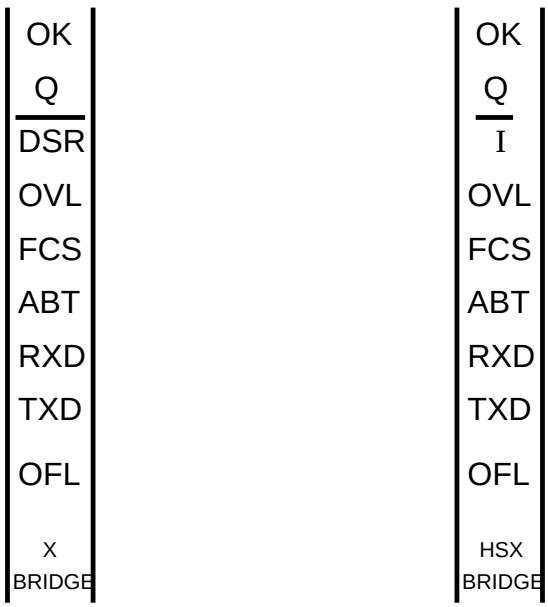


Figure 2-2 Standard XBridge and HSXBridge Card Indicators

OK Indicator

This indicator is a watchdog timer that monitors software. If extinguished then the software is not running and a serious problem has occurred (refer to Chapter 5).

Q (Query) Indicator

When this indicator is off, each indicator below it has its own meaning. When on, it indicates that a problem has arisen. The cause of the problem is indicated by which of the seven status indicators is (are) blinking.

Status Indicators

When **Q** is off, the seven status indicators have the following meanings when lit :

$\overline{\text{DSR}}$ Data Set Ready absent (Standard XBridge only).
The modem is disconnected or switched off.

$\overline{\text{I}}$ Indication absent (HSXBridge only).
The modem is disconnected or switched off.

OVL Overload.
The working memory is almost fully committed and system degradation will occur. If this LED is ever illuminated then connection window sizes should be reduced.

FCS Receive Frame Check Sum Error.
A frame has been received which has a frame checksum error. The LED will stay on until a frame is received which does not have as FCS error.

ABT Frame Aborted.
A receive or transmit frame has been aborted. The LED will stay on until a frame which has not been aborted is received or transmitted.

RXD X.25 Receiving.
An X.25 frame is currently being received.

TXD X.25 Transmitting.
An X.25 frame is currently being transmitted.

OFL Offline.
The X.25 link is down.

Query Indication

When the **Q** indicator is on, the seven indicators below are used to show the cause of the trouble.

If a query situation occurs, then the blinking indicators should be noted and reported to your supplier.

3 Installation

This chapter lists the installation and associated configuration tasks. It details the initial requirements, switch settings and strappings, and configuration within the network.

Installation should be undertaken only by persons qualified in the configuration of the DCXs to be used.

Warning Ensure that the parent DCX is powered off at all times before removing or inserting the XBridge card.

3.1 DCX Requirements

XBridge is designed to operate in a DCX 840/850/860/870 frame with the proviso that the following minimum configuration requirements are met:

For 840 or 850

STC in slot 17
Master ARQ or TAC in slot 16
BUF3 card in slot 1

For 860 or 870

STC in slot 20
Master ARQ or TAC in slot 19
BUF3 card in slot 1

It is possible to use a BUF2 instead of BUF3 for Standard XBridge, but with reduced performance.

XBridge occupies a single slot and may be located in any high speed device position. Any number of bridges may be installed in a single DCX frame.

3.2 Option Switches and Card Straps

After unpacking and checking that there is no physical damage to the card, the option switches and straps should be set as appropriate to the Standard XBridge or HSXBridge.

3.2.1 Standard XBridge

Each card has a bank of four miniature DIL switches, labelled SW1, as shown in Figure 3-1 and 3-2 (depending on version of card). Switches 1, 2 and 3 are only read during a warm or cold start.

Switch 1

open	Don't read switches 2 and 3.
closed	Read switches 2 and 3 (if this facility has not been disabled in the XBridge manager).

Switch 2

open	Operate as a logical DTE. Refer to Section 4.7.
closed	Operate as a logical DCE. Refer to Section 4.7.

Switch 3

open	External clocking.
closed	Internal clocking at 19200 bps.

Switch 4

open	Indicators show diagnostic code, not status. See Section 4.9.
closed	Indicators show status, not diagnostic code. See Section 4.9. It is recommended that this switch is kept open.

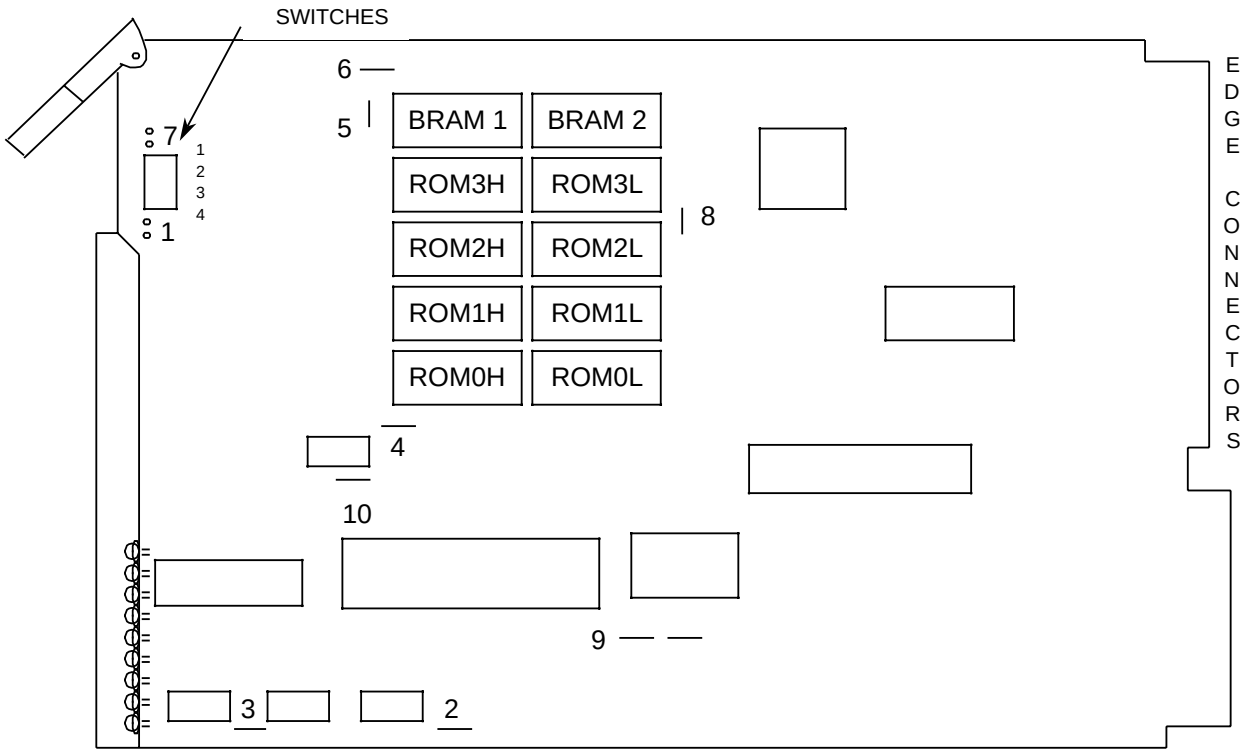


Figure 3-1 XBridge Switches and Straps (X840-603913)

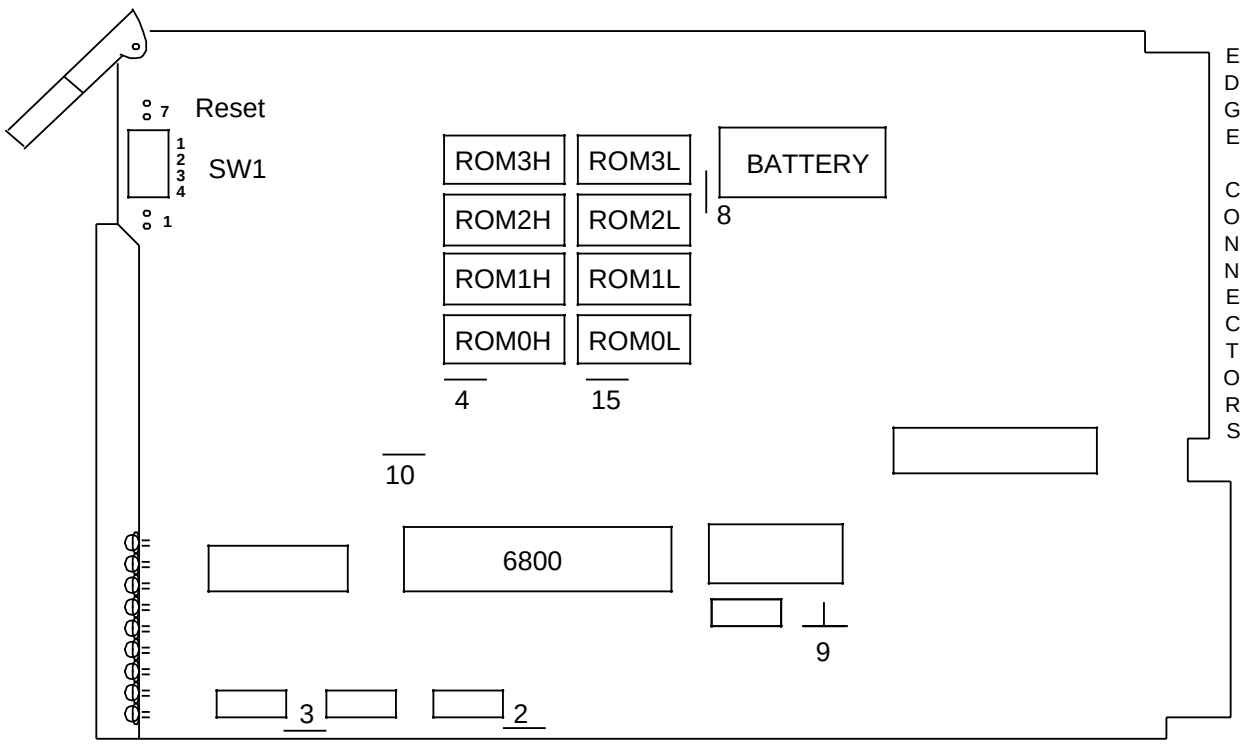


Figure 3-2 XBridge Switches and Straps (X840-603915)

There are option straps located as shown in Figure 3-1 and 3-2 (depending on version of card). The state of these straps for normal operation is shown in Table 3-1 and 3-2. If the card is to be stored (without saving the configuration) then strap 8 should be disconnected (down).

Note that momentarily shorting the pins in position 7 causes a card reset and warm start.

STRAP NUMBER	STRAP NAME	NORMAL OPERATIONAL SETTING	
		CHOICE	STRAP POSITION
1	SFINT	ENABLED	NO STRAP
2	(PROM Size)	27128	STRAP LEFT
3	WDOG	ENABLED	STRAP ON
4	BERR	ENABLED	STRAP ON
5	6264/6116	6264	STRAP LEFT
6	6116/6264	6264	STRAP UP
7	RESET	ENABLED	NO STRAP
8	(Battery supply)	CONNECTED	STRAP UP
9	RAM/128K/256K	128K	STRAP RIGHT
10	BDS/BAS	BAS	STRAP RIGHT

Note that strap names shown in brackets are not marked on the card

Table 3-1 XBridge Strap States (X840-603913)

STRAP NUMBER	STRAP NAME	NORMAL OPERATIONAL SETTING	
		CHOICE	STRAP POSITION
1	SFINT	ENABLED	NO STRAP
2	(PROM Size)	OTHER	STRAP RIGHT
3	WDOG	ENABLED	STRAP ON
4	BERR	ENABLED	STRAP ON
7	RESET	ENABLED	NO STRAP
8	(Battery supply)	CONNECTED	STRAP UP
9	RAM/128K/OTHER	OTHER	STRAP UP
10	BDS/BAS	BAS	STRAP RIGHT
15	512K/OTHER	OTHER	STRAP RIGHT

Note that strap names shown in brackets are not marked on the card

Table 3-1 XBridge Strap States (X840-603915)

3.2.2 HSXBridge

This card has a bank of eight miniature DIL switches, shown in Figure 3-2. It has no straps.

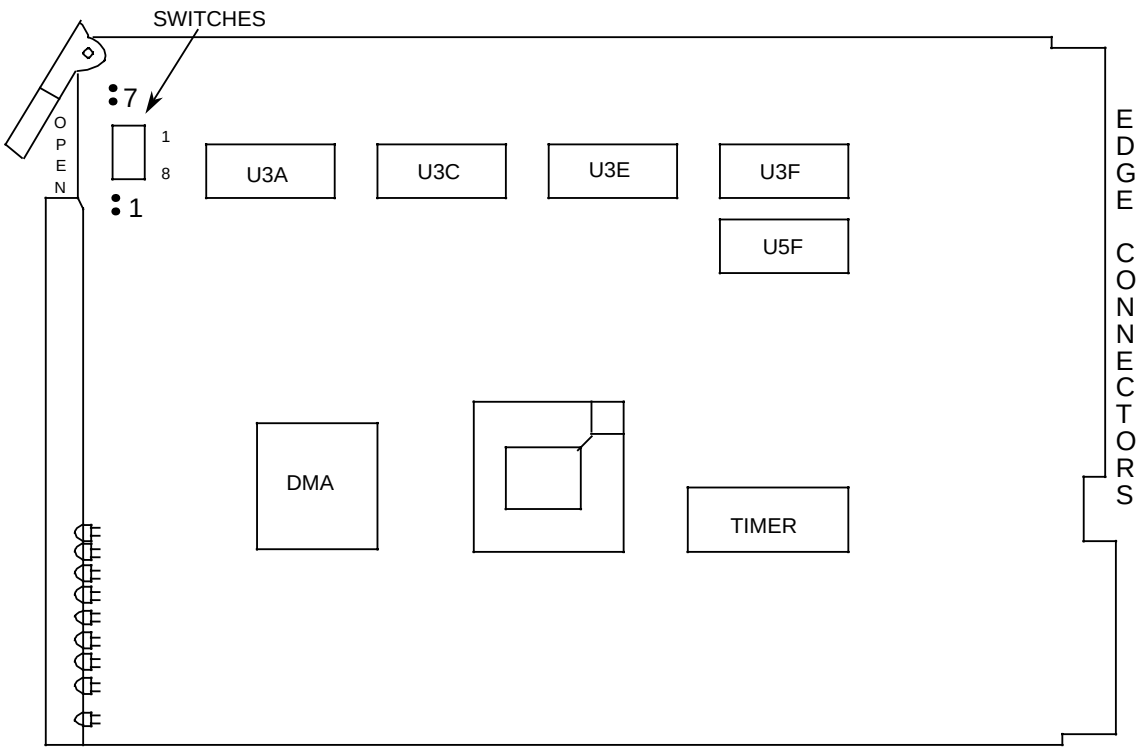


Figure 3-3 HSXBridge Switches

Switches 1, 2, 3 and 5 are only read during a warm or cold start. Switches 6 and 7 are not used. The actions of the others are:

Switch 1

open	Don't read switches 2, 3 and 5.
closed	Read switches 2, 3 and 5 (if this facility has not been disabled in the XBridge manager).

Switch 2

open	Operate as a logical DTE. Refer to Section 4.7.
closed	Operate as a logical DCE. Refer to Section 4.7.

Switch 3

open	External clocking.
closed	Internal clocking at 19200 bps, if switch 5 is closed. Internal clocking at 64000 bps, if switch 5 is open.

Switch 4

open	Indicators show diagnostic code, not status. See Section 4.9.
closed	Indicators show status, not diagnostic code. See Section 4.9. It is recommended that this switch is left open.

Switch 5

open	X.21 interface port used for the X.25 link.
closed	V.24 interface port used for the X.25 link (note that this prevents use of the X.25 diagnostic trace facility).

Switch 8

open	The normal position. Momentarily closing the switch causes a card reset.
closed	May be placed in this position for removing the card whilst the DCX is still powered up.

3.3 DCX Configuration

When the card's straps and switches have been set, then XBridge can be installed in a DCX 840, 850, 860 or 870. (Note that the DCX 860 and 870 are designed to be soft-configurable, and physical access to the plug-in cards is normally unnecessary. It is prevented by a panel, which may only be removed by suitably qualified personnel for installation and maintenance purposes.)

3.3.1 Installing XBridge

1. Turn off mains power.
2. If installing into a DCX 860/870 for connection to KiloStream, barrier PAMs must be fitted. (Instructions for doing this are given in Appendix A of the DCX Installation Guide X840-305351.)
3. Insert the XBridge card in the required slot.
4. Turn on mains power.
5. Allocate a DCX size (i.e. number of DCX channels) of between 1 and 128.
6. Connect the XBridge composite link port on the DCX rear panel with the correct cable (refer to Appendix C). Ensure that there are suitable clocking arrangements.
7. Ensure that the XBridge LEDs have stopped flashing, thus indicating a successful completion of diagnostics, and check that the green **OK** LED is fully illuminated. (Should this not be the case, then refer to Chapter 5 and Appendix E.)

3.3.2 Providing Access to the Local Manager

Channel 1 provides local supervisor access to the manager. Proceed as follows:

840: Permanently map channel 1 to a DCX destination (e.g. to an LSC).

850: Configure channel 1 as an UMP with no connection event and DTR disconnection event. (Refer to USO manual.)

860/870: Configure channel 1 under NCAM Other Device Configuration. (Refer to NCAM manual).

3.3.3 PMC Connection Channels

Each permanently mapped DCX channel should be mapped to XBridge channels 2 to 128. Its proposed destination channel should be mapped to the corresponding destination XBridge channel, or that configured in the PMC routing table, if different.

3.3.4 USO Connection Channels

XBridge channels which are self-mapped are available for use by the USO. XBridge appears as an open link to the USO and may be configured within a pipe, either alone or with other high speed devices. The USO may specify routes to other nodes via XBridge and may send connection requests for these nodes to XBridge.

When a connection request is received from the USO, the corresponding transport connection number is obtained from the routing tables. The default configuration specifies that the transport connection corresponding to all remote DCX nodes is connection 1. In this way the default configuration is suitable for point-to-point USO connections.

3.4 Network Applications

3.4.1 Point-to-Point Operation

An example of point-to-point operation is shown in Figure 3-3.

Figure 3-3 Point-to-Point Application

The default configuration is adequate for point-to-point applications. Only the DIL switches require setting to define which XBridge supplies clocking and acts as a DCE. One XBridge (A) should be powered up with switches 1, 2 and 3 closed. The other XBridge (B) should be powered up with switch 1 closed and switches 2 and 3 open. The settings of the other switches should be set to meet the interface and other operational requirements.

3.4.2 Operation Via an X.25 Network

An example of operation via an X.25 network is shown in Figure 3-4.

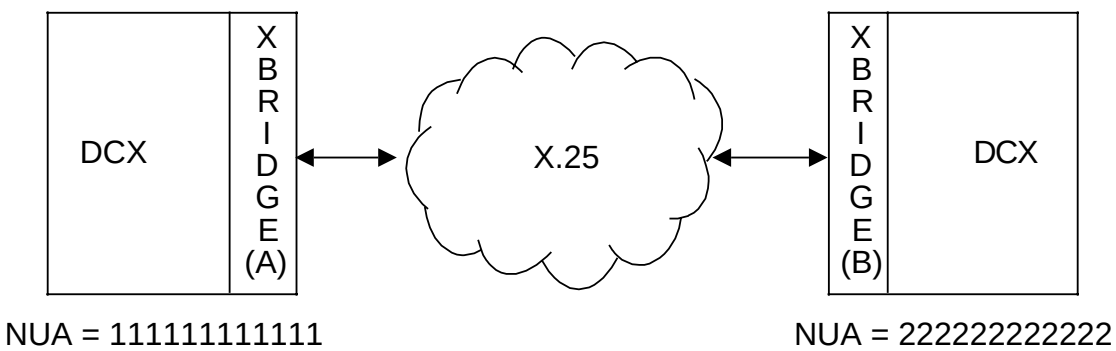


Figure 3-4 Example X.25 Application

The X.25 configuration of each XBridge should be configured to satisfy the requirements of the network interface. In particular, the logical channel allocation, in the Network Layer Menu, should be checked. It is

recommended that 'Configuration from Switch Settings' is disabled in the X.25 Configuration Menu.

Otherwise, the default configuration is adequate for this application. Only the X.121 address of connection 1 needs to be configured to match the NUA, assigned by the network to the 'other' XBridge.

In the Connection Configuration Menu the following configuration changes should be made:

XBRIDGE(a)	Connection 1	X.121 Address:	**222222222222**
XBRIDGE(b)	Connection 1	X.121 Address:	**111111111111**

3.4.3 Multiple Destinations

An example of multiple destination operation is shown in Figure 3-5.

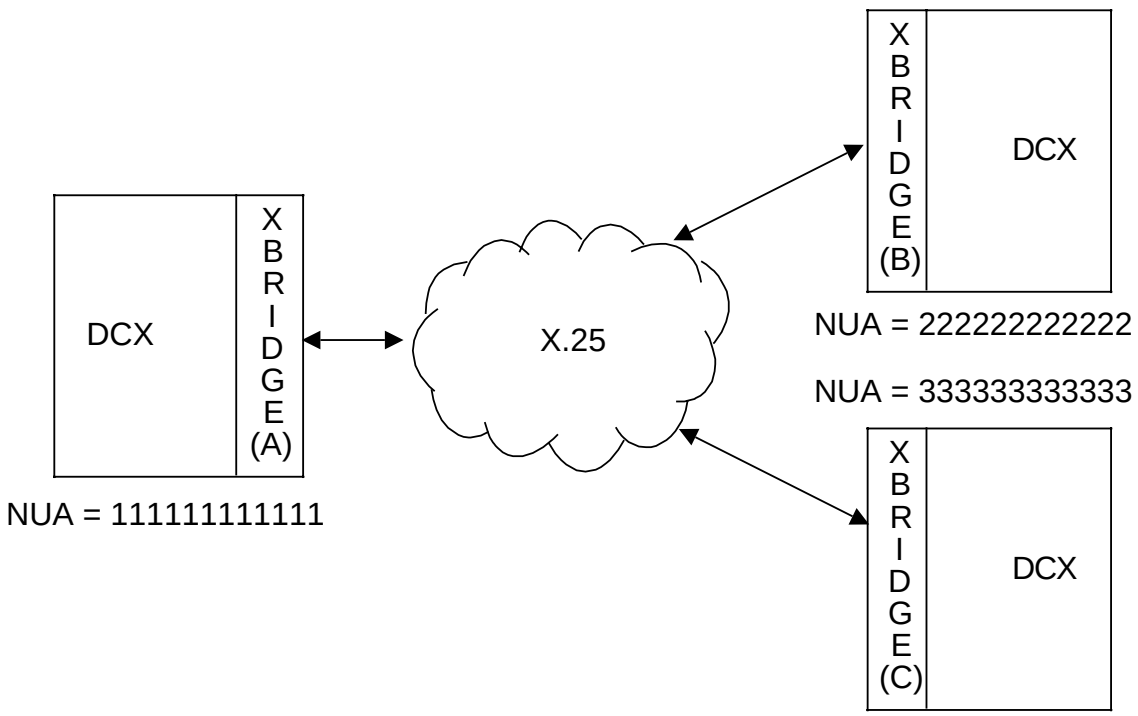


Figure 3-5 Example Multiple Destination Application

Assuming that the X.25 configuration changes have been made for operation via an X.25 network, DCX PMC or USO connections are routed to different XBridges by configuring transport connections to them and referencing these connections in the PMC and USO Routing Tables. The default configuration is adequate for this application except for the following configuration changes:

XBRIDGE(A)	Connection 1	Destination name:	**XBRIDGE B cnx 1**
		X.121 address:	**222222222222**
		Subaddress:	**01**
XBRIDGE(A)	Connection 2	Destination name:	**XBRIDGE C cnx 1**
		X.121 address:	**333333333333**
		Subaddress:	**01**
XBRIDGE(B)	Connection 1	Destination name:	**XBRIDGE A cnx 1**
		X.121 address:	**111111111111**
		Subaddress:	**01**
XBRIDGE(B)	Connection 2	Destination name:	**XBRIDGE C cnx 2**
		X.121 address:	**333333333333**
		Subaddress:	**02**
XBRIDGE(C)	Connection 1	Destination name:	**XBRIDGE A cnx 2**
		X.121 address:	**111111111111**
		Subaddress:	**02**
XBRIDGE(C)	Connection 2	Destination name:	**XBRIDGE B cnx 2**
		X.121 address:	**222222222222**
		Subaddress:	**02**

4 Manager Configuration

4.1 Introduction

This chapter explains the operation of the menu-driven XBridge manager. It details menu operation, facilities offered and configuration options.

The manager is password-protected to prevent unauthorised access. It can be accessed 'locally' via a terminal on the DCX network, or 'remotely' from the X.25 network.

Local access from the DCX network is on the dedicated XBridge Channel 1. This channel should be mapped to an LSC port connected to any ASCII 80-column terminal.

Remote access from the X.25 network is achieved with an X.25 call having a subaddress which matches the Remote Manager Subaddress.

The terminal used to configure the manager is referred to here as the 'supervisor terminal'.

After password entry initial menu display starts with the Main Menu, and each subsequent menu is displayed on request. The manager menus display operational information and contain options to make configuration changes. Several of the options available are designed to allow the performance and efficiency of XBridge to be optimised to the particular application and environment in which it is to be used.

A minimum default configuration is initially present and is suitable for immediate point-to-point operation when used in conjunction with compatible DIL switch settings (see Sub-section 3.4.1). However, these configuration values may have to be amended to conform to the values agreed with the administration of the particular X.25 network to which XBridge is linked. Note also that the default configuration details suggested may not be suitable for the normal operational running of XBridge (refer to Section 3.4).

4.2 Access to the Manager

The manager facilities may be accessed from the supervisor terminal by initially entering a carriage return (**<CR>**).

XBridge will then display the banner:

X.25 Bridge - Version 1.1

or

High Speed X.25 Bridge - Version 1.1

and prompt for a password:

Enter Password :

There is no default password (just enter **<CR>**), but if a password has been configured (in the Management Configuration Menu) enter:

<password><CR>

which will display the Main Menu.

Four attempts are allowed to enter the correct password. If all passwords entered are incorrect, or more than 1 minute is taken to enter the correct password, then the supervisor terminal is disconnected.

4.3 Operating the Menus

The XBridge menus are controlled from the supervisor terminal using the following principles:

<number><CR>	Selects the specified item number from the menu.
X<CR>	Returns to the menu level above the current one.
<CR>	Causes the currently selected menu to be redisplayed.
<ESC>	Aborts the current selection.

Where a menu option has only two possible values, then selecting that option will cause the value to toggle and the menu to be redisplayed showing the new value.

In this manual, every menu option is given its own sub-section, titled to correspond with the phrase which appears in the manager menus. Each title is followed by the number sequence (shown in brackets) that is required to reach that menu from the Main Menu. For example entering 1.2 (**1<CR> 2<CR>**) goes to the Manager Password option.

XBridge responds to invalid entries with a 'help' message before re-displaying the prompt.

4.4 Edit and Active Configurations

XBridge maintains an 'edit' and an 'active' configuration. The edit configuration is stored in BRAM and contains the changes requested by the XBridge supervisor. The active configuration is stored in RAM and contains the values currently in use.

Values from both configurations are displayed, in separate fields, opposite their corresponding options in the manager menus. A configuration change which does not adversely affect run time operation causes the entry in both fields to be changed simultaneously. Otherwise only the edit field is changed.

During a warm start the edit configuration is verified and copied to the active configuration.

4.5 Management Configuration Menu (1)

The Management Configuration Menu contains manager access parameters. It should be noted that if local, remote and NMC access are all disabled then, after logoff or warm start, a cold start would be required to re-access the manager (see Section 4.11).

Loading and dumping of configuration data is managed from this menu; i.e. data may be saved (dumped) onto a magnetic medium, and subsequently be sent (loaded) to other XBridges on the network. This enables installation, upgrades and global configuration changes to be applied easily. This procedure can be done in one of two ways – via the NMC or using an asynchronous capture device.

– When XBridge receives an X.25 call from an NMC (e.g. Cray 5800/5350) with a subaddress which matches the NMC subaddress and XBridge has the NMC option enabled, the call will be accepted and the NMC will then specify the required action. If a DUMP is required then the NMC (in terms of IEEE 802.1 request parameters) requests the edit configuration. In response to each request, XBridge will make X.25 calls back to the NMC (with X.121 address 9999 000 0000 000) to send the configuration data. After loading data the NMC has the capability of warm starting XBridge to activate the new configuration.

– Alternatively, an asynchronous device capable of saving captured data to a file, such as a PC with communications software, can be connected locally or remotely to the XBridge manager. This device may then be used to carry out and save a partial or complete configuration dump. Subsequently the same device may be used to load the saved configuration to any XBridge or HSXBridge in the network.

- **XBridge Name (1.1)**

It may be useful for each XBridge in the network to be allocated a unique name. If configured, this name appears on the Main Menu, thus providing immediate identification of the XBridge on entry to the manager.

XBridge Message	Supervisor Response
Enter XBridge name :	**<0 to 16 alpha numeric characters><CR>**

- **Manager Password (1.2)**

Each XBridge has a manager access password (which has no connection with any other password on the DCX system). This password must be entered to gain access to the XBridge manager. The default value is none (i.e. just **<CR>**).

XBridge Message	Supervisor Response
Enter Old Password :	**<old password><CR>**
Enter New Password :	**<0 to12 alphanumeric characters><CR>**
Please Re-enter New Password :	**<new password><CR>**

- **Manager Idle Timeout (1.3)**

For security reasons the XBridge manager provides an optional idle timeout facility. If no commands are entered for a period exceeding this interval then the supervisor terminal is logged off automatically. This timeout is configured in minutes. A value of 0 disables the facility. The default value is 5.

XBridge Message	Supervisor Response
Enter Manager Idle Timeout :	**<0 - 255><CR>**

- **Local Manager (1.4)**

This facility allows access to the XBridge manager on the DCX channel 1. This facility may optionally be disabled if access to the manager from DCX is to be barred. Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **Remote Manager (1.5)**

This facility allows access to the XBridge manager from the X.25 network using the XBridge transparent logon facility, an X.25 PAD, or a Network Management Centre. This facility may optionally be disabled if access to the manager from X.25 is to be barred. Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **Remote Manager Subaddress (1.6)**

A connection to the 'remote' manager facility is achieved by making an X.25 call to XBridge with the called address having a subaddress which matches the remote manager subaddress configured here. The remote manager facility has priority over all other XBridge connection types. Consequently, it is important that it is configured so that it does not match any other connection subaddress. The default subaddress is 99.

XBridge Message	Supervisor Response
Enter Remote Manager subaddress : <00-99><CR>	

- **Echo of Commands to Remote Manager (1.7)**

The remote manager facility optionally echoes the data that it receives from X.25. In order to prevent corruption of the menu displays, each full command is echoed rather than individual characters. If remote echo is not required then this facility should be disabled. Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **Network Management Centre (1.8)**

XBridge may be accessed by a Cray Network Management Centre for configuration upload/download or device restart. If these facilities are not required then this option should be disabled. Disabling this feature does not prevent transparent logon from the Network Management Centre. Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **NMC Subaddress (1.9)**

A connection from the Network Management Centre facility for configuration, upload/download or device restart is achieved from the NMC by using a called address having a subaddress which matches this NMC subaddress. The NMC facility has priority over all other XBridge connection types except the remote manager. Therefore it is important that it is configured so that it does not match any other connection subaddress. The default subaddress is 98.

XBridge Message	Supervisor Response
Enter Subaddress :	**<00-99><CR>**

- **Load Configuration (1.10)**

Saved data can be loaded by choosing the Load Configuration option, to which XBridge issues the following prompt:

XBridge Message	Supervisor Response
Load Configuration ?	**YES<CR>** or **NO<CR>**

If the response is YES then XBridge issues the following:

Awaiting Configuration :

XBridge will then wait for 1 minute to receive the first S-record. If this is not received within 1 minute a time-out message will be displayed.

XBridge should always be warm started after a successful load so that the new configuration takes effect.

If a configuration load fails one of the following error messages may be displayed:

Timed Out	A valid S-record has not been received within a 1 minute time period.
Unable to read S0-record	An invalid S0-record was received when an S0 record was expected.
Unable to read S1-record	An invalid S1-record was received when an S1 record was expected.
Unable to read S9-record	An invalid S9-record was received when an S9 record was expected.
Bad S0-record	An invalid S0-record was received.
Bad S1-record	An invalid S1-record was received.
Bad S9-record	An invalid S9-record was received.
Checksum error	An S-record was corrupted.
Unrecognised format	An S-record transfer was successful but the file contents were invalid.
Memory Shortage	The configuration file is too large or other activity on XBridge is using all the available memory.

- **Dump Configuration Menu (1.11)**

This menu allows the supervisor to dump all or a portion of the edit configuration. The options available are:

Complete Configuration	Dumps the entire edit configuration.
Connection Configuration	Dumps the edit configuration from the Connection Configuration Menu for all connections.
X.25 configuration	Dumps the edit configuration from the X.25 Configuration Menu.

XBridge prompts:

XBridge Message	Supervisor Response
Dump Configuration ?	**YES<CR>** or **NO<CR>**

If the response is YES then XBridge issues the following prompt:

Prepare device, type <CR> when ready.

XBridge will wait 1 minute for a <CR>. If this is not received then a timeout message will be displayed. On receipt of a <CR> the requested data will be sent in Motorola S-Record format. Note that it is up to the user to prepare the capture device. On completion, the Dump Configuration Menu is re-displayed after a <CR> is entered or after 1 minute.

4.6 Connection Configuration Menu (2)

The Connection Configuration Menu enables various call parameters and timeouts associated with the connections to other XBridges in the X.25 network to be defined.

One XBridge communicates with another via a single connection. Each XBridge may support multiple connections, so providing simultaneous data transfer between itself and other XBridges in the X.25 network. A single X.25 call is established for each connection and is shared by all channels using that connection.

On selecting this menu the specific connection number is requested.

XBridge Message	Supervisor Response	
Enter connection number :	**<1-8><CR>**	for Standard XBridge
	<1-64><CR>	for HSXBridge

- **Destination Name (2.1)**

Each connection corresponds to a single destination XBridge. For configuration and diagnostic purposes it may be useful to associate a name with each connection. This name will appear as information in the Connection Statistics. It is not used by XBridge for validation during setup procedures.

XBridge Message	Supervisor Response
Enter Destination Name :	**<0 to16 alphanumeric characters><CR>**

- **Call Inactivity Timeout (2.2)**

Each connection uses a single X.25 call to send data. Normally there is no reason why this call should ever be cleared by XBridge. However, for use with public networks where call charges are related to duration, XBridge provides a call inactivity timeout. This specifies the duration for which an X.25 call will be maintained in the absence of data transfer.

If this timeout is configured and the X.25 call is cleared for any reason, XBridge will only attempt to re-establish that call if there is data to send. Note that, if an X.25 network failure occurs while the X.25 call is not established, XBridge will not notice the fault until there is data to send over that connection. In particular, USO-connected channels will not be

disconnected until one channel attempts to send data. Therefore, use of the call inactivity timeout is not recommended in conjunction with non-resilient X.25 networks.

If the value is 0 then the call inactivity timeout is disabled. Furthermore, if the X.25 call is cleared for any reason, XBridge will attempt to re-establish that call even if there is no data to send.

This timeout is configured in minutes. The default value is 0.

XBridge Message	Supervisor Response
Call Inactivity Timeout :	**<0-255><CR>**

- **Transport Window Size (2.3)**

XBridge utilizes a transport window to enable re-transmission of lost data units. It indicates the number of unacknowledged data units, at the Transport Level, which may be transmitted before an acknowledgement response is required.

Each data unit sent may contain an acknowledgement of data units received. However, when data is being transmitted in one direction only, the receiving XBridge uses a special unit to acknowledge the data. This acknowledgement unit is sent after either half a window is received or 30 seconds, whichever occurs first. The transport window size should relate to the transit delay between the two XBridges. Connections over public networks or large distances should be given larger transport window sizes than those over private networks and short distances. It is recommended that the total of all the transport window sizes for connections to be used simultaneously, should not exceed the total number of unused buffers reported in the Diagnostics Menu at power up.

XBridge must store unacknowledged data units in its memory buffers. If many connections with large transport window sizes are in use then buffer levels may be depleted. If the number of unused buffers displayed in the Diagnostics Menu is ever lower than 50, then transport window sizes on some connections should be reduced.

The default is 32.

XBridge Message	Supervisor Response
Enter Transport Window :	**<1-127><CR>**

Call Establishment Procedure

XBridge uses an X.25 call to transport data for each connection. If an X.25 call is cleared before the transport connection is established, then XBridge may retry the call. The delay between receiving the X.25 clear request and transmitting the next call request is determined by the value of the initial call retry time. This procedure is repeated until the initial call retry count is exceeded. The final retry procedure is then used with a delay determined by the value of the final call retry time until the final call retry count is exceeded. If the call is unsuccessful the retry procedure is abandoned and the fact reported in the detailed connection statistics menu.

The connection is still ready to receive X.25 calls but will not make further calls until either the retry sequence is restarted or the connection is reset. The retry sequence is restarted whenever both the X.25 call and the transport connection are established.

- **Initial Call Retry Time (2.4)**

Refer to the Call Establishment Procedure above. This timeout is configured in seconds. A value of 0 disables the facility. The default value is 5.

XBridge Message	Supervisor Response
Enter Call Retry Time :	**<0-255><CR>**

- **Initial Call Retry Count (2.5)**

Refer to the Call Establishment Procedure above. A value of 0 indicates that the calls should be repeated indefinitely. The default value is 5.

XBridge Message	Supervisor Response
Enter Call Retry Count :	**<0-127><CR>**

- **Final Call Retry Time (2.6)**

Refer to the Call Establishment Procedure above. This timeout is configured in minutes. A value of 0 disables the facility. The default value is 1.

XBridge Message	Supervisor Response
Enter Call Retry Time :	**<0-255><CR>**

- **Final Call Retry Count (2.7)**

Refer to the Call Establishment Procedure above. A value of 0 indicates that the calls should be repeated indefinitely. The default value is 0.

XBridge Message	Supervisor Response
Enter Call Retry Count :	**<0-127><CR>**

- **X.25 Call Configuration Menu (2.8)**

This menu is used to specify the X.25 address and facilities to be included in the X.25 call request for each connection.

- **X.121 Address (2.8.1)**

The X.121 address specifies the called address used to make an X.25 call to the destination XBridge for this connection. When establishing a transport connection the Destination Subaddress is appended to this address in the X.25 call request packet. When establishing a transparent logon the Transparent Logon Subaddress is appended to this address in the X.25 call request packet. Refer to Appendix B for additional information.

The default value is none.

XBridge Message	Supervisor Response
Enter X.121 Destination Address :	**<0 to 13 digits><CR>**

- **Destination Subaddress (2.8.2)**

This is the last two digits of the X.121 address and should be the same as the connection number subaddress of the destination XBridge.

The default value matches its own connection subaddress.

XBridge Message	Supervisor Response
Enter Connection subaddress :	**<00-99><CR>**

- **Transparent Logon Subaddress (2.8.3)**

The transparent logon subaddress is appended to the X.121 address and is used for transparent logons to other XBridge managers. It should match the remote manager subaddress of the destination XBridge.

The default value is 99.

XBridge Message	Supervisor Response
Enter Transparent Logon subaddress :	**<00-99><CR>**

- **Protocol Identifier (2.8.4)**

The protocol identifier constitutes the first four bytes of the 16-byte user data field. Although XBridge does not use this field to validate received X.25 calls, it is configurable in case it is required by the network. When user data is configured then this field is padded with 0s as required. It is conventional that this field is expressed in terms of hexadecimal pairs, each pair representing one byte. When changing this value no punctuation should separate the hexadecimal pairs. For example <01020304>.

The default value is none.

XBridge Message	Supervisor Response
Enter Protocol Identifier :	**<0 to 4 hexadecimal pairs><CR>**

- **User Data (2.8.5)**

The user data constitutes the last 12 bytes of the 16-byte user data field of the X.25 call request packet. Although XBridge does not use this field to validate received X.25 calls, it is configurable in case it is required by the network.

The default value is none.

XBridge Message	Supervisor Response
Enter User Data :	**<0 to 12 alphanumeric characters><CR>**

- **Closed User Group (2.8.6)**

This X.25 security feature limits network user connections within a specified group. A closed user group is a collection of DTEs requiring only to communicate with each other to the exclusion of all other DTEs. XBridge does not verify CUGs, accepting calls from all originators. However it is configurable in case it is required by the network. The default value is none.

XBridge Message	Supervisor Response
Enter Closed User Group :	**<0-99><CR>**

- **Reverse Charging (2.8.7)**

Reverse charging may be requested for X.25 calls made by XBridge for each connection. If this feature is enabled then Reverse Charge Acceptance must be enabled on the destination XBridge.

Selecting this option toggles the value between Enabled and Disabled. The default value is Disabled.

- **Window and Packet Negotiation (2.8.8)**

If this facility is enabled then window and packet size negotiation is performed using the configured values in all X.25 call requests for this connection. In addition, all call requests with packet negotiation, received on this connection, must request the configured packet size for this connection.

If this facility is disabled then window and packet size negotiation is not performed in X.25 call request packets for this connection. In addition, all call requests with packet negotiation, received on this connection, must request the default packet size configured in the X.25 Network Layer Menu.

Received call requests which do not obey these requirements will be cleared with diagnostic code 65 (facility code not allowed).

Selecting this option toggles the value between Enabled and Disabled. The default value is Disabled.

- **Window Size (2.8.9)**

If Window and Packet Negotiation is enabled then this value specifies the level 3 window size to be negotiated. The default value is 2.

XBridge Message	Supervisor Response
Enter Window Size :	**<1-7><CR>**

- **Packet Size (2.8.10)**

If Window and Packet Negotiation is enabled then this value specifies the level 3 maximum packet size to be negotiated.

Selecting this option toggles the value between 128 and 256. The default value is 128.

- **Restart Retry Sequence (2.9)**

This option resets both the Initial and Final Retry counts. If there is data to send on this connection, or no inactivity timeout is configured, then the X.25 call will be retried. No data loss is caused by this facility.

- **Reset Connection (2.10)**

This option copies the edit configuration of this connection to the active configuration before it disconnects it and flushes all data. The connection may subsequently be re-established when there is data to send.

Warning This option may cause data loss on this connection.

4.7 X.25 Configuration Menu (3)

The X.25 Configuration Menu defines the values of the X.25 parameters. These values must be agreed with the administration of the X.25 network to which XBridge is to be connected. Refer to Appendix A for more information.

- **Physical Layer Menu (3.1)**

The X.25 Physical Layer is concerned with the electrical interface, clock source and clocking rate of the X.25 link.

- **Physical Interface (3.1.1)**

The physical interface defines the electrical interface used on the X.25 link. Configuration of the physical interface is only available on HSXBridge (Standard XBridge provides a V.24 interface only, so this option is not configurable). HSXBridge offers the choice of V.24 or X.21 interfaces. If V.24 is required then the X.25 trace facility is not available as that port is used for the X.25 link.

Selecting this option toggles the value between V.24 and X.21. The default value is X.21.

Warning This option may be affected by the position of the DIL switches.

- **Clock Source (3.1.[1 or 2])**

Clocking should be provided by a single source on each X.25 link. It may be provided by a modem or line driver, the X.25 network DCE, or by XBridge itself. Where the clock source is provided by XBridge then Clock Source should be Internal. Otherwise it should be External. The clocking rate should be correctly configured, regardless of the clock source, to enable accurate statistics.

Selecting this option toggles the value between Internal and External. The default value is External.

Warning This option may be affected by the position of the DIL switches.

- **Clocking (3.1.[2 or 3] to 3.1.[7 or 13])**

The clocking value limits the rate of data transfer across the X.25 link. XBridge provides clocking rates of 2400, 4800, 7200, 9600 and 19200 bps.

HSXBridge provides additional clocking rates of 48000, 56000, 64000, 96000 and 128000 bps. These higher rates should only be used in conjunction with the X.21 physical interface.

On XBridge the default value is 19200 bps. On HSXBridge the default value is 64000 bps with the X.21 interface (however, if the physical interface has been configured as V.24 using the DIL switches, then the default value is 19200 bps).

- **Data Link Layer Menu (3.2)**

The Data Link Layer provides error-free data transmission over the circuit provided by the physical layer. The supervisor is only able to update the edit configuration. The newly specified values do not become active until XBridge is warm started.

- **Logical Operation (3.2.1)**

For correct LAPB operation data transmission is provided between the DCE and the DTE. Normally the X.25 network provides a DCE operation, in which case XBridge must provide DTE operation; however for a point-to-point application one XBridge must be configured as a DCE. Selecting this option toggles the value between DTE and DCE. The default value is DTE.

Warning This option may be affected by the position of the DIL switches.

- **Protocol Variant (3.2.2)**

The LAPB link start-up procedures used by XBridge are compatible with all CCITT 1980 conformant products. Therefore protocol variant 1 should be used with most networks. However some assertive networks may require passive link start-up procedures provided by protocol variant 2. Selecting this option toggles the value between 1 and 2. The default value is 1.

- **Retry Count N2 (3.2.3)**

The retry count N2 is the maximum number of frame re-transmissions after expiry of the command timeout period T1. The default value is 10.

XBridge Message	Supervisor Response
Enter Retry Count:	**<1-20><CR>**

- **Command Timeout T1 (3.2.4)**

The command timeout T1 defines the delay between successive polls of command frames while no response is being received. This timeout is configured in tenths of a second. The default value is 30.

XBridge Message	Supervisor Response
Enter Timeout:	**<10-100><CR>**

- **Idle Timeout T4 (3.2.5)**

The idle timeout T4 defines the delay between successive polls of command frames during periods of no data transfer. This timeout is configured in tenths of a second. The default value is 80.

XBridge Message	Supervisor Response
Enter Timeout:	**<10-200><CR>**

- **Window Size K (3.2.6)**

The window size K defines the maximum number of unacknowledged information frames which may be transmitted. The default value is 7.

XBridge Message	Supervisor Response
Enter Window size K:	**<1-7><CR>**

- **Network Layer Menu (3.3)**

The network layer provides error-free data transmssion over the data link layer for multiple X.25 calls.

Logical Channel Allocation

Each X.25 call is assigned a logical channel number, each associated with a switch virtual circuit. Each transport connection in use by XBridge uses an X.25 call and therefore requires an SVC. One SVC is also required for remote access to the manager, one for transparent logon and two for NMC support. The Standard XBridge supports 16 SVCs and HSXBridge supports 72. There are three types of SVCs supported by XBridge: incoming, 2-way and outgoing.

When the network layer logical operation is specified as DCE, incoming SVCs are used in preference to 2-way SVCs for making X.25 calls. Outgoing SVCs may only be used for receiving calls.

When the network layer logical operation is specified as DTE, outgoing SVCs are used in preference to 2-way SVCs for making X.25 calls. Incoming SVCs may only be used for receiving calls.

Normally only 2-way SVCs need to be used, but if the network requires the use of incoming or outgoing SVCs then the total number of SVCs configured must not exceed the maximum number permitted.

The order of logical channel allocation to the SVC groups is also significant. Incoming SVCs must be allocated lower logical channel numbers than 2-way SVCs, which in turn must be allocated lower logical channel numbers than outgoing SVCs. If these rules are violated then, when a warm start occurs, the new values will not be copied to the active field, which will return to the default values.

Note that some networks specify LCNs in terms of LCGNs and LCNs, where the X.25 LCN is a 12-bit number comprising a 4-bit LCGN (high order bits) and an 8-bit LCN. For this type of network the LCGN plus LCN supplied by the network administration must be translated into an X.25 LCN acceptable to XBridge. Refer to Logical Channel Group Numbers in Appendix D.

- **Logical Operation (3.3.1)**

XBridge supports both DTE and DCE logical operation. Normally the X.25 network provides DCE operation, in which case XBridge should provide DTE operation. However for point-to-point applications one XBridge should be configured as DCE. When requesting X.25 calls, the DCE allocates the lowest available logical channel, whilst the DTE allocates the highest. Therefore frequent call collisions are avoided if the logical operation is different at both ends of the X.25 link. Selecting this option toggles the value between DTE and DCE. The default value is DTE.

Warning This option may be affected by the position of the DIL switches.

- **Low In SVC (3.3.2)**

Refer to the Logical Channel Allocation (above). The Low In SVC specifies the lowest logical channel number in the range of channels allocated as incoming SVCs. A value of 0 specifies that no incoming SVCs are defined. The default value is 1.

XBridge Message	Supervisor Response
Enter Low Incoming SVC :	**<0-4095><CR>**

- **High In SVC (3.3.3)**

Refer to the Logical Channel Allocation (above). The High In SVC specifies the highest logical channel number in the range of channels allocated as incoming SVCs. The default value is 1.

XBridge Message	Supervisor Response
Enter High Incoming SVC :	**<0-4095><CR>**

- **Low 2-way SVC (3.3.4)**

Refer to the Logical Channel Allocation (above). The Low 2-way SVC specifies the lowest logical channel number in the range of channels allocated as 2-way SVCs. A value of 0 specifies that no 2-way SVCs are defined. The default value is 1024.

XBridge Message	Supervisor Response
Enter Low 2-Way SVC :	**<0-4095><CR>**

- **High 2-way SVC (3.3.5)**

Refer to the Logical Channel Allocation (above). The High 2-way SVC specifies the highest logical channel number in the range of channels allocated as 2-way SVCs. The default value is 1031.

XBridge Message	Supervisor Response
Enter High 2-Way SVC :	**<0-4095><CR>**

- **Low Out SVC (3.3.6)**

Refer to the Logical Channel Allocation (above). The Low Out SVC specifies the lowest logical channel number in the range of channels allocated as outgoing SVCs. A value of 0 specifies that no outgoing SVCs are defined. The default value is 0.

XBridge Message	Supervisor Response
Enter Low Outgoing SVC :	**<0-4095><CR>**

- **High Out SVC (3.3.7)**

Refer to the Logical Channel Allocation (above). The High Out SVC specifies the highest logical channel number in the range of channels allocated as outgoing SVCs. The default value is 0.

XBridge Message	Supervisor Response
Enter High OutgoingSVC :	**<0-4095><CR>**

- **Default Window Size (3.3.8)**

The network layer window size defines the maximum number of unacknowledged packets that may be transmitted. If no window size negotiation occurs during X.25 call establishment then the value of the default window size is used for the duration of that call. The default value is 2.

XBridge Message	Supervisor Response
Enter Window Size :	**<1-7><CR>**

- **Default Packet Size (3.3.9)**

The network layer packet size defines the maximum number of data characters that may be contained by each packet. If no packet size negotiation takes place during X.25 call establishment then the value of the default packet size is used for that call. Selecting this option toggles the value between 128 and 256. The default value is 128.

- **Restart Timeout T10 or T20 (3.3.10)**

The restart timeout defines the delay, while waiting for a response to a restart request, before a definitive action is taken. This timeout is configured in seconds. The default value is 180.

XBridge Message	Supervisor Response
Enter new timeout :	**<10-500><CR>**

- **Call Timeout T11 or T21 (3.3.11)**

The call timeout defines the delay, while waiting for a response to a call request, before a definitive action is taken. This timeout is configured in seconds. The default value is 200.

XBridge Message	Supervisor Response
Enter new timeout :	**<10-500><CR>**

- **Reset Timeout T12 or T22 (3.3.12)**

The reset timeout defines the delay, while waiting for a response to a reset request, before a definitive action is taken. This timeout is configured in seconds. The default value is 180.

XBridge Message	Supervisor Response
Enter new timeout :	**<10-500><CR>**

- **Clear Timeout T13 or T23 (3.3.13)**

The clear timeout defines the delay, while waiting for a response to a clear request, before a definitive action is taken. This timeout is configured in seconds. The default value is 180.

XBridge Message	Supervisor Response
Enter new timeout :	**<10-500><CR>**

- **Configuration from Switch Settings (3.4)**

When XBridge is cold or warm started certain configuration values may be configured by the positions of the DIL switches. These include the physical layer clock source, the data link and network layer logical operation and, for HSXBridge, the physical interface. Configuration from the switch settings may be disabled to ensure that configuration changes made by the supervisor are used. Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **X.25 Facility Configuration Menu (3.5)**

During X.25 call establishment, facilities are requested, negotiated and validated. Many facilities are configured individually for each transport connection, but some facilities and validation considerations are relevant to all X.25 calls. Values configured in the X.25 facilities menu are used during all X.25 call establishment procedures.

- **Facilities Negotiation (3.5.1)**

If Facilities Negotiation is enabled then XBridge will negotiate window and packet size in the call accept packet, if these were negotiated in the received call request packet.

If Facilities Negotiation is disabled then XBridge will not negotiate window or packet size in the call accept packet. If these were negotiated in the received call request packet then the call will be rejected unless the negotiated values match the XBridge default values.

Selecting this option toggles the value between Enabled and Disabled. The default value is Enabled.

- **Reverse Charge Acceptance (3.5.2)**

If XBridge receives an X.25 call which requests reverse charge then it will only be accepted if Reverse Charge Acceptance is enabled. Selecting this option toggles the value between Enabled and Disabled. The default value is Disabled.

- **Calling Address (3.5.3)**

The calling address is included in every X.25 call request packet to indicate, to the destination, the source of the call. If the calling address is configured, then the transport connection subaddress is appended to it when a transport connection sends a call request, and the remote manager subaddress is appended to it when a transparent logon is requested. The default value is none.

XBridge Message	Supervisor Response
Enter Calling Address :	**<0 to 13 digits><CR>**

- **Calling Address Validation Table (3.5.4)**

The calling address in every received call request packet which requests a transport connection, is validated against a table of 20 validation addresses. If no match is found then the call is rejected.

A validation address consists of 0 to 15 characters. These characters may be digits, question marks or asterisks. A digit is used to indicate the only digit acceptable in that position. A question mark is used to indicate that any digit is acceptable in that position. An asterisk is used to indicate that any sequence of digits is acceptable in that position. Only 2 asterisks are permitted in each validation address.

Note that 2 adjacent asterisks are equivalent to a single asterisk and consequently not permitted.

For example,
suppose that one of the validation addresses is 1234*789*??
and that the calling address received is 12345678901

When the address is validated, the first asterisk will match 56, the second asterisk matches an empty sequence of digits, and the question marks match 0 and 1 respectively.

Note that the validation address <*> matches all calling addresses and effectively disables the validation facility.

The default value of the first validation address is <*>.

XBridge Message	Supervisor Response
Enter Validation Address :	**<validation address><CR>**

4.8 DCX Configuration Menu (4)

The DCX configuration menu specifies parameters relevant to the DCX node containing the XBridge card.

- **Link Speed Reporting to USO (4.1)**

The USO monitors link utilisation of XBridge against its link speed for load sharing with other high speed devices. The link utilisation reported to the USO is calculated as a percentage of the link speed reported to the USO, and is not necessarily the actual link utilisation. For tuning purposes the link speed reported need not match the actual link speed. The values available are 2400, 4800, 7200, 9600, 19200, 48000, 56000, 64000, 80000 and 96000 bps. The default value is 96000 bps.

- **Optimisation (4.2)**

XBridge may be configured to optimise operation for different applications.

File Transfer optimises performance while operating in a volume data transfer capacity.

User Interaction ensures that all DCX channels are serviced regularly.

When all channels are permanently mapped and running large file transfer applications, and performance is critical, then File Transfer should be used. For all other operations, User Interaction should be used.

Selecting this option toggles the value between File Transfer and User Interaction. The default value is User Interaction.

- **Connection Down Timeout (4.3)**

If a connection fails to establish within the Connection Down Timeout period then a DCX Link Down message is reported to all permanently mapped channels, and a forced disconnection sent to all USO-connected channels that are using that connection. While the connection remains down all USO connection requests will be refused. This timeout is configured in seconds. The default value is 10.

XBridge Message	Supervisor Response
Enter Connection Down Timeout :<1-255><CR>	

- **USO Routing Table (4.4)**

When XBridge receives a USO connection request it uses the node routing table to select the appropriate connection to route across the X.25 network to the requested DCX node. Each node number from 0 to 255 may be assigned to any connection number. XBridge supports 8 connections and HSXBridge supports 64. Hence a USO connection request may be sent across the X.25 network to any of 8 other XBridges from a Standard XBridge, or to any of 64 other XBridges from an HSXBridge. The default value for all nodes is connection 1.

XBridge Message	Supervisor Response
Enter node number :	**<0-255><CR>**
Enter connection number :	**<1-8><CR> <1-64><CR>**

- **PMC Routing Table (4.5)**

XBridge channels which are not self-mapped during a warm or cold start, or become permanently mapped on the STC, take their destination from the PMC Routing Table. This destination is then fixed until the channel becomes self-mapped even if the value in the PMC Routing Table is changed. Hence, the destination of a permanently mapped channel is only changed if the channel is self-mapped and subsequently remapped, or XBridge is warm started.

The destination of an XBridge channel is uniquely defined with a connection number and a destination channel number. The PMC Routing Table displays their edit configuration values for every channel.

Each PMC can be routed via any available connection and mapped to any destination channel. However, the destination of every channel must be unique. If destinations are shared then a warning message is displayed. If the conflict involves channels which are within the XBridge DCX device size then the configured values are not copied to the active configuration. In addition, if a warm start occurs while this conflict exists then the default values for all channels are copied to the active configuration.

The default value for all channels is connection 1 with their corresponding destination channel number.

XBridge Message	Supervisor Response
Enter channel number :	**<2-128><CR>**
Enter connection number :	**<1-8><CR> <1-64><CR>**
Enter destination channel number :	**<2-128><CR>**

4.9 Diagnostics (5)

The diagnostics menu provides detail on the current status and operation of XBridge. This assists performance optimisation and analysis of any problems that arise. An additional benefit is the information provided for billing comparison.

Time since last reboot indicates the length of time that XBridge has been operational since it was last rebooted.

Last reboot indicates the cause of the last warm or cold start where the possible causes are:

Initial cold start.
Warm start caused by reboot or hardware reset.
Cold start caused by software version change.
Cold start caused by manager request.
Warm start caused by manager request.
Cold start caused by STC request.
Warm start caused by watchdog timeout.
Warm start caused by fatal software error.
Warm start caused by fatal hardware error.
Warm start caused by DCX device map change.
Warm start caused by NMC request.

Unused Buffers indicates the number of memory buffers remaining available within the card. If the number of unused buffers is frequently less than 50 then configuration changes such as reduction in the Transport Window Sizes are recommended. Buffer shortages may also be caused by flow-controlled terminals.

Link Utilisation indicates the data transfer over the X.25 link expressed as a percentage of its maximum capacity. The transmit and receive utilisations are displayed separately.

- **X.25 Diagnostic Trace (5.1)**

XBridge provides a diagnostic facility to monitor the X.25 link. A terminal may be connected to the diagnostic port to display all X.25 data in hexadecimal format. The terminal used must be ASCII compatible, running at 9600 bps for Standard XBridge, or 19200 bps for HSXBridge, and set to 7-bit data no parity. (Crossover cable part number X840-404411 should be used.)

Each frame displayed is prefixed by 'R' or 'T' for Received and Transmitted data respectively. The diagnostic trace should be disabled during normal operation.

Selecting this option toggles the value between Enabled and Disabled. The default value is Disabled.

Note that if HSXBridge is using a V.24 physical interface then the diagnostic trace facility is not available.

- **X.25 Data Link Layer Statistics (5.2)**

The data link layer statistics provide the essential information required to diagnose faults at this level.

Link State indicates whether the link is up or down. If the link is down, check the cabling and that there is a clock source. Check that the logical operation is different at each end of the link.

Link Level Resets indicates the number of times the link has been re-established. If this number frequently increases, check the cabling and that there is only one clock source.

Information frames indicates the number of frames that have been transmitted and received.

Rejects indicates the number of rejects that have been transmitted and received. If rejects are occurring, check that there is only one clock source. Rejects may be caused by a high clocking rate.

- **Reset Statistics (5.2.1)**

Resetting the statistics causes the values in the data link layer statistics to be cleared.

- **X.25 Network Layer Statistics (5.3)**

The network layer statistics provide the essential information required to diagnose faults at this level. Note that these statistics are stored in BRAM and consequently are not cleared during a warm start.

Calls indicates the number of X.25 calls that have been transmitted and received.

Clears indicates the number of X.25 clears that have been transmitted and received.

Resets indicates the number of X.25 resets that have been received. Note that XBridge does not normally transmit network layer resets. However, resets may result from the receipt of invalid packets. These resets are recorded as received.

Data Packets indicates the number of data packets that have been transmitted and received.

- **Reset Statistics (5.3.1)**

Resetting the statistics causes the values in the network layer statistics to be cleared.

- **Connection Statistics (5.4)**

The connection statistics provide the essential information required to diagnose faults at this level. Note that some of these statistics are stored in BRAM and consequently are not cleared during a warm start.

Connection Number indicates the connection to which these statistics relate.

D**estination Name** indicates the name of the destination configured in the Connection Configuration Menu.

Network State indicates the current state of the X.25 call associated with this connection. The possible states are:

Disconnected	There is no X.25 call established for this connection. The Connection Status indicates the reason for this. If the Connection Status is OK then there is no data to send at present.
Waiting for Call Confirm	If an X.25 call request has been sent by XBridge then a call confirm would normally be expected almost immediately. If the network remains in this state for more than a few seconds then there is an X.25 logical channel number mismatch or there is serious network congestion. The configuration of the SVCs in the X.25 Network Layer menu should be checked.
Data Transfer	An X.25 call is established for this connection.

Connection State indicates the current state of this transport connection. The possible states are:

Disconnected	The connection is not established. The Connection Status indicates the reason for this. If the Connection Status is OK then there has never been any data to send for this connection.
Suspended from data transfer	The connection is temporarily unusable because the network state is not in data transfer. The Connection Status indicates the reason for this. If the Connection Status is OK then there is no data to send at present.
Waiting for connection request	XBridge has received an X.25 call to this connection which it has accepted. Normally it would expect to receive a connection request almost immediately, so if one is not received within 10 seconds then the X.25 call is cleared. If there are repeated occurrences of this state then XBridge is receiving X.25 calls from an unrecognised device.
Waiting for connection confirm	XBridge has made an X.25 call on this connection and it has been accepted. XBridge has subsequently sent a connection request and would normally expect to receive a connection confirm almost immediately. If one is not received within 10 seconds then the X.25 call is cleared and XBridge waits for its retry timer to expire before repeating the call. If there are repeated occurrences of this state then XBridge is sending X.25 calls to an unrecognised device. The X.121 address in the X.25 Call Configuration Menu for this connection should be checked.
Data transfer	The connection is established and able to pass data.
Data resynchronisation	The Connection State was in data transfer when the previous X.25 call was cleared. XBridge has subsequently sent a reconnection request and would normally expect to receive a

	reconnection response almost immediately. If one is not received within 10 seconds then the X.25 call is cleared and XBridge waits for its retry timer to expire before repeating the call. If there are repeated occurrences of this state then XBridge is sending X.25 calls to an unrecognised device. The X.121 address in the X.25 Call Configuration Menu for this connection should be checked.
Waiting for reconnection request	The Connection State was in data transfer when the previous X.25 call was cleared. XBridge has subsequently received an X.25 call on this connection which it has accepted. Normally it would expect to receive a reconnection request almost immediately, so if one is not received within 10 seconds then the X.25 call is cleared. If there are repeated occurrences of this state then XBridge is receiving calls from an unrecognised device.
Data resynchronisation after reset	A Network Layer reset has occurred while the Connection State was in data transfer. XBridge has sent a reconnection indication almost immediately. If one is not received within 10 seconds then the X.25 call is cleared and XBridge waits for its retry timer to expire before repeating the call. If there are repeated occurrences of this state then serious network data integrity problems exist which should be investigated.

Last Clear indicates whether there has been an X.25 clear on this connection. If a clear has occurred then its direction is reported together with the cause and diagnostic codes in decimal.

Last Call indicates whether there have been any X.25 calls on this connection. If a call has occurred then its direction is reported. If the call was transmitted then the called address used by the call is reported. If the call was received then the calling address used by the call is reported.

Connection Status indicates the status of this connection, and should be evaluated in conjunction with the current Connection State. The possible values are:

Connection Status OK.	XBridge is not aware of any problems with this connection. If the Network State is Disconnected then there is no data to send at present. If the Connection State is Disconnected then there has never been any data to send and this connection has never been attempted or verified.
Trying to connect but X.25 call requests are being cleared.	There is data to send for this connection, or no inactivity timeout is configured, but the previous X.25 call request was rejected. The cause and diagnostic of this clear is displayed in the Last Clear field. XBridge will retry the call, obeying the initial and final retry times and counts configured in the Connection Configuration Menu.
Trying to connect but the X.25 destination is not an operational XBridge.	There is data to send for this connection, or no inactivity timeout is configured, but the previous X.25 call timed out while waiting for a connection or reconnection indication. XBridge suspects that the destination is not an operational XBridge but will retry the call, obeying the initial and final retry times and counts configured in the Connection Configuration Menu.
Given up because all X.25 call requests were cleared.	There is data to send for this connection, or no inactivity timeout is configured, but the previous X.25 call request was rejected. The cause and diagnostic of this clear is displayed in the Last Clear field. The call retry counts configured in the Connection Configuration Menu have expired and XBridge will not retry the X.25 call until the connection is reset, the retry sequence is restarted, or an X.25 call is received from another XBridge resulting in data transfer Connection State.

Given up because the X.25 destination is not an operational XBridge	There is data to send for this connection, or no inactivity timeout is configured, but the previous X.25 call timed out while waiting for a connection or reconnection indication. The call retry counts configured in the Connection Configuration Menu have expired and XBridge will not retry the X.25 call until the connection is reset, the retry sequence is restarted, or an X.25 call is received from another XBridge resulting in data transfer Connection State.

Network Calls indicates the number of X.25 calls that have been transmitted and received on this connection.

Network Clears indicates the number of X.25 clears that have been transmitted and received on this connection.

Network Resets indicates the number of X.25 resets that have been received on this connection. Note that XBridge does not normally transmit network layer resets. However, resets may result from the receipt of invalid packets. These resets are recorded as received.

Network Packet Size indicates the current maximum X.25 packet size in use by this connection.

Network Window Size indicates the current X.25 window size in use by this connection.

Data Units indicates the number of data units that have been transmitted and received on this connection.

Retransmitted Data Units indicates the number of data units that have been retransmitted on this connection.

- **Reset Statistics (5.4.1)**

Resetting the statistics causes the values in the connection statistics to be cleared on this connection.

Channel Tracing

XBridge provides diagnostic information to trace a channel, through the X.25 network, to its destination. This information may be obtained from the Channel Trace, Connection Trace, and Call Trace tables.

The destination channel number and connection number are obtained from the Channel Trace Table.

Subsequently, the destination name of that connection may be obtained from the Connection Trace Table.

Alternatively the logical channel number for that connection may be obtained from the Call Trace Table. The destination XBridge may then be identified by tracing this logical channel number through the X.25 network.

- **Channel Trace (5.5)**

The Channel Trace Table displays the connection number being used, together with its corresponding channel number on the destination XBridge.

All channels up to the allocated device size are displayed, with the exception of the manager channel. Self-mapped channels are available for USO connections, but have no current destination, and consequently appear as unused.

Note that each permanently mapped channel will display the connection number and the destination channel number which were configured correctly in the PMC Routing Table the last time this channel was remapped on the STC, or XBridge was warm or cold started.

- **Connection Trace (5.6)**

The Connection Trace Table displays the X.121 address, including the subaddress, and the destination name, from the active configuration of the connection configuration menus. This configuration summary is useful for verifying the connection configurations and also provides a quick reference for tracing connections to their destinations.

- **Call Trace (5.7)**

The Call Trace Table displays all logical channel numbers in use and identifies whether the call is being used by a transport connection, a remote supervisor, or the NMC.

If a connection number does not appear in the Call Trace Table then no X.25 call is established for that connection. The reason for this will be displayed in the Connection Statistics Menu.

- **Current LED Display (5.8)**

The LEDs on the front of the XBridge card may be configured to perform a number of diagnostic functions. These functions are only operational if DIL switch 4 is open. The default value is Disabled.

- **Disabled (5.8.1)**

If the LED display is disabled then all status LEDs will remain off.

- **Link Utilisation (5.8.2)**

If the LED display is configured to display the link utilisation then the number of LEDs illuminated represents the transmitted or received link utilisation, whichever is greater. Each LED represents approximately 12% of maximum capable with the current link speed. The display is updated every half second.

- **XBridge operational (5.8.3)**

If the LED display is configured to display that XBridge is operational then the LEDs display a cyclic pattern whenever XBridge is powered up and running.

4.10 Warm Start (6)

A warm start is the procedure during which XBridge runs its hardware diagnostics, initialises memory and activates the software. During a warm start the edit configuration in BRAM is verified and copied to the active configuration in RAM. The DIL switch settings are checked and may cause some values in the active configuration to be changed.

The edit configuration is preserved even if the combination of some of its values is invalid. Invalid values are replaced, in the active configuration, with the default values.

The X.25 link is reset, causing all X.25 calls to be cleared. Statistics and diagnostic values which are not stored in BRAM are cleared. Transport connections are reset and all outstanding data are discarded. Data in the DCX BUF card read and write queues of XBridge channels are discarded. Flow control of DCX channels is reset. All USO-connected channels are disconnected.

A warm start is caused whenever:

- XBridge is powered up.
- The reset pins are shorted.
- Warm Start is selected by the supervisor.
- The STC map is swapped and the XBridge base or size has changed.
- The Watchdog times out.
- A fatal software error occurs.
- A fatal hardware error occurs.
- A Device Restart is requested from the Network Management Centre.
- Switch 8 is opened on HSXBridge.

Warning. This option may cause data loss on all connections.

XBridge Message	Supervisor Response
Do you want to activate the edit configuration and restart ?	**<YES or NO><CR>**

4.11 Cold Start (7)

A cold start is the procedure which XBridge uses to restore the default edit configuration and perform the operations of a warm start.

A cold start is caused whenever:

- XBridge is powered up for the first time.
- XBridge is powered up with a new version of software.
- Cold Start is selected by the supervisor.
- A cold start is requested by the STC.
- A fatal software error which corrupts the edit configuration occurs.
- A fatal hardware error which corrupts the edit configuration occurs.

Warning. This option will cause all configuration changes to be lost.

XBridge Message	Supervisor Response
Do you want to restore the default configuration and restart ?	**<YES or NO><CR>**

4.12 Transparent Logon (8)

The XBridge manager provides the facility to connect transparently to the manager of any other XBridge in the X.25 network. This offers the remote manager facility even when no X.25 terminals or PADs are available on the network.

When this option is selected XBridge generates an X.25 call using the X.121 address and facilities configured for the requested connection number. The configured transparent logon subaddress for that connection is appended to its X.121 address to ensure that the remote manager facility is accessed on the destination XBridge.

XBridge Message	Supervisor Response
Enter Connection Number :	**<1-8><CR> <1-64><CR>**

The remote manager connection procedure should then be followed.

If the destination is incorrectly configured and some other X.25 application is accessed then this call may be disconnected by logging off from the manager.

If the transparent logon was made through the local manager, logoff by sending a break, or if the local manager was accessed via the USO, by sending a USO disconnect request.

If the transparent logon was made through the remote manager, logoff by clearing the X.25 call to it.

When the transparent logon is disconnected, then a message is displayed containing the X.25 cause and diagnostic of the clear.

4.13 Logoff (9)

Logoff terminates the current manager session. The manager may subsequently be accessed by the methods described in Section 4.2, provided the facility remains enabled in the Management Configuration Menu.

A logoff is caused whenever:

- Logoff is selected by the supervisor.
- A break is sent to the local manager.
- A USO diconnect request is sent to the local manager.
- The X.25 call to the remote manager is cleared.
- The Manager Idle Timeout expires.
- XBridge is warm started.
- XBridge is cold started.

5 Troubleshooting

This chapter describes and provides diagnoses for the majority of the operational problems that could occur within an XBridge environment.

Troubleshooting should be undertaken only by persons qualified in the configuration of the DCXs used.

Note that the LED display may sometimes correspond to an error condition when it is configured to display the link utilisation or the CPU load.

Blinking LEDs turn on and off once every 3 seconds.

Flashing LEDs turn on and off twice each second.

If any LEDs are flashing while the **Q** and **OK** LEDs are on full then a hardware fault or exception condition has occurred. Refer to Appendix F for more information.

All LEDs are off.	Power failure.
The **OK** LED is off and all the red LEDs are off except **RXD** which is on.	There is an internal bus error which is preventing operation. Replace the card.
The **OK** LED is off.	The software is not operational. Check card strappings for Standard XBridge. Open DIL switch 8 for HSXBridge. Check that all chips are seated firmly in their sockets.
The **Q** LED is blinking with some other combination of LEDs.	Record all LEDs that are blinking and contact your supplier. Perform a warm start.
$\overline{\text{DSR}}$ LED on for XBridge or **$\overline{\text{I}}$** LED on for HSXBridge.	These signals are absent on the X.25 physical interface. Check cabling.

The Link State is down, the **OFL** LED is on.	Check cabling and X.25 Data Link Layer configuration.
Cannot access the local manager.	Check DCX configuration for correct channel allocation.
The Link State is up but XBridge is not passing data.	Check DCX mappings. Check Connection Statistics.
XBridge is receiving network layer resets.	Check the Connection Statistics for mismatched packet or window sizes. Check for network faults.
An excessive number of calls is being made.	Check the Connection Statistics to identify the connection at fault. Check for invalid called address. Check the value of the idle timeout. Check the Data Link Layer Statistics for link failures.
Data transfer is bursty with pauses of up to 30 seconds.	Check the number of unused buffers in the Diagnostics Menu. If there are less than 50 reduce some transport window sizes.
The link utilisation reported in the Diagnostics is 100%.	The Physical Layer external clocking value is too low.
The link utilisation reported to the USO is 50%.	The Link Speed Reporting to USO is lower than the actual link speed.
A high number of rejects is reported in the Data Link Layer Statistics.	Check that there is only one clock source. Rejects may be caused by a high clocking rate or errors on the link due to noise.
USO connections failing.	Check the USO configuration. Check that there are self-mapped DCX channels on both the source and the destination XBridge. Check that the Node Routing Table is configured correctly. Check that the Connection Status is OK in the Connection Statistics. USO connection requests may fail under heavy load if Optimisation is File Transfer.

Appendix A The X.25 Recommendation

A.1 X.25 Description

The CCITT Recommendation X.25 defines in detail how Packet Switching Public Data Networks are accessed. X.25 specifies the protocol across the interface between a network and equipment connecting to it.

In 1980 the CCITT produced the Yellow Book version which specified a new link level protocol, LAPB. Most of today's networks conform to the 1980 version of X.25 employed by XBridge.

X.25 defines the protocol between Data Terminal Equipment and Data Circuit-terminating Equipment which are operating in packet mode. The DTE may be a terminal or a host computer. The DCE may be the entry point into a PSE or into a network such as PSS.

X.25 describes three functional layers: physical, link and packet, and is consistent with the ISO OSI model.

- **The Physical Layer – Level 1**

The Physical Layer describes the physical, functional and electrical characteristics of the line connecting the DTE and DCE. It references the X.21 and X.21*bis* standards. X.21 is designed for high speed access to digital networks. X.21*bis* is equivalent to V.24 and makes allowance for modems on analogue networks. The Physical Layer provides a full duplex, synchronous facility at speeds up to 128000 bps.

- **The Data Link Layer – Level 2**

The Data Link Layer describes the procedures across a line between a DTE and DCE, and makes use of the services provided by the Physical layer. It uses the LAPB which is consistent with the ISO HDLC procedures. It transfers frames of information between the DCE and DTE. These frames consist of address, control and check sequence fields which may enclose a packet of user data. Frames may hold any data patterns and are delimited

by flags. A flag is a unique bit pattern and, to prevent the pattern occurring within the frame, the technique of 'bit stuffing' is used, whereby the transmitter inserts zero bits into the data stream to avoid the occurrence of flags inside the frame. The receiver carries out the reverse process to remove the extra bits from the data stream and thus restore the original data.

The address field of frames holds little information because, as the Data Link Layer operates over a point-to-point link, only the direction of transfer needs to be identified.

- **The Network Layer – Level 3**

The Network Layer describes the exchange of packets between the DTE and the DCE. It transfers packets by making use of the services provided by data link layer. The X.25 Network Layer is also covered by the ISO OSI standards.

The Network Layer manages logical channels and provides Switched Virtual Circuits (SVCs) and Permanent Virtual Circuits (PVCs). PVCs are unsuitable for use by XBRIDGE and are not used.

An SVC channel requires the user to set up a call before exchanging data, and to clear down the call when data transmission is complete. Thus the same channel may be re-used by a second user when the first user releases it by clearing the call. The Network Layer multiplexes virtual circuits over a link so that a DTE may have many concurrent connections to many other DTEs via the Packet Switching Network. It handles flow control independently for each virtual circuit, and provides User Facilities such as Reverse Charging.

The Network Layer handles packets of information, each packet consisting of a header and user information.

Figure A-1 is an example of the normal procedures for SVC call establishment.

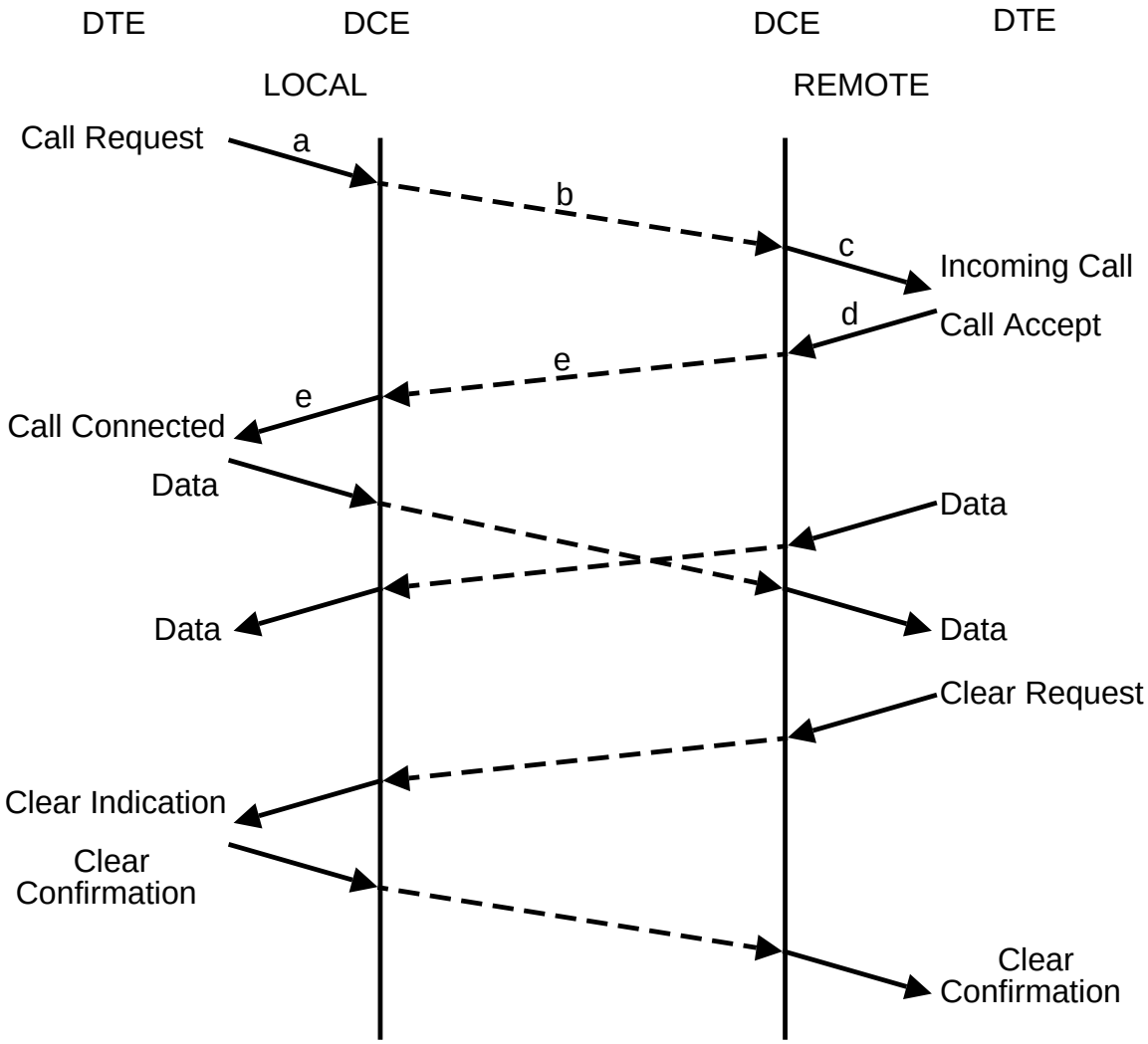


Figure A-1 Procedure for a Switched Virtual Circuit

1) A DTE requests an SVC by sending a Call Request packet to the DCE. The DTE allocates the highest available logical channel number to the call. The Call Request packet holds the X.121 address of the called DTE. It contains requests for any User Facilities or User Data (a very small amount) that the DTE wishes to send.

2) The DCE uses the specified destination address to route the packet across the Packet Switching Network to the remote, destination DCE.

3) The remote DCE forwards the packet to the called DTE as an Incoming Call packet, choosing the lowest logical channel number which is available at that link.

4) The called DTE accepts the request for a virtual circuit by sending a Call Accepted packet to its DCE.

5) This packet is passed back across the network and sent to the calling DTE as Call Connected.

The two DTEs may now exchange data across the SVC.

DTEs exchange data in Data and Interrupt packets over an established SVC. Various other types of packet are used for flow-control or to 'reset' the circuit if a problem arises.

To clear the SVC, either of the DTEs may send a Clear Request packet to its DCE. The packet is forwarded to the remote DTE as a Clear Indication which the DTE acknowledges with a Clear Confirmation. The Clear Confirmation packet is then passed to the DTE which originated the clear request. The SVC has now been removed and the logical channels may be allocated to other virtual circuits.

A.2 X.25 Diagnostic Codes

Table A-1 specifies the subset of X.25 diagnostic codes which can be generated by XBridge. These codes are included in X.25 Clear packets, and are listed here to assist in identifying the specific cause of any unexpected problems in clearing calls.

HEX	DEC	DIAGNOSTIC CODES	HEX	DEC	DIAGNOSTIC CODES
00	0	No Additional Information	2A	42	Packet Type Not Compatible
01	1	P(S) Invalid	2B	43	Unauthorised Interrupt Confirm
02	2	P(R) Invalid	2C	44	Unauthorised Interrupt
10	16	Invalid Packet	30	48	Timer Expired
11	17	Packet Type Invalid for State R1	31	49	Timer Expired for Incoming Call or for DTE Call Request
12	18	Packet Type Invalid for State R2	32	50	Timer Expired for Incoming Call or for DTE Clear Request
13	19	Packet Type Invalid for State R3	33	51	Timer Expired for Reset Indication
14	20	Packet Type Invalid for State P1	34	52	Timer Expired for Restart Indication
15	21	Packet Type Invalid for State P2	40	64	Unspecified Call Setup Problem
16	22	Packet Type Invalid for State P3	41	65	Facility Code Not Allowed
17	23	Packet Type Invalid for State P4	42	66	Facility Parameter Not Allowed
18	24	Packet Type Invalid for State P5	43	67	Invalid Called Address
19	25	Packet Type Invalid for State P6	44	68	Invalid Calling Address
1A	26	Packet Type Invalid for State P7	82	130	DTE Inoperable
1B	27	Packet Type Invalid for State D1	84	132	DTE Subaddress Busy
1C	28	Packet Type Invalid for State D2	85	133	DTE Subaddress Address Invalid
1D	29	Packet Type Invalid for State D3	A2	162	DTE Not Operational
20	32	Packet Not Allowed	A8	168	Timer Expired, nothing valid received
21	33	Unidentifiable Packet	A9	169	Call Idle Timer Expired
22	34	Call on One Way LCN	AA	170	Invalid PDU received
23	35	Invalid Packet Type on PVC	AB	171	Transport Connection Terminated
24	36	Packet on Unassigned LCN	AC	172	Transport Connection Reset
25	37	Reject Not Subscribed to	B1	177	X.25 Link is Down
26	38	Packet too Short			
27	39	Packet too Long			
28	40	Invalid GFI			
29	41	Restart with Non-Zero bits 5-16			

Table A-1 X.25 Diagnostic Codes

Appendix B The X.121 Recommendation

The CCITT Recommendation X.121 concerns the international numbering of Packet Switched Networks.

On most networks it has the form of a 14 digit decimal number, though 15 digits, where a 3 (instead of 2) digit subaddress is present, can be used. Its composition is shown in Figure B-1.

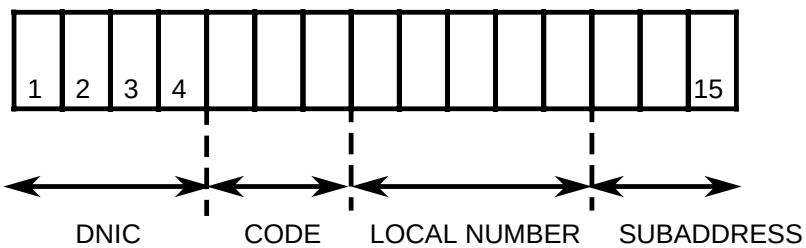


Figure B-1 X.121 Address Format

Note that the DNIC is subdivided into:

1	The Continent (e.g. 2 for Europe).
2 and 3	The Country (e.g. 34 and 35 for Britain).
4	The Network.

The X.121 address (or NUA as it is sometimes known) to access an XBRIDGE will be supplied by the Network Administrator. For point-to-point operation, only the subaddress is required.

Appendix C Interconnections

C.1 Standard XBridge

C.1.1 Interface Signals

Each Standard XBridge card composite X.25 interface terminates in a 25-way D-type connector. The interface signals conform to CCITT V.24/V.28 and are listed in Table C-1.

PIN No.	CCITT CCT. No.	Signal	Mnemonic
2	103	Transmitted Data	TxD
3	104	Received Data	RxD
4	105	Request To Send	RTS
5	106	Clear To Send	CTS
6	107	Data Set Ready	DSR
7	102	Signal Ground	SG
8	109	Carrier Detect	DCD
15	114	Transmitter Clock	TxC
17	115	Receiver Clock	RxC
20	108/2	Data Terminal Ready	DTR
22	125	Ring Indicator	RI
24	113	External Transmit Clock	XTxC

Table C-1 Standard XBridge Composite Link Interface

C.1.2 Cables

The standard cable to connect the Standard XBridge D-type connector to a synchronous modem (for operation over public telephone lines) is part number X840-400911, as illustrated in Figure C-1.

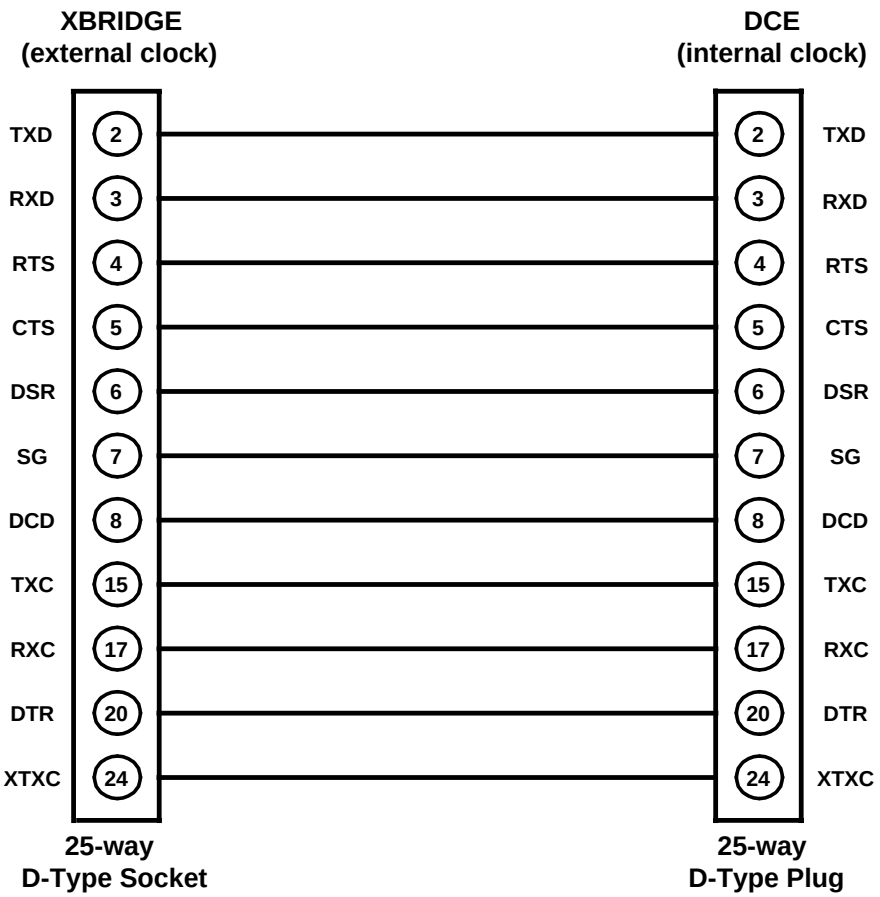


Figure C-1 Standard X.21*bis* Cable X840-400911

For DCE mode a crossover cable is required. Part number X840-404411, as illustrated in Figure C-2.

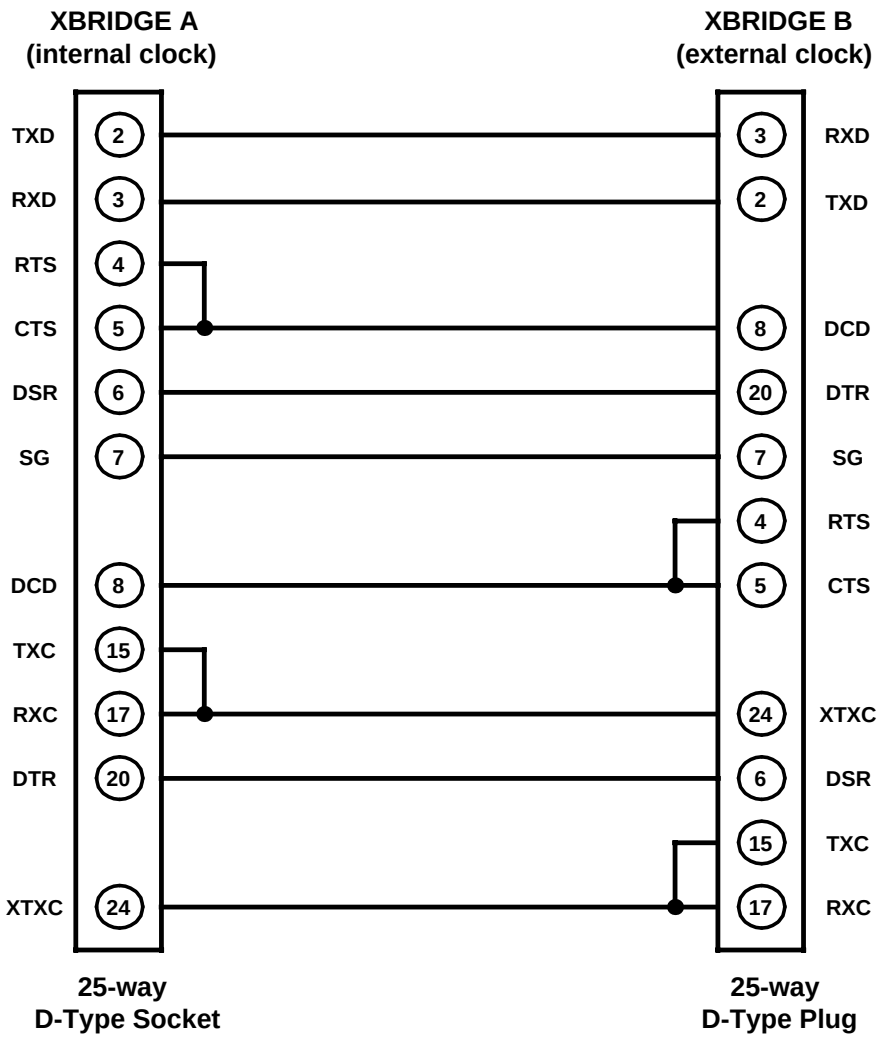


Figure C-2 Crossover X.21*bis* Cable X840-404411

C.2 HSXBridge

C.2.1 Interface Signals

Each HSXBridge card composite X.25 interface terminates in a 25-way D-type connector. If HSXBridge is configured with a V.24 physical interface then the interface signals for standard XBridge apply using the diagnostic trace port. Otherwise the interface signals conform to CCITT X.21 and are listed in Table C-2.

Pin No.	Interchange Circuit	Signal
5	C (A)	Control 1
6	T (A)	Transmit 1
7	G	Signal Ground or Common Return
11	S (A)	Signal Element Timing 1
12	R (A)	Receive 1
13	I (A)	Indication 1
18	C (B)	Control 2
19	T (B)	Transmit 2
23	I (B)	Indication 2
24	S (B)	Signal Element Timing 2
25	R (B)	Receive 2
4	S'(A)	Signal Element Timing 1
17	S'(B)	Signal Element Timing 2

Table C-2 HSXBridge Composite Link Interface

Note that pins 4 and 17, for DCE mode, replace pins 11 and 24 in DTE mode, in order to provide Signal Element Timing to the remote DTE. It is imperative that a correct interface cable is used.

C.2.2 HSXBridge Cables

The standard cable to connect HSXBridge to the X.21 synchronous modem is part number X840-402711, as illustrated in Figure C-3.

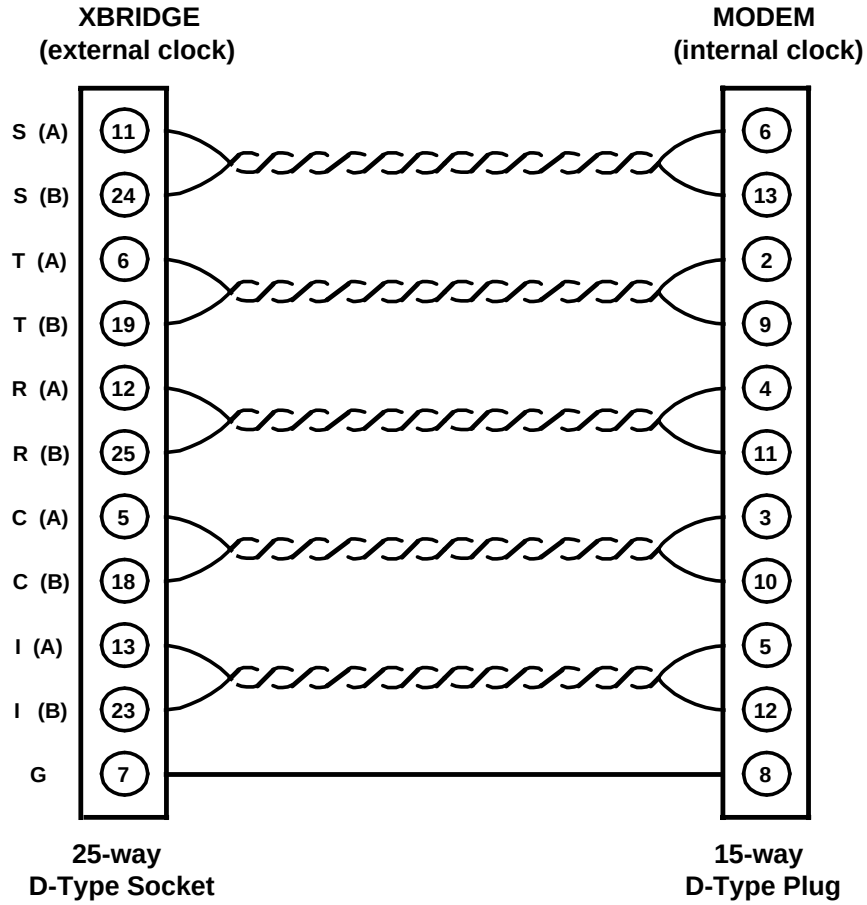


Figure C-3 X.21 Interface Cable X840-402711

The standard cable for HSXBridge point to point operation is part number X840-407811, as illustrated in Figure C-4.

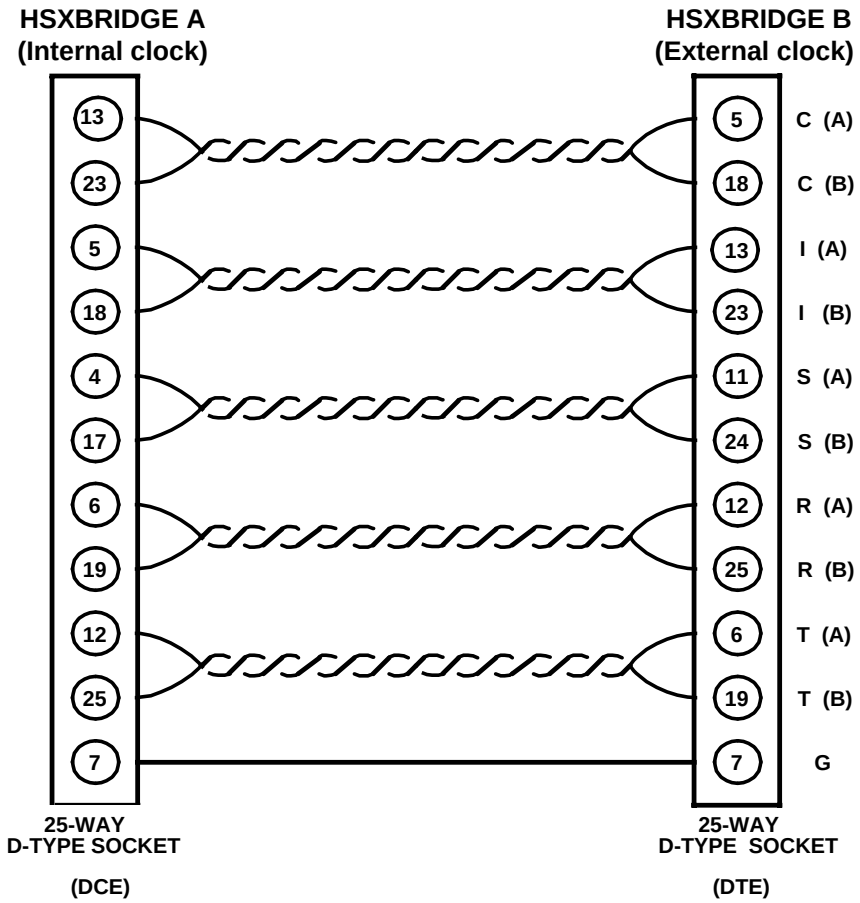
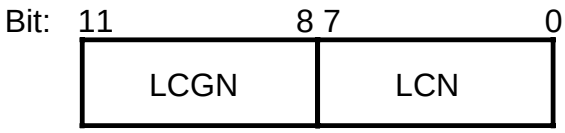


Figure C-4 X.21 Crossover Cable X840-407811

C.3 V.35 Interface

The HSXBridge card may be converted to run a V.35 interface specified to 48000 bps via an X.21-to-V.35 interface adapter which connects to the back of the card. The interface adapter to provide a DTE interface is part number X840-102711. The interface adapter to provide a DCE interface is part number X840-103411.

Appendix D Logical Channel Group Numbers



LCGN	XBRIDGE X.25 LCN
0	0
1	256
2	512
3	768
4	1024
5	1280
6	1536
7	1972
8	2048
9	2304
10	2560
11	2816
12	3072
13	3328
14	3584
15	3840

Appendix F XBridge Hardware Diagnostic Error Codes

All power-up diagnostic error codes cause the **OK** and **Q** LEDs to remain on. Only those LEDs that are flashing should be read to determine the fault number. The full pattern of the LEDs that should be expected for each code is given in binary format, where the first digit corresponds to the **DSR** or **I** $\overline{\text{LED}}$ and the last to the **OFL** LED. The following symbols are used to describe the state of each LED:

1 indicates that the LED is on
0 indicates that the LED is off
f indicates that the LED is flashing
x indicates that the LED could be either on or off.

100000x	Waiting for STC to finish initialising.
111111f	PROM test failure.
11111fx	BRAM test failure.
1111f0x	Exception processing failure.
111f00x	PTM timer fault.
111ff0x	PTM timer failure and exception fault.
11f000x	SCC failure.
11f0f0x	SCC and exception fault.
10ff00x	PTM and SCC failure.
1f0000x	Dynamic RAM failure.
1f00b0x	DRAM and exception faults.
1f0f00x	PTM and DRAM failure.
1ff000x	SCC and DRAM failure.
1fff00x	PTM, SCC and DRAM failure.
1ffff0x	Unexpected exception.
f00000x	A-M-D bus error.
f00000f	Bus error.
f0000f0	Address error.
f0000ff	Illegal instruction.
f000f00	Zero divide.

f000f0f	CHK instruction.
f000ff0	TRAPV instruction.
f000fff	Privilege violation.
f00f000	Trace.
f00f00f	Line 1010 emulator.
f00f0f0	Line 1011 emulator.
f00f0ff	Parity error.
f00ff00	Software abort.
f00ff0f	Watchdog timeout.