NSC®
Network Systems Corporation

PB703 Telecommunications Interface (CDA Rel 7.6) for 1.544 to 44.736 Mbps Communications Facilities

Installation and Reference Manual

Data Exchange DX

460678-08

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Revision Record

Revision	Description
02 (8/90)	Manual revised to reflect change in bandwidth range. Miscellaneous editorial corrections. Manual upgraded to reflect tab 06 of part number 219601.
03 (09/91)	Manual revised to reflect increase in bandwidth range, new 6 and 12 slot chassis, embedded addressing mode, non-acknowledge mode, fault message enable, packet elements, and buffer hold mode.
04 (12/91)	Work Element firmware part number 219601 upgraded to reflect tab 09. Manual reflects tab 01 of Packet Element firmware part number 221162.
05 (04/92)	Restructure manual to include installation information contained in PB703/NB703 Hardware Installation and Maintenance Manual. Inactivate installation and maintenance manual. Restructure Internal Firmware Event Trace description. Manual reflects tab 06 of Packet Element firmware part number 221162 (Version 3.0 of Common Device Architecture Code). Due to the extensive technical and editorial corrections and changes reflected in this edition, change bars ("|") are not used. This edition obsoletes all previous editions.
06 (04/93)	Miscellaneous technical and editorial changes. Manual reflects tab 08 of Packet Element firmware part number 221162 (Version 5.0 of Common Device Architecture Code).
07 (02/94)	Added Display Circuit profiles and queue commands, Set Circuit queue command, and Display and Set Buffer Memory commands. Manual reflects tab 11 of Packet Element firmware part number 221162 (Version 7.0 of Common Device Architecture Code).
07 (09/95)	Prepared electronic copy of document for viewing on CD ROM. Added hypertext links and updated "Reference Material" section to use current publication numbers. No technical changes were added.
08 (08/96)	Manual updated to correspond to CDA Release 7.6.

Portions of text which have been changed or added at this revision are indicated by a bar ("|") in the margin.

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Preface

Purpose of this Manual

This manual describes the Network Systems® PB703 Telecommunications Interface for 1.544 Mbps (U.S. T1) to 44.736 (U.S. T3) million bits per second (Mbps) Communications Facilities. This interface is a specified or optional component in selected models of the Network System 64xx and 68xx series of Data Exchange (DX) Bridge/Routers and Network Systems 70xx series Host Controllers.

Conventions Used in this Manual

The following typographical conventions are used in this manual.

Format	Description
`displayed information`	Information displayed on a CRT (or printed).
`user entry`	Information to be entered by the user.
BOLD	Minimum spelling of a keyword entered in uppercase.
USER-SUPPLIED SUB-OPERAND	A user-supplied name or string for a sub-operand.
variable	A variable text.
DEFAULT	Default parameters or options.
<key>	The label of a key on the keyboard. If this is uppercase, it is the exact key you must press on the keyboard (for example: <ENTER>). If it is lowercase, it describes the key (for example: <up arrow>) that you must press.
<key1><key2>	Two keys to be pressed simultaneously.

Reference Material

Reference material may be found in the following publications:

Number	Title
460390	*Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual*
460456	*Nucleus Reference Manual*
460828	*Bridging for DX Interfaces Reference Manual*
4460928	*Data Exchange Extended (DXE) Chassis Installation and Reference Manual*

Physical dimensions, power, and environmental requirements are defined by the chassis and are described in the appropriate chassis reference manual.

Contact your Network Systems representative for information about ordering these manuals.

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Xerox Corporation	Xerox, Ethernet, XNS
Network Systems Corporation	Network Systems, HYPERchannel, HYPERbus, NETEX, NSC, BFX, PFX, RDS, Link Adapter, USER-Access, Packet Control Facility, and EnterpriseChannel

These references are made for informational purposes only.

The diagnostic tools and programs described in this manual are **not** part of the products described.

FCC Compliance Statement

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

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This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications. Le présent appareil numérique n´émet pas de bruits radioélectriques dépassant les limites applicables aux appariels numériques de Classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

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Interconnection directly, or by way of apparatus, to ports marked: *"SAFETY WARNING: See instructions for use."* with ports marked or not so marked, may produce hazardous conditions on the British Telecom Network. Advice should be obtained from a competent engineer before such a connection is made. Apparatus connecting to these ports should either have been approved to BS 6301 or have been previously evaluated against British Telecommunications plc (Post Office) Technical Guides 2 or 26 and given permission to attach; and that other usage will invalidate any approval given to the apparatus.

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Translation

This equipment is Type 1 Data Processing Equipment and is intended for use in commercial and industrial districts. When used in residential districts, or their peripheral areas, radio and TV receiver units may be subject to radio interference. **VCCI-1**

Contents

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Tables

Introduction

The PB703 Telecommunications Interface is one of several interfaces that may be installed in a Network Systems® 64xx or 68xx Data EXchange (DX) Bridge/Router or Network Systems 70xx Host Controller. Each interface in a DX unit is designed to communicate with a specific host, device, or network over a specific transmission media.

The PB703 Telecommunications Interface provides full duplex serial data transmission over a single 1.544 Mbps (U.S. T1) to 44.736 Mbps (U.S. T3) digital data link. This link allows a local network, host, or device connected to a DX unit to communicate with a remote network, host, or device connected to the DX unit through a full duplex data communications facility. Each PB703 Interface must be attached to a Network Systems LIT-1/VIT-1, CLC10, VIT-2, LIT-3/VIT-3 or equivalent vendor supplied Data Service Unit (DSU) using a separately supplied 50-foot maximum length digital interface cable. The local and remote DSU are connected to the communications facility via transmit and receive digital interconnection cables. Figure 1 shows a sample configuration incorporating Lit-3 DSUs and PB703s.

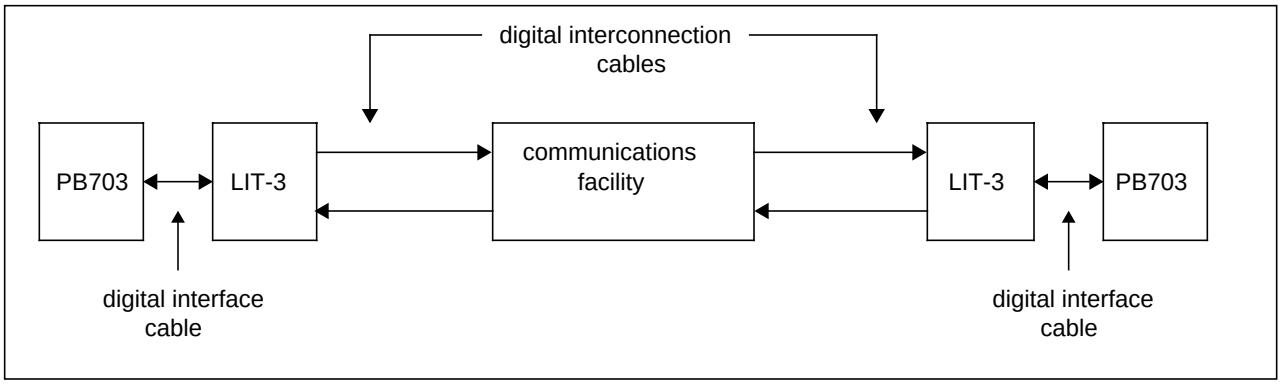


Figure 1. Sample Link Configuration

The PB703 also supports the Network Systems AR78 Encryption Device Interface (EDI) Option. This option is used to force data encryption equipment to re-synchronize following a loss of synchronization. The PB703 informs the AR78 option when a loss of synchronization has occurred. The AR78 is designed to connect to the following encryption devices:

- KG34
- KG81
- KG94
- KG95-1
- KG194

The information contained in this manual also applies to the NB703 Interface. This product is no longer in production. The NB703 is functionally the same as the PB703 with the exception of the pin count on the connectors used to attach the interface boards to the DX chassis backpanel. Because of this difference, NB703 boards are not interchangeable in the same chassis with PB703 boards.

Capabilities

The PB703 supports a single DSU link with a data rate between 1.544 Mbps (U.S. T1) and 44.736 Mbps (U.S. T3). The remote segment of each DSU channel **must** be attached directly to another PB703 Interface. A single custom synchronous Link Layer Protocol (LLP) is supported. This protocol is described in Appendix A. "N70x Frame Formats" on page 93.

The PB703 supports HYPERchannel® IP, IPX, DECnet IV, Appletalk II, and XNS routing protocols, and encapsulation bridging.

The interface also supports internet-based Simple Network Management Protocol (SNMP) and HYPERchannel-based Network Management System (NMS).

Encapsulation bridging permits the transportation of frames from the source media to the destination media without frame alteration.

The interface is also configured with a subset of the logic and firmware comprising the DX Router Coprocessor. This allows the PB703 to route datagrams when forwarding information is already available (resolved). A DX Router Coprocessor must be installed in the DX unit to route unresolved datagrams and control messages.

The PB703 supports a Maximum Transmission Unit (MTU) negotiated size (at startup time) and a Maximum Receive Unit (MRU) size of 18,944 bytes.

N70x LLP is a HYPERmedia protocol. This implies the use of HYPERchannel format message protocol encapsulated within the N70x LLP. Two routing and bridging transmission modes are supported by the N70x LLP:

- Connectionless transmission of datagrams.
- Full Connection transmission of datagrams encapsulated in HYPERchannel message format.

Acknowledgment, re-transmission, and error recovery must be provided by higher level protocols when using connectionless service. Full connection HYPERchannel traffic and connectionless routed and bridged traffic may be intermixed on the link.

The user may select either 2K or 4K data buffers using the nucleus monitor Set Large Page Size (PS) command described in the DX Nucleus Installation and Reference Manual (460456). This command sets the buffer size for ALL interfaces in the DX unit. Both ends of the link MUST be set to the same buffer size. The user MUST select 2K data buffers when any type of coprocessor is installed in the DX unit. When transferring HYPERchannel traffic, a maximum of 238 associated data buffers may be transmitted with each HYPERchannel message. The PB703 is capable of attaching to a DSU using either of the following electrical standards: V.35 or V.11.

Figure 2 on page 3 shows a block diagram of a sample DX unit configured with a PB703 Interface, and an FDDI Network Interface.

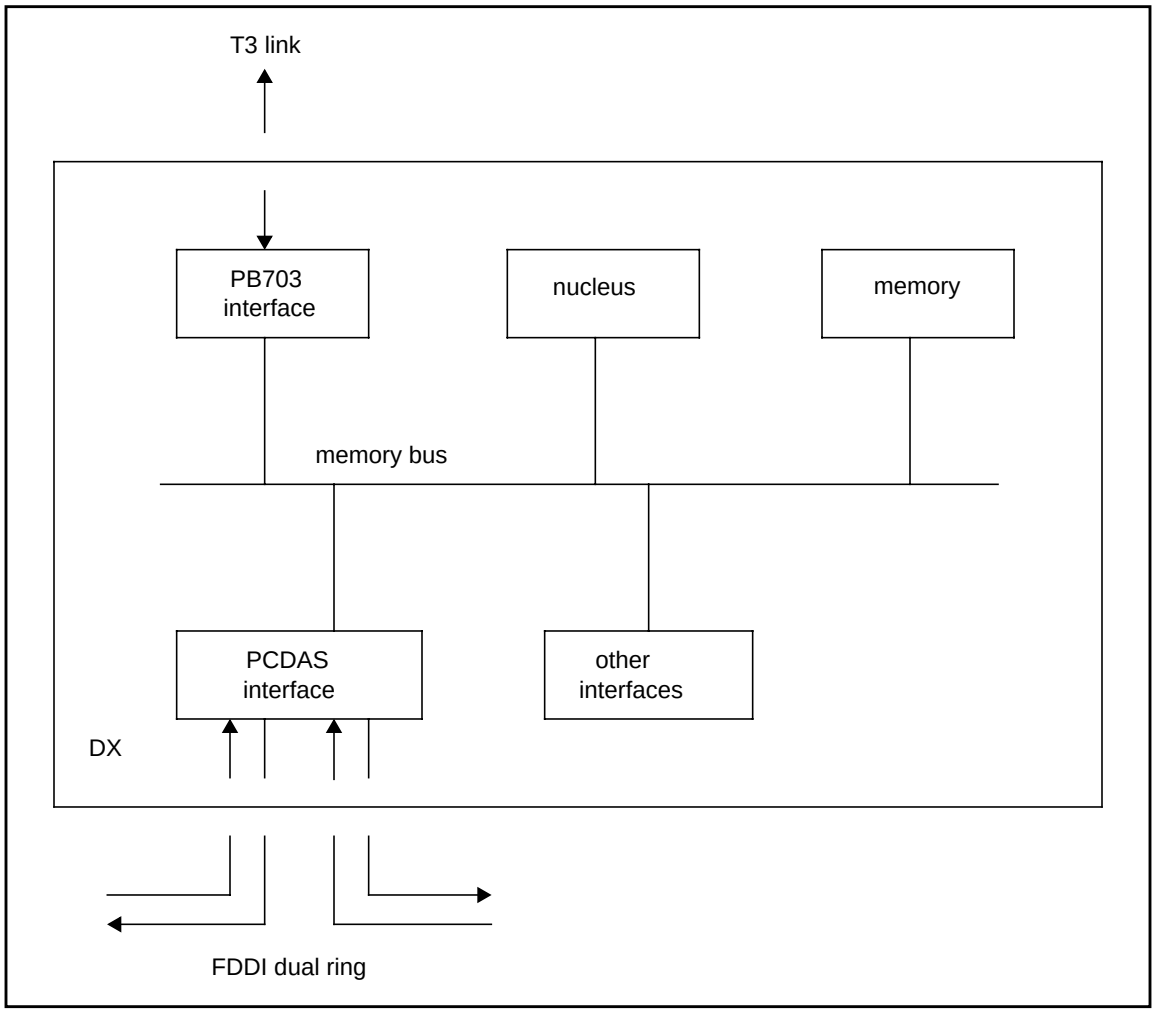


Figure 2. Sample DX Configuration

The PB703 uses a Non-Return-to-Zero (NRZ) data encoding method. NRZ provides a transition in the data stream when changing from zero to one or one to zero.

This NRZ encoding method is combined with "zeros" insertion provided by the PB703 to maintain a sufficient number of transitions to ensure synchronization on the DCE interface of the DSU. This type of insertion adds a minimum of one "zero" for every string of five consecutive "ones" in the DCE data stream.

"Ones" insertion capability is provided as a switchable option on the DS1 (telco) interface of the DSUs. This option adds a "one" every 8th bit in the DS1 data stream. "Ones" insertion on the DSU DS1 interface MUST be selected when using the NRZ encoding method.

N70x Protocol Circuit Initialization Negotiation

This feature is used to determine line continuity during the transition to the “on” interface state from the “loop-back”, “test”, or “off” states At these times, the feature transmits Query frames on each interface and checks for Query Response frames from the remote interface. Refer to “Query/Query Response Frames” on page 101 for a description of Query/Query Response frames.

Failure to detect activity on the interface for a period in excess of one second removes the interface from the "on" state. The receipt of a valid Query Response frame causes the interface to transition to the "on" state. A "valid" response implies that (1) the local and remote interface are set to the same Large Page Size, (2) data has not been externally looped back, and (3) the profiled non-zero destination matches the actual destination.

N70x Line Quality Monitoring (LQM)

The LQM feature automatically removes the interface from service and restores the interface back into service following problem resolution.

Operator profiles allow the user to enable or disable LQM for the interface. When enabled, the LQM feature transmits repeated Query frames on the interface and checks Query Response frames from the remote interface. The information contained in the Query Response is used to build an acceptability data base. Refer to "Link Control Protocol (80) Frames" on page 101 for a description of Query/Query Response frames.

Profile parameters allow the user to select an Expected Quality Level (EQL) in the range between 10% and 99%, and a time window (**w**) used to accumulate the EQL data base for the interface. The EQL window parameter (**w**) may be set in the range from 10 to 400 seconds. The recommended window range is shown in Table 1 on page 5. Operator profiles for **EQL** and **window** must be set the same for both ends of the interface.

An acceptability check is periodically performed on the EQL data base at time (**t**). Time (**t**) is equal to the window (**w**) divided by 32. For example, a window of 30 seconds will result in an acceptability check being performed every 938 milliseconds (approximately). The equation used to define **t** is as follows:

$$\mathbf{t\ (milliseconds) = \frac{w * 1000}{32}\ (rounded)}$$

The acceptability check determines the percentage of lost transmit packets, lost transmit bytes, lost received packets, and lost received bytes for the interface. If any of these percentages are equal to or greater than the% Allowed Lost (**%AL**) value for a Good-to-Bad transition ($\mathbf{\%AL_{G-B}}$), the interface is removed from service. If the percentage returns to the % Allowed Lost value for a Bad-to-Good transition ($\mathbf{\%AL_{B-G}}$), the interface is returned to service.

The equation used to define %AL for a Good-to-Bad transition is as follows:

$$\mathbf{\%AL_{G-B} = (100\% - EQL)}$$

The equation used to define %AL for a Bad-to-Good transition must generate a level of hysteresis that prevents rapid service changes. The $\%AL_{B-G}$ equation is as follows:

$$\mathbf{\%AL_{B-G} = (100\% - EQL) * .6}$$

Table 1. LQM Window Profile

Data Rate	Recommended Window (w) Selection Range (seconds)	Minimum Allowable Window (seconds)
44 megabits	10-30	10
34 megabits	10-30	10
22 megabits	12-30	10
6 megabits	14-30	10
2 megabits	15-30	10
1.5 megabits	20-30	10
1.0 megabits	20-40	10

To reduce the rapid service change that could occur when the error rate suddenly drops to zero, a line saturation process is continuously performed on any line that falls below the Expected Quality Level (EQL). This process is implemented using Echo/Echo Response frames. The frames sent and received contain random data and are transmitted at a rate of 500 packets per second. This process is used to detect when line quality has returned to an acceptable level. The lengths of the Echo and Echo Response frames are adjusted to fully utilize the line bandwidth.

The PB703 Interface is fully contained on a single PND703 link interface board. Figure 3 shows the external interface paths for an PB703 Interface.

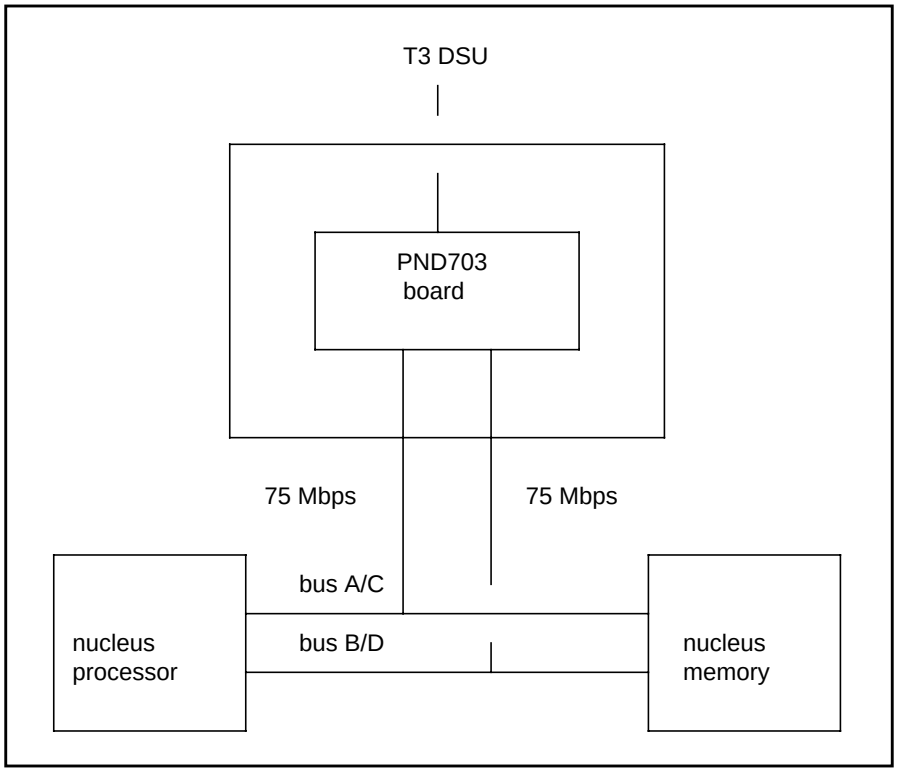


Figure 3. PB703 External Interface Paths

The configurator sheet shipped with the PND703 link interface board specifies the slot location where the PND703 board should be installed in the DX chassis. Configuration parameters for the nucleus and PB703 Interface are entered using a standard Personal Computer (PC) with Terminal Emulation. The interface monitor resident on the PND703 link interface board allows the operator to examine memory, enter parameters, and generally monitor interface activity.

All signals in and out of the PND703 link interface board are routed through connectors J1 and J2 on the backpanel. A ribbon cable is used to route these signals from connector J1 to the I/O panel. This ribbon cable trails from the back of the I/O panel and is attached to backpanel connector J1 at the slot location containing the PND703 link interface board. An LED cable trails from the back of the I/O panel and is attached to backpanel connector J2 at the slot containing the PND703 link interface board.

PND703: Link Interface Board

The link board contains the functional components described in Table 2 on page 9.

NOTE: Network Systems Ethernet vendor number is $A9_{16}$.

The functional firmware executed by the background processor and profile data are stored in EEPROM. Local RAM serves as a scratchpad and also contains program firmware after code is down-loaded from EEPROM.

The link interface board has a set of card edge DIP switches (S1) for setting up processor identification (PID), and key identification (KID). The PID selection allocates bandwidth in the nucleus for the DMA processor. The KID allocates memory space in the nucleus, and provides information that enables the nucleus to route data through the interface.

The logic on the PND703 board can be reset by any of the following operations:

- Executing a power up reset
- Pressing Master Clear switch on DX unit front panel
- Executing a Reset command at the background processor
- Executing a reset (Z) command at the nucleus processor

Table 2. PND703 Board Components

Component	Description
Background Processor	The background processor is a 32-bit AMD Am29000 Micro-Processing Unit (MPU) operating at 25 MHz. It is capable of one instruction per cycle (25 MIPS) peak, or 17 MIPS sustained.
Background Processor Nucleus Memory Interface	Nucleus memory interface is the path used by the background processor to exchange control information with the nucleus processor. The background processor can communicate with nucleus memory in longword mode (32-bits). A transfer occurs in response to a read or write request from the background processor.
DMA Engines Nucleus Memory Interface	Nucleus memory is the path used by the DMA engines to exchange data with other interfaces in the DX unit. Each DMA engine can communicate with nucleus memory in long word mode. A transfer occurs in response to a read or write request from the DMA Engine processors.
Program EEPROM (Locations 90000000 to 9003FFFF or 90000000 to 9007FFFF)	Program EEPROM consists of 256K or 512K bytes organized into 64K or 128K 32-bit words. Following a power-up reset, manual master clear, system programmable master clear, or internal background processor reset, the data stored in program memory is down-loaded to instruction RAM for execution. The EEPROMs are write protected on power-up and power-down by a voltage comparator that holds the output enable (Read) active when the voltage drops below 4.7 volts. The EEPROMs are also write protected by the EEWE bit in the memory control register which must be set to enable a write to program memory.
Background MPU Instruction RAM (Locations 88000000 to 8803FFFF)	Background MPU instruction RAM consists of 256K or 512K bytes of high speed memory organized into 64K or 128K 32-bit words. Instruction RAM is accessed in longword mode.
Data RAM (Locations 80000000 to 80007FFF)	Data RAM consists of 32K bytes configured as 8K long words.
Shared Memory (Locations C0000000 to C0007FFF)	Shared memory consists of 32K bytes of RAM that can be accessed by the background processor or the DMA controllers. Each access by the DMA processors or background processor transfers a longword of data.
Transmit and Receive DMA Engines	The DMA engines control the transfer of data to and from the serial link. Each engine consists of a 32-bit AMD Am29000 MPU, instruction RAM, and a corresponding transmit and receive serial input/output (SIO). The instruction RAM is organized into 2K 32-bit words at locations $A0400000_{16}$ through $A0401FFF_{16}$ for the receive DMA Engine and $A0800000_{16}$ through $A0801FFF_{16}$ for the transmit DMA engine. This instruction RAM is mapped into the address space for both engines at locations 88000000_{16} through $88001FFF_{16}$.
Arbitration Logic	The arbitration logic controls access by the background processor and DMA engines to either shared memory or nucleus memory. During normal operation, access is granted as shown in Table 3 on page 10. The background processor also has access to the instruction memories of both transmit and receive DMA processors in the intervals when these processors are held reset. This is required because the background processor down-loads code to instruction RAM for both DMA processors following a reset or power up. Once the DMA processors begin execution, access to Instruction RAM is inhibited from the background processor.
Ethernet Address PROM	This 32-byte memory contains an address value that is required when operating with Ethernet framing protocol. The value is unique for each PC board. This PROM is socketed to permit the Ethernet address to be moved to a new board in the event that a board must be replaced. Data read from memory is CRC checked.

Table 3. Arbitration Priority

Path	Interval
Background processor to/from nucleus*	Every window
Transmit DMA to/from nucleus*	Every other window
Receive DMA to/from nucleus*	Every other window
Transmit DMA to/from shared memory**	Every third window
Receive DMA to/from shared memory**	Every third window
Background processor to/from shared memory**	Every third window
*Two independent accesses are provided using separate PIDs. One 50 megabit access is granted to the background processor. A second 100 megabit access is shared equally by the two DMA processors.	
**Each access provided with a separate time slot.	

Physical Interfaces

The physical interface consists of the I/O panel segment and external interface cables.

I/O Panel Segment

The PB703 I/O panel segment is configured with one 50-pin connector and one ACTIVE LED. The LED lights when the link is enabled to transfer data (solid ON), looping data (fast ON and OFF), or trying to establish a connection (slow ON and OFF).

Figure 4 on page 11 shows the indicators and connectors on the PB703 I/O panel segment.

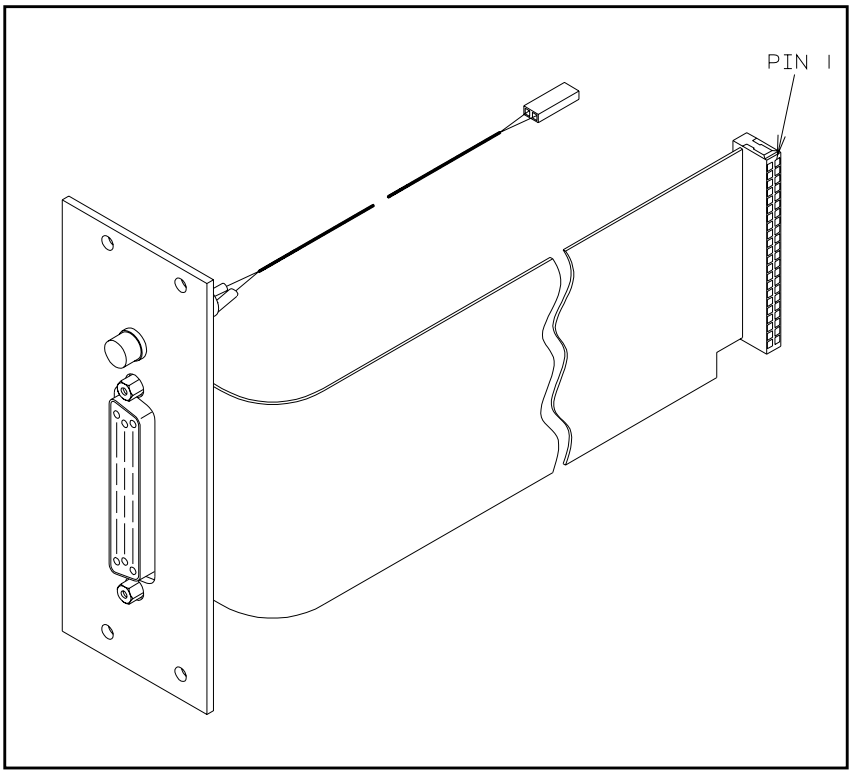


Figure 4. PB703 I/O Panel Segment

Telecommunications Interface Cables and Pin-Outs

This section lists the cable designators and pin-outs for the digital interface cables used with the PB703.

The PB703 supports two electrical standards: V.35 and V.11. The desired protocol is selected by connecting the proper cable between the 50-pin D-type connector on the PB703 I/O panel and the corresponding V.35 or V.11 type DSU. The cables are described in Table 4 on page 11.

Table 4. Drop Cables

Part Number	Protocol	Cable Pinouts	DX Connector	DSU Connector
T20H	V.35	See Table 5 on page 13	See Figure 6 on page 14	See Figure 7 on page 15
T21H	V.35	See Table 6 on page 15	See Figure 6 on page 14	See Figure 8 on page 16
T25E	V.11	See Table 7 on page 16	See Figure 6 on page 14	See Figure 9 on page 17

The cables all have 50-pin D-type male connectors on the PB703 end and protocol-specific connectors on the user end. The 50-pin cable connector is shown in Figure 6 on page 14.

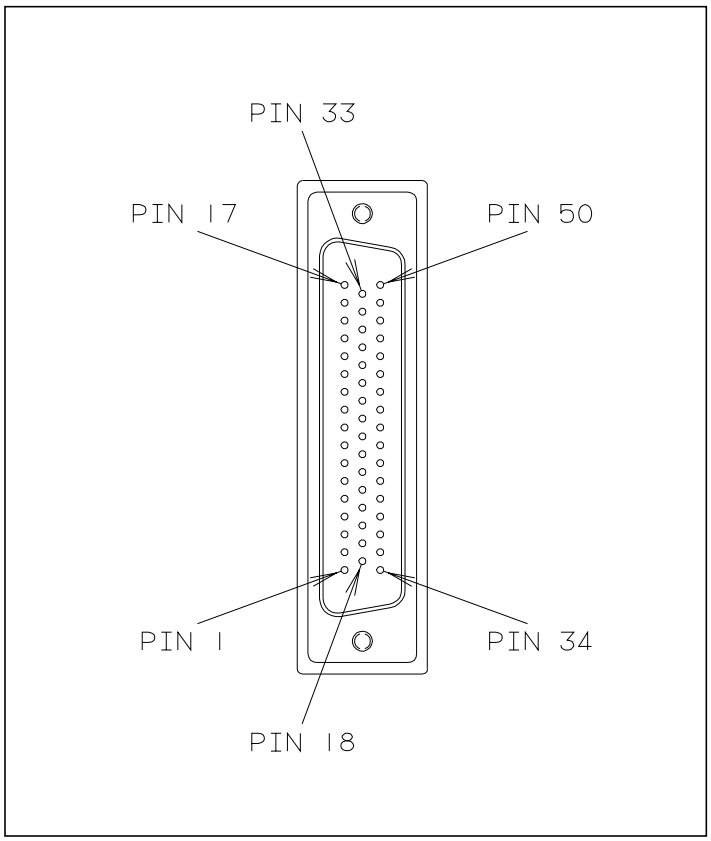


Figure 5. 50-Pin Male Cable Connector

The maximum length for the PB703-to-communications facility interface cable is 50 feet.

NOTE: V.35 and V.11 protocol interface cables designed for older Network Systems link products cannot be used on the PB703.

T20H V.35 Cable Pin-Outs (34-Pin MRAC Connector)

The connector pin-outs for the T20H drop cable attached to the PB703 are listed in Table 5. Figure 7 on page 15 shows a drawing of the 34-pin connector that attaches to DSUs configured with a 34-pin MRAC receptacle.

Note: This cable type is required for the installation of LIT 3A, VIT-3C and VIT-2C type DSUs.

Table 5. T20H (V.35) Connector Pin-Outs

50-Pin Number (male)	Signal Name	34-Pin Number (male)	Wire Color
36	Transmit Data A	P	White/Blue
03	Transmit Data B	S	Blue/White
02	Transmit Clock A	Y	White/Orange
18	Transmit Clock B	a	Orange/White
40	Receive Data A	R	White/Green
07	Receive Data B	T	Green/White
06	Receive Clock A	V	White/Brown
22	Receive Clock B	X	Brown/White
21	Serial Clock Transmit External A (SCTE)	U	White/Grey
37	Serial Clock Transmit External B (SCTE)	W	Grey/White
45 connected to 14	V.35 Enable		White
11	DSR	E	Red/Blue
44	Carrier Detect	F	Blue/Red
Shield	Ground (Protective)	A	
34	Ground (Logic)	B	Orange/Red

NOTE: The PB703 does not support Request To Send (RTS) and Data Terminal Ready (DTR) signals. These signals can be replicated by installing additional pins and jumper wires on the 34 pin cable connector. Install jumpers in accordance with DCE manufacturers recommendations. Contact Network Systems Technical Support for additional information.

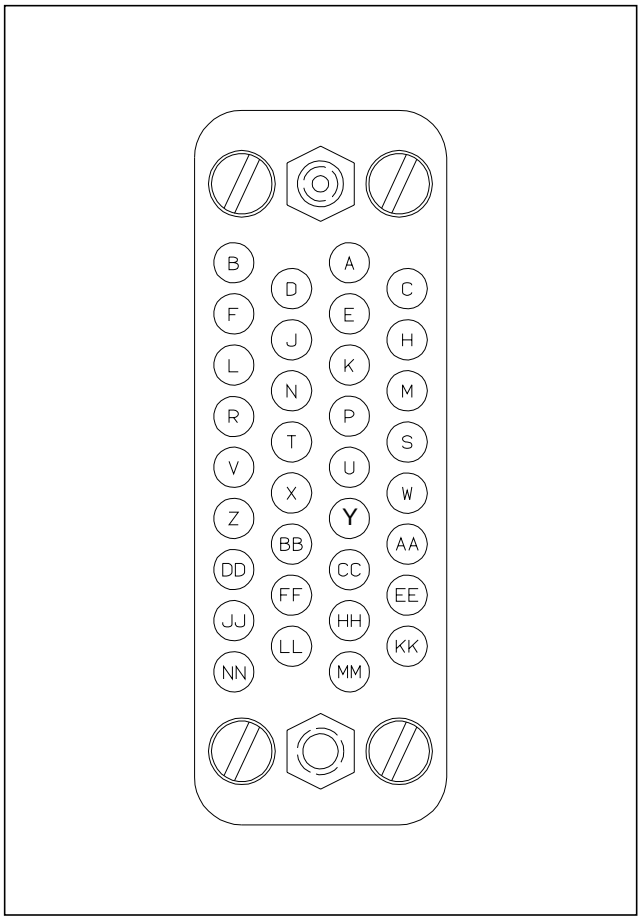


Figure 6. 34-Pin V.35 Male Cable Connector

T21H V.35 Cable Pin-Outs (25-pin D Sub-connector)

The connector pin-outs for the T21H cable attached to the PB703 are listed in Table 6 on page 15. Figure 7 on page 15 shows a drawing of the 25-pin connector that attaches to DSUs configured with a 25-pin receptacle.

Note: This cable type is required for the installation of LIT-3B DSUs.

Table 6. T21H (V.35) Connector Pin-Outs

50-Pin Number (male)	Signal Name	25-Pin Number (male)	Wire Color
36	Transmit Data A	14	White/Blue
03	Transmit Data B	01	Blue/White
02	Transmit Clock A	02	White/Orange
18	Transmit Clock B	15	Orange/White
40	Receive Data A	04	White/Green
07	Receive Data B	16	Green/White
06	Receive Clock A	17	White/Brown
22	Receive Clock B	05	Brown/White
21	Serial Clock Transmit External A (SCTE)	06	White/Grey
37	Serial Clock Transmit External B (SCTE)	19	Grey/White
45 connected to 14	V.35 Enable		White
11	DSR	20	Red/Blue
44	Carrier Detect	07	Blue/Red
cable shield	Ground (Protective)	03	Red/Orange
34	Ground (Logic)	18	Orange/Red

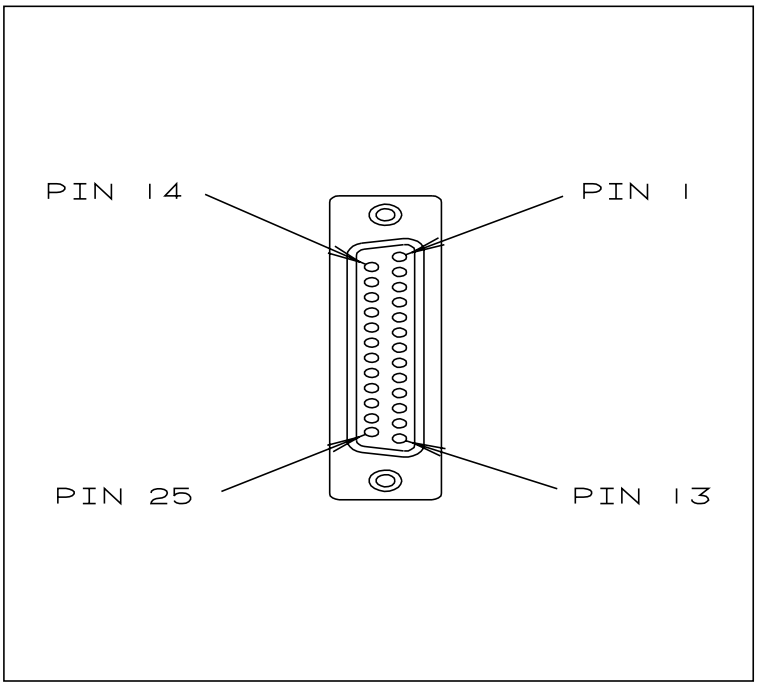


Figure 7. 25-Pin V.35 Male Cable Connector

T25E V.11 Cable Pin-Outs

The 50-pin connector pin-outs for the T25E cable attached to the PB703 are listed in Table 7. Figure 8 shows a drawing of the 15-pin connector that attaches to DSUs configured with a 15-pin receptacle.

Table 7. T25E (V.11) Connector Pin-Outs

50-Pin Number (male)	Signal Name	15-Pin Number (male)	Wire Color
46	Transmit Data A	02	Red
13	Transmit Data B	09	Black
40	Receive Data A	04	White
07	Receive Data B	11	Black
06	Signal Clock A (Harmony A)	06	Green
22	Signal Clock B (Harmony B)	13	Black
29 connected to 14	V.11 Enable		White
26	Control Line B	10	Blue
10	Control Line A	03	Black
43	Indicator Line B	12	Yellow
27	Indicator Line A	05	Black

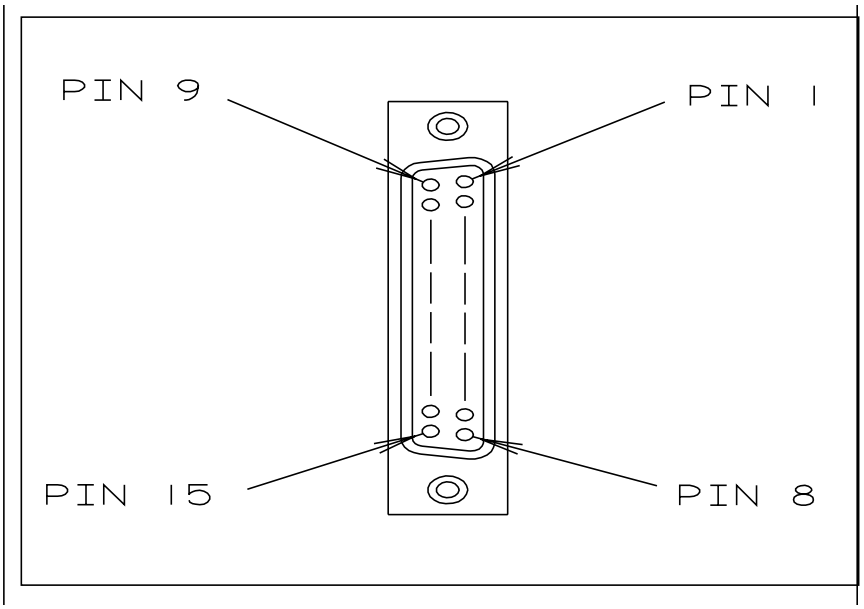


Figure 8. 15-Pin V.11 Male Cable Connector

This section describes the switches, jumpers, and alphanumeric display on the PND703 link interface board. The recommended settings for the switches and jumpers are provided in the section of this manual.

PND703

The link processor board has two sets of card edge DIP switches (S1, and S2), one jumper block (TAB), and an alphanumeric display (U3).

Figure 9 is an outline of the PND703 board showing the locations of S1, S2, TAB jumper block, and alphanumeric display U3.

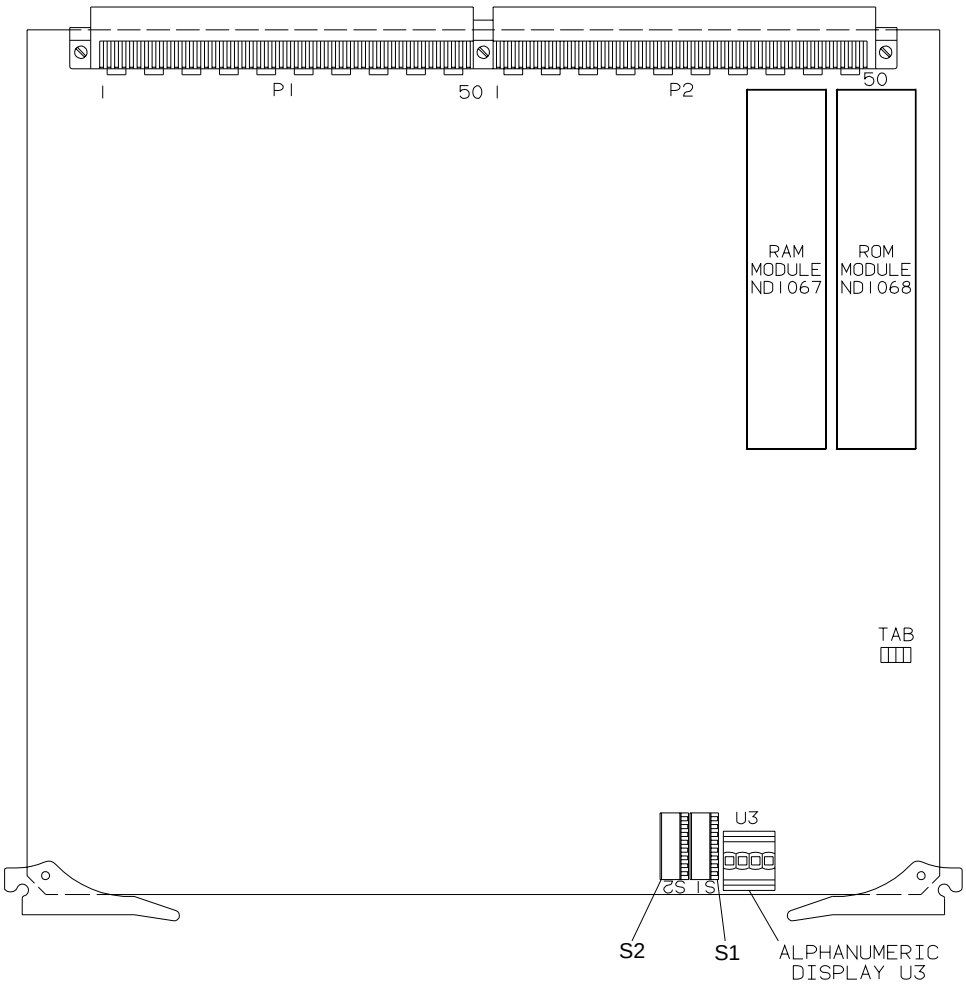


Figure 9. PND703 Board Outline

Switch Assembly S1

DIP switch S1 is used to set the PID for the DMA functions on the PND703 board, and also allows service personnel to set the signals entering and leaving the DMA controller and background processor to a high impedance state for maintenance purposes. The PID selection allocates nucleus bandwidth for the DMA processor on the link interface board. Refer to Figure 10.

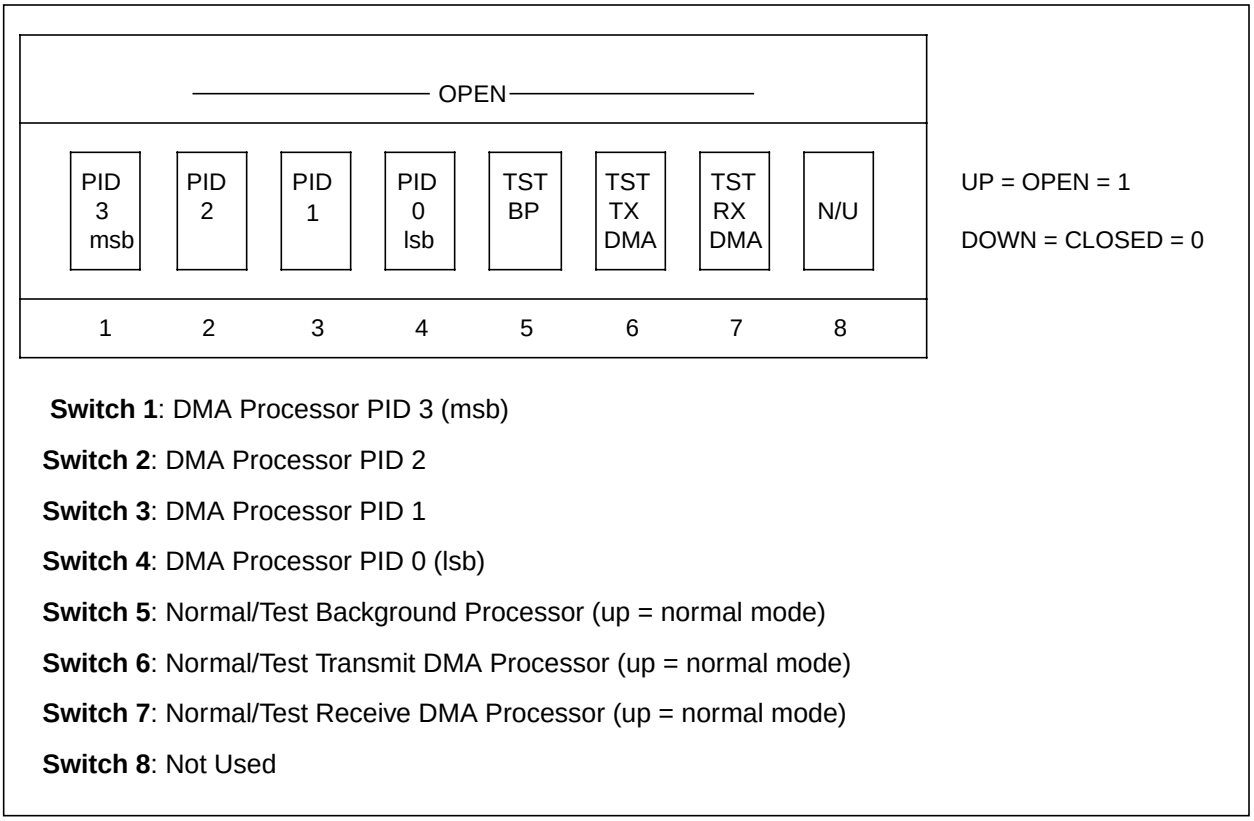


Figure 10. Switch S1 Definitions

NOTE: Test switches 5, 6 and 7 should always be set to up (normal) position.

Switch Assembly S2

DIP switch S2 is used to set the PID for the background processor on the PND703 board, and the KID for all processor functions on the board. The PID selection allocates nucleus bandwidth for the background processor on the link interface board. The KID allocates nucleus memory space for the link interface and provides information that enables the nucleus to route data to and from the link interface board. The PID for the background processor on the PND703 board, and the KID for all processor functions on the PND703 board are set by physical switches 1-8 of DIP switch assembly S2. Physical switches 1-4 are bits 3-0 respectively of the background processor PID.

Physical switches 5-8 are bits 3-0 respectively of the KID. The corresponding bit is high (active, a logical one) when the physical switch is open. Figure 11 on page 19 defines the functions of the switches on switch assembly S2.

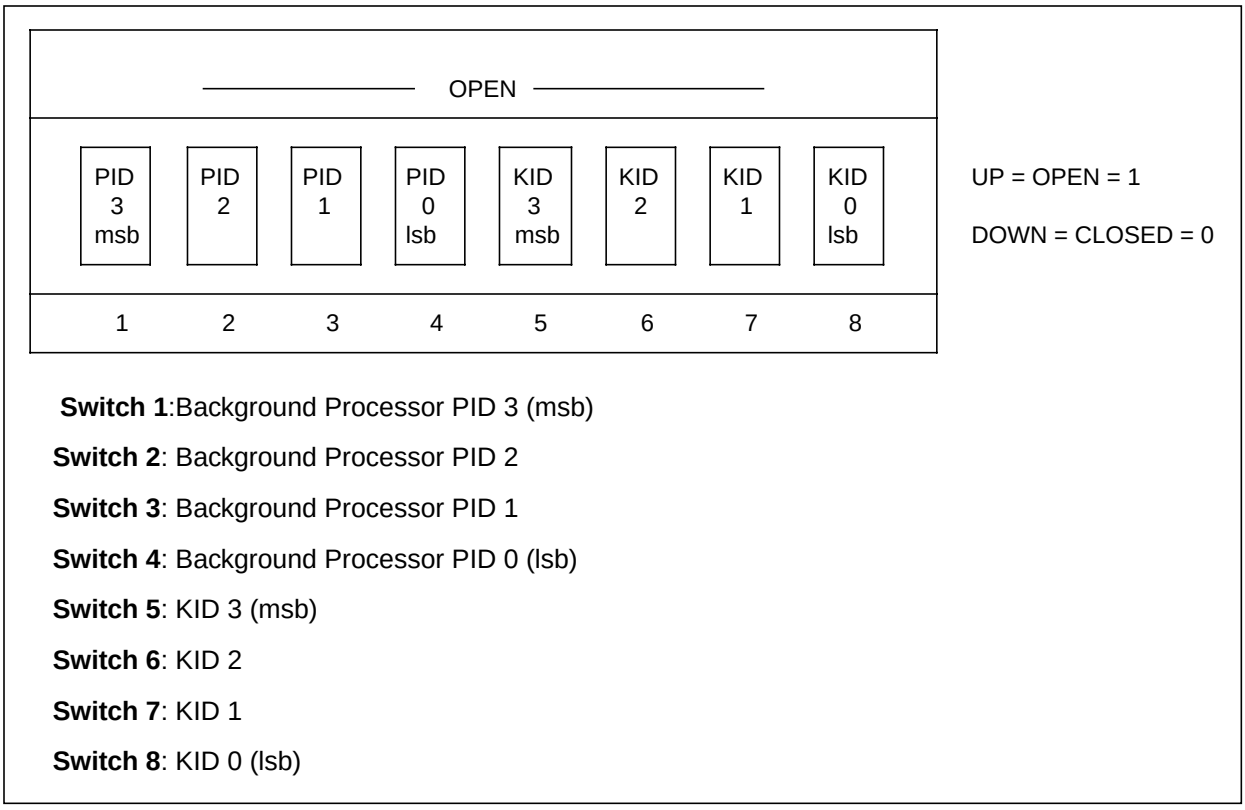


Figure 11. PND703 Switch S2 Definition

Tab of Board (TAB)

The TAB jumper block indicates the least-significant digit of the current tab (the last digit of the eight-digit part number) of the board. The jumper block consists of four pairs of terminals. The least significant digit in this jumper is one (1). The screened number next to the missing jumper is inserted to binary to arrive at the tab of board number. If there is more than one missing jumper, the binary values are added together to derive the tab of board number.

Table 8 on page 20 indicates the jumper installation needed to achieve the desired tab number. A zero (0) indicates that a jumper is installed; one (1) indicates a jumper is **not** installed.

Table 8. Tab Number Calculation Table

Jumper Number				TAB Number
8	4	2	1	
0	0	0	0	-x0
0	0	0	1	-x1
0	0	1	0	-x2
0	0	1	1	-x3
0	1	0	0	-x4
0	1	0	1	-x5
0	1	1	0	-x6
0	1	1	1	-x7
1	0	0	0	-x8
1	0	0	1	-x9
0 = jumper installed 1 = jumper not installed				

Alphanumeric Display

The alphanumeric display provides a four symbol ASCII compatible display of PND703 status conditions and self test (POST) error codes.

The user can monitor the progression of POST testing by observing the sequence of display messages described in Table 9 on page 21.

Table 9. POST Display Messages

Message	Description
POST	This message is displayed during the Internal Test sequence of POST after the CPU side of the display register has been verified as good. It indicates that all initialization and interrupt tests have passed and POST is now running all tests of hardware directly accessed by the background processor.
NUC	This message is displayed during the Test Buffer Memory sequence of POST. It indicates that POST is now running all tests of the Nucleus Memory data and address bus lines.
EXT	This message is displayed during the External Test sequence of POST. It indicates that POST is now running all tests of the hardware accessed by the transmit and receive DMA processors other than SIO circuitry.
LPBK	This message is displayed during the External Test sequence of POST. It indicates that POST is testing the SIO circuitry by looping data from the SIO transmitter to the SIO receiver.
EXLP	This message is displayed during the External Test sequence of POST only if Debug Mode is selected. It indicates that POST is now looping data out to the DSU to test all signals out to the I/O panel. While this test is running, the Transmit LED on the I/O panel should be lit.
MFLT	This message is displayed during the Test Memory Protect Fault sequence of POST. It indicates that POST is now forcing a Memory Protect Fault to test the associated interrupt and status hardware.
RST	This message is displayed during the Test Reset Line sequence of POST. It indicates that POST is in the process of being reset and re-started by the nucleus processor.

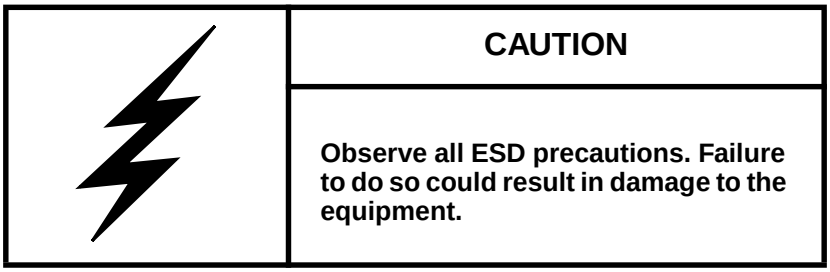
I/O Panel Indicator

The indicator on the I/O panel lights when the link is enabled to transfer data.

Configuring a Factory-built PB703 Interface

A DX unit is equipped at the factory with a customer specified set of options. It may also be re-equipped in the field with additional options, or a completely different set of options. In either case, the DX unit must be configured to the site requirements, and the mix of options. Installation of a factory configured DX unit consists mainly of verifying switch settings, and running diagnostics. Installation in the field consists of adding and/or repositioning I/O panels and internal interface cables in addition to re-configuring the DX unit to match the revised set of options.

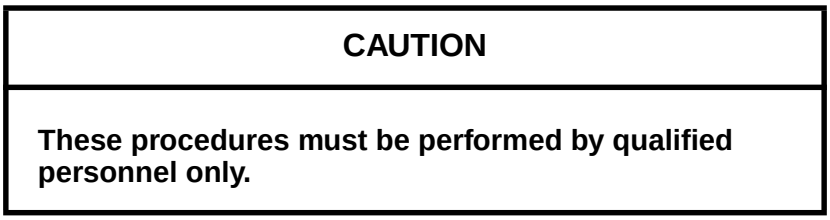
The appropriate chassis manual contains a generic installation procedure that applies to the DX unit without regard to the set of options installed in the unit. This section supplements that procedure by providing the PB703 specific information required to complete the installation.



Before You Begin

The procedures described in this section assume that the nucleus and coprocessor installation procedures are complete and the chassis is in the following state:

- The DX unit has been unpacked and inspected.
- The card cage is uncovered.
- A Personal Computer (PC) with Terminal Emulation has been connected to the monitor port.
- The main power switch is on and DC power has been turned off.
- The clock cables (or clock board), backpanel, and I/O cables have been installed at the factory.



Verifying Jumpers and Switch Settings

Refer to “Controls and Indicators” on page 17 and the configuration sheet shipped with the kit. Remove the boards from the chassis one at a time and verify that the following jumpers and switches on the PND703 board are set in accordance with the configuration sheet.

1. Turn off power to the chassis by placing the main AC power switch in the OFF position.
2. Remove the boards from the chassis one at a time and verify that the following jumpers and switches on the designated boards are set in accordance with the configuration sheet.
3. While verifying, mark the configuration sheet to reflect the actual switch settings of the DX chassis for Site Log Information.
4. Verify that TAB jumper block matches the least significant digit of the tab level of the board (stamped near the front edge). (See “Tab of Board (TAB)” on page 19.)
5. Verify that DIP switches S1 and S2 are set as shown on the configuration sheet. Refer to “Controls and Indicators” on page 17 for a description of these switches and to determine the correct setting for jumper JB1.

Mark the configuration sheet to reflect the actual switch settings of the DX unit for Site Log Information.

Verifying Current DX Chassis Operation

Performing a Power On Self Test

Applying power to the DX chassis causes it to execute the Power On Self Test (POST).

1. Turn DC power ON.

   Post should be run before connecting the DX chassis to the customer’s equipment and before entering additional profile information (POST should pass using factory entered bandwidth/configuration PROM profiles and default values for other profiles).

   The POST program displays **FAIL** on the ASCII display when it fails. **HALT** indicates an initialization failure. **PASS** indicates normal POST completion. (Refer to DX Self Test Book (460553) for detailed information about POST, BIST, and HALT error codes.)

2. If the self-test program failure is caused by incorrect profile settings (**halt**). refer to ”Verifying the Bandwidth”. If self-test passes, go to ”Entering Environmental Profiles”.

Verifying and Entering Profiles

DX chassis require four types of profile entries: bandwidth, environmental (addressing), configuration PROM, and processor-specific.

Verifying the Bandwidth

Ensure that the bandwidth profiles entered at the factory are set in accordance with the configuration sheet accompanying the DX chassis. Failure to comply will prevent POST from completing normally. If the bandwidth profiles do not match the configuration sheet, refer to the appropriate chassis reference manual to determine the procedures for bandwidth re-profiling.

NOTE: The bandwidth table is manually entered using the Bandwidth Profile Editor (BW).

Entering Environmental Profiles

Use the nucleus Routing Table Editor (R) Examine/Modify Addresses (A) command to allocate an address for the PB703 interface. A minimum of 32_{10} (20_{16}) subaddresses must be specified. Refer to the description of this command in the DX Nucleus Installation and Reference Manual (460456).

NOTE: The PB703 does not use the info field of the Examine/Modify Address (A) command to specify the circuit assignments.

The circuit assignment must be specified in the **info** field of the Examine/Modify Domain Forwarding Information (DF), Examine/Modify Network Forwarding Information (NF), and Examine/Modify Unit Forwarding Information (UF) commands in the nucleus Routing Table Editor (R). This circuit assignment is mapped into the 32-bit "Processor x Port Information" field of the HYPERchannel message where it is used to profile the forwarding information received by each processor. Refer to the descriptions of these commands in the DX Nucleus Installation and Reference Manual (460456) and the information contained in the following paragraph.

The data contained in bit positions 0 through 2 of the "Processor x Port Information" field define the routing of messages received from the nucleus as shown in Figure 12 on page 26. A circuit entry of 0 in the lowest three bit positions indicates a non-HYPERchannel message that must be processed internally by the routing engine in this PB703 or the DX Router Coprocessor in this DX unit. A circuit entry of 1 in these bit positions indicates a HYPERchannel message that must be routed to the network attached to circuit 1 for remote processing.

When a HYPERchannel message is received from the nucleus, the "Processor x Port Information" field must also contain the information shown in bit positions 3 through 31 of Figure 12. Table 10 on page 26 contains a description of bit positions 16 through 27.

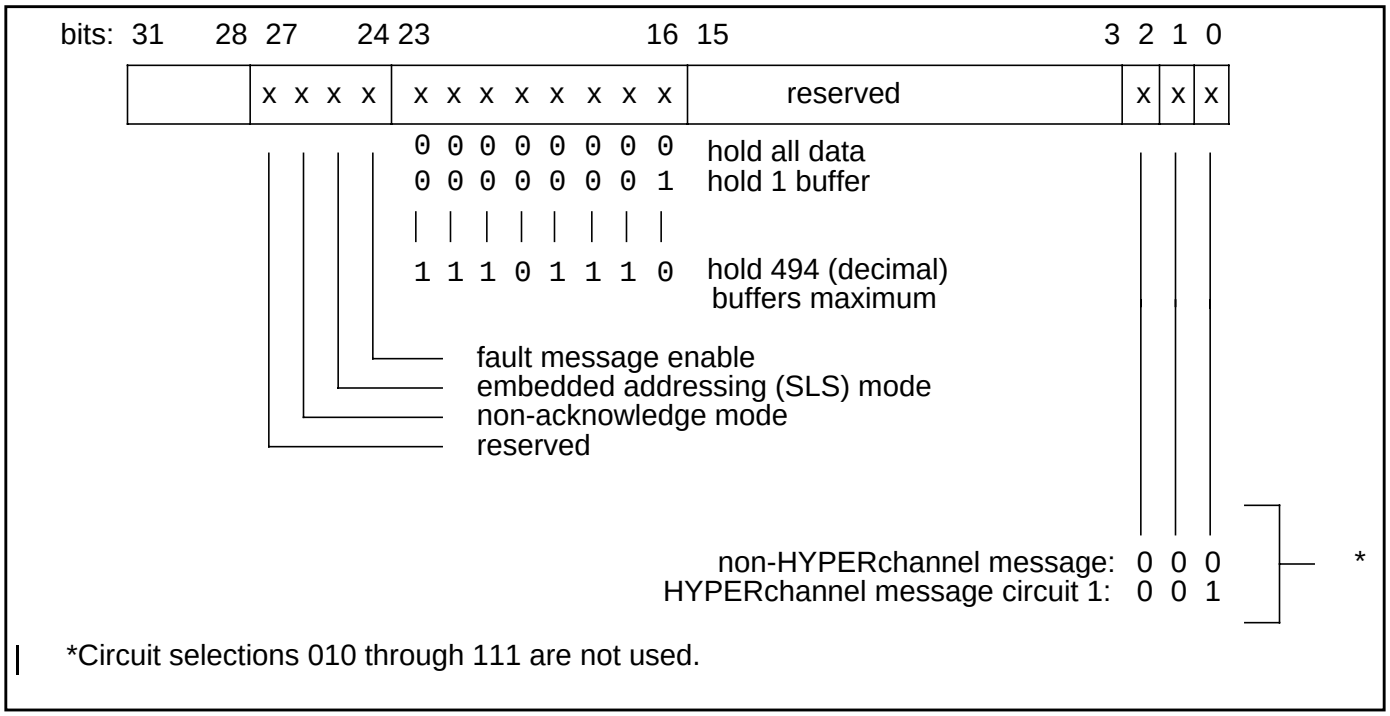


Figure 12. Interface Selection/HYPERchannel Message Information, Factory-Built DX Units

Table 10. Processor X Port Information - Bits 16 through 27, Factory-Built DX Units

Bit(s)	Description
16-23	Buffer Hold This mode of operation permits the receiving PB703 to either hold all data buffers, or hold a selected count of buffers. When the threshold of buffers is reached, the network message and all subsequently received data buffers are sent to the destination processor in the receiving DX unit.
24	Fault Message Enable This mode of operation permits fault messages to be returned to a host processor. **NOTE: This selection must made in the local link processor for the host requesting the fault information.**
25	Embedded Addressing (Satellite) Mode This mode enables the PB703 to process the message received as an embedded address type message.
26	Non-Acknowledge Mode This mode of operation permits the PB703 transmitter to release each buffer after frame transmission without waiting for acknowledgment. mode can accommodate up to 511 associated data buffers with each HYPERchannel message.
27	Reserved

An example of a Unit Forwarding command is shown in Figure 13 on page 27.

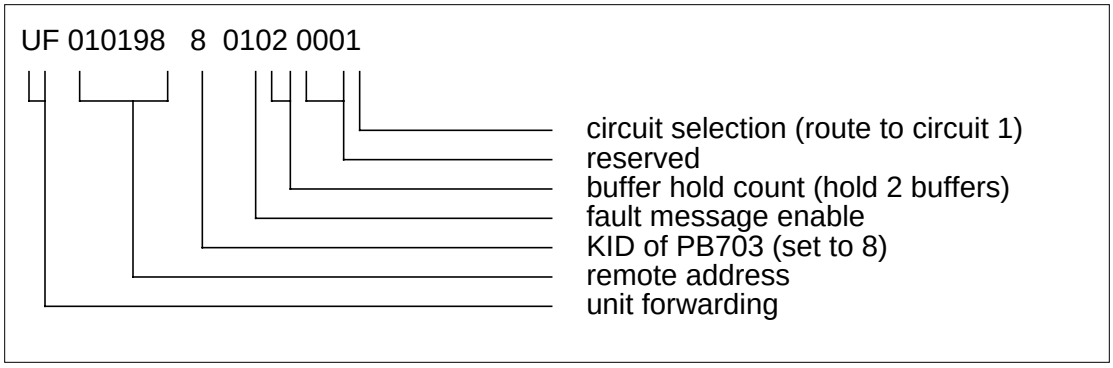


Figure 13. Unit Forwarding Example

Extraneous routing information may be in the nucleus profiles in a factory-built DX unit; therefore, routing information should be displayed and checked. Options to display, clear all routing information, or delete individual entries are available through the nucleus Routing Table Editor (R). Refer to the DX Nucleus Installation and Reference Manual (460456) for more information.

Verifying the BIST Configuration PROM (CP Command)

Ensure that the chassis size, board types, and board slot locations are in accordance with the configuration sheet accompanying the DX chassis. An incorrect chassis size entry will prevent POST from completing normally. If the Configuration PROM profiles do not match the configuration sheet, refer to the procedure for re-building the BIST configuration PROM in the appropriate chassis reference manual.

Entering Processor-specific Profiles

To profile the PB703, the user must access the PND703 monitor. Refer to “Monitor Commands” on page 39 for descriptions of these profiling procedures.

Master Clear the DX chassis and use the nucleus Display Configuration (DC) command to verify that all interfaces initialize.

Connecting External Cables

1. Power-down the DX unit by turning off the main AC power switch.
2. Connect the 50-pin connector on the drop cable to the connector on the PB703 I/O panel. Connect opposite end of cable to the communications facility DSU.

Table 11 lists the interface standard cables that may be attached to the PB703.

Table 11. External Cables, Factory-Built DX Units

Part Number	Interface
T20H	V.35 (34-pin MRAC connector) (LIT-3A, VIT-3C, VIT-2C)

Table 11. External Cables, Factory-Built DX Units

Part Number	Interface
T21H	V.35 (25-pin D sub-connector) (LIT-3B)
T25E	V.11

Verifying the Installation

Power up the DX chassis by turning on the main AC power switch (this causes POST to execute)

After self-test completes, execute the nucleus monitor Online Diagnostics (OD) Wrap (W) command and/or the DX Router Coprocessor Ping command. The Online Diagnostics (OD) Wrap (W) command is described in the DX Nucleus Installation and Reference Manual (460456). The Ping command is described in the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390).

If a problem is found on the link, use the Test command described in "Monitor Commands" on page 39 to isolate and repair the problem.

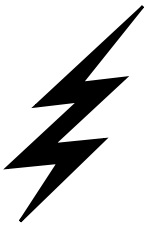
Sealing the Card Cage

Refer to the procedures described in the appropriate chassis manual for information on sealing the card cage.

NOTE: The DX chassis RFI shield on 16-slot chassis manual must be installed prior to installing the decorative cover. Installing the decorative cover alone does not provide sufficient clearance for the fiber optic cable and may cause damage to these cables.

Installing a PB703 Interface in the Field

This section describes the installation and configuration of a PB703 into a functioning DX unit in the field. It is similar to the procedure for configuring a factory-built DX unit except that it also includes the installation of the PND703 board, the internal I/O cables, and the I/O panel.



CAUTION

Observe all ESD precautions. Failure to do so could result in damage to the equipment.

Before You Begin

The procedures described in this section assume that the coprocessor installation procedures are complete and the chassis is in the following state:

- A Personal Computer (PC) with Terminal Emulation has been connected to the monitor port.
- The main power switch is on and DC power is turned off.

If these conditions are not present, refer to the appropriate chassis manual for setup procedures.

Required Tools and Materials

These procedures require the following tools:

- The applicable chassis manual (refer to “Reference Material” on page iv)
- Personal Computer (PC) with Terminal Emulation software
- Phillips screwdriver, medium
- Slotted screwdriver, medium
- Flashlight

CAUTION

These procedures must be performed by qualified personnel only.

Unpacking and Inspecting

1. Unpack the PB703 kit.
2. Verify that the contents match the packing list and that there is no visible damage to any of the contents.
3. Refer to the appropriate chassis manual for an explanation of the configuration sheet packed with the kit.

Verifying Current DX Unit Operation

Turn on DC power. Applying power to the DX unit causes it to execute self-test. Refer to the self-test procedures described in the appropriate chassis manual to determine how to verify the current configuration. For additional information about POST, BIST, and HALT error codes, see the DX Self Test Book (460553).

Verifying Jumpers and Switch Settings

While performing this procedure, refer to "Controls and Indicators" on page 17 and the configuration sheet shipped with the kit.

1. Turn off power to the chassis by placing the main AC power switch in the OFF position.
2. Verify that TAB jumper block matches the least significant digit of the tab level of the board (stamped near the front edge). (See "Tab of Board (TAB)" on page 19.)
3. Set DIP switches S1 and S2 as shown on the configuration sheet. Refer to "Controls and Indicators" on page 17 for a description of these switches and to determine the correct setting for jumper JB1.

Installing Boards

Refer to the appropriate chassis manual for information on gaining access to the DX card cage. Ensure that power is removed from the DX chassis (main power switch is set to off) before installing boards or internal cables.

Pseudo-Slot Designators

NOTE: Make sure that the ROM and RAM boards, located on the PND703 board, are seated firmly before installing the PND703 board.

The following board installation procedure refers to a scheme of pseudo-slot locations using letters of the alphabet. Pseudo-slot locations are correlated to actual (numbered) slot locations in the chassis by the configuration sheet accompanying each product. In most cases where more than one slot is required, the slots must be contiguous. Slot allocations typically vary from 1 to 4. Unused slots allocated to an interface may contain filler boards. An example of a four board pseudo-slot configuration with slot assignments **w**, **x**, **y**, and **z** is shown below:

- **w** refers to the top or left-most (lowest-numbered) slot in the group of four slots
- **x** refers to the slot under or to the right of slot **w**
- **y** refers to the slot under or to the right of slot **x**
- **z** refers to the bottom or right-most (highest-numbered) slot of the group of four slots

The PB703 requires one backpanel board slot (*target slot*) that is identified as slot w. Slots x, y and z are not defined for the PB703 Interface.

Installing Boards in Appropriate Slots

Use the configuration sheet shipped with the product to determine which slot the PND703 board should be installed and fill in the real slot number in this procedure before performing the installation steps.

1. Remove the existing board from the **target slot** (if this slot was previously occupied).
2. Return any unused filler boards to Network Systems.
3. Make sure all components are properly seated on the PND703 board, and then install the board in slot **w___**.

Installing Internal Cables

Refer to the appropriate chassis manual for information on gaining access to the DX backpanel.

Install clock cables in the slot used for the PB703 if these cables are not already installed. Refer to the appropriate chassis manual for instructions on installing these cables.

NOTE: Clock cables must not be moved during the installation process.

NOTE: A template is provided for both the J1 and J2 sides of the backpanel. It has been trimmed on one side, allowing room for the clock cables.

Four twisted-pair ribbon cables (one cable for each link) interconnect the backpanel to the I/O panel. The I/O panel is shipped to the field with one end of these cables attached to the I/O panel. The other end of these cables must be attached to the backpanel.

A two pin/one connector cable interconnects the backpanel to the LED located on the I/O panel. The I/O panel is shipped to the field with one end of this cable attached to the I/O panel. The connectors on the opposite end of this cable must be installed on the J2 side of the DX backpanel.

There is an indentation (or the presence of a brown/tan conductor pair) on ribbon cable connectors to identify pin 1. Pin 1 should always be on the right when installed in the backpanel. The 44-pin connector attached to the backpanel connects two rows of 22 pins.

Figure 14 on page 32 shows the backpanel cabling that must be installed for the PB703 Interface.

Connect the 44-pin twisted-pair ribbon cable connector to the J1 side of the backpanel as follows:

- Connect J1-1 of I/O cable to slot w___ J1B-02.

Verify the accuracy of the previous step by ensuring that the cable notch (or brown/tan conductor pair) is on the right side of the 44-pin ribbon cable connector where it attaches to the backpanel.

Connect the two-pin LED cable connectors to the J2 side of the backpanel as follows:

- Connect the white lead of the LED cable to slot w___ J2E-46.
- Connect the black lead of the LED cable to slot w___ J2A-46.

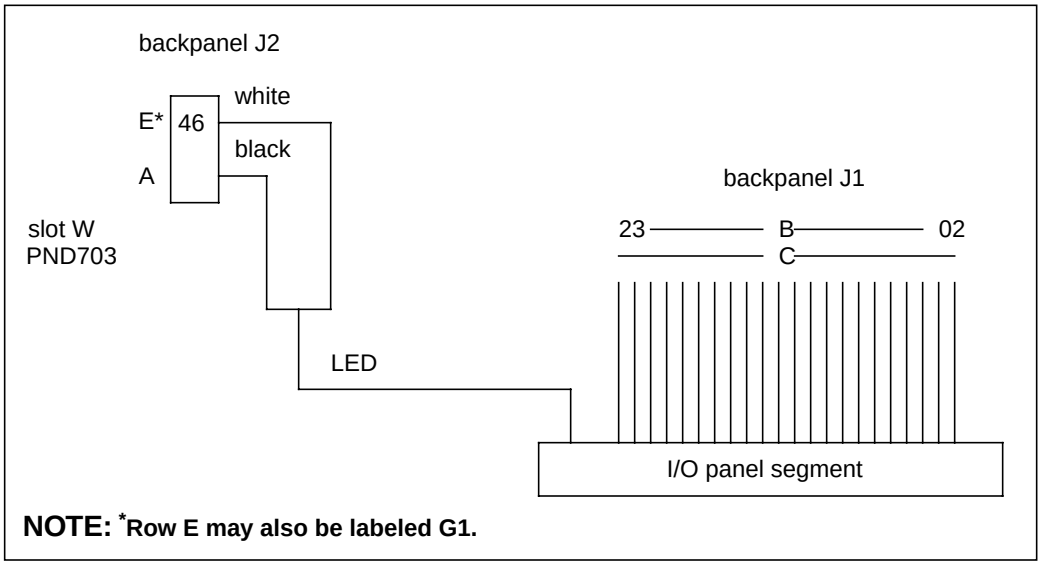


Figure 14. Backpanel Cabling

Installing the I/O Panel Segment

Figure 15 on page 33 shows the indicators and connectors on the PB703 I/O panel segment.

1. Refer to the configuration sheet shipped with the equipment to determine the position to install the I/O panel segment. Use a slotted screwdriver to remove any filler I/O panel segments to provide enough space to mount the new I/O panel segment. Also remove/re-arrange the other I/O panel segments to match the configuration sheet.
2. Use a slotted screwdriver to mount the I/O panel segment in the appropriate location on the I/O panel assembly. Use the mounting screws provided with the PB703 kit. (The left edge of each I/O panel segment is tabbed, insert it first.)
3. If the I/O panel assembly was removed to gain access to the slots at the bottom of the 16-slot chassis, refer to the appropriate chassis manual for I/O panel assembly reinstallation procedures.

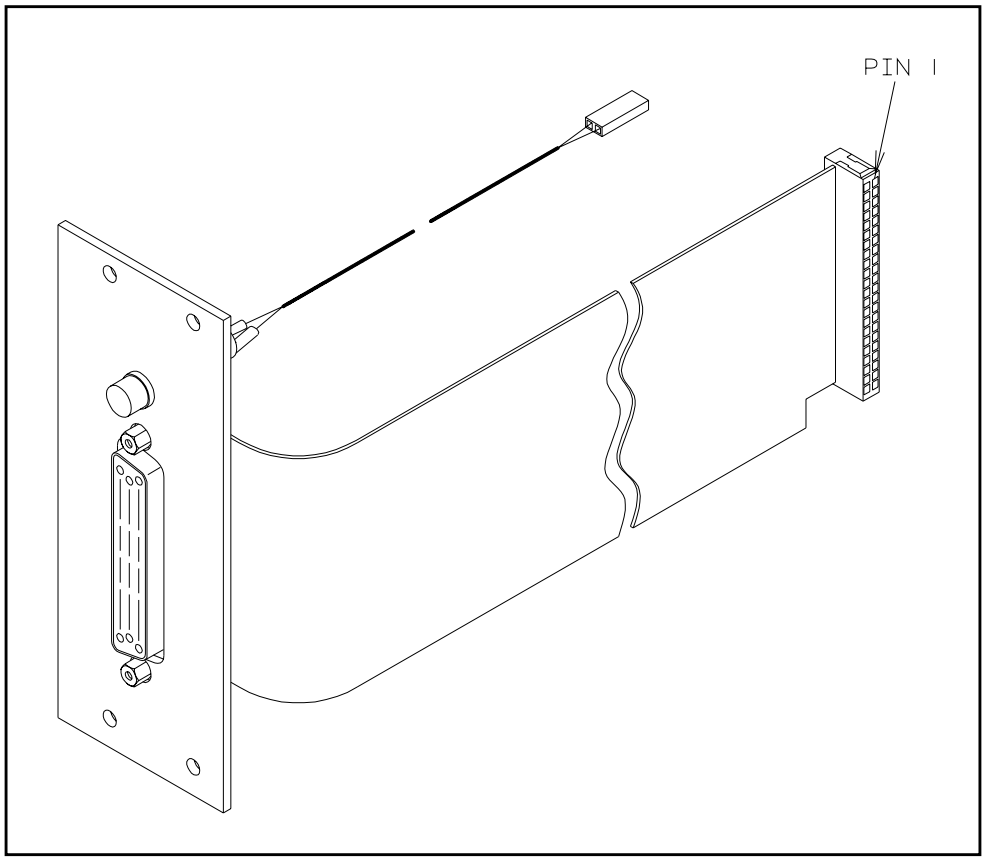


Figure 15. I/O Panel-Field Installation

Sealing the Card Cage

Refer to the procedures described in the appropriate chassis manual for information on sealing the card cage.

NOTE: The DX chassis RFI shield on 16-slot chassis manual must be installed prior to installing the decorative cover. Installing the decorative cover alone does not provide sufficient clearance for the fiber optic cable and may cause damage to these cables.

Verifying and Entering Profiles

DX chassis require four types of profile entries: bandwidth, environmental (addressing), configuration PROM, and processor-specific.

Verifying the Bandwidth

Ensure that the bandwidth profiles entered at the factory are set in accordance with the configuration sheet accompanying the DX chassis. Failure to comply will prevent POST from completing normally. If the bandwidth profiles do not match the configuration sheet, refer to the appropriate chassis reference manual to determine the procedures for bandwidth re-profiling.

NOTE: The bandwidth table is manually entered using the Bandwidth Profile Editor (BW).

Entering Environmental Profiles

Use the nucleus Routing Table Editor (R) Examine/Modify Addresses (A) command to allocate an address for the PB703 interface. A minimum of 32_{10} (20_{16}) subaddresses must be specified. Refer to the description of this command in the DX Nucleus Installation and Reference Manual (460456).

NOTE: The PB703 does not use the INFO field of the Examine/Modify Addresses command to specify the circuit assignment.

The interface assignment must be specified in the INFO field of the Examine/Modify Domain Forwarding Information (DF), Examine/Modify Network Forwarding Information (NF), and Examine/Modify Unit Forwarding Information (UF) commands in the nucleus Routing Table Editor (R). This interface assignment is mapped into the 32-bit "Processor x Port Information" field of the HYPERchannel message where it is used to profile the forwarding information for this station on the FDDI network. Refer to the descriptions of the commands in the DX Nucleus Installation and Reference Manual (460456) and the information contained in the following paragraph.

The data contained in bit positions 0 through 2 of the "Processor x Port Information" field define the routing of messages received from the nucleus as shown in Figure 16 on page 34. A circuit entry of 0 in the lowest three bit positions indicates a non-HYPERchannel message that must be processed internally by the routing engine in this PB703 or the DX Router Coprocessor in this DX unit. An entry of 1 in bit position 0 indicates a HYPERchannel message that must be routed to the corresponding circuit for remote processing.

When a HYPERchannel message is received from the nucleus, the "Processor x Port Information" field must also contain the information shown in bit positions 3 through 31 in Figure 16. Table 12 on page 35 contains a description of bit positions 16 through 27.

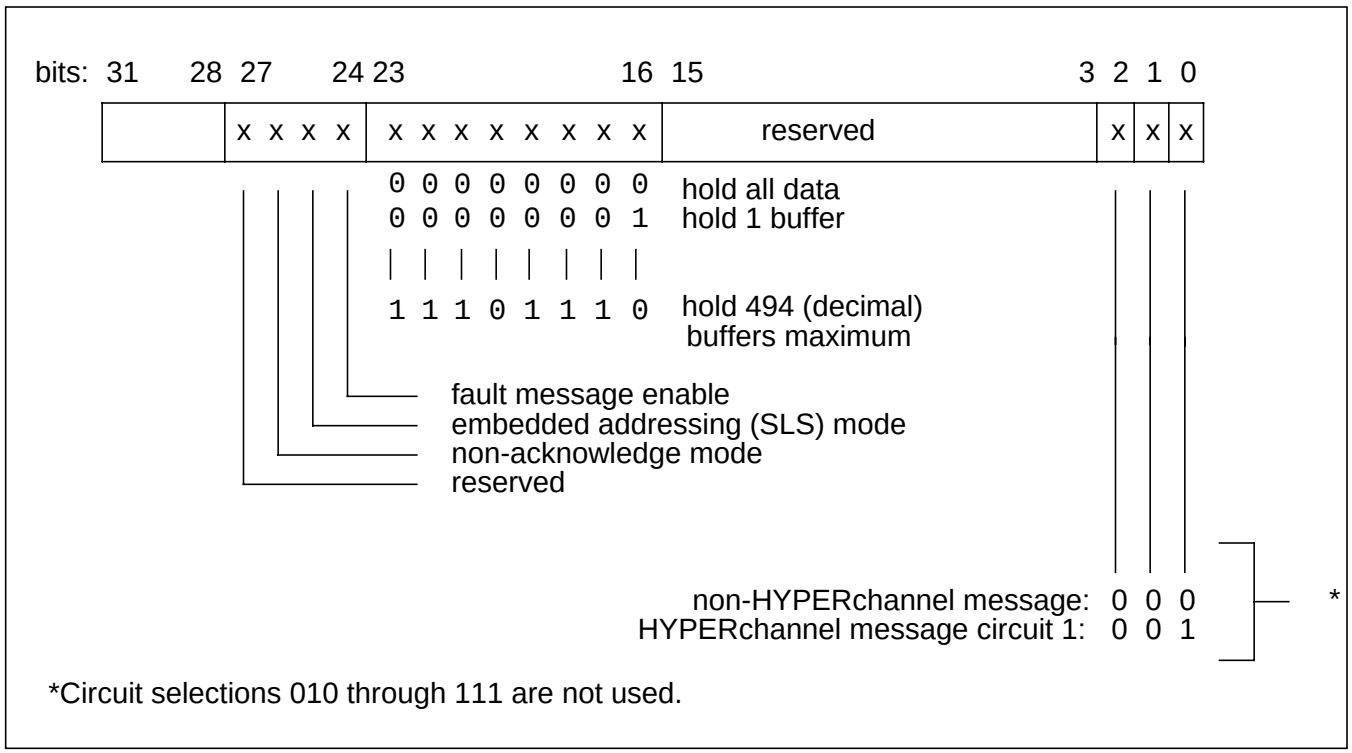


Figure 16. Interface Selection/HYPERchannel Message Information, Field-Built DX Units

Table 12. Processor X Port Information - Bits 16 through 27, Field-Built DX Units

Bit(s)	Description
16-23	Buffer Hold This mode of operation permits the receiving PB703 to either hold all data buffers, or hold a selected count of buffers. When the threshold of buffers is reached, the network message and all subsequently received data buffers are sent to the destination processor in the receiving DX unit.
24	Fault Message Enable This mode of operation permits fault messages to be returned to a host processor. **NOTE: This selection must made in the local link interface for the host requesting the fault information.**
25	Embedded Addressing (Satellite) Mode This mode enables the PB703 to process the message received as an embedded address type message.
26	Non-Acknowledge Mode This mode of operation permits the PB703 transmitter to release each buffer after frame transmission without waiting for acknowledgment. Non-acknowledge mode can accommodate up to 511 associated data buffers with each HYPERchannel message.
27	Reserved

An example of a Unit Forwarding command is shown in Figure 17.

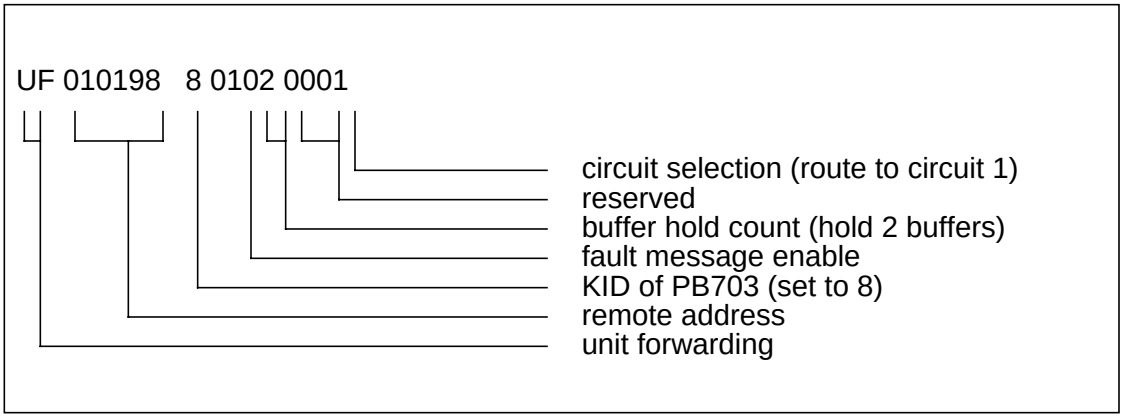


Figure 17. Unit Forwarding Example-Field Built DX Units

Entering Processor-specific Profiles

NOTE: Master Clear the DX unit before entering the processor-specific profiles.

To profile the PB703, the user must access the PND703 monitor. Refer to “Monitor Commands” on page 39 for descriptions of these profiling procedures.

NOTE: The operator must execute a Save command or Set Autosave command to store the processor-specific profiles after entry.

Master Clear the DX unit and use the nucleus Display DX Unit Configuration (DC) command to verify that all interfaces initialize.

Rebuilding the BIST Configuration PROM

Refer to the appropriate chassis reference manual to determine the procedures for re-building the BIST configuration PROM.

Afterward, ensure that the chassis size, board types, and board slot locations are in accordance with the configuration sheet accompanying the DX unit. An incorrect chassis size entry will prevent self-test from completing normally.

NOTE: The process of re-building the BIST Configuration PROM is automatically initiated by executing selected commands in the Configuration PROM Command Set (CP).

Running Self-Test

Applying power to the DX chassis causes it to execute the Power On Self Test (POST).

1. Turn DC power ON.

   Post should be run before connecting the DX chassis to the customer's equipment and before entering additional profile information.

   The POST program displays **FAIL** on the ASCII display when it fails. **HALT** indicates an initialization failure. **PASS** indicates normal POST completion. (Refer to DX Self Test Book (460553) for detailed information about POST, BIST, and HALT error codes.)

2. If the self-test program failure is caused by incorrect profile settings (**halt**). refer to "Verifying the Bandwidth". If self-test passes, go to "Entering Environmental Profiles".

Connecting External Cables

1. Power-down the DX unit by turning off the main AC power switch.
2. Connect drop cables to PB703 I/O panel. Connect opposite end of cables to communications facility DSU.

Table 13 lists the cable designators that correspond to each electrical standard.

Table 13. External Cables, Field-Built DX Units

Part Number	Interface
T20H	V.35 (34-pin MRAC connector) (LIT-3A, VIT-3C, VIT-2C)
T21H	V35 (25-pin D sub-connector) (LIT-3B)
T25E	V.11

Verifying the Installation

Power up the DX chassis by turning on the main AC power switch (this causes POST to execute)

After self-test completes, execute the nucleus monitor Online Diagnostics (OD) Wrap (W) command and/or the DX Router Coprocessor Ping command. The Online Diagnostics (OD) Wrap (W) command is described in the DX Nucleus Installation and Reference Manual (460456). The Ping command is described in the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390).

If a problem is found on the link, use the Test command described in "Monitor Commands" on page 39 to isolate and repair the problem.

Sealing the Card Cage

Refer to the procedures described in the appropriate chassis manual for information on sealing the card cage.

NOTE: The DX chassis RFI shield on 16-slot chassis manual must be installed prior to installing the decorative cover. The decorative cover alone does not provide sufficient clearance for the fiber optic cable and may cause damage to these cables.

Removing the PND703 Printed-Circuit Board

The following procedure should be used to remove a PC board for maintenance purposes.

1. Take any other interfaces off-line. Other interfaces may or may not have an OFFLINE switch on the I/O panel; see the applicable manual for off-line instructions.
2. Turn off DC power.
3. Refer to the appropriate chassis manual to determine how to access the card cage.
4. DX circuits may be damaged by electrostatic discharge. Follow the ESD precautionary procedures when performing the following task.
5. Remove the board.
6. Refer to the appropriate chassis manual to determine how to seal up the card cage.
7. Turn on DC power.
8. Place on-line any interfaces that were placed off-line at the start of this procedure.

Removing a PB703 Interface

Refer to the procedures in the chassis manual to determine how to access the card cage and backpanel.

1. Place all interfaces in the DX unit that can be placed off-line to the off-line state.
2. Remove power from the DX unit by placing the main AC power switch to off.
3. Remove the external cables from the I/O panel connectors.
4. Remove the backpanel cables from slot w___.

5. Remove the I/O panel segments
6. Replace the I/O panel segments with filler I/O panel segments.
7. Replace the PND703 board in slot w___ with a filler board.
8. Refer to the appropriate chassis manual to determine how to seal up the front and back of the chassis.
9. Apply power to the DX unit by placing the main AC power switch to on.
10. Refer to the appropriate chassis manual for the procedure on re-building the BIST configuration PROM.
11. Place on-line any interfaces you placed off-line when you started this procedure.

Monitor Commands

This section describes the PND703 commands. ThePND703 Monitor is used during installation to enter and save interface specific profiles, and run line tests. It may be used at other times to display statistics, selected counters and registers, and also to perform diagnostic tests.

Use the Set and Save commands described in this section to set and save the desired operating characteristics. The term "circuit" defines a set of firmware instructions that controls and assigns attributes to the line. The single line in a PB703 is defaulted to "on" following initial power up. The logical circuit is automatically activated when the line is activated.

The PND703 monitor may be entered from the Nucleus Monitor by using the Attach (A) command specifying the KID of the PND703 board background processor. Refer to the DX Nucleus Installation and Reference Manual (460456) for instructions on the use of the Nucleus Monitor.

After attaching to the PND703 monitor from the nucleus monitor, or following execution of a Display Version command, the information in Figure 18 is displayed:

```
N703 Link Console (version) (date/time)
Common Device Architecture (CDA) Vx.x
Processor Key 0xx, Firmware #xxxxxx-xx, Hardware #xxxxxx-xx
Copyright (c) 1987-1993 Network Systems Corporation.  All rights reserved
.
Linked from directory /tmp-mnt/home/pallas2/lnmaster/new/link.
POST Part # xxxxxx-xx Rev xx Ver x.x (C) NSC 1996
>
```

Figure 18. Banner Screen Example

A prompt (>) at the bottom of each display enables the user to enter a command. A console name, if selected, is inserted in front of the prompt (refer to “Set Name” on page 86). A command line entry must be followed by a carriage return.

Alpha characters may be entered in upper or lower case. The monitor does **not** require the operator to enter all characters in the menu option--only a sufficient number of characters to distinguish the option from other choices in the menu. Numeric values may be entered in decimal or hexadecimal. Hexadecimal entries must be preceded by *0x*. Unless otherwise specified, all parameter values described in this section are decimal.

Entering a question mark (?) with no command entry displays the command help screen shown in Figure 19 on page 40.

```
> ?
one of the following:
   bridge - bridge commands
   clear - clear statistics and console/profile parameters
   date - display current date and time
   display - display information
   logout - logout console
   save - save profile
   set - set operating parameters
   test - run tests
>
```

Figure 19. PND703 Monitor Commands

Entering a command displays the parameter help screen corresponding to the command. Command parameters are parsed by spaces (any number).

NOTE: The PND703 Monitor does not normally require the user to specify an interface. In those instances when an interface entry is required, the only valid entry is "1".

Bridge Commands

These commands allows the user to display various bridge parameters.

NOTE: A PB703 configured with CDA 5.0 (or later) firmware cannot be used as a bridge master. Bridge commands are required only when the PB703 is acting as "bridge master".

Entering bridge followed by a question mark displays the help screen shown in Figure 20.

```
> bridge ?
one of the following:
   show - show various bridge information
>
```

Figure 20. Bridge Commands Help Screen

The Bridge Show command allows the user to display selected bridging parameters. The bridge commands are described in the Bridging for DX Interfaces Reference Manual (460828).

Clear Command

This command clears (but does not display) the accumulated statistics and parameters for the specified function within the PB703

Command	Optional Parameters - Select One
CLear	Aplstats Circuit COnsole Decstats HYstats Ifs IPCstats IPStats IPXstats Log PCfstats PRofiles Trace_level Xnsstats

CLEAR

This is the required verb for this command. One and only one of the following parameters must be selected.

Aplstats

The *aplstats* parameter clears the Appletalk routing protocol statistics generated by the Appletalk routing engine on the PND703 board.

Circuit

The *circuit* parameter clears the circuit statistics.

COnsole

The *console* parameter clears the current console severity level and facility selection.

Decstats

The *decstats* parameter clears the DECnet routing protocol statistics generated by the DECnet routing engine on the PND703 board.

HYstats

The *hystats* parameter clears the HYPERmedia statistics.

Ifs

The *ifs* parameter clears the interface statistics.

IPCstats

The *ipcstats* parameter clears the statistics generated by the inter-processor communication messages.

IPStats

The *ipstats* parameter clears the statistics generated by the IP Routing Engine.

IPXstats

The *ipxstats* parameter clears the statistics generated by the Novell Internet Packet Exchange routing

engine on the PND703 board.

Log
This parameter clears the trace message log.

PCfstats
The *pcfstats* parameter clears the PCF statistics generated by the IP Routing Engine on the PND703 board. The Packet Control Facility for IP datagrams is described in the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390).

PRofiles
The *profiles* parameter resets the profiles previously set using the SET command to default settings.

Trace_level
This parameter resets the trace level events stored in the message log to the default severity.

Xnsstats
The *xnsstats* parameter clears the statistics generated by the Xerox Network Systems routing engine on the PND703 board.

Entering clear followed by a question mark displays the help screen shown in Figure 21.

```
> clear ?
one of the following:
   aplstats - clear AppleTalk statistics
   circuit - clear circuit statistics
   console - reset console parameters
   decstats - clear DECNET statistics
   hystats - clear HYPERmedia interface statistics
   ifs - clear interface statistics
   ipcstats - clear IPC statistics
   ipstats - clear IP statistics
   ipxstats- clear IPX statistics
   log - clear log of trace messages
   pcfstats - clear Packet Control Facility statistics
   profiles - reset profiles to default
   trace_level - reset severity of events put in trace area [8]
   xnsstats - clear XNS statistics
>
```

Figure 21. Clear Statistics and Console/Profile Parameters Command Help Screen

Clear HYPERmedia Statistics

Entering clear hystats followed by a question mark displays the help screen shown in Figure 22 on page 43.

```
> clear hystats ?
one of the following:
   <int> - optional interface number for selected clear
>
```

Figure 22. Clear HYPERmedia Statistics Help Screen

A HYPERmedia port in the range from 1 to 15 may be specified.

Current Date and Time Command

Command	Optional Parameters
DAte	

DATE

This is the required verb for this command. There are no parameters for this command.

The format of a typical date command screen is shown in Figure 23.

```
> date
07-Mar-1996 14:52:40.122
>
```

Figure 23. Date and Time Command

The date and time can be set using the nucleus Set Clock (C) command. Refer to the DX Nucleus Installation and Reference Manual (460456) for a description of this command.

Display Command

This command displays statistics, counters and registers.

Command	Optional Parameters - Select One
DIsplay	Aplstats Apply_cache Bind BMstats Circuit COnsole CRc DAte DEcstats HEap Hystats Ifs IPCstats IPstats IPXstats Log Mcounts PCfstats PRofiles TAsks TEsts TImeout_queue TRace_level Uptime Version Xnsstats

DISPLAY

This is the required verb for this command. One and only one of the following parameters must be selected.

Aplstats

This parameter displays the statistics generated by the Appletalk routing engine on the PND703 board.

Apply_cache

This parameter displays the local table cache.

BInd

This parameter displays the assignment of routing engines and/or bridging engine to the interface port.

BMstats

This parameter displays the buffer memory statistics.

Circuit

This parameter displays the circuit configuration for all circuits, or a selected circuit.

COnsole
This parameter displays the current console severity level and facility selection.

CRc
This parameter displays the firmware CRC values.

DAte
This parameter shows the current date and time.

DEcstats
This parameter displays the statistics generated by the DECnet routing engine on the PND703 board.

HEap
This parameter displays free heap - local (on-board) memory area used by the PND703 firmware.

Hystats
This parameter displays the HYPERmedia statistics for all HYPERmedia ports, or a selected HYPERmedia port.

Ifs
This parameter shows the interface statistics for all physical interfaces, or a selected physical interface.

IPCstats
This parameter show statistics about interprocessor communication activity.

IPstats
This parameter shows the statistics generated by the IP Routing Engine on the PND703 board.

IPXstats
This parameter displays the Novell Internet Packet Exchange statistics generated by the IPX routing engine on the PND703 board.

Log
This parameter displays the log of trace messages.

Mcounts
This parameter displays the message counters.

PCfstats
This parameter shows the PCF statistics generated by the IP Routing Engine on the PND703 board. The Packet Control Facility for IP datagrams is described in the Routing for 64xx and 68xx Series and Other DX Routers Reference Manual.

PRofiles
This parameter shows all profiles previously set under the SET command.

TAsks
This parameter displays the tasks that are active.

TEsts
This parameter shows the interface test results.

TImeout_queue
This parameter displays the timeout queue.

TRace_level
This parameter displays the severity of events put in the trace area.

Uptime
This parameter displays the time elapsed since the last master clear

Version
This parameter displays the console start screen.

Xnsstats
This parameter displays the Xerox Network Systems statistics generated by the XNS routing engine on the PND703 board.

Entering display ? displays the help screen shown in Figure 24.

```
> display ?
    aplstats - display AppleTalk statistics
   apply_cache - display the local apply table cache
   bind - display bind status
   bmstats - display buffer memory statistics
   circuit - display circuit information
   console - display console parameters
   crc - display firmware  date and time
   decstats - display DECNET statistics
   heap - display free heap
   hystats - display HYPERmedia statistics
   ifs - display interface information
   ipcstats - display IPC statistics
   ipstats - display IP statistics
   ipxstat - display IPX statistics
   log - display log of trace messages
   mcounts - display message counts
   pcfstats - display Packet Control Facility statistics
   profiles - display profiles
   tasks - display active tasks
   tests - display interface test statistics
   timeout_queue - display timeout queue
   trace_level - display severity of events put in trace area
   uptime - display time since last master clear
   version - redisplay console start screen
   xnsstats - display XNS statistics>
>
```

Figure 24. Display Command Help Screen

NOTE: Several parameters may be entered on the same command line.

Display Appletalk Statistics

This command displays the statistics generated by the Appletalk routing engine on the PND703 board. The format of a typical display aplstats command is shown in Figure 25 on page 47. The information categories are described in Table 14 on page 47.

```
> display aplstat
        Appletalk Statistics (Routing Engine only)
         0 packets from local (attached) media
         0 packets routed in from another interface
         0 packets sent to local media
         0 packets sent to another interface
         0 control packets deferred to coprocessor
>
```

Figure 25. Display Appletalk Statistics

Refer to the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390) for a detailed description of Appletalk protocol.

Table 14. Appletalk Statistics Description

Name	Description
packets from local (attached) media	The number of packets received from the local attached media by this processor including those received in error.
packets routed in from another interface	The number of packets received from another processor in this DX unit.
packets sent to local media	The number of packets transmitted to the media by this processor.
packets sent to another interface	The number of packets sent to another processor in this DX unit.
control packets deferred to coprocessor	The number of control packets received from the media that were sent to the coprocessor for processing.

Display Bind Statistics

This command shows which protocol engines (including the bridging engine) are assigned to each port. The format of a typical display bind command is shown in Figure 26 on page 48. The information categories are described in Table 15 on page 48.

```
> display bind
Interface  Protocol        Packet          Bind        Recipient   Engine
Name       Name            Disposition     State       Key.Port    Enabled

lnk1*      SNMP Status                     Active        2.0
           IP              Discard         Disabled      2.0         Yes
           DECnet          Forward         Active        2.0         Yes
           Appletalk       Forward         Active        2.0         Yes
           XNS             Forward         Active        2.0         Yes
           IP_ARP          Discard         Disabled      2.0         N/A
           Appletalk_ARP   Forward         Active        2.0         Yes
           Bridging        Discard         Disabled      8.0         Yes
>
```

*lnk1 is decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 26. Display Bind Statistics

Table 15. Display Bind

Name	Description
Protocol Name	Routing and/or bridging protocols active on the physical interface
Packet Disposition	A packet for a selected protocol can either be forwarded to a final destination or discarded.
Recipient Key and Port	KID and port number
Engine Enabled	Denotes the state of the corresponding routing or bridging engine in this interface.
Bind State	Denotes the state of the coprocessor (disabled, down, active)

Display Buffer Memory Statistics

This command shows the allocation of large and small memory pages. A typical Display Buffer Memory Statistics command is shown in Figure 27 on page 49.

```
> display bm

small pages:  76 ( 30/ 60/ 90)
large pages:  27 ( 20/ 40/ 60)
local pages: 478
private pages: 255

small allocate requests   =          1
small deallocate requests =          0
large allocate requests   =          1
large deallocate requests =          0
small allocate request threshold   = 10
small deallocate request threshold = 10
large allocate request threshold   = 10
large deallocate request threshold = 10
small nominal ceiling =  240
large nominal ceiling =  160
dynamic memory is on
>
```

Figure 27. Display Buffer memory Statistics

Display Circuit Information

The PB703 has only one logical circuit (circuit 1). This command is used to show various information relating to circuit 1. Entering display circuit ? provides the display shown in Figure 28.

```
> display circuit ?
one of the following:
   <int> optional circuit number for expanded information
>
```

Figure 28. Display Circuit Help Screen 1

Entering display circuit 1 ? provides the display shown in Figure 29 on page 50.

```
> display circuit 1 ?
one of the following:
    profiles - display circuit profiles
    queue - display WAN backup queue information
    traffic - alternative display of traffic statistics
>
```

Figure 29. Display Circuit Help Screen 2

Display Circuit 1 Profiles

The format of a typical display circuit 1 profiles command is shown in Figure 30.

```
> display circuit 1 profiles
Circ   Interfaces  Circuit Name     Protocol
lnk1*   1                            N70x    lqm quality 90 window 30
                                             des gna  00000000
>
```

*lnk1 through lnk4 are decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 30. Display Circuit 1 Profiles

Display Circuit 1 Queue

Entering display circuit 1 queue ? provides the information shown in Figure 31.

```
> display circuit 1 queue ?
one of the following:
   profiles - display WAN backup queue profiles
   statistics - display WAN backup queue statistics
>
```

Figure 31. Display Circuit 1 Queue Help Screen

Entering Display Circuit 1 Queue Profiles provides the information shown in Figure 32.

```
> display circuit 1 queue profiles
Circuit queue profiles for circuit 1

Time to Live (ms)            1000
Maximum Packet Depth         auto
Maximum Time Depth (ms)      1000
Maximum % of Multicast         50
>
```

Figure 32. Display Circuit Queue Profile

Entering display circuit 1 queue statistics provides the information shown in Figure 33. Refer to "Set Circuit Queue" on page 75.

```
> display circuit 1 queue statistics

                Circuit 1 Transmit Queue Statistics

   68134 total packets handled         68134 total packets forwarded
       0 total packets queued              0 current packets queued
       0 current bytes queued              0 timed out packets

       0 total multicast packets           0 current multicast queued
   68134 total selected packets            0 current selected queued
       0 total indexed packets             0 current indexed queued
       0 total balanced packets            0 current balanced queued

    1544 queue packet threshold            0 packet threshold exceeded
  193000 queue byte threshold              0 byte threshold exceeded
     772 queue multicast threshold         0 multicast threshold exceeded

   68134 hardware forced packets           0 default selected packets
       0 forced packets discarded          0 total packets discarded
>
```

Figure 33. Display Circuit 1 Queue Statistics

Display Circuit 1 Traffic

Entering display circuit 1 traffic provides the information shown in Figure 34 on page 52.

```
> display circuit 1 traffic
Circuit lnk1*                 Interface(s) - 1
                     Link Traffic Summary

Statistics collected over 16 hours, 49 minutes, 40 seconds
                      Transmit        Avg             Receive         Avg
Protocol        Packets        Bytes  Size   %   Packets        Bytes  Size   %
Link Control    2943510     247254840   84   1   2943371    247243164    84   7
HYPER Frames    6403424   12195268932 1904  97   2429130   3037039250  1250  89
HYPER Acks      2429125      38866000   16   0   6402102    102433632    16   3
Total          11776059   12481389772 1059 100  11774603   3386716046   287 100
>
```

*lnk1 is decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 34. Display Circuit Traffic

Display Circuit 1 Summary

Entering display circuit without specifying an interface number provides a summary of information relating to circuit 1 as shown in Figure 35.

```
> display circuit
circ   interfaces   circuit name     protocol  lqm   state
lnk1*  1                              N70X       ON  Active
>
```

*lnk1 is decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 35. Display Circuit Summary

Entering display circuit 1 provides the information shown in Figure 36 on page 53.

```
> display circuit 1
circuit lnk1*                 Interface(s) - 1
Protocol = N70x           Link MTU = 12848
Current circuit state is ON.  Last changed 10:13:52.534

Protocol Name   Packet Disp.  Recipient  Bind State
IP              Forward         2.0      Active
BRIDGING_EC     Discard         2.0      Disabled
STP_EC          Discard         2.0      Disabled

Backup List          0 Total     0 Current     0 Max        0 Discarded
HYPERmedia circuit up
              Headers   Messages  AssocData     EndOps
Xmit                3          0          0          0            0 Acks
ReXmit                         0          0          0
Receive             3          0          0          0            0 Acks
Receive ReXmit                 0          0          0
            0 ReXmitLimitExceeded          0 PassThruAborts
            0 FaultMsgs                0 FaultsNotReported
  0/0  Current/Max Xmits Active    0/0  Current/Max Xmits Pending
>
```

*lnk1 is decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 36. N70X Protocol Circuit Information

Display Console

The format of a display console command is shown in Figure 37.

```
> display console
Console 00000001 Status
 Severity: 8
 Facility_mask: Executive, Console, Packets,
                Bridge, Interface, LocalIP, HYPERmedia
>
```

Figure 37. Display Console

Display Current Date and Time

The format of a display date command is shown in Figure 38 on page 54.

```
> display date
07-Mar-1996 14:55:19.648
>
```

Figure 38. Display Date and Time

The date and time can be set using the nucleus Set Clock (C) command. Refer to the DX Nucleus Installation and Reference Manual (460456) for a description of this command.

Display DECnet Statistics

This command displays the DECnet statistics generated by the DECnet Routing Engine on the PND703 board. The format of a display decnet command is shown in Figure 39. The information categories are described in Table 16 on page 55.

```
> display decstats
   Decnet Statistics (Routing Engine only)
    0 packets from local (attached) media
    0 packets routed in from another interface
    0 packets sent to local media
    0 packets sent to another interface
    0 control packets deferred to coprocessor
>
```

Figure 39. Display DECnet Statistics

Refer to the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390) for a detailed description of DECnet statistics.

Table 16. DECnet Statistics Description

Name	Description
packets from local (attached) media	The number of packets received from the local attached media by this processor including those received in error.
packets routed in from another interface	The number of packets received from another processor in this DX unit.
packets sent to local media	The number of packets transmitted to the media by this processor.
packets sent to another interface	The number of packets sent to another processor in this DX unit.
control packets deferred to coprocessor	The number of control packets received from the media that were sent to the coprocessor for processing.

Display HYPERmedia Statistics

This command allows the user to display the status of IP datagrams that have been encapsulated in HYPERchannel message format. The command may be used to specify a single HYPERchannel logical interface (port), or all HYPERchannel logical ports within the DX unit. When specifying a single logical port, the entry must be in the range from 1 to 15.

Entering display hystats ? displays the help screen shown in Figure 40.

```
> display hystats ?
one of the following:
   <int> - optional interface number for expanded statistics
>
```

Figure 40. Display HYPERmedia Statistics Help Screen

Entering display hystats without specifying a port displays HYPERmedia statistics for all 15 ports as shown in Figure 41 on page 56. The information categories are described in Table 17 on page 57.

```
> display hystats

port   InUcastPkts  InDiscards  InErrors  OutUcastPkts  OutDiscards  OutErrors
   1           0           0           0             0            0          0
   2           0           0           0             0            0          0
   3           0           0           0             0            0          0
   4           0           0           0             0            0          0
   5           0           0           0             0            0          0
   6           0           0           0             0            0          0
   7           0           0           0             0            0          0
   8           0           0           0             0            0          0
   9           0           0           0             0            0          0
  10           0           0           0             0            0          0
  11           0           0           0             0            0          0
  12           0           0           0             0            0          0
  13           0           0           0             0            0          0
  14           0           0           0             0            0          0
  15           0           0           0             0            0          0
>
```

Figure 41. Display HYPERmedia Statistics (All Ports)

Entering display hystats with a port specified displays the screen shown in Figure 42. The information categories are described in Table 17 on page 57.

```
> display hystats 1

port   InOctets   InUcastPkts  InDiscards   InErrors  InUnknProtos InFiltered
   1           0             0           0          0             0          0

port  OutOctets  OutUcastPkts OutDiscards  OutErrors    OutQLenMax    OutQLen
   1           0             0           0          0             0          0
>
```

Figure 42. Display HYPERmedia Statistics (Selected Port)

Table 17. HYPERmedia Interface Statistics

Name	Description
InOctets	Total number of octets received on the interface, including framing characters
InUcastPkts	Number of unicast packets delivered to a higher level protocol
InDiscards	Number of error free inbound packets that were discarded to prevent transfer of these packets to a higher level protocol
InErrors	Number of inbound packets containing errors that were discarded to prevent transfer of these packets to a higher level protocol
InUnknownProtos	Number of unsupported or unknown protocol packets that have been discarded
InFiltered	Number of packets discarded by Packet Control Facility (PCF) when installed and enabled.
OutOctets	Total number of octets transmitted on the interface, including framing characters
OutUcastPkts	Number of packets requested by higher level protocols for delivery to a unicast address, including those that were discarded or not sent
OutDiscards	Number of error free outbound packets that were discarded to prevent transmission of these packets
OutErrors	Number of outbound packets containing errors that were discarded to prevent transmission of these packets
OutQLenMax	Maximum length of output packet queue in packets
OutQLen	Current length of output packet queue in packets

Display Interface Information

The PB703 has one physical interface (interface 1).

Entering display ifs 1 ? displays the help screen shown in Figure 43.

```
> display ifs ?
one of the following:
   <int> - optional interface number for expanded information
>
```

Figure 43. Display Interface Information Help Screen 1

If an interface is not specified, the information in Figure 44 on page 58 is displayed.

```
> display ifs

if  circ interface name     state   protocol xmt/rcv clks     xpkts     rpkts
 1  lnk1*                   ON      N70x      1.398 Mbps       2695      2592
>
```

*lnk1 is decoded as follows:

- ln = link media
- k = KID number
- 1 = logical circuit group number

Figure 44. Display Interface(s) Information - Interface(s) Not Specified

The interface information categories for Figure 44 are defined in Table 18.

Table 18. Interface Information

Name	Description
if	Physical interface number (interface "1")
circ	Logical circuit number (circuit "1")
interface name	Operator profiles physical interface name
state	Physical interface state (off, loopback, test, on, mismatch, looped, bad dest, no resp, polling, no clock). Refer to Table 19 on page 59.
protocol	n70x LLP
xmit/rcv clks	Transmit and receive clock rate
xpkts	Transmit packets
rpkts	Receive packets

Table 19. Interface States

State	Description
on	Activates transmitter and receiver and connects port to the interface table. This state is entered after initialization is complete on both ends of the link, and the link is available for service.
off	Deactivates transmitter and receiver.
no clocks	No transmitter or receiver clocks detected
no resp	No response from remote port.
looped	Local or remote DSU in loopback.
loopback	Activates transmitter and receiver and causes the information on the transmitter to be looped to the receiver.
test	Activates transmitter and receiver and disconnects port from the interface table.
bad line	LQM has placed this interface out of service
ready	Waiting for the opposite end of the link to enter the "on" state
mis-configure	Mis-configure can be caused by any of three conditions: destination mismatch, source mismatch, or circuit group mismatch.

Entering display ifs 1 ? provides the display shown in Figure 45.

```
> display ifs 1 ?
one of the following:
   traffic - alternative display of traffic statistics
   traffic_manager - display Traffic Manager interface information
>
```

Figure 45. Display Interface Information Help Screen 2

Display Interface 1 Traffic Information

Entering a display interface 1 traffic command provides a summary of information relating to interface 1 as shown in Figure 46 on page 60.

```
> display ifs 1 traffic
Interface 1
                     Link Traffic Summary


Statistics collected over 16 hours, 49 minutes, 40 seconds
                      Transmit        Avg             Receive         Avg
Protocol        Packets        Bytes  Size   %   Packets        Bytes  Size   %
Link Control    2943510     247254840   84   1   2943371    247243164    84   7
HYPER Frames    6403424   12195268932 1904  97   2429130   3037039250  1250  89
HYPER Acks      2429125      38866000   16   0   6402102    102433632    16   3
Total          11776059   12481389772 1059 100  11774603   3386716046   287 100
>
```

Figure 46. Display Interface Traffic

Display Interface 1 Traffic Manager Information

Entering a question mark after entering display ifs 1 tm displays the help screen shown in Figure 47. The interfaces average, median and peak measurement speeds for rate and burst rate are set using "Set Interface" on page 79.

```
> display ifs 1 tm ?
one of the following:
   configuration - display Traffic Manager current configuration
   profiles - display Traffic Manager profile
   statistics - display Traffic Manager statistics
>
```

Figure 47. Display Interface Traffic Manager Configuration

Entering display ifs 1 tm configuration displays a summary of information relating to interface 1 as shown in Figure 48.

```
> display ifs 1 tm configuration
Current Traffic Manager configuration for interface 1:
(burst in bits, rate in bits/second)

Level        Rate  Burst
Average   1999872 147456
Median    1999872 147456
Peak      1999872 147456
Status        off
>
```

Figure 48. Display Interface Traffic Manager Configuration

Entering display ifs 1 tm profiles displays a summary of information relating to interface 1 as shown in Figure 49.

```
> display ifs 1 tm profiles
Traffic Manager profiles for interface 1 - Average/Median/Peak
(burst in Kbits, rate in Kbits/second)
Hour         0     1     2     3     4     5     6     7     8     9    10    11
A.Burst    144   144   144   144   144   144   144   144   144   144   144   144
A. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
M.Burst    144   144   144   144   144   144   144   144   144   144   144   144
M. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
P.Burst    144   144   144   144   144   144   144   144   144   144   144   144
P. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
Hour        12    13    14    15    16    17    18    19    20    21    22    23
A.Burst    144   144   144   144   144   144   144   144   144   144   144   144
A. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
M.Burst    144   144   144   144   144   144   144   144   144   144   144   144
M. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
P.Burst    144   144   144   144   144   144   144   144   144   144   144   144
P. Rate   1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953  1953
>
```

Figure 49. Display Interface Traffic Manager Profiles

Entering display ifs 1 tm statistics displays a summary of information relating to interface 1 as shown in Figure 50.

```
> display ifs 1 tm statistics
Traffic Manager statistics for interface 1:

Packets exceeding average burst threshold          0
Packets exceeding peak burst threshold             0
Packets exceeding median burst threshold           0
Packets below median burst threshold               0
>
```

Figure 50. Display Interface Traffic Manager Statistics

Interface 1 Specific Display Formats

If display ifs 1 is entered, the information contained in Figure 51 on page 62 is displayed. The interface(s) information headings for Figure 51 are defined in Table 20 on page 62.

```
> display ifs 1
Interface 1                  Protocol = N70x              Link MTU = 12848
Interface is ON         Last changed 06-May-1992 16:19:50.848

   1220359 Transmit Packets              92747104 Transmit Bytes
   1220210 Receive Packets               92735780 Receive Bytes

Errors:
         0 Receive bad frames                    0 Receive short frames
         0 Receives lost, no 1k buffers          0 Receives w bad length
         0 Receives lost, no 2k buffers          0 Receives lost, recv queue
 full

Transmit clock = 1.536 Mbps          1 baud rate changes detected
Receive clock  = 1.536 Mbps            Last change 06-May-1992 16:19:35:999
         3 msecs round-trip time
         0 usecs inter-packet xmit delay

 LQM    Last  Expect    Window   Sample     Lost Xmit   Lost Recv   Quality
State  Report Quality    Size     Time      Pkts/Bytes  Pkts/Bytes  Changes
 On     Good    90%     30 secs   938 msecs   0%/  0%     0%/  0%       1
>
```

Figure 51. Display Interface Information - Interface 1 Specified

Table 20. Line Statistics

Name	Description
Receive bad frames	Count of HDLC frames not properly enclosed in flag bytes
Receive short frames	Count of frames that did not contain enough information to be interpreted
Receives lost, no 1k buffers	Count of frames that could not be received due to lack of 1k buffers
receives w bad length	Count of frames that exceeded MRU or did not match length value inserted in frame
Receives lost, no 2k buffers	Count of frames that could not be received due to lack of 2k buffers
Receives lost, recv queue full	Count of frames that could not be received because the receive queue was full
LQM State	Operating state (on or off)
Last Report	Status of the interface (bad or good)
Expect Quality	The value assigned in the Set Circuit Quality command
Window Size	The value assigned in the Set Circuit Window command
Sample Time	Time interval being used for acceptability checks.
Lost Xmit Pkts/Bytes	Percentage of lost transmit packets and bytes detected by the last acceptability check
Lost Recv Pkts/Bytes	Percentage of lost receive packets and bytes detected by the last acceptability check
Quality Changes	Number of quality transitions from "good" to "bad".

Display IP Statistics

This displays a summary of the normal and abnormal IP statistics generated by the IP Routing Engine on the PND703 board. The format of a typical display ipstats command is shown in Figure 52. Any statistic with a zero value is not displayed. A description of the information categories is provided in Table 21 on page 64.

```
> display ipstats
   IP Statistics (Routing Engine only)
   28 packets with destination lookup failure
   28 routing lookups
>
```

Figure 52. Display IP Statistics

Table 21. IP Statistics

Description
n packets received from a local interface
n packets received from a HYPERmedia interface
n packets routed to a local interface
n packets forwarded to another routing engine
n packets forwarded to a HYPERmedia interface
n output packets discarded
n packets fragmented
n packets failed fragmenting
n fragments created
n packets with multicast media address
n packets with options
n packets forwarded for loopback to same network
n packets forwarded with destination interface offline
n packets with destination lookup failure
n packets with header not long word aligned
n packets with header in non-contiguous memory
n packets with datagram truncated
n packets with unsupported version number
n packets with unsupported header length
n packets with unsupported total datagram length
n packets with time to live expired
n packets with bad header checksum
n packets with bad HYPERchannel source port
n packets with bad HYPERchannel header offset to datagram
n routing lookups
n routing cache hits
n routing cache purges
n packets received from another routing engine
n packets from Packet Control Facility request made to PIT
n packets rerouted by Packet Control Facility
n packets discarded by Packet Control Facility

Display IPX Statistics

This command displays the IPX statistics generated by the IPX Routing Engine on the PND703 board. The format of a typical display ipxstats command is shown in Figure 53. The information categories are described in Table 22.

```
> display ipxstats
   Ipx Statistics (Routing Engine only)
    0 packets from local (attached) media
    0 packets routed in from another interface
    0 packets sent to local media
    0 packets sent to another interface
    0 control packets deferred to coprocessor
>
```

Figure 53. Display IPX Statistics

Refer to the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390) for a detailed description of IPX statistics.

Table 22. IPX Statistics Description

Name	Description
packets from local (attached) media	The number of packets received from the local attached media by this processor including those received in error.
packets routed in from another interface	The number of packets received from another processor in this DX unit.
packets sent to local media	The number of packets transmitted to the media by this processor.
packets sent to another interface	The number of packets sent to another processor in this DX unit.
control packets deferred to coprocessor	The number of control packets received from the media that were sent to the coprocessor for processing.

Display Packet Control Facility (PCF) Statistics

This command displays the PCF statistics generated by the IP Routing Engine on the PND703 board. The Packet Control Facility for IP datagrams is described in the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390).

NOTE: The PND703 IP Routing Engine PCF access table filter point must be selected to obtain PCF statistics. The format of a typical display pcfststs **command is shown in Figure 54 on page 66. The information categories are described in Table 23 on page 67.**

```
> display pcfstats

          PCF Statistics
        0 packets processed
        0 packets failed
        0 bad filter
        0 depth exceeded
        0 no 1k for stats table
        0 hw source address check not ok
        0 stats hash entries used
        0 stats hash entries linked
        0 stats cache hits
        0 stats cache misses
        0 stats cache entry deletes
        0 filter hash entries used
        0 filter hash entries linked
        0 filter cache hits
        0 filter cache misses
        0 filter cache purges
        0 filter cache offset
        0 filter table overflows
        0 filter pointer start
        0 filter pointer free
        0 filter pointer end
        0 apply table cache hash entries used
        0 apply table cache hash entries linked
        0 apply table cache hits
        0 apply table cache misses
        0 apply table cache purges
        0 apply table entries deleted

        2 1k pages in stats table
>
```

Figure 54. Display PCF Statistics

Table 23. PCF Statistics Description

Name	Description
packets processed	Total number of packets processed by PCF.
packets failed	Total number of packets failed by PCF.
bad filter	Number of times a defective filter was detected by PCF.
depth exceeded	Number of times filter processing terminated due to maximum filter depth exceeded.
no 1k for stats table	Number of times adding entry to statistics table failed due to lack of DX memory.
hw source address check not ok	Number of times hardware source address check failed to match.
stats hash entries used	Number of statistics hash table locations containing a statistics pointer.
stats hash entries linked	Number of statistics cache table entries linked to a used statistics hash table entry.
stats cache hits	Number of times statistics were gathered for a source/destination IP address that was already stored in the statistics cache table.
stats cache misses	Number of times statistics were gathered for a source/destination IP address that was not already stored in the statistics cache table. If there is room in the table, the entry is automatically placed in the table.
stats cache entry deletes	Number of times entries were deleted from the statistics cache table because no statistics have been gathered for a particular address pair in the last 2 seconds.
filter hash entries used	Number of filter hash table locations containing a filter pointer.
filter hash entries linked	Number of filter cache table entries linked to a used filter hash table entry.
filter cache hits	Number of times a filter was used that was already stored in the filter cache table.
filter cache misses	Number of times a filter was used that was not stored in the filter cache table.
filter cache purges	Number of times all of the filters in the filter cache were purged from the filter cache table.
filter cache offset	Total number of filter cache entries used.
filter table overflows	Number of times a filter had a cache table entry available, but no room in the filter table. At this time, the filter cache table will point to the filter in nucleus memory.
filter pointer start	The starting address of the filter cache.
filter pointer free	The next location in the filter table that is free to receive a filter. Following an overflow, this pointer may not point to the last address.
filter pointer end	The last address in the filter table.
apply table cache hash entries used	Number of apply table cache hash locations containing an apply pointer.
apply table cache hash entries linked	Number of apply table cache hash locations linked to a used apply table entry.
apply table cache hits	Number of times an apply cache hash entry was used that was already stored in the apply table.
apply table cache misses	Number of times an apply cache hash entry was used that was not already stored in the apply table.
apply table cache purges	Number of times all apply cache hash entries were purged from the apply table.
apply table entries deleted	Number of apply cache entries deleted from the apply table.
1k pages in stats table	Number of 1K pages used for PCF statistics collection.

Display Profiles

The format of a typical display profiles command is shown in Figures Figure 55.

```
> display profiles
Profiles last written = 5/13/92  17:03:38
Current profile values not saved
Proc type = 0403, Profile version = 10, Autosave off, Name = (name)

If  Interface Name  State Idle Char_delay Time_delay
 1                   off  flag      0          0
>
```

Figure 55. Display Profiles

Display Interface Tests Statistics

The format of a typical display tests command is shown in Figure 56. This command should be executed during interface testing to display intermediate results.

```
 > display tests
       If      Test     Test  Packet   Transmit    Receive      Error       Lost
 If    State   State    Type    Size    Packets    Packets    Packets    Packets
  1    Off     stopped  incr    1500          0          0          0          0
 >
```

Figure 56. Display Interface Test Statistics

Display Version

This command re-displays the banner screen. The format of a typical display version command is shown in Figure 57 on page 69.

```
> display version
N703 Link Console (version) (date/time)
Common Device Architecture (CDA) Vx.x
Processor Key 0xa, Firmware #xxxxxx-xx, Hardware #xxxxxx-xx
Copyright (c) 1987-1996 Network Systems Corporation. All rights reserved.
Linked from directory /tmp-mnt/home/pallas2/lnmaster/new/link.
POST Part # xxxxxx-xx Rev xx Ver x.x (C) NSC 1996
>
```

Figure 57. Display Version

Display XNS Statistics

This command displays the XNS statistics generated by the XNS Routing Engine on the PND703 board. The format of a typical display xnsstats command is shown in Figure 58. The information categories are described in Table 24 on page 70.

```
> display xnsstats
   Xns Statistics (Routing Engine only)
    0 packets from local (attached) media
    0 packets routed in from another interface
    0 packets sent to local media
    0 packets sent to another interface
    0 control packets deferred to coprocessor
>
```

Figure 58. Display XNS Statistics

Refer to the DX Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390) for a detailed description of XNS statistics.

Table 24. XNS Statistics Description

Name	Description
packets from local (attached) media	The number of packets received from the local attached media by this processor including those received in error.
packets routed in from another interface	The number of packets received from another processor in this DX unit.
packets sent to local media	The number of packets transmitted to the media by this processor.
packets sent to another interface	The number of packets sent to another processor in this DX unit.
control packets deferred to coprocessor	The number of control packets received from the media that were sent to the coprocessor for processing.

Logout Console Command

This command returns control to the nucleus monitor.

Command	Optional Parameters
Logout	

LOGOUT

This is the required verb for this command. There are no parameters for this command.

Save Profile Command

This command stores the profiles established by the SET *ifs* parameters in nucleus memory. PB703 profiles are **not** stored on the PND703 board.

Command	Optional Parameters
SAve	

SAVE

This is the required verb for this command. There are no parameters for this command.

Set Command

Command	Optional Parameters - Select One
SEt	Autosave Circuit COnsole Ifs Memory Name [NO] Rds Trace_level

SET

This is the required verb for this command.

Autosave

The *autosave* parameter is used to automatically store in nucleus memory any changes to the interface parameters established by the SET parameter *ifs*.

Circuit

The *circuit* parameter is used to define the circuit parameters.

COnsole

The *console* parameter is used to define the facility mask and severity level of events to be displayed on the console.

Ifs

The *ifs* parameter is used to define the interface parameters.

Memory

The *memory* parameter is used to set the count of large and small memory buffers.

Name <string>

The *name* parameter allows the user to define a logical name for the console.

[NO] Rds

The *[no]rds* parameter controls the small and large memory nominal and nominal ceiling values. If RDS traffic will be handled, the use of “set rds” is encouraged.

Trace Level

This parameter specifies the severity level (0-15) of event messages that are to be placed into the trace area.

Entering set followed by a question mark displays the parameter help screen shown in Figure 59.

```
> set ?
one of the following:
   autosave - set automatic save of profiles
   circuit - set circuit parameter(s)
   console - set console parameters
   ifs - set interface(s) parameter(s)
   memory - set memory parameters
   name - set console command prompt name
   [no] rds - set RDS operation mode
   trace_level - reset severity of events put in trace area [8]
>
```

Figure 59. Set Command Help Screen

Set Autosave

The Set autosave parameter is used to automatically store any changes to the profiles entered using the Set Interface command. Entering set autosave ? displays the screen shown in Figure 60.

```
> set autosave ?
one of the following:
   off - disable autosave
   on - enable autosave
>
```

Figure 60. Set Autosave Help Screen

If not specified, Set Autosave defaults to "off" when using CDA firmware below 5.0. When CDA 5.0 firmware is used, Set Autosave defaults to "on".

Set Circuit

The set circuit parameter is used to assign a circuit name and LLP to circuit 1.

Entering set circuit 1 ? displays the help screen shown in Figure 61 on page 73.

```
> set circuit 1 ?
one of the following:
   n70x - N70x link protocol
   name - circuit name (16 characters or less)
   queue - set WAN circuit backup queue profiles
>
```

Figure 61. Set Circuit Help Screen

Set Circuit to N70x LLP

This parameter is used to select N70x LLP for the PB703.

Entering set circuit 1 n70x ? displays the parameter help screen shown in Figure 62.

```
> set circuit 1 n70x ?
one of the following:
   dest_gna - Global Network Address of remote interface
   [no]lqm - Link Quality Monitoring
   messages - maximum allowed HC Messages on Backup List
   quality - required line quality level in percent
   timeout - timeout override for Circuit Mgr Queue (0 = AUTO)
   window - LQM window size in seconds
>
```

Figure 62. Set Circuit to N70x LLP Parameter Help Screen

The N70x link protocol is described in Appendix A. "N70x Frame Formats" on page 93.

Set Circuit N70x LLP Destination: This parameter is used to determine whether the GNA address of the remote logical circuit is the expected logical circuit GNA address. It is used as a line validity check. GNA addresses are exchanged in the N70x LLP Query/Query Response frames at power-up time and at other times provided the operator has requested LQM.

Note: Use of this check may result in errors if the external cabling is modified at some time after profiling has been performed.

The format of a typical set circuit 1 n70x destination command specifying a GNA address of *010158c1* is shown in Figure 63 on page 74.

```
> set circuit 1 n70x destination 010158c1

>
```

Figure 63. Set Circuit N70x LLP Destination

Set Circuit N70x LLP Select/Deselect LQM: This parameter allows the operator to select or deselect Line Quality Monitoring (LQM). LQM uses N70x LLP Query frame activity on each interface in the circuit to determine line quality. Refer to "N70x Line Quality Monitoring (LQM)" on page 4.

The format of a typical set circuit 1 n70x lqm command is shown in Figure 64.

```
> set circuit 1 n70x lqm
>
```

Figure 64. Set Circuit N70X LLP Select LQM

Set Circuit N70x LLP Messages: This parameter sets the maximum allowed HC Messages on Backup List. The format of a typical set circuit 1 n70x messages command is shown in Figure 65.

```
> set circuit 1 n70x messages 64
>
```

Figure 65. Set Circuit N70x LLP Messages

Set Circuit N70x LLP Quality: This parameter is used to set an Expected Quality Level (EQL) for the LQM feature. The operator must enter a percentage value between 10% and 99%. If no entry is made, this parameter defaults to 90%. The format of a typical set circuit 1 n70x quality command specifying a quality level of 10% is shown in Figure 66.

```
> set circuit 1 n70x quality 10
>
```

Figure 66. Set Circuit N70x LLP Quality

Set Circuit N70x LLP Timeout: This parameter sets the timeout override for Circuit Mgr Queue (0 = AUTO). The format of a typical set circuit 1 n70x timeout command is shown in Figure 67.

```
> set circuit 1 n70x timeout 20
>
```

Figure 67. Set Circuit N70x LLP Timeout

Set Circuit N70x LLP Window: This parameter is used to set an Expected Quality Level (EQL) window for the LQM feature. The operator must enter a time interval value between 10 and 400 seconds. If no entry is made, this parameter defaults to 30 seconds. The format of a typical set circuit 1 n70x window command specifying a time window of 10 seconds is shown in Figure 68.

```
> set circuit 1 n70x window 10
>
```

Figure 68. Set Circuit N70x LLP Window

Set Circuit Name

This parameter is used to apply a logical name to circuit 1.

The format of a typical set circuit 1 name command is shown in Figure 69.

```
> set circuit 1 name <name>
>
```

Figure 69. Set Circuit Name

The operator must specify an alphanumeric character string for "name" of which the first 16 characters are used. The name may be any combination of alpha or numeric characters. Any alpha entry made in upper case will be changed to lower case unless the entry is enclosed in quotes.

Set Circuit Queue

This parameter allows the operator to select the WAN circuit backup queue profiles.

Entering set circuit 1 queue ? displays the parameter help screen shown in Figure 70.

```
> set circuit 1 queue ?
one of the following:
   bytes - backup queue 'Milliseconds Worth of Data (100-60000ms)
   multicast - backup queue maximum % of Multicast packets (1-100%)
   packets - backup queue maximum number of packets (0-1024)
    ttl - backup queue 'Time to Live (100-60000ms)'
>
```

Figure 70. Set Circuit Queue

Set Circuit Queue Bytes: The set circuit *1* queue bytes command sets the number of milliseconds worth of data, measured in bytes, at the current baud rate that can accumulate in the backup data queue before the newest (least priority) packet is discarded. The range is 100 to 60000 milliseconds. The default is 1000 milliseconds.

Entering the command followed by a question mark displays the help menu shown in Figure 71.

```
> set circuit 1 queue bytes ?
an integer value for bytes.
>
```

Figure 71. Set Circuit Queue Bytes Help Menu

Set Circuit Queue Multicast: he set circuit *1* queue multicast command sets the maximum percentage of multicast packets allowed to gather in the backup data queue. If the number of multicast packets in the queue exceeds the percentage, the newest (least priority) multicast packet is discarded. The range is 1 to 100 percent. The default is 50 percent.

Entering the command followed by a question mark displays the help menu shown in Figure 72.

```
> set circuit 1 queue multicast ?
an integer value for multicast.
>
```

Figure 72. Set Circuit Queue Multicast Help Menu

Set Circuit Queue Packets: The set circuit *1* queue packets command specifies the number of packets allowed in the backup queue before the newest (least priority) packet is discarded. The range is 0 to 1024. The default is 0. If 0 is used, the packet count threshold is automatically set by the formula:

$$\frac{\textbf{baud rate}}{\textbf{1000}} = \textbf{packet threshold}$$

A zero entry displays “auto” when executing “Display Circuit 1 Queue” on page 50.

Entering the command followed by a question mark displays the help menu shown in Figure 73.

```
> set circuit 1 queue packets ?
an integer value for packets.
>
```

Figure 73. Set Circuit Queue Packets Help Menu

Set Circuit Queue Time to Live (TTL): The set circuit *1* queue ttl command sets the maximum amount of time in milliseconds a packet may reside in the backup queue before it is discarded. The range is 100 to 60000 milliseconds. The default is 1000 milliseconds.

Entering the command followed by a question mark displays the help menu shown in Figure 74.

```
> set circuit 1 queue ttl ?
an integer value for ttl.
>
```

Figure 74. Set Circuit Queue Time to Live Help Menu

Set Console

The Set Console command is used to define the facility and severity level of events to be displayed on the console. Entering set console ? displays the screen shown in Figure 75 on page 78.

```
> set console ?
one of the following:
   facility - set facilities displayed on console
   severity - set severity of console events displayed (0 - 15)
>
```

Figure 75. Set Console Help Screen

Entering set console facility ? displays the screen shown in Figure 76.

```
> set console facility ?
one of the following:
   all - display all events
   [no]bridge - display bridging events
   [no]console - display console task events
   [no]executive - display general operational events
   [no]hyper - display HYPERmedia interface events
   [no]interface - display interface management events
   [no]localip - display local IP events
   none - display no events
   [no]packets - display packet switching events
>
```

Figure 76. Set Console Facility Help Screen

Console facility defaults to "all" if no selection is made.

Entering set console severity ? displays the screen shown in Figure 77.

```
> set console severity ?
an integer value for severity
>
```

Figure 77. Set Console Severity Help Screen

All console messages have a severity assigned to them in the numerical range of 0-15 inclusive. Higher numbers indicate that the message is more important than lower numbers. If a severity value is not specified, console severity defaults to “8”.

0-4
Indicate messages sent to or through this PB703 regarding problems on the remote PB703. Reporting of messages of this severity during normal operation would result in a flood of largely irrelevant messages to

the PC.

5-7
Indicate messages sent to or through this PB703 that affect this interface in a minor way. These messages can be saved to a file if minor events are of interest to you.

8-11
Indicate an event occurring in this PB703 that may be of interest to operations personnel, such as loss of access to a remote PB703 or a PC command to change the state of the PB751.

12-15
Indicate events that are leading to failure of a PB703 component.

Set Interface

This command assigns the interface state (on, off, loopback, or test, interface name, inter-packet idle symbol (flag or mark), interface character delay, and interface time delay) for PB703 interface 1.

Entering set ifs 1 ? displays the parameter help screen shown in Figure 78.

```
> set ifs 1 ?
one of the following:
   average - Traffic Manager average profiles
   loopback - set interface state to loopback local messages (n70x only)
   median - Traffic Manager median profiles
   name - interface name (16 characters or less)
   off - set interface state to off
   on - set interface state to on[default]
   peak - Traffic Manager peak profiles
   test - set interface state to run test messages only (n70x only)
>
```

Figure 78. Set Interface Help Screen

NOTE: If an interface is not being used by the circuit, it should be profiled to the "OFF" state.

These parameters may be entered in any order. Parameter entries are required only when making a change from the current values.

Multiple parameters may be entered on the same command line. If the entered parameters conflict, only the last conflicting parameter on the command line is accepted.

Set Interface Average Traffic Manager Profile

The traffic manager profile command allows data rates for each interface to be shaped on an hourly basis to match service contract requirements. The Set Interface 1 Average command string sets the normal rate (in bits per second) for data transmission. The command also sets the average burst (in bits)

that the remote device can receive. The command is a string that specifies whether rate or burst is to be set, the time in hours to start and stop each period of the rate shaping profile (0 to 23, where 0 = midnight, 12 = midday, start begins on the hour, and stop ends on the hour plus 59 minutes), and the rate in bits/second or the burst in bits. The Set Interface 1 Average Rate command has the syntax set interface 1 average rate <*start_time*> <*stop_time*> <average_data_*rate*>. The Set Interface 1 Average Burst command has the syntax set interface 1 average burst <*start_time*> <*stop_time*> <average_*burst_rate*>.

Figure 79 shows an average profile starting at 0:00, stopping at 23:59, transmitting at an average rate of 600,000 bits/second, and accepting an average burst of 1,200,000 bits. Median and peak profiles use the same type of command strings with parameter entries appropriate for the transmitting and receiving interfaces.

```
> set ifs 1 average rate 0 23 600000
  set ifs 1 average burst 0 23 1200000
>
```

Figure 79. Set Interface Average Traffic Manager Profile

Set Interface N70x Protocol Loopback

This parameter sets the selected interface line state to **loopback**. The default line status is **on** if no other line state selection is made (such as on, off, loopback, or test).

The format of a typical set ifs 1 loopback command is shown in Figure 80.

```
> set ifs 1 loopback
>
```

Figure 80. Set Interface N70x Protocol Loopback

Set Interface Median Traffic Manager Profile

The traffic manager profile command allows data rates for each interface to be shaped on an hourly basis to match service contract requirements. The Set Interface 1 Median command string sets the short term rate (in bits per second) for data transmission. The command also sets the median burst (in bits) that the remote device can receive. The command is a string that specifies whether rate or burst is to be set, the time in hours to start and stop each period of the rate shaping profile (0 to 23, where 0 = midnight, 12 = midday, start begins on the hour, and stop ends on the hour plus 59 minutes), and the rate in bits/second or the burst in bits. The Set Interface 1 Median Rate command has the syntax set interface 1 median rate <*start_time*> <*stop_time*> <median_data_*rate*>. The Set Interface 1

Median Burst command has the syntax set interface 1 median burst <*start_time*> <*stop_time*> <median_*burst_rate*>.

Figure 81 shows entries for an median profile starting at 0:00, stopping at 23:59, transmitting at a median rate of 800,000 bits/second, and accepting an median burst of 1,600,000 bits. Average and peak profiles use the same type of command strings with parameter entries appropriate for the transmitting and receiving interfaces.

```
> set ifs 1 median rate 0 23 800000
  set ifs 1 median burst 0 23 1600000
>
```

Figure 81. Set Interface Median Traffic Manager Profile

Set Interface Name

This parameter applies a logical name to the interface specified in the command. The alphanumeric character string may be up to 16 characters long. Any alpha entry in upper case is changed to lower case unless the entry is enclosed in quotes.

Set Interface Off

This parameter sets the selected interface line state to **off**. The default line status is **on** if no other line state selection is made (such as on, off, loopback, or test).

The format of a typical set ifs 1 off command is shown in Figure 82.

```
> set ifs 1 off
>
```

Figure 82. Set Interface Off

Set Interface On

This parameter sets the selected interface state to **on**. The default is **on** if no line state selection is made (such as on, off, loopback, or test).

The format of a typical set ifs 1 on command is shown in Figure 83 on page 82.

```
> set ifs 1 on
>
```

Figure 83. Set Interface On

Set Interface Peak Traffic Manager Profile

The Traffic Manager Profile command allows data rates for each interface to be shaped on an hourly basis to match service contract requirements. The Set Interface Peak command string sets the very short term rate (in bits per second) for data transmission. The command also sets the peak burst (in bits) that the remote device can receive. The command is a string that specifies whether rate or burst is to be set, the time in hours to start and stop each period of the rate shaping profile (0 to 23, where 0 = midnight, 12 = midday, start begins on the hour, and stop ends on the hour plus 59 minutes), and the rate in bits/second or the burst in bits. The Set Interface 1 Peak Rate command has the syntax set interface 1 peak rate <*start_time*> <*stop_time*> <peak_data_*rate*>. The Set Interface 1 Peak Burst command has the syntax set interface 1 peak burst <*start_time*> <*stop_time*> <peak_*burst_rate*>.

Figure 84 shows entries for a peak profile starting at 0:00, stopping at 23:59, transmitting at a peak rate of 1,000,000 bits/second, and accepting an peak burst of 2,000,000 bits. Average and median profiles use the same type of command strings with parameter entries appropriate for the transmitting and receiving interfaces.

```
> set ifs 1 peak rate 0 23 1000000
  set ifs 1 peak burst 0 23 2000000
>
```

Figure 84. Set Interface Peak Traffic Manager Profile

Set Interface N70x Protocol Test

This parameter sets the line state to **test**. The line state defaults to **on** if no line state selection is made (such as on, off, loopback, or test).

The format of a typical set ifs 1 test command is shown in Figure 85.

```
> set ifs 1 test
>
```

Figure 85. Set Interface N70x Protocol Test

Set Memory

The set memory command specifies the number of large and small nucleus memory buffers assigned to this PND703. The PND703 board asks for an initial amount of memory on initialization. This is call the "memory pool." The size of the memory pool is determined by hard-coded defaults in the PND703 and is adjustable during operation.

Any adjustments to the memory pool made during operation will not be saved across boots.

The pool is marked by a low-water, a high-water mark and a nominal setting. By default, the nominal setting is the average of the low and high watermarks. The PND703 requests a nominal amount for both small (1024 byte) and large (2048 byte) pages on initialization. The set memory command calculates the low and high water marks for small and large byte pages based on the nominal value *<integer>* supplied.

When PND703 needs a page of memory from its pool, and the number of free pages in the pool is at the low-water mark, PND703 requests additional memory for its pool from the nucleus processor. The size of the request is enough to bring the pool back to the nominal level.

There are four status indicators in DX memory management. These are called denials (drops), waits, delays and pendings (out-standings). These counters are shown by entering the display bm command.

- A denial occurs when a PND703 board makes a request to the nucleus processor without waiting. If the nucleus processor cannot satisfy the request, the denial counter increments.
- A wait occurs when a PND703 board makes a request to the nucleus processor and waits for a response. When the nucleus processor responds positively (allocating memory), the wait counter increments.
- A delay occurs when a PND703 board makes a request to the nucleus processor and waits for a response. When the nucleus processor responds negatively (no memory available), the delay flag sets, and the request is re-issued one millisecond later. The process repeats until the nucleus processor responds positively, and the delay flag is cleared. The delay flag is a toggle (not a counter).
- A pending occurs when a PND703 board makes a request to the nucleus processor. During the time the nucleus processor is acting on this request, the pending flag is set. When the nucleus processor responds (with or without allocating memory), the pending flag is cleared. The pending flag is a toggle.

NOTE: The set [no]rds command (see "Set [no]RDS" on page 86) controls the small and large memory nominal and nominal ceiling values. If the interface is being used to handle RDS traffic, the use of set rds is encouraged. If enabled, the CDA dynamic memory feature is also enabled, the small and large nominal watermarks are set to four times the default, and the small and large nominal ceiling values are set to four times the default ceiling value. If disabled (by set nords), the CDA dynamic memory feature is left unchanged, the small and large nominal watermarks are set to default values, and the small and large nominal ceiling values are set to default values. No reset is needed for the value to take effect.

Entering the set memory command followed by a question mark displays the help screen shown in Figure 86 on page 84. The parameter range is from 20 to 1024 pages. The large buffer parameter setting defaults to 40 pages of 2048 byte memory. The small buffer parameter setting defaults to 60 pages of 1024 byte memory.

CAUTION

Proper use of the set memory **command requires careful analysis of system demands and requirements. Inappropriate settings may cause unreliable system response.**

```
> set memory ?
one of the following:
   [no]dynamic_memory - use dynamic memory algorithm
   large - set large buffer parameters
   large_athresh - set large allocation threshold level
   large_ceiling - set large buffer nominal ceiling
   large_dthresh - set large deallocation threshold level
   small - set small buffer parameters
   small_athresh - set small allocation threshold level
   small_ceiling - set small buffer nominal ceiling
   small_dthresh - set small deallocation threshold level
>
```

Figure 86. Set Memory Help Screen

Set Memory Dynamic_memory

This command is used to enable dynamic memory allocation. To enable this capability, enter *set memory dynamic_memory*. To disable this capability, enter *set memory nodynamic_memory*.

When dynamic memory is enabled, the following additional commands control the allocation behavior.

Note: The default dynamic_memory **setting for the PB703 is** on**.**

Set Memory Large <int>

This command sets the nominal value for the number of free large pages in the memory pool.

Set Memory Large_athresh <int>

This command is used to establish the threshold value (limit) for the number of Nucleus memory large page allocation requests (per second). The default is 10 and should not be adjusted without guidance from an NSC Service representative.

Set Memory Large_ceiling <int>

This command is used to establish an upper bound (ceiling) on the number of large pages allowed for the nominal value. The original nominal value is established using the default described above, or by entering set memory large <int>. The default ceiling value is four times the default nominal value. The maximum value permitted is 1,024.

Set Memory Large_dthresh <int>

This command is used to establish the threshold value (limit) for the number of Nucleus memory large page deallocation requests (per second). The default is 10 and should not be adjusted without guidance from an NSC Service representative. The dynamic memory algorithm will increase or decrease the memory pool values accordingly when the threshold values are exceeded. If the allocation/deallocation requests fall to zero, the memory pool values return to their original (startup) values, smoothed over a time interval.

Set Memory Small <int>

This command sets the nominal value for the number of free small pages in the memory pool.

Set Memory Small_athresh <int>

This command is used to establish the threshold value (limit) for the number of Nucleus memory small page allocation requests (per second). The default is 10 and should not be adjusted without guidance from an NSC Service representative.

Set Memory Small_ceiling <int>

This command is used to establish an upper bound (ceiling) on the number of small pages allowed for the nominal value. The original nominal value is established using the default described above, or by entering set memory small <int>. The default ceiling value is four times the default nominal value. The maximum value permitted is 1,024.

Set Memory Small_dthresh <int>

This command is used to establish the threshold value (limit) for the number of Nucleus memory small page deallocation requests (per second). The default is 10 and should not be adjusted without guidance from an NSC Service representative.

The format of a typical command is shown in Figure 87.

```
> set memory dynamic_memory
>
```

Figure 87. Set Memory Dynamic_Memory Format

Set Name

This command allows the user to define a logical name for the console. The name may be any combination of up to 16 alphanumeric characters. Any alpha entry made in upper case will be changed to lower case unless the entry is enclosed in quotes.

The format of a typical set name command is shown in Figure 88.

```
> set name <name>
(name)>
```

Figure 88. Set Name

Set [no]RDS

This command controls the small and large memory nominal and nominal ceiling values. If the PB703 is being used to handle RDS traffic, the use of set rds is encouraged. If enabled, the CDA dynamic memory feature is also enabled, the small and large nominal watermarks are set to four times the default, and the small and large nominal ceiling values are set to four times the default ceiling value. If disabled (by set nords), the CDA dynamic memory feature is left unchanged, the small and large nominal watermarks are set to default values, and the small and large nominal ceiling values are set to default values. No reset is needed for the value to take effect. (See also "Set Memory" on page 83.)

The profile will be saved if autosave if enabled or a manual save command is entered. The current values may be seen by issuing a display profile command on the PB703 console.

The format of a set [no]rds command is shown in Figure 89.

```
> set [no]rds
>
```

Figure 89. Set [No]RDS

TRace_level

This command resets the trace level events stored in the message log to the default severity. The format of a typical set trace_level command is shown in Figure 90 on page 87.

```
> set trace_level
>
```

Figure 90. Set Trace_level

Test Command

Command	Optional Parameters - Select One
Test	Ifs

TEST
This is the required verb for this command.

Ifs
The *ifs* parameter is used to select testing of the logical interface.

Entering test with the test type unspecified displays the message shown in Figure 91.

```
> test
one of the following:
   ifs - test interface(s)
>
```

Figure 91. Test Command Help Screen

Test Interface

The Test Interface command allows the user to test the function of the interface by looping Echo/Echo Response frames internally within the PB703 interface, or between the PB703 interface and external units on the link. The test checks for missing data or mismatched data. The Test Interface(s) command must be used in conjunction with Set Interface command described under. Refer to "Problem Isolation Using Test Command" on page 135 to determine when to execute the Test Interface command. Entering test ifs ? displays the screen shown in Figure 92 on page 88.

```
> test ifs ?
one of the following:
   count - test repeat count [10]
   delay - inter-block gap in milliseconds [10]
   [no]echo - use echo frames vs. noecho (discard) frames [echo]
   fixed - fixed byte test [255 = 0xFF]
   increment - incrementing bytes test
   length - fixed data buffer size
   max - maximum data buffer size [1500]
   min - minimum data buffer size [1500]
   quit - stop current test
   random - random bytes test
   [no]report_on_error - report on each test error [noreport]
   [no]stop_on_error - stop test on next error [stop]
   [no]verify - verify test data [verify]
   <intlist> - optional interface list
>
```

Figure 92. Test Interface Help Screen (Interface Not Selected)

Entering test ifs 1 followed by a question mark displays the menu shown in Figure 93.

```
> test ifs 1 ?
one of the following:
   count - test repeat count [10]
   delay - inter-block gap in milliseconds [10]
   [no]echo - use echo frames vs. noecho (discard) frames [echo]
   fixed - fixed byte test [255 = 0xFF]
   increment - incrementing bytes test
   length - fixed data buffer size
   max - maximum data buffer size [1500]
   min - minimum data buffer size [1500]
   quit - stop current test
   random - random bytes test
   [no]report_on_error - report on each test error [noreport]
   [no]stop_on_error - stop test on next error [stop]
   [no]verify - verify test data [verify]
>
```

Figure 93. Test Interface Help Screen (Interface Selected)

If no circuit and interface are selected following initial power up, the circuit and interface selections both default to “1”. Subsequent Test command selections remain in effect until new selections are made.

The operator may select a fixed, incrementing, or random, test byte pattern. Failure to specify a test pattern causes this parameter to default to an increment by "1" test pattern starting at all"0s".

NOTE: Multiple parameters may be entered on the same command line. If the entered parameters conflict, only the last conflicting parameter on the command line is accepted.

A command line used to set up a random test pattern with a maximum data buffer size of 1000, a minimum data buffer size of 100, a repeat count of 20, an inter-block time delay of 10 milliseconds, no stop on error, report test errors, and verification is shown in Figure 94.

```
> test ifs 1 random max 1000 min 100 count 20 delay 10 nostop report verify
>
```

Figure 94. Test Interface Example

The format of a typical result screen is shown in Figure 95.

```
%Interface-8-1003, 12-Jun-1996 15:23:20:776
test_if 2  pkts sent         20,   seq errs       0,   data errs       0,
           pkts lost          0,   blk size    1500
>
```

Figure 95. Test Interface Result

Test Interface Repeat Count

Entering test ifs 1 count with a repeat count parameter not specified displays the message shown in Figure 96.

```
> test ifs 1 count
number required.
>
```

Figure 96. Test Interface Repeat Count Selection Help Screen

The operator may select any decimal value. Failure to specify a repeat count causes this parameter to default to 10 packets. Selecting a repeat count of 0 causes the test to repeat indefinitely. When a repeat count of 0 is selected, the operator must use the Quit parameter (example: test ifs 1 quit) to terminate testing.

Test Interface Inter-Block Time Delay

Entering test ifs 1 delay with an inter-block time delay parameter not specified displays the message shown in Figure 97.

```
> test ifs 1 delay
number required.
>
```

Figure 97. Test Interface Inter-Block Time Delay Help Screen

The operator may select any value other than zero. Failure to specify an inter-block time delay causes this parameter to default to 10 milliseconds.

Test Interface Select/Deselect Echo Frames

Entering test interface with this parameter unspecified causes the test to generate Echo frames.

Test Interface Fixed Pattern Selection

Entering test ifs 1 fixed displays the message shown in Figure 98.

```
> test ifs 1 fixed
number required.
>
```

Figure 98. Test Interface Fixed Pattern Help Screen

The operator **must** specify a fixed test pattern between 0 and 255. Failure to enter a value causes the test to halt and display an error message.

Test Interface Increment Pattern Selection

Entering test ifs 1 increment ? displays the help screen shown in Figure 99 on page 91.

```
> test ifs 1 increment ?
one of the following:
   count <int> - test repeat count [10]
   delay <int> - inter-block gap in milliseconds [10]
   [no]echo - use echo frames vs. noecho (discard) frames [echo]
   fixed <int> - fixed byte test [255 = 0xFF]
   increment - incrementing bytes test
   length - fixed data buffer size
   max <int> - maximum data buffer size [1500]
   min <int> - minimum data buffer size [1500]
   quit - stop current test
   random - random bytes test
   [no]report_on_error - report on each test error [noreport]
   [no]stop_on_error - stop test on next error [stop]
   [no]verify - verify test data [verify]
   <int> - starting byte to increment from [0]
>
```

Figure 99. Test Interface Increment Pattern Help Screen

Items shown in brackets [ ] within parameter description are the parameter defaults.

The test pattern byte value increments by "1" for each pass. The operator may specify a starting byte value. Failure to specify a starting byte value causes the byte to increment from "0".

Test Interface Fixed Length Data Buffer Size

This parameter allows the operator to select a fixed length buffer size for testing.

Test Interface Maximum Data Buffer Size

The maximum data buffer size may range in size up to the Maximum Transmission Unit (MTU). Failure to specify causes this parameter to default to 1500 byte packets. If maximum data buffer size differs from minimum data buffer size, the value assigned to maximum data buffer size **must** be larger than minimum data buffer size. When different values are assigned, testing occurs in the range between these values.

Test Interface Minimum Data Buffer Size

The minimum data buffer size may range in size up to the Maximum Transmission Unit (MTU). Failure to specify causes this parameter to default to 1500 byte packets. Refer to description of Test Interface(s) Maximum Data Buffer Size Command.

Test Interface Quit

This parameter aborts the test currently executing.

Test Interface Random Pattern Selection

The operator may request a test interfaces random test pattern provided by a random number generator. No parameter entry is required.

Test Interface Report/No Report on Error

Entering test interface with this parameter unspecified causes the test to default to Report On Error. This parameter may be overridden by a Stop On Error parameter selection.

Test Interface Stop/No Stop on Error

Entering test interface with this parameter unspecified causes the test to default to Stop On Error.

Test Interface Verify/No Verify

Failure to select causes this parameter to default to “verify”. When verification is selected or defaulted, the “pkts_errdata” column of the Display Interface Test Statistics command provides the operator with a count of the number of data packets with errors.

Appendix A. N70x Frame Formats

This section contains a description of N70x framing formats and operations.

Link Layer Protocol (LLP) Frames

The unit of information transferred using N70x LLP is termed a “link frame”. Two types of link frames are defined: a control frame, and a data frame.

Link Control Frame

Link control frames (Figure 100 on page 94) are used during initialization to establish communication with the remote device on the link, and at other times to perform the following functions:

- Abort a data stream sequence due to timeout, retries exceeded, or cancellation.
- Acknowledge the end of a data stream sequence.
- Acknowledge previously received data frames.
- Inform the originating link that a frame is missing within a data stream sequence.
- Periodically test the condition of the link.
- Temporarily suspend transmission of data as a result of congestion at the remote link.
- Request generation of fault messages.

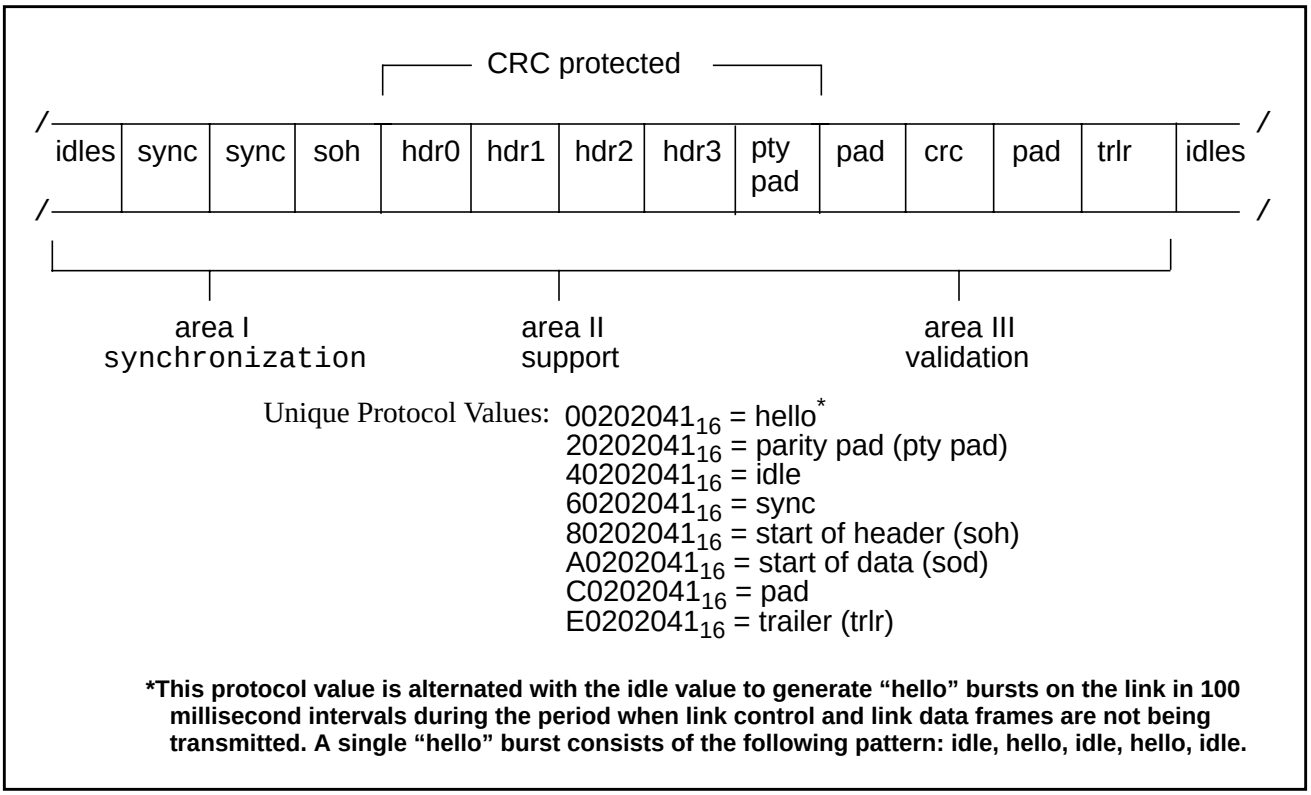


Figure 100. N70x Protocol Control Frame Format

Synchronization (Area I)

The synchronization area of a control frame consists of a minimum of ten idle words (40202041_{16}), two synchronization words (60202041_{16}), and one start of header word (80202041_{16}). These words in the order shown in Figure 100 identify the start of a link control frame.

Support (Area II)

The support area of a control frame consists of header words 0 through 3. The information fields within header words 0 through 3 are shown in Figure 101 on page 95.

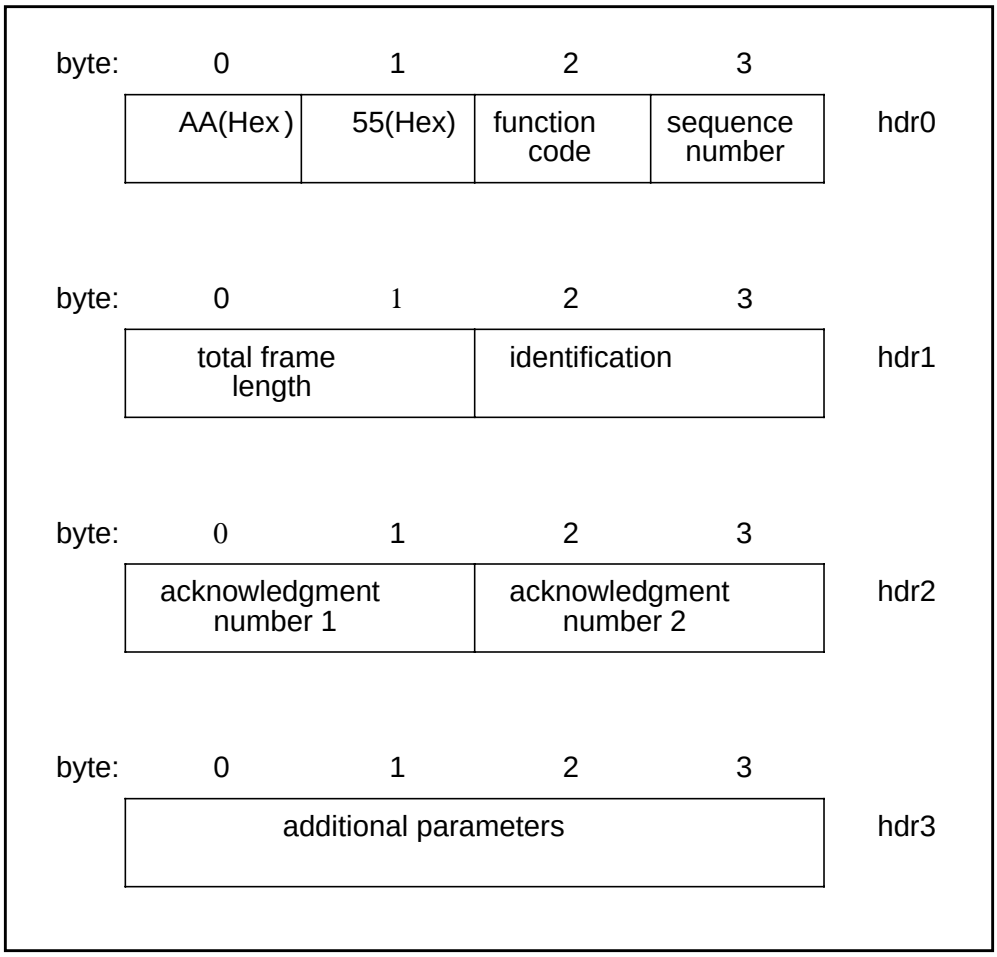


Figure 101. Link Control Frame Header Words 0-3

Header Word 0

Header word 0 contains two bytes of header validation data, one byte of function code, and a sequence number byte. The header validation field (“AA” followed by “55”) is used to detect the start of header. The function code field defines the type of operation to be performed by the frame. Control frame function codes are described in Table 25 on page 96. The sequence number field is incremented each time a frame is transmitted and the receiving unit compares this field to the number of the next frame expected. The value “00” is not used.

Table 25. Link Control Frame Function Codes

Code[1] 16	Description	Notes
01	Initialize Request	
03/23	Abort Link Stream (ac730 compatibility)	1
05/25	End Operation	1
10	Acknowledgment Only	2
11	Initialize Response	
12	Abort Link Stream	1
13	Negative Acknowledgment (ac730 compatibility)	1
14	Periodic (two second) Heartbeat	1
15	Link Level Flow Control (ac730 compatibility)	1
16	Remote Fault Message Request	1
2x	Retransmitted Frame	1
NOTE: [1]These control functions may also contain one or two acknowledgment fields for previously received frames.		
NOTE: [2]An Acknowledgment Only function may contain up to three acknowledgment fields for previously received frames. If the count of queued acknowledgment type frames exceeds two, an Acknowledgment Only frame is sent before any queued data frames.		

Header Word 1

Header word 1 contains two bytes defining the total length of the header and data areas of each frame, and two bytes of frame identification information. Because a control frame does not contain a data area, total frame length is always set to 10_{16}.

Header Word 2

Header word 2 contains two acknowledgment fields. An acknowledgment field, if non-zero, is used to inform the opposite PB703 of the status of a previously received frame. If a positive acknowledgment is received, the value contained in the acknowledgment field is used by the background processor in the opposite PB703 to return the buffer blocks for the frame being acknowledged to the “free pool”.

Header Word 3

The additional parameters contained in header word 3 are used only during initialization to convey configuration information. The information transmitted defines the data buffer size.

Validation (Area III)

The validation area of a control frame consists of a parity pad word (20202041_{16}), two pad words ($C0202041_{16}$), one CRC word, and one word of trailer ($E0202041_{16}$). These words in the order shown in Figure 100 on page 94 identify the end of a link control frame. The CRC word is used to ensure the validity of information transmitted on the link.

Link Data Frame

PB703 link data frames (Figure 102) are used to transmit messages and data blocks to remote hosts, devices, or networks, to allow telecommunications interfaces to exchange diagnostic data, and to allow a host to communicate directly with a telecommunications interface.

Those data frames requiring Acknowledgment are retained by the transmitting link until a positive response is received from the destination link. Link Management Protocol (LMP) and Internet Protocol (IP) datagrams do not require acknowledgment. A response to a frame transmission is not required before transmitting subsequent frames. These frames are held in buffer memory on the transmitting link until they have been acknowledged. If a link failure occurs, the originating link automatically retransmits the lost frames. Frames retransmitted out of sequence are inserted in their proper order by the receiving link. Simultaneous receive and transmit operations may occur on a communications link. When this occurs, acknowledgment fields are inserted in the transmit stream frames of each link to acknowledge that data has been received.

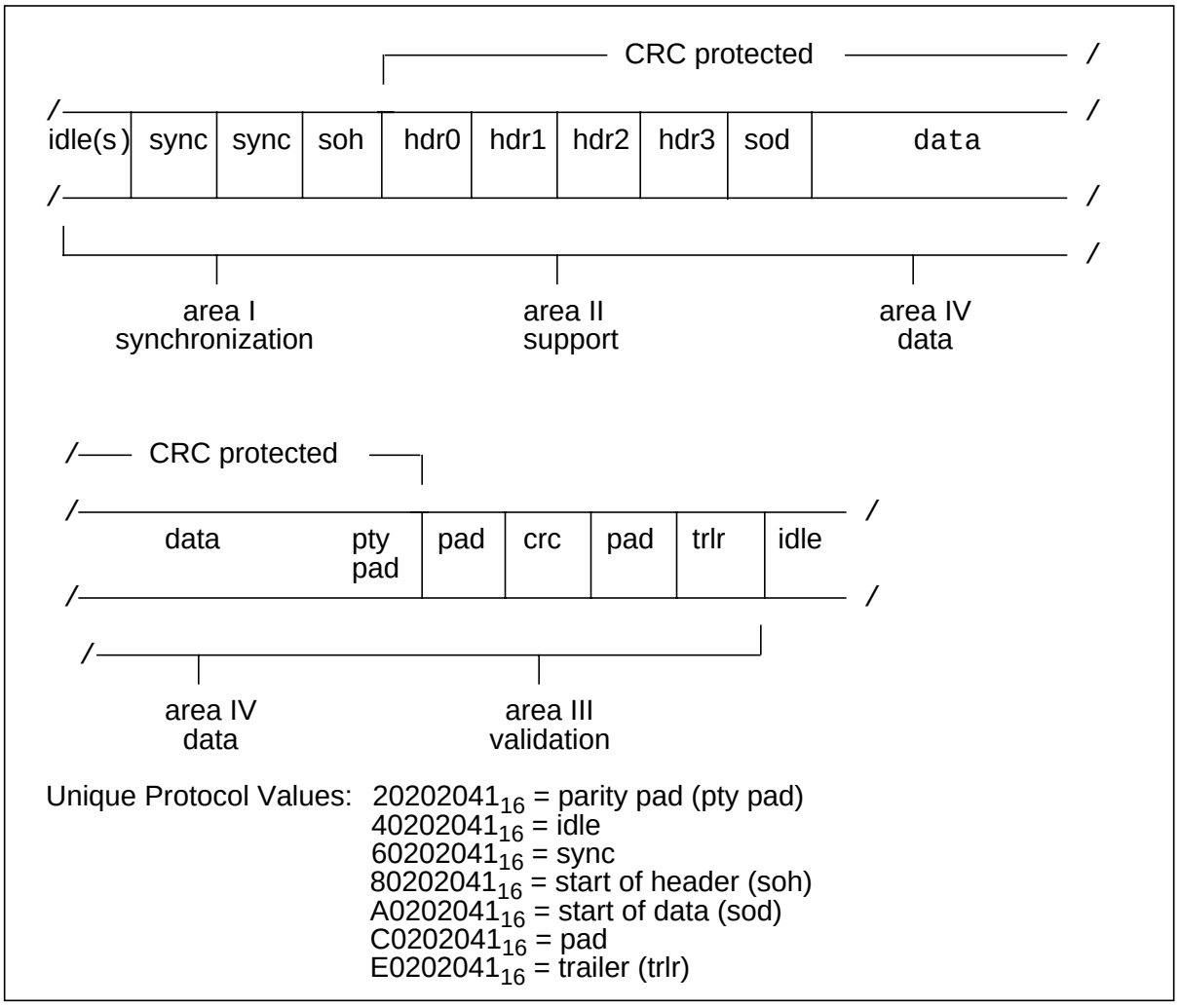


Figure 102. PB703 Link Protocol Data Frame

Synchronization (Area I)

The synchronization area of a data frame consists of a minimum of three idle words (40202041_{16}), two synchronization words (60202041_{16}), and one start of header word (80202041_{16}). These words in the order shown in Figure 102 on page 97 identify the start of a link data frame.

Support (Area II)

The support area of a data frame consists of header words 0 through 3. The information fields within header words 0 through 3 are shown in Figure 103.

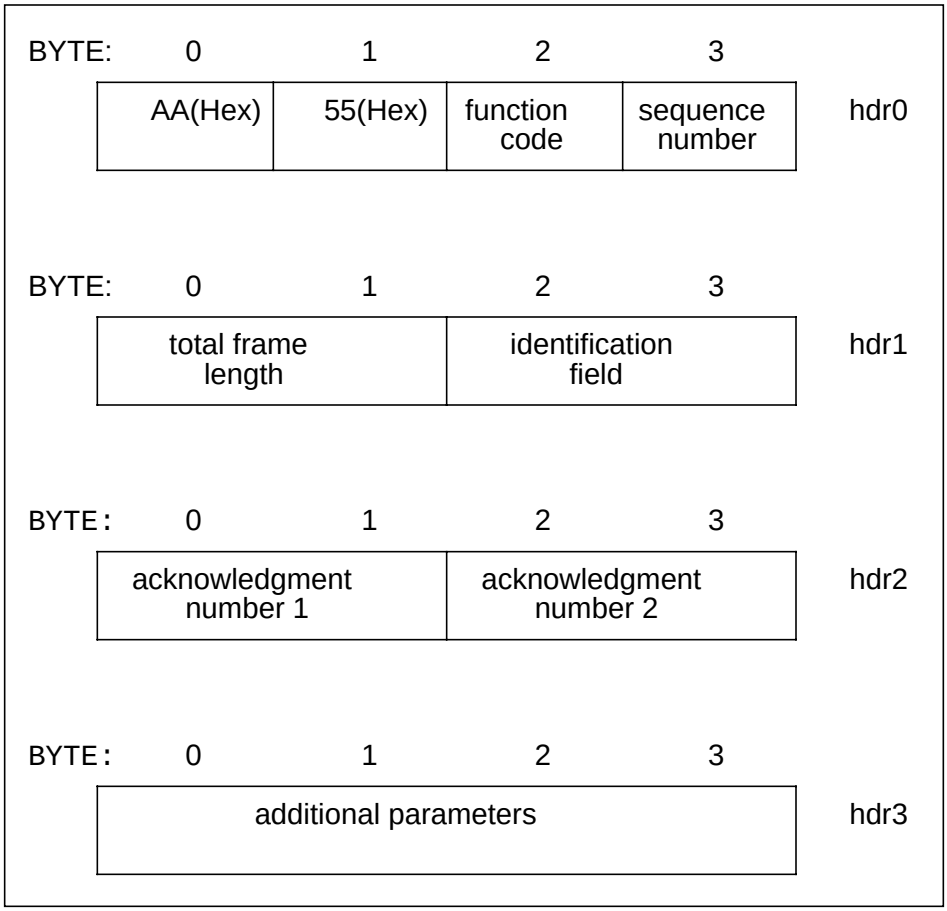


Figure 103. Link Data Frame Words 0-3

Header Word 0

Header word 0 contains two bytes of header validation data, one byte of function code, and a sequence number byte. The header validation field (“AA” followed by “55”) is used to detect the start of header. The function code field defines the type of operation to be performed by the frame. Link Data frame function codes are described in Table 26 on page 99. The sequence number field is incremented each time a frame is transmitted and the receiving unit compares this field to the number of the next frame expected. The value “00” is not used.

The LLP link data frames for AC730 and PB701 are basically the same except for the addition of the 8x class of functions used by the PB701. These functions are required to permit the PB701 to distinguish IP data frames, and to determine activity on the link. These frames are described under “Link Control Protocol (80) Frames”.

Table 26. Link Data Frame Function Codes

$Code_{16}$	Description
06/26	Remote Fault Message
07/27	Loopback Request (diagnostic)
08/28	Standard Message without Associated Data
09/29	Standard Message with Associated Data
0A/2A	Embedded Message without Associated Data
0B/2B	Embedded Message with Associated Data
0C/2C	Remote Maintenance Message without Associated Data
0D/2D	Remote Maintenance Message with Associated Data
0E/2E	Associated Data
0F/2F	Last Associated Data
17/37	Loopback Response (diagnostic)
2x/3x	Retransmitted Frame
4x	Non-acknowledge mode link data frames
80	Link Control Protocol*
81	IP Datagram (not applicable to AC730)
Note: All link data frames may also contain one or two acknowledgment fields for previously received frames.	
Note: *An AC730 Adapter can respond but cannot generate a Link Control Protocol frame.	

Header Word 1

Header word 1 contains two bytes defining the total length of the header and data areas of each frame, and two bytes of frame identification information. The frame identification information is used by the transmitting PB703 to a completed transmit with the original internal message element. If the frame requires acknowledgment, the identification field uniquely defines the sequence of frames within a message or data block to enable the receiving PB703 to re-assemble these frames in the correct order in the event of a transmission error.

Header Word 2

Header word 2 contains two acknowledgment fields. An acknowledgment field, if non-zero, is used to inform the opposite PB703 of the status of a previously received frame. If a positive acknowledgment is received, the value contained in the acknowledgment field is used by the background processor in the opposite PB703 to return the buffer blocks for the message or associated data block to the “free pool”.

Note: Link Management Protocol (80) and Internet Protocol (81) datagrams are not acknowledged (buffers are released when transmit is complete).

Header Word 3

Header word 3 is not used in a link data frame.

Validation (Area III)

The validation area of a data frame consists of a parity pad word (20202041_{16}), two pad words ($C0202041_{16}$), one CRC word, and one word of trailer ($E0202041_{16}$). These words in the order shown in Figure 102 on page 97 identify the end of a link data frame. The CRC word is used to ensure the validity of information transmitted on the link.

Data (Area IV)

The data area of a data frame contains user message or associated data and control information required by higher level protocols.

Link Operations

The PB703 LLP firmware is designed to provide and maintain non-stop, fully acknowledged (if required) link communications. This is accomplished through the use of high performance RISC processors and their associated data buffering and queueing mechanisms. These operations occur in a full duplex environment at line speeds up to U.S. T3 (44.736 million bits per second).

The following paragraphs describe the link transmit and receive operations.

Link Transmit Operations

A typical link transmit sequence begins with the reception of a process unit from the inbound nucleus processor queue. The process unit contains a network message that is passed to one of the upper level protocol handlers. The handler firmware performs the required message processing and generates a transmit queue entry for use by the transmit DMA engine. The handler also generates a transmit queue entry for each associated data buffer that is complete and valid at this time. The DMA engine constantly scans its acknowledgment, transmit, and mailbox queues searching for queue entries. If more than two acknowledgments are waiting, or no other transmits are waiting, the DMA engine prepares a link control acknowledgment frame. If no more than two acknowledgments are waiting, and one or more transmit entries are waiting, the DMA engine inserts the acknowledgments into the link data frame.

NOTE: The mailbox queue is used to convey control information from the background processor to the DMA processors.

The DMA engine generates and transmits the synchronization area (Area I) and support area (Area II) of the frame prior to sending the requested message or data block. The DMA engine also activates the CRC generation hardware which computes a CRC on a selected portion of the link data frame (refer to Figure 102 on page 97). The DMA engine appends the validation area (Area III) to the end of the frame as it transmits the frame on the link. The DMA engine indicates successful frame transmission by adding a unique entry to the transmit complete queue.

Several network messages and associated data buffer blocks may be outstanding and awaiting acknowledgments at the same time. The buffer blocks are released back to the originating DX interface in the same order in which the acknowledgments are received and processed from the remote link interface.

A list of outstanding incomplete network messages is continuously scanned to detect buffer valid or buffer last conditions and the corresponding transmit queue entries are generated. When all of the acknowledgments for a given network message have been received, the process unit is returned to the originating DX interface (via the nucleus) with a positive status indication.

Error handling and re-transmission routines are invoked as required to process timeouts, line errors, and other aborts that may occur during link operations. Transmit flow control is dynamically asserted whenever outstanding message or buffer block resources reach unacceptable thresholds, or line quality deteriorates below a predetermined level.

Link Receive Operations

Each link is designed to process received frames in virtually any out of order sequence. The support area (Area II) of each link data frame is used by the background processor to ensure that message and data portions are forwarded to the nucleus in the same order that they were transmitted. A typical link receive sequence begins with the receipt of a frame that indicates the data area (Area IV) contains a network message proper. The Receive DMA Engine processor has previously inserted the network message into the appropriate area of a standard Work Element (WE) or Packet Element (PE) in preparation for sending it to the nucleus. Afterward, the background processor checks the message to ensure that it is not a duplicate of one previously received. If it is not a duplicate, the background processor performs an additional check to ensure proper sequence conformity. Each network message and all associated data blocks are checked as described above, and then linked until all related blocks are received. The background processor on the receiving unit then obtains a free Data List (DL) and starts to reassemble the Data Elements (DEs) back into their originally transmitted sequence. When all DEs are successfully attached, the process unit is queued to the nucleus processor for delivery to another interface in the DX unit. Frame processing can occur on several network messages concurrently and in parallel. The messages and associated data block(s) are managed, acknowledged, validated, and checked for duplication independent of each other.

The Receive DMA Engine processor is designed to receive and capture each link frame and perform all required validation in real time. This is accomplished through the use of a very fast (25 MHz) Am29000 RISC processor that is interfaced to Serial Input/Output (SIO) receiver hardware. The DMA Engine scans mailboxes for commands from the background processor. Queues of small and large data buffers are accessed and used to receive messages and associated data blocks respectively. The DMA Engine also checks for idle characters from the link receive SIO hardware that define the start of a frame. When the first idle character is detected, the DMA Engine is dedicated to frame reception and validation. Each word (32-bits) of the frame is gated into an internal register in the order in which it was received, and either validated or stored in nucleus memory as appropriate. When the entire frame has been successfully received and checked for CRC errors, hardware/firmware length conflicts, and sequence conformity, a four-word frame received entry is generated. This receive entry contains fields for address, length, function code, sequence, and acknowledgment. These fields are used by the background processor to process the received link control or data frame.

Link Control Protocol (80) Frames

Two types of link control protocol (80) frames are currently defined: Query/Query Response, and Echo/Echo Response. The frame type is identified by the function code contained in the first byte of the data field in the link control protocol frame.

Query/Query Response Frames

Query/Query Response frames are used to implement the transition from “loopback”, “test”, or “off” interface states to the “on” interface state, and to support the enabled LQM feature on each interface. Refer to “N70x Protocol Circuit Initialization Negotiation” on page 3 and “N70x Line Quality Monitoring (LQM)” on page 4.

The transmission of Query frames are initiated at a frequency (**f**) defined by the following equation:

$$f\ (\text{milliseconds}) = \frac{25\ \text{MHz (background processor clock frequency)}}{\text{baud rate (DSU supplied line speed)}}$$

Query frames are sent at a maximum rate of 10 per second (minimum frequency = 100 milliseconds).

If no valid frames (including user data frames) are received for approximately one second, the physical interface is removed from service. The format of a Query/Query Response frame is shown in Figure 104. The subfields in the frame are described in Table 27 on page 103.

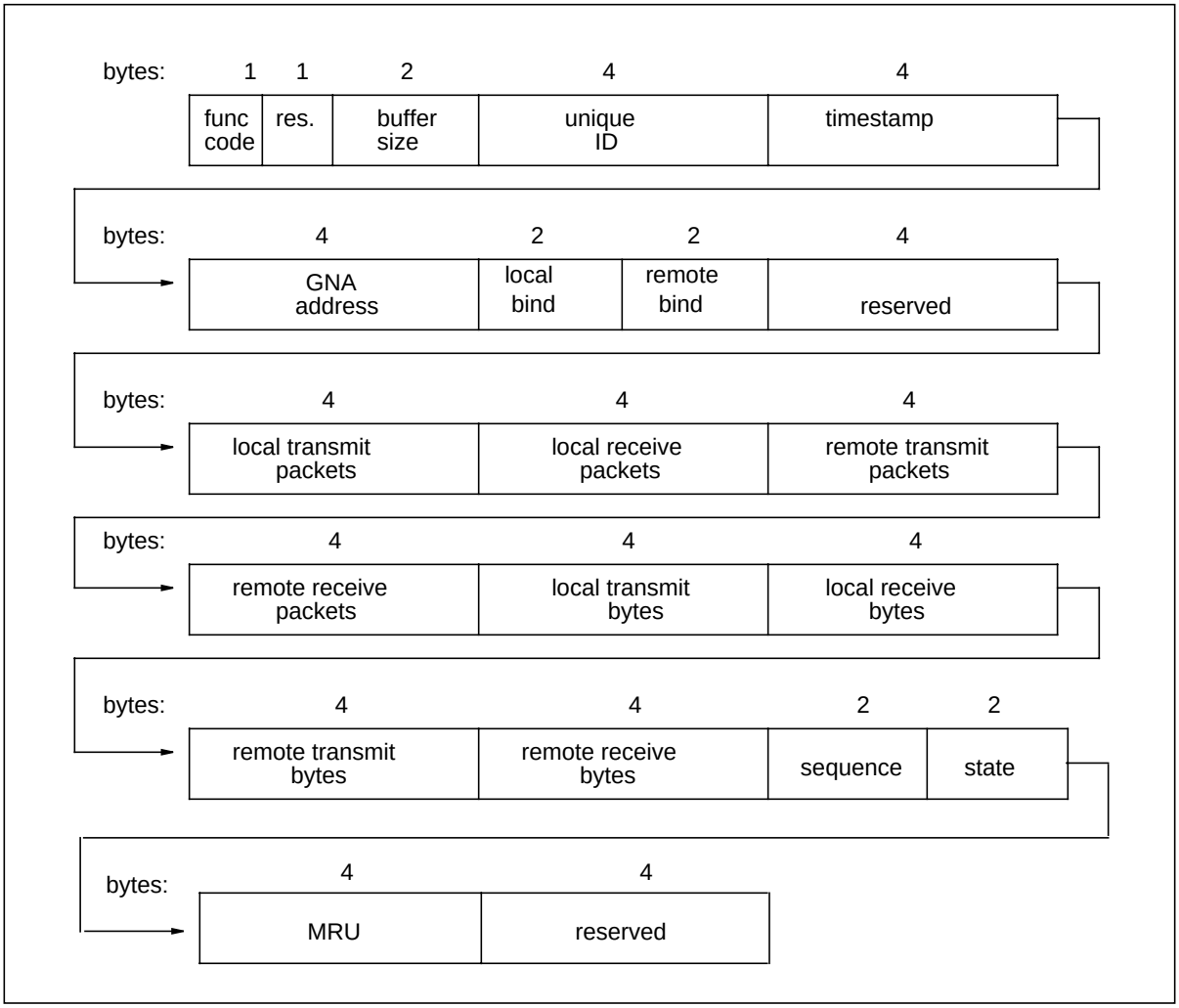


Figure 104. Query/Query Response Format

Table 27. Query/Query Response Frame Description

Subfield	Description	Byte length
function code	Query=02. Remote circuit group responds with a function code of 03.	1
reserved	Always set to zero.	1
buffer size	Contains the buffer size (2Kor 4K) of this unit. Buffer size is selected by the nucleus monitor Set Large Page Size (PS) command. Remote unit responds with its buffer size selection.	2
unique ID	Contains the unique ID number of this physical link. The unique ID is derived from a random number generator. Remote link responds with its unique physical link ID. If the two numbers are the same, the query is discarded and a new query is initiated.	4
timestamp	Places the current time into the request and sends it to the remote physical link. Remote physical link responds by returning the value entered in the query unchanged.	4
GNA address	Contains the GNA address of this interface. Remote link responds by returning its interface GNA address.	4
GNA address	Contains the GNA address of this interface. Remote link responds by returning its interface GNA address.	4
local bind	Contains the bit mask representing each upper level protocol in the local unit. Local Bind is set in the Query frame.	2
remote bind	Contains the bit mask representing each upper level protocol in the remote unit. Remote Bind is set in the Query Response.	2
reserved	Always set to zero.	4
local transmit packets	Contains the number of local packets attempted to be transmitted by this interface.	4
local receive packets	Contains the number of packets received by this interface.	4
remote transmit packets	Contains the number of packets attempted to be transmitted by the remote link interface.	4
remote receive packets	Contains the number of packets received by the remote link interface.	4
local transmit bytes	Contains the number of bytes attempted to be transmitted by this interface.	4
local receive bytes	Contains the number of bytes received by this interface.	4
remote transmit bytes	Contains the number of bytes attempted to be transmitted by the remote link interface.	4
remote receive bytes	Contains the number of bytes received by the remote link interface.	4
sequence number	Contains an incrementing sequence number for this Query frame.	2
state	Current state of the interface sending the Query/Query Response frame.	2
Maximum Receive Unit	Contains the MRU for the link layer protocol assigned to this circuit.	4
reserved	Always set to zero.	4

Echo/Echo Response Frames

The Echo/Echo Response frame is required to implement link testing. The format of an Echo/Echo Response frame is shown in Figure 105. The subfields in the frame are described in Table 28.

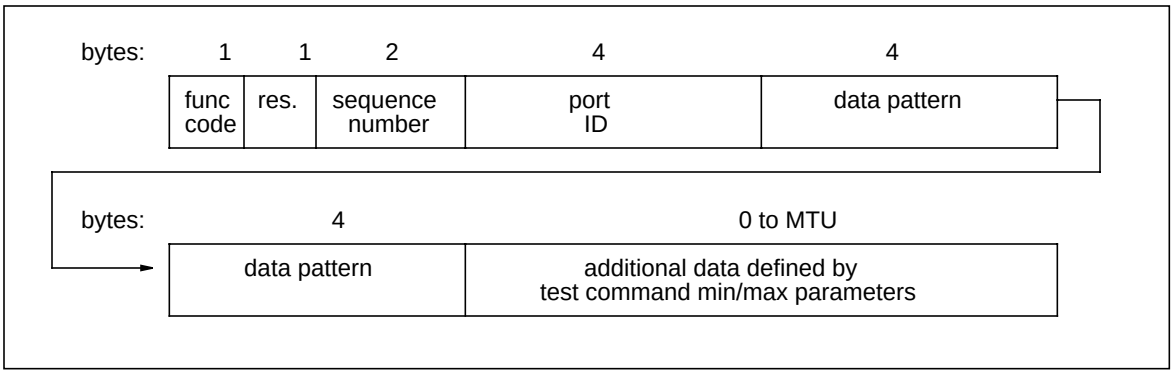


Figure 105. Echo/Echo Response Format

Table 28. Echo/Echo Response Frame Description

Subfield	Description	Byte length
function code	Echo=00. Remote circuit group responds with a function code of 01.	1
reserved	Must be set to zero.	1
sequence number	Contains the sequence number of each frame within a message. Remote circuit group responds by returning each frame unchanged.	2
port ID	Contains a randomly selected port ID number. Remote physical link responds by returning this value unchanged.	4
data pattern	Contains the data pattern selected using Test Interface command. Remote physical link responds by returning this pattern unchanged.	8
additional data	Contains the amount of additional test pattern data beyond that contained in the frame header. The amount of additional data is determined by the min/max parameter selections in the Test Interface command. Remote physical link responds by returning this data unchanged.	0-MTU

Appendix B. HYPERchannel Link Messages

HYPERchannel Message Formats

Two types of HYPERchannel message formats may be interpreted by the nucleus logic in a DX unit: HYPERchannel Compatibility Mode (HCM) and Global Network Address (GNA). Messages of either type consist of a message proper and, optionally, associated data.

An HCM message proper consists of at least nine and up to 64 8-bit bytes and is indicated by the presence of zero in bytes 02 and 03 of the message proper. A GNA message proper consists of nine to 512 8-bit bytes and is indicated by the presence of non-zero data in bytes 02 and 03 of the message proper.

A message proper consists of a message header and one or more parameter fields. The message header indicates the source and destination addresses of both the physical unit and the logical unit to which they are attached, the routing control information, and the unit access codes. The parameter field(s) contain user dependent information.

The PB701 supports up to 238 2K or 4K associated data blocks on HYPERmedia messages exchanged between two PB701's. The number of 2K or 4K associated data blocks is limited to 63 on HYPERmedia messages exchanged between a PB701 and AC730. The maximum length of HYPERchannel messages and IP datagrams varies with the network media.

HYPERchannel Message Categories

Each PB701 circuit supports four types of HYPERchannel messages, all of which are identified by either the contents of the function code of the message (byte 08 of the message proper) and/or by the PHYSICAL TO ADDRESS (byte 04 of the message proper) to which they are sent.

Pass Through Network Messages

These messages are used to provide network communications between the various nodes. These messages, and any accompanying associated data, are always directed to a profiled address of the local link that is not the base/satellite access address of the link. Bytes 08-3F of these messages can be used to contain telecommunications/user-dependent information. A pass-through message header consists of eight 8-bit bytes numbered 0 through 7.

Embedded Addressing Mode Messages

Embedded addressing messages are also referred to as Satellite Link Subsystem (SLS) messages. Embedded addressing extends the length of the normal message header on HYPERchannel messages to permit them to function as an alternative method of routing data. Unlike the header in Pass Through Network Messages, the embedded addressing message header uses bytes 0 through 5 to address the base address of the intended link. These bytes must still conform to the restrictions, if any, as defined for the message header data.

Embedded addressing messages are detected when bit 25 in the “Processor x Port Information” field of the Work Element or Packet Element is set. When this occurs, the PB701 performs additional processing prior to link transmission.

NOTE: SLS messages may be either acknowledged or non-acknowledged.

The additional message header bytes are embedded within the standard HYPERchannel message. The following paragraphs describe the embedded addressing message format. All undefined or unused message locations are available to the user.

Bytes 0-7: Message Header

These 8 bytes are used to address the base address of the intended link to execute the embedded addressing. Message byte 4 contains the base address of the intended link.

Bytes 08-15: Not Used

Bytes 16-1B: Embedded Addressing Data

These six bytes contain the address of the intended remote destination unit. The data must conform to the formatting restrictions for message headers. When the intended link processes this message, these bytes are swapped with message bytes 0 through 5 before link transmission. In addition, byte 17 must correspond to the contents of byte 1.

Bytes 1C-3F: Not Used

Interface Maintenance Messages

These messages are used specifically for monitoring the local and remote interface and the communications equipment installed between the interfaces. They provide statistics gathering, data loopback between paired links, and initialization of local and remote links. These messages, and any accompanying associated data, are always directed to the base address of the local circuit. Refer to ”Interface Maintenance Messages” for more information.

Each PB703 requires a base address range of 32 sub-addresses.

Fault Messages

In the event of an abnormal termination of a specific link operation, the link (if enabled) generates a fault message and sends it back to the originator. Refer to “Fault Messages” on page 106.

Interface Maintenance Messages

Interface maintenance messages are always directed to the base interface address of the local circuit. The base circuit address is the only address which accepts and processes interface maintenance messages.

Each interface maintenance message results in a response message being generated by the receiving interface. The response message contains either requested information or an indication that the requested function has been performed. Table 29 on page 107 contains a list of supported link maintenance messages.

Table 29. Interface Maintenance Messages

Bytes 08-09	Command Description
FF 00	Local Link Message Loopback*
FF 01	Return Local Statistics*
FF 02	Return and Clear Local Statistics*
FF 09	Return Local Link Telecommunications Statistics
FF 0A	Return and Clear Local Link Telecommunications Statistics
8F 00	Remote Link Message Loopback
8F 01	Return Remote Statistics
8F 02	Return and Clear Remote Statistics
8F 09	Return Remote Link Telecommunications Statistics
8F 0A	Return and Clear Remote Link Telecommunications Statistics
***These commands are intercepted by the DX nucleus and do not return statistics on the operation of the link.**	

Bytes 00 through 07 use the pass-through message header format. Bytes 08 and 09 of the message specify the function to be performed and also indicate whether it is to be performed in the local or remote link. Byte 08 contains an FF to specify the local link or an 8F for the remote link. Byte 09 contains the sub-function, specifying what type of action is to be performed. Unless otherwise indicated, all network maintenance messages consist of at least ten bytes.

The response messages vary in length from function to function. Bytes 08 and 09 of the response messages for successfully executed commands are the same as those contained within the received message, except the most significant bit of byte 09 is set and byte 08 is always returned with a value of FF. Refer to the individual interface maintenance command message description for the appropriate response message format.

The local and remote link statistical counters described in Figure 115 on page 115 may be examined by entering the selected interface subaddress into maintenance messages FF 09 and 8F 09 respectively.

Message Loopback Command (FF 00 / 8F 00)

This function causes a message-only or a message and up to 8K bytes of associated data to be sent to the nucleus in this DX unit (FF 00 only) or to the remote nucleus (8F 00 only) attached to the link.

The receiving nucleus reverses the addressing in the message header and returns the balance of the message and data unchanged. The upper bit of byte 09 is also set to identify the returned information as a response. If associated data is to accompany the message, the associated data bit (message byte 01, bit 7) must also be set in the transmitted message. The Message Loopback Command format is shown in Figure 106 on page 108. The Message Loopback Response format is shown in Figure 107 on page 109.

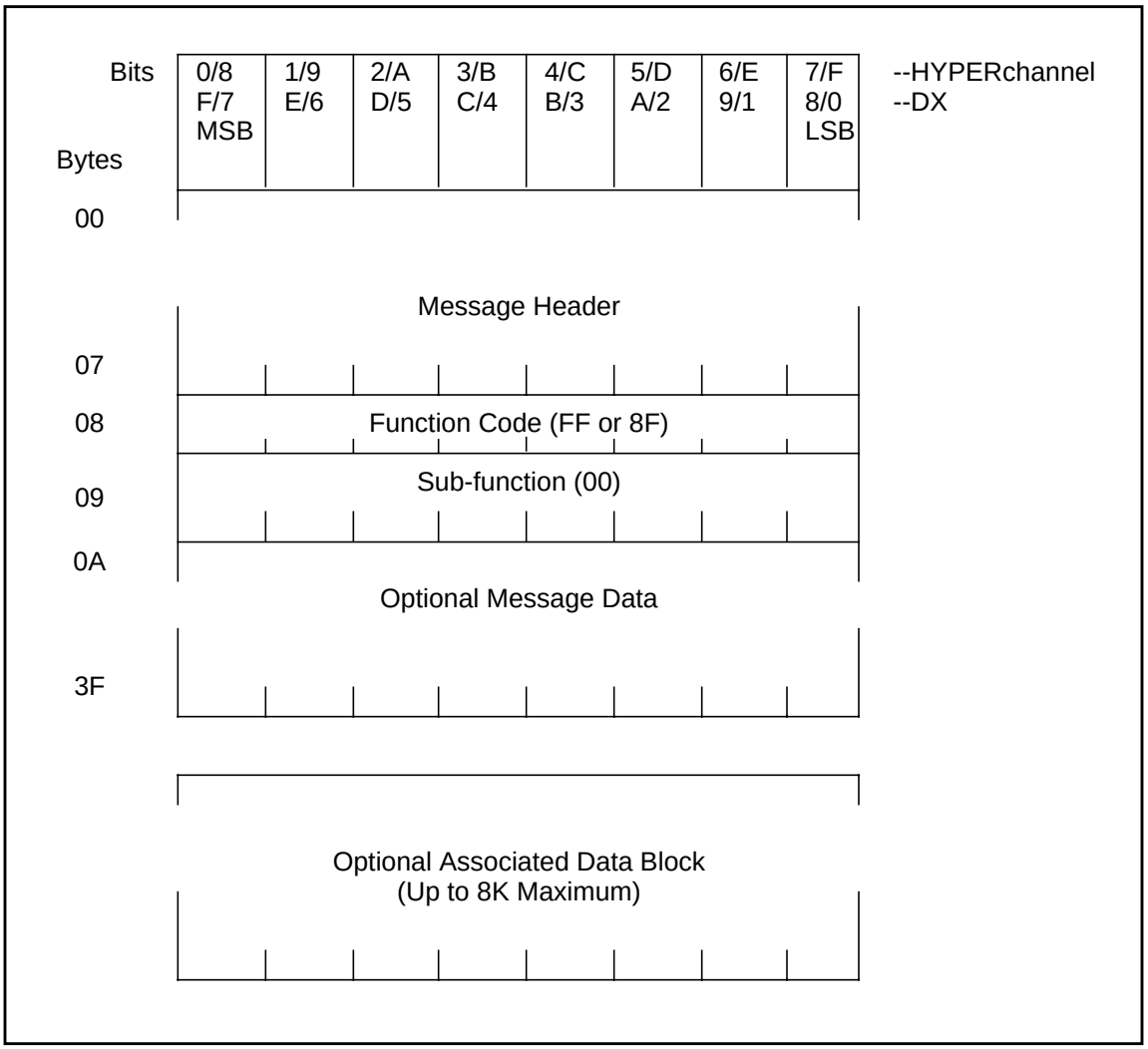


Figure 106. Message Loopback Command (FF 00 / 8F 00)

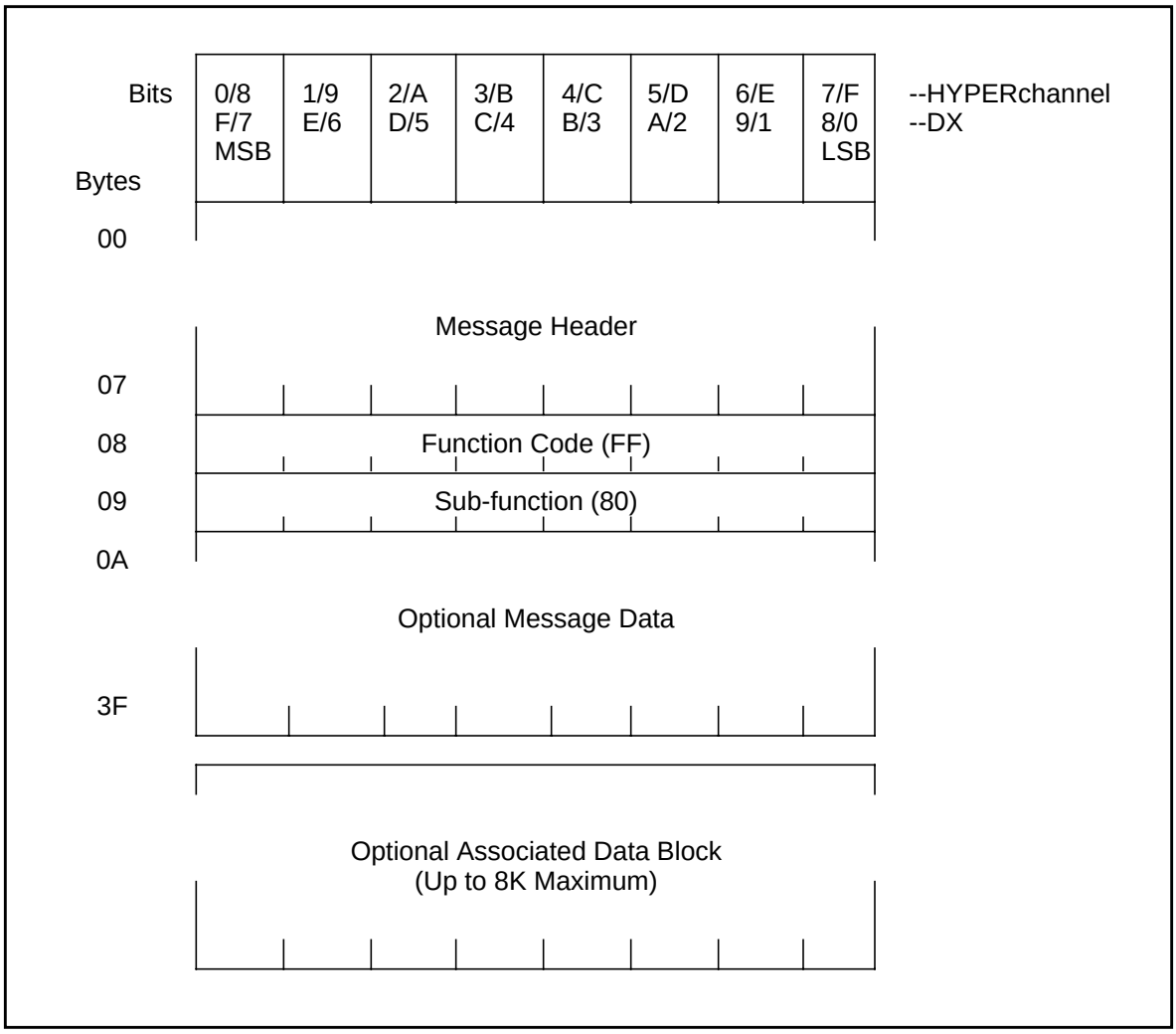


Figure 107. Message Loopback Response (FF 80)

Return Statistics Command (FF 01 / 8F 01)

This function causes a 32-byte statistics package to be returned by the nucleus in this DX unit (FF 01 only) or the nucleus in the remote DX unit (8F 01 only). The statistics package is contained in the response starting at address 0A. The response to the FF 01 and 8F 01 returns all zeros in the status counters.

The response to an FF 01 returns a minimum status package that contains only the local PB703 model number, KID, and base unit address. The response to an 8F 01 returns a minimum status package that contains only the remote PB703 model number, zeros, and base unit address. The Return Statistic Command format is shown in Figure 108 on page 110. The Return Statistics Response format is shown in Figure 109 on page 110.

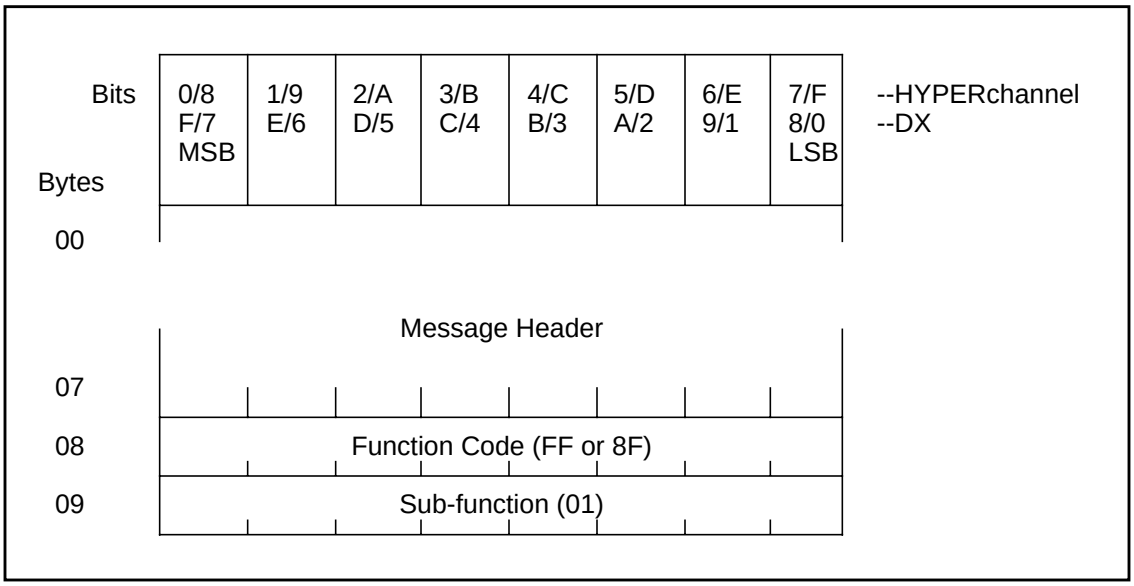


Figure 108. Return Statistics Command (FF 01 / 8F 01)

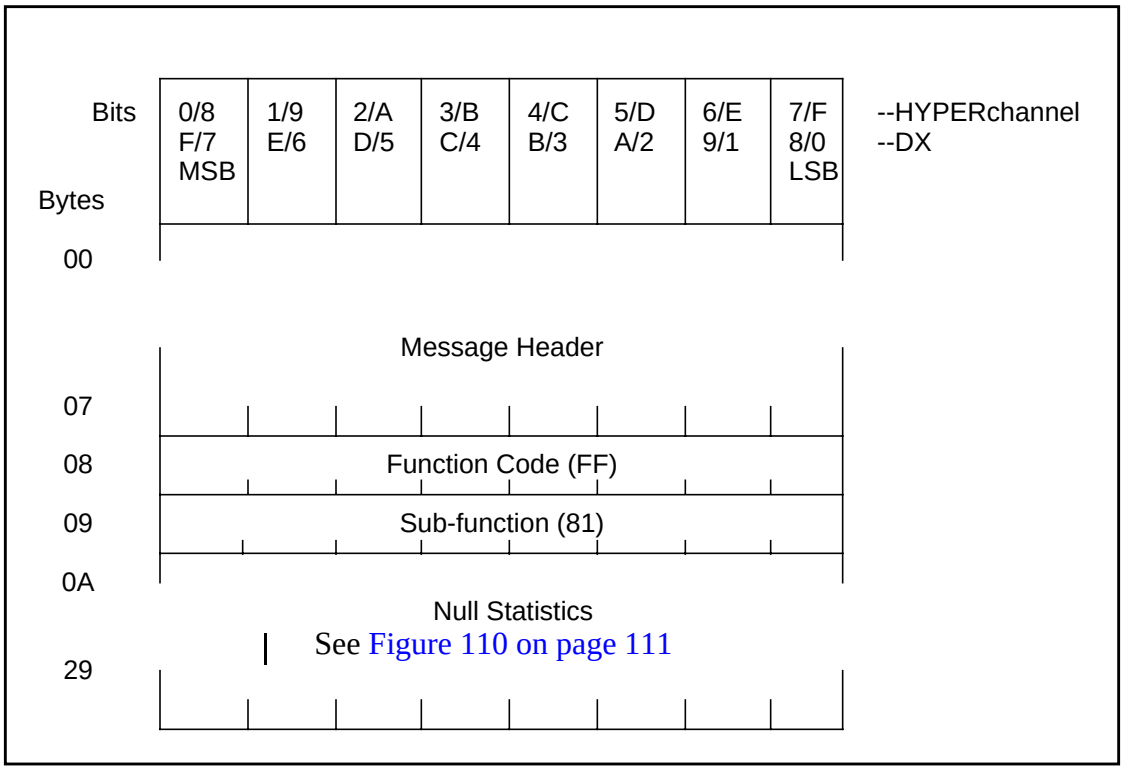


Figure 109. Return Statistics Response (FF 81)

Figure 110 on page 111 represents the data returned in message bytes 0A-29 of the response to an FF 01/8F 01 or FF 02/8F 02 message. All message bytes except 26, 27, and 29 are forced to zero.

Bytes Msg. Loc.	0 2	3 5	6 8	9 B	C D	E F	
0A-19	all zeroes	all zeroes	all zeroes	all zeroes	all zeroes	all zeroes	
1A-29	all zeroes	all zeroes	all zeroes	all zeroes	D401	KID*	unit #

Figure 110. Null Statistics Package

NOTE: *KID returned only in response to FF 01, 8F 01 returns zeros.

Return and Clear Statistics Command (FF 02 / 8F 02)

This function is identical to the return statistics function described under "Return Statistics Command (FF 01 / 8F 01)" on page 109 with the exception that the statistics counters of the responding unit are cleared following their placement into the response message. The Return and Clear Statistic Command format is shown in Figure 111. The Return and Clear Statistics Response format is shown in Figure 112 on page 112.

NOTE: The statistics counters are already set to zero on DX units.

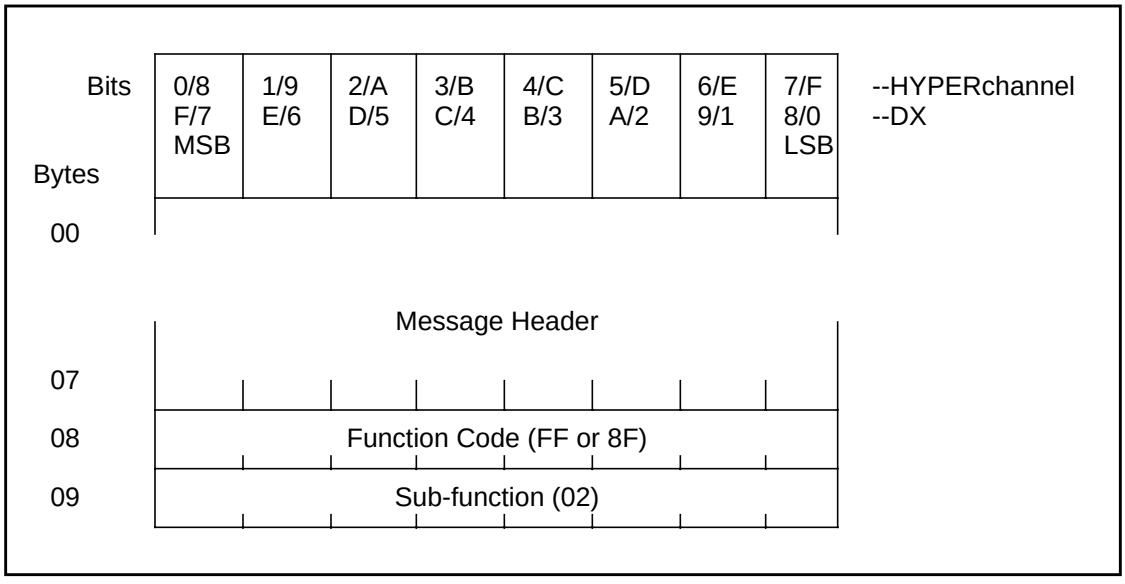


Figure 111. Return and Clear Statistics Command (FF 02 / 8F 02)

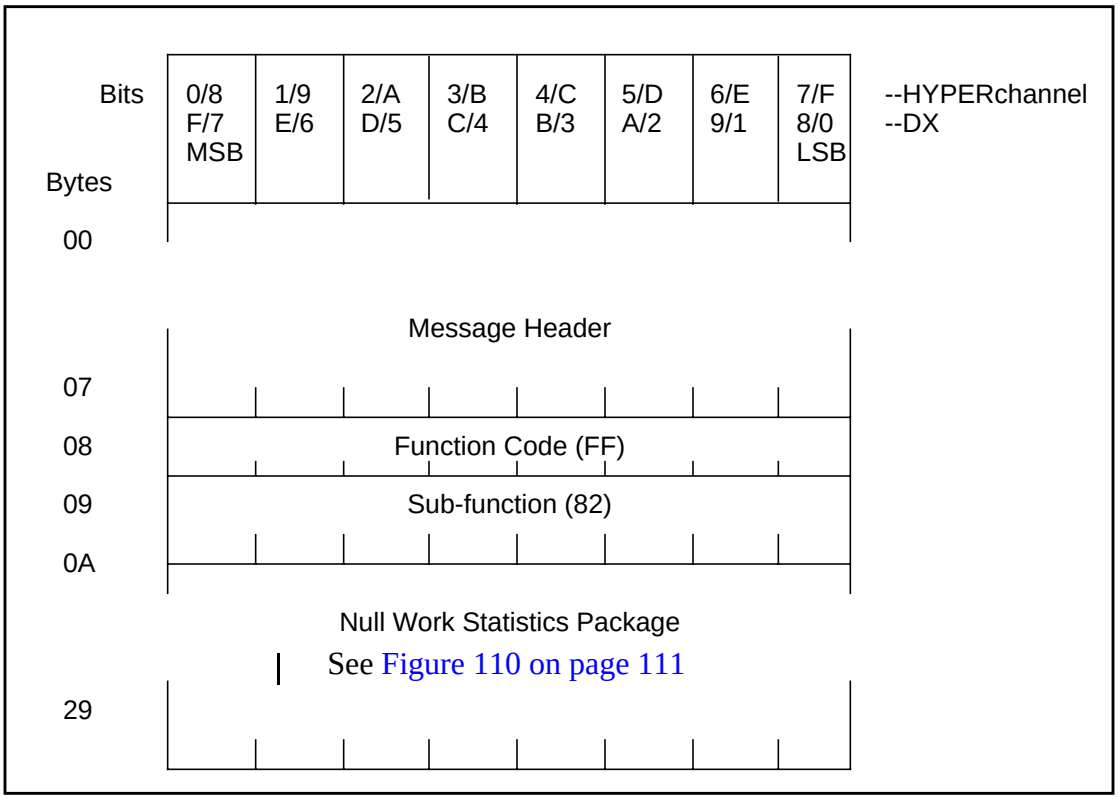


Figure 112. Return and Clear Statistics Response (FF 82)

Return Telecommunications Dependent Statistics Command (FF 09 / 8F 09)

This maintenance message retrieves the statistical data pertaining to the communications link operation. The returned data indicates the number of message and data frames that have been transmitted and/or received by the indicated link. The number and type of errors that were detected and recovered are also included in this packet. This data packet is returned to the requestor in the form of associated data (184 bytes) following a return telecommunications dependent statistics response message. The Return Telecommunications Dependent Statistics Command format is shown in Figure 113 on page 113. The Return Telecommunications Dependent Statistics Response format is shown in Figure 114 on page 114.

NOTE: The first 64 bytes in the response pertain to the transmit link, the next 64 bytes pertain to the receive link, and the remaining 73 bytes contain telecommunications-dependent data.

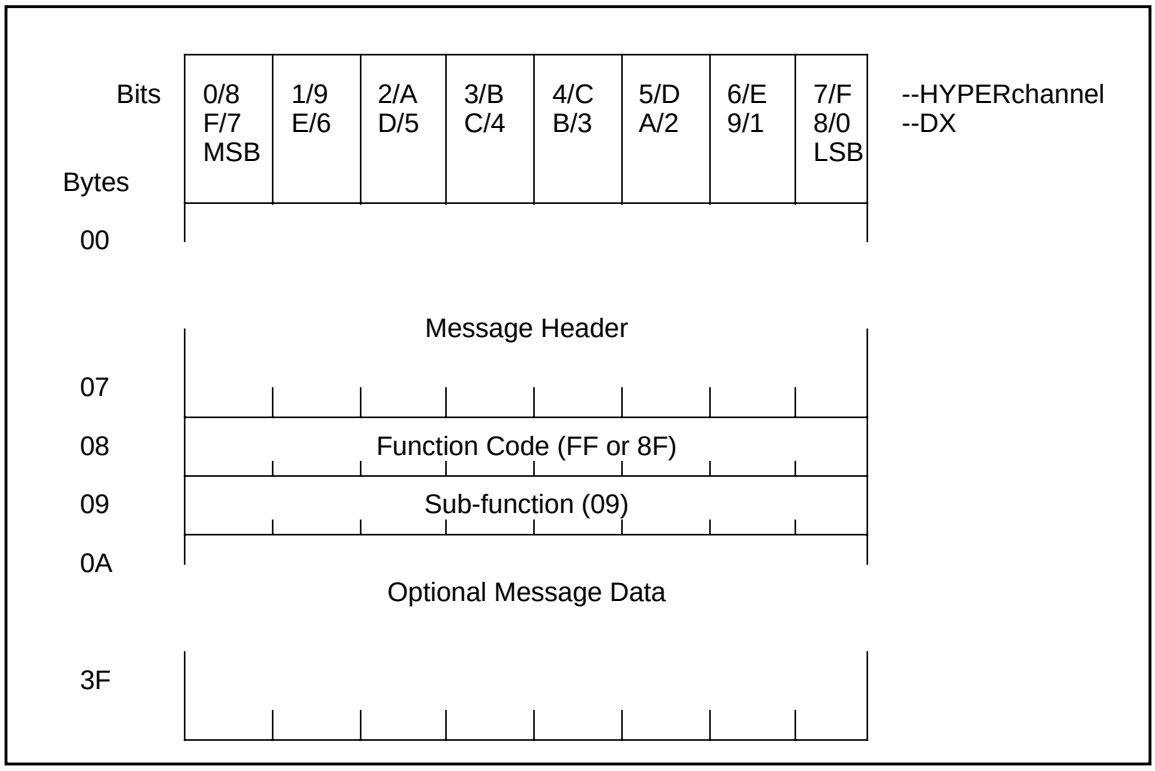


Figure 113. Return Telecommunications Dependent Statistics Command (FF 09 / 8F 09)

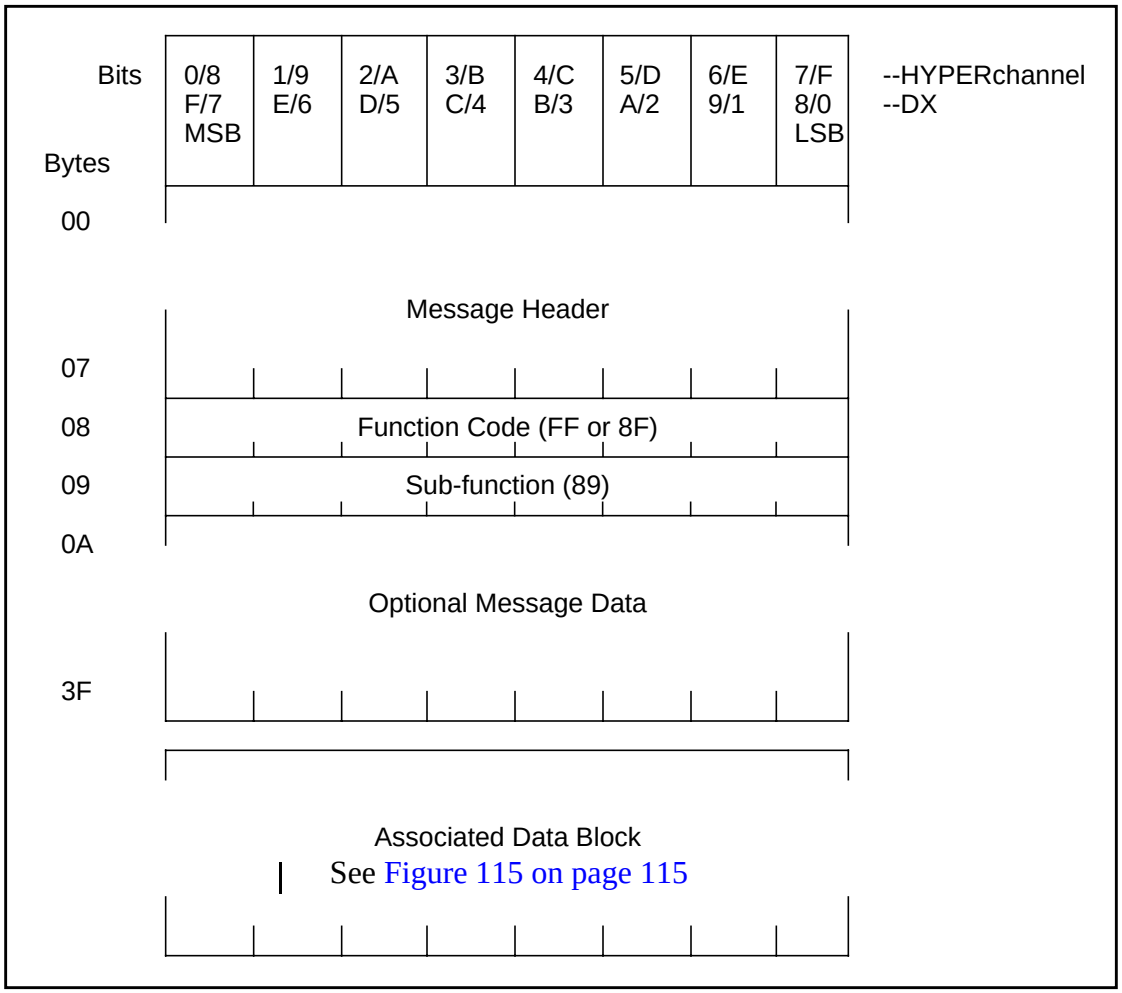


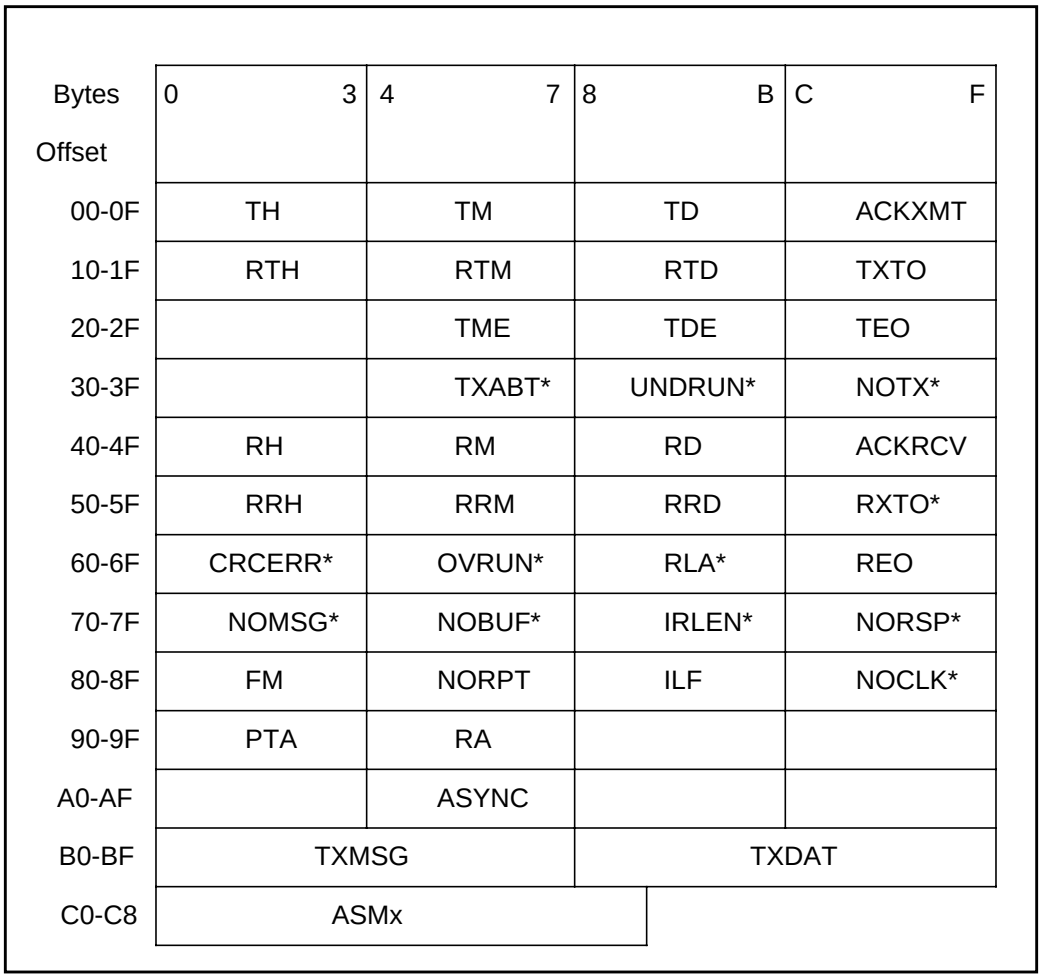
Figure 114. Return Telecommunications Dependent Statistics Response (FF 89)

The link statistical counter memory area consists of a number of counters that record various operations and error conditions encountered by each link circuit while processing message and data traffic via the attached communication facility. The contents of these counters are used to determine the overall performance of link operations and the monitoring of any encountered error condition. Counters without designators are reserved for future use.

Each defined statistical counter is incremented once for the operation it is designed to record. After reaching a maximum count, the counter wraps around and resets to a zero state when it records the next event. The statistical counters are arranged in a way to analyze link transmit and receive conditions relatively easily.

The following paragraphs define the events the counters are designed to record. Figure 115 on page 115 shows the counter offsets within the statistical memory area.

These counters are maintained within nucleus memory and can be interrogated by inserting the selected circuit base address into the header of an FF 09 or 8F 09 maintenance message.



Bytes Offset	0 3	4 7	8 B	C F
00-0F	TH	TM	TD	ACKXMT
10-1F	RTH	RTM	RTD	TXTO
20-2F		TME	TDE	TEO
30-3F		TXABT*	UNDRUN*	NOTX*
40-4F	RH	RM	RD	ACKRCV
50-5F	RRH	RRM	RRD	RXTO*
60-6F	CRCERR*	OVRUN*	RLA*	REO
70-7F	NOMSG*	NOBUF*	IRLEN*	NORSP*
80-8F	FM	NORPT	ILF	NOCLK*
90-9F	PTA	RA		
A0-AF		ASYNC		
B0-BF	TXMSG		TXDAT	
C0-C8	ASMx			

Figure 115. HYPERmedia Link Statistical Counters

NOTE: *These errors may occur during link operations involving any of the routing protocols supported by the PB703

The abbreviations listed above reflect the label names used within the link program to identify the individual statistical counters. Counters without a designator are currently undefined and are reserved for future use.

HYPERmedia Link Statistical Counters

The link program for each circuit maintains a number of statistical counters that are used to record various types of activities performed by the unit, and to record any type of error conditions encountered. The counters indicate the overall operational capabilities of both the circuit and the attached communication link.

The link statistical counters consist of four bytes each and are divided into the following three sections: link transmit, link receive, and telecommunications-dependent.

Link Transmit Statistical Counters: The link transmit statistical counters record events and the type of activity associated with the transmission of frames onto the attached communication link. Table 30 on page 116 describes the contents of each link transmit counter.

Table 30. Link Transmit Statistical Counters

Counter/Offset	Description
Transmitted Header (TH, 0-3)	This counter records the number of header-only fields in transmitted control frames.
Transmitted Message (TM, 4-7)	This counter records the number of network messages that were transmitted. Message frames transmitted consist of a header field and a data field that can be up to 64 bytes long. Header functions of 06, 08, 09, 0A, 0B, 0C, and 0D are the only types logged within this counter. Transmitted message frames logged within this counter represent the start of a new physical link sequence.
Transmitted Data (TD, 8-B)	This counter records the number of associated-data blocks that were transmitted. Data frames transmitted consist of a header field and a data field that can be up to 4k bytes long, depending on unit configuration. Header functions of 0E, and 0F are the only types logged within this counter.
Acknowledgments Sent (ACKXMT, C-F)	This counter records the number of response frames that were transmitted. Response frames consist of only the header field and are generated whenever an acknowledgment is required for a received link frame. This counter represents the number of successfully received link frames that the link has processed, providing that the link was profiled for link acknowledgments. Only header functions with bit 2 (response flag) set are logged within this counter.
Retransmitted Header (RTH, 10-13)	This counter records the number of header-only frames that were retransmitted due to the failure of its previous transmission from being acknowledged as being successfully received by the remote unit. This counter only logs header function 05 (End Operation).
Retransmitted Message (RTM, 14-17)	This counter records the number of message frames that were retransmitted due to the failure of its previous transmission from being acknowledged as being successfully received by the remote unit. This counter only logs header functions 26, 28, 29, 2A, 2B, 2C, and 2D. This counter is not used if the link was profiled for non-acknowledgments, because the indicated message frame is only transmitted once.
Retransmitted Data (RTD, 18-1B)	This counter records the number of associated-data frames that were retransmitted due to a failure of its previous transmission from being acknowledged as being successfully received by the remote unit. This counter only logs header functions 2E and 2F. This counter is not used if the link was profiled for non-acknowledgments, because the indicated data frame is only transmitted once.
Transmit Internal Timeout (TXTO, 1C-1F)	This counter records the number of physical link transmission sequences that were terminated due to a failure to receive a continuation or termination function from the background processor prior to expiration of this timer. This timer is set to reflect the profiled deadman timeout value plus one second.
Exceeded Retransmitted Message (TME, 24-27)	This counter records the number of times an individual message frame exceeded its retry value due to a failure of the indicated function as being successfully received and acknowledged by the remote unit. Upon being recorded within this counter, the indicated physical link sequence is terminated by generation and transmission of a link abort (13) frame. Additional error recovery is performed based upon entered link profile data, any accompanying associated-data is thrown away. Only message functions 26, 28, 29, 2A, 2B, 2C, and 2D are logged as being exceeded. This counter is not used if the link was profiled for non-acknowledgments, because the indicated message frame is only transmitted once.
Exceeded Retransmitted Data (TDE, 28-2B)	This counter records the number of times an individual associated-data frame exceeded its retry value due to a failure of the indicated function as being successfully received and acknowledged by the remote unit. Upon being recorded within this counter, the indicated physical link sequence is terminated by generation and transmission of a link abort (13) frame. Additional error recovery is performed based upon entered link profile data. All other not transmitted or awaiting re-transmission associated-data frames for the failing physical link sequence are thrown away. The remote unit, upon receiving the generated link abort frame, terminates processing the failed link sequence. Only data functions 2E and 2F are logged as being exceeded. This counter is not used if the link was profiled for non-acknowledgments, because the indicated data frame is only transmitted once.

Table 30. Link Transmit Statistical Counters (Continued)

Counter/Offset	Description
Transmitted End Operation (TEO, 2C-2F)	This counter records the number of End Operation link control frames that were transmitted. Header function 05 is the only type logged within this counter.
Telecommunications Transmission Abort (TXABT, 34-37)	This counter records the number of times a frame transmission was abnormally terminated due to a failure within the transmit logic. When a frame transmission fails to complete before expiration of its transmit clock (TDCLK), the frame transmission is terminated and the error is logged within this counter. General causes of this type of error are loss of transmit DSU clock or failure of the attached communication facility.
Telecommunications Transmission Underrun (UNDRUN, 38-3B)	This counter records the number of times a frame transmission was abnormally terminated due to a failure within the link logic to provide data to the transmitting logic when requested. This type of failure is generally the result of losing internal timing within the DMA read logic paths.
No Link Transmit (NOTX, 3C-3F)	This counter records the number of times a link frame was not transmitted due to loss of line synchronization or line clock prior to the start of actual transmission. Upon recording this error, the link frame is then processed as if it were transmitted and handled at a later time during normal processing of frames that did not receive a response.

Link Receive Statistical Counters: The link receive statistical counters record events and the type of activity associated with the receipt of frames from the attached communication link. Table 31 describes the contents of each link receive counter.

Table 31. Link Receive Statistical Counters

Counter	Description
Received Header (RH, 40-43)	This counter records the number of successfully received header-only frames that were not re-transmissions.
Received Message (RM, 44-47)	This counter records the number of successfully received message frames that were not re-transmissions. Received message frames consist of a header field and a data field that can be up to 64 bytes long. Header functions of 06, 08, 09, 0A, 0B, 0C and 0D are the only types logged with in this counter. Message frames received and logged within this counter indicate a start of a new physical link sequence.
Received Data (RD, 48-4B)	This counter records the number of successfully received associated-data frames that were not re-transmissions. Received data frames consist of the header field and a data field that can be up to 4k bytes long, depending on unit configuration. Header functions 0E and 0F are the only types logged within this counter.
Acknowledgment Received (ACKRCV, 4C-4F)	This counter records the number of response frames successfully received. Response frames consist of the header field only and have bit 2 (response flag) set within the header function. Received response frames are the result of the remote unit successfully receiving a frame transmitted by this unit and acknowledging its reception.
Received Retransmitted Header (RRH, 50-53)	This counter records the number of successfully received retransmitted header frames that were previously either received in error or out of sequence. Header frames consist of the header field only and contain function code 05 (End Operation) only. If the link is profiled for non-acknowledgments, no counts are recorded because data frames are transmitted only once.

Table 31. Link Receive Statistical Counters (Continued)

Counter	Description
Received Retransmitted Message (RRM, 54-57)	This counter records the number of successfully received retransmitted message frames that were previously either received out of sequence of received in error. Message frames logged within this counter consist of the header field and a data field that can be up to 64 bytes long. Only header functions 26, 28, 29, 2A, 2B, 2C, and 2D are recorded. This counter is not used if the link is profiled for non-acknowledgments, because message frames are only transmitted once. Message frames logged within this counter can indicate a start of a new physical link sequence.
Received Retransmitted Data (RRD, 58-5B)	This counter records the number of successfully received retransmitted associated-data frames that were previously either received in error or received out of sequence. Data frames logged within this counter consist of the header field and a data field that can be up to 4k bytes long, depending on unit configuration. Only header functions 2E and 2F are recorded, and they must have been preceded by a message frame to be successfully processed.
Receive Internal Timeout (RXTO, 5C-5F)	This counter is used to record the number of physical link receive sequences that were terminated due to an error condition that prevented the sequence from completing. This timer is set to reflect the profiled interface deadman timeout value plus one second.
Received CRC Errors (CRCERR, 60-63)	This counter records the number of received link frames that contained detected CRC errors within either the header or data field. Link frames received in error are thrown away with no further action taken by the recording unit, providing the unit is profiled for link acknowledgments. If not, the current receive sequence is terminated and the link interface is set up expecting a new physical link sequence.
Telecommunications Receive Overrun (OVRUN, 64-67)	This counter records the number of times the link receive logic was unable to place the received data into its internal memory area. This condition generally indicates a failure within the DMA write logic or expiration of the write DMA length descriptor.
Telecommunications Receive Link Abort (RLA, 68-6B)	This counter records the number of times a link receive sequence was aborted by the link logic. This condition is generally a result of the link logic receiving an invalid flag byte, caused by a line hit while there is no actual data on the line. This condition can be an abort frame caused by a single zero bit getting flipped, resulting in an abort flag (eight consecutive ones) being recognized by the receiver.
Received End Operation (REO, 6C-6F)	This counter records the number of End Operation link control frames that were received. Header type 05 is the only type logged within this counter.
No Message Buffers (NOMSG, 70-73)	This counter records the number of times an invalid message buffer was placed on the link interface due to the unavailability of message buffers within the receiving unit. This counter indicates that the receiving interface is having difficulties in passing received message and data traffic.
No Data Buffers (NOBUF, 74-77)	This counter records the number of times an invalid associated-data buffer was placed onto the link interface due to the unavailability of data buffers within the receiving unit. This counter indicates that the receiving interface is having difficulties in passing message and data traffic.
Invalid Link Frame Length (IRLEN, 78-7B)	This counter records the number of received link frames that consisted of more or less data than was indicated within the header field (HLEN). Link frames received with an invalid length are discarded and handled in the same manner as a frame received in error.
No Response Generation (NORSP, 7C-7F)	This counter records the number of times a valid received link frame was thrown away because it could not be processed at the time of reception. Though not fatal for links profiled for link acknowledgments, this counter indicates a level of error recovery due to abnormal link conditions. Within links profiled for non-acknowledgments, this counter indicates the number of valid link frames thrown away and not recovered at a later time.

Telecommunications-Dependent Statistics: The telecommunications-dependent statistical counters are used to record events that are generally not associated with link transmission or reception events. These counters are defined in Table 32 on page 119.

Table 32. Telecommunications Dependent Statistics

Counter	Description
Generated Fault Messages (FM, 80-83)	This counter records the number of fault messages generated by this unit and returned to a fault reporting address. This counter indicates the number of not recoverable error conditions that this unit has encountered with passing message and data traffic to the remote unit for those operations that have an enabled fault reporting condition (FLTDIS).
Not Reported Error Conditions (NORPT, 84-87)	This counter records the number of non-recoverable error conditions that were encountered while passing messages and data traffic to the remote unit that were not reported due to a disabled fault reporting option (FLTDIS) for the failing operation.
Illegal Link Frames Received (ILF, 88-8B)	This counter records the number of link receive frames that contain an illegal function code. The event is counted here and any held resources dismissed. This error is detected by the HYPERchannel protocol handler.
Loss of Receive Clock (NOCLK, 8C-8F)	This counter records the number of times the link program detected a loss of link receive clock.
Pass Through Aborts (PTA, 90-93)	This counter records the number of messages forwarded from one interface to another within a DX unit that returned abnormal status to the forwarding interface.
Received Aborts (RA, 94-97)	This counter records the number of receive aborts that have occurred while processing a link operation.
Auto Link Resync (ASYNC, A4-A7)	This counter records the number of times the link program has detected a hardware-initiated auto-resync of the attached communication facility due to the loss of line synchronization. This counter is used only when the unit contains the auto resync option as part of its configuration.
Transmitted Message Data (TXMSG, B0-B7)	This eight byte counter records the cumulative total of message bytes received from the nucleus and transmitted via the link to the remote interface. Messages that are retransmitted due to an error condition are not recorded.
Transmitted Associated Data (TXDAT, B8-BF)	This eight byte counter records the cumulative total of associated data bytes received from the nucleus and transmitted via the link to the interface. Associated data that is retransmitted due to an error condition is not recorded.
Program Identification (ASMx, C0-C8)	These nine bytes are used to contain information identifying the link program. They are defined as shown in Table 33.

Table 33. Program Identification Bytes

Address (Hex Offset)	Name	Contents
C0-C1	Circuit identification	These two bytes contain the value “d403” that identifies the circuit as a PB703.
C2-C3	Circuit base address	Contains the PB703 circuit base address (lower 16 bits of circuit GNA address). This address is used to direct maintenance and control messages to the background processor on the PB703
C4	Firmware revision	This byte contains the firmware revision level of the program residing in the background processor EEPROM.
C5	Hardware revision	This byte contains the TAB level of the PND701 board.
C6-C8	Program Assembly Date	These three bytes contain the month, day and year, respectively, when the installed PB703 interface background processor program EEPROM was last revised and assembled.

Return and Clear Telecommunications Dependent Statistics Command (FF 0A / 8F 0A)

This maintenance message returns and clears the Link Statistics Counters of the indicated link. The Return and Clear Telecommunications Dependent Statistics Command format is shown in Figure 116. The Return and Clear Telecommunications Dependent Statistics Response format is shown in Figure 117 on page 121.

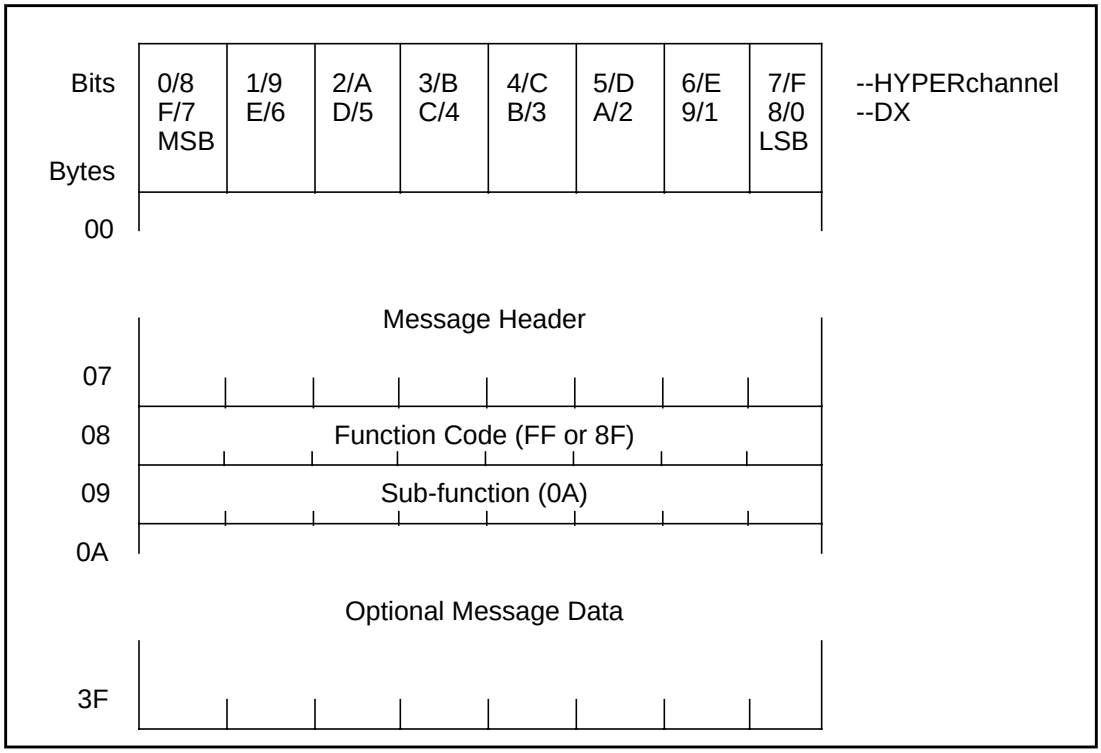


Figure 116. Return and Clear Telecommunications Dependent Statistics Command

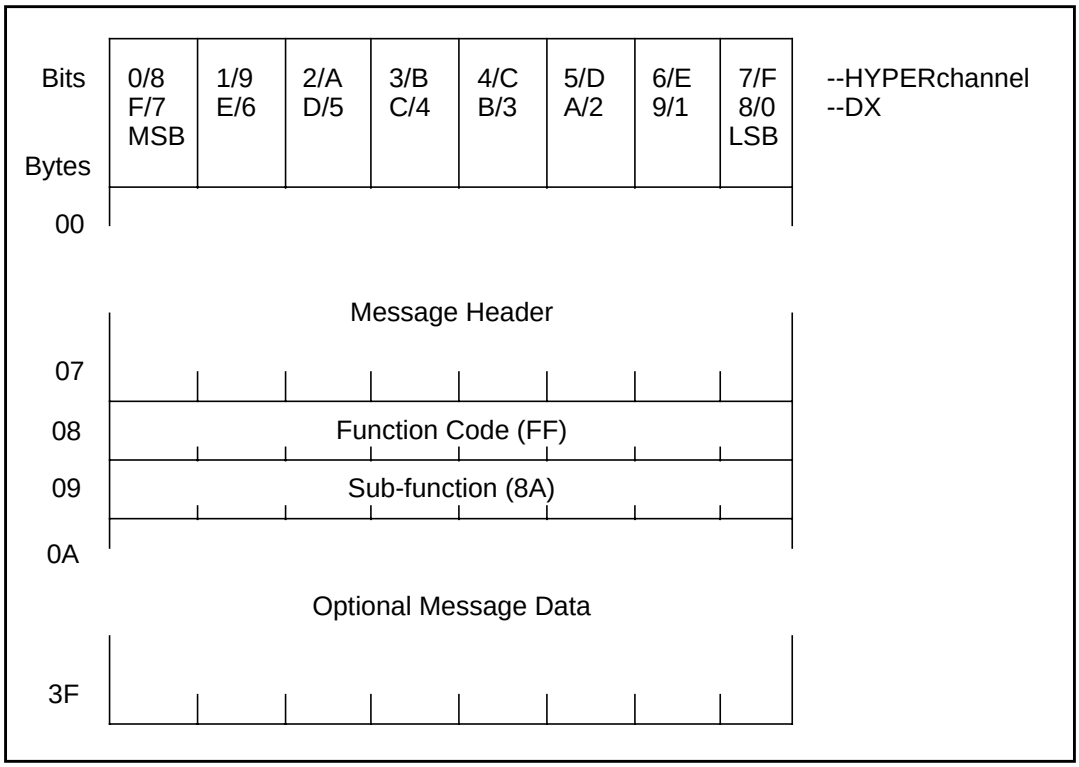


Figure 117. Return and Clear Telecommunications Dependent Statistics Response (FF 8A)

Fault Message Formats

These messages are generated and returned to the user whenever a unrecoverable error has occurred within either the local or the remote link during the processing of message and data traffic. These messages inform the user that the operation has been aborted. The local link generates and returns fault messages to an originating unit address. The link with an enabled fault message disposition and which initiated the link transmission for that failing operation is referred to as the local link.

All fault messages consist of fourteen bytes of data with bytes 00 through 07 being common to all messages (refer to “HYPERchannel Message Formats” on page 99). Byte 08 always contains a 09 and byte 09 contains the error code (Table 34 on page 122). Bytes 0A through 0D are defined within the individual fault message description. Bit 5 (exception message) of byte 01 of the returned fault message is always set to indicate that this is an exception message.

The following subsections define the fault messages that can be generated by the local link.

Table 34. Fault Error Message Codes

Error Code (Byte 09)	Description
00	Reserved for future use
01	Remote pass-through abort
02	Reserved for future use
03	Reserved for future use
04	Reserved for future use
05	Local link transmit port unavailable
06	Reserved for future use
07	Local link exceeded retries
08	Remote contention fault

Remote Pass-Through Abort (01)

The fault message shown in Figure 118 is generated whenever the remote link is aborted during a transmit operation.

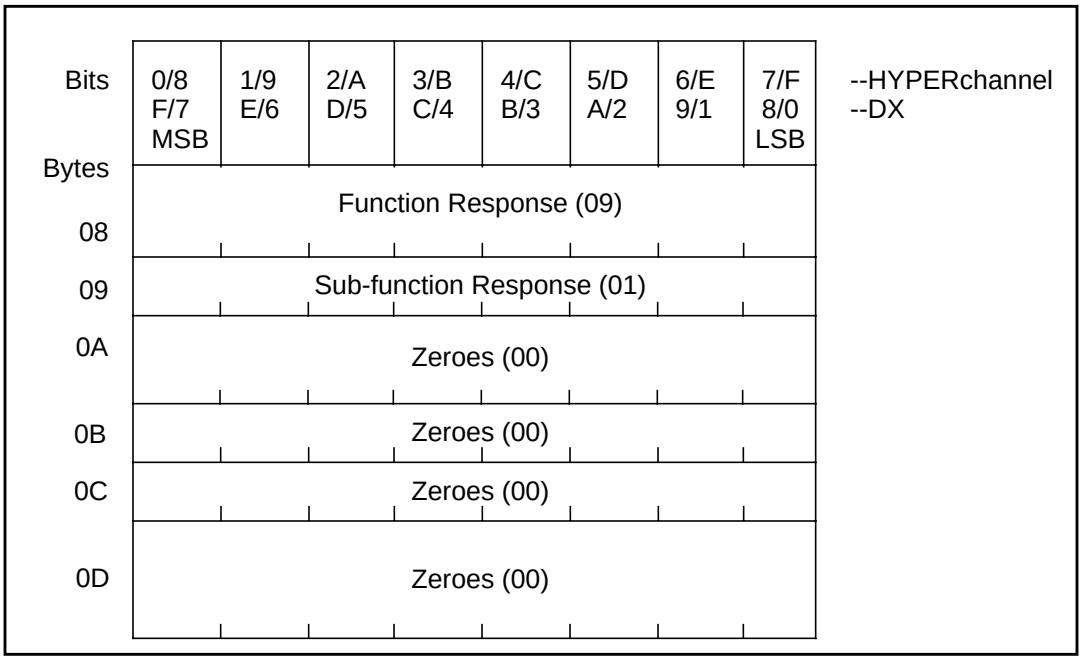


Figure 118. Remote Pass-Through Abort (01)

Local Link Transmit Port Unavailable (05)

The fault message shown in Figure 119 is generated whenever the local link has determined, or has been informed that, the remote link has been removed from normal link operations, resulting in the premature termination of the indicated operation.

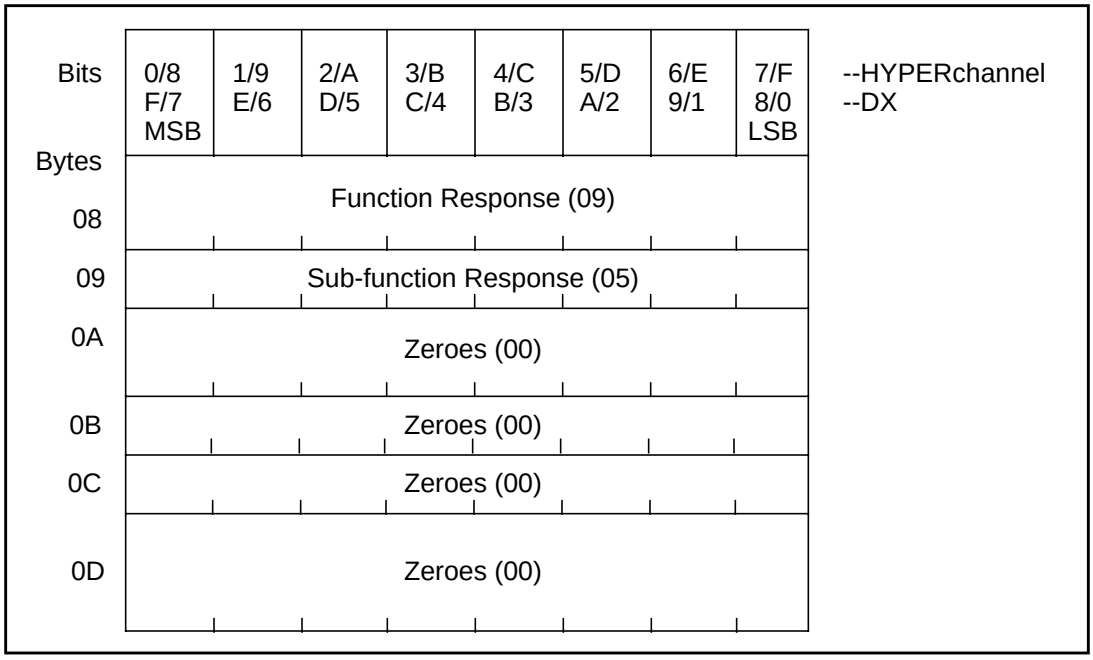


Figure 119. Local Link Transmit Port Unavailable (05)

Local Link Exceeded Retries (07)

The fault message in Figure 120 on page 124 is generated if the local link has fails to successfully transmit a message or data frame to the remote link within the allotted Retry Count value. The retry count is set to five.

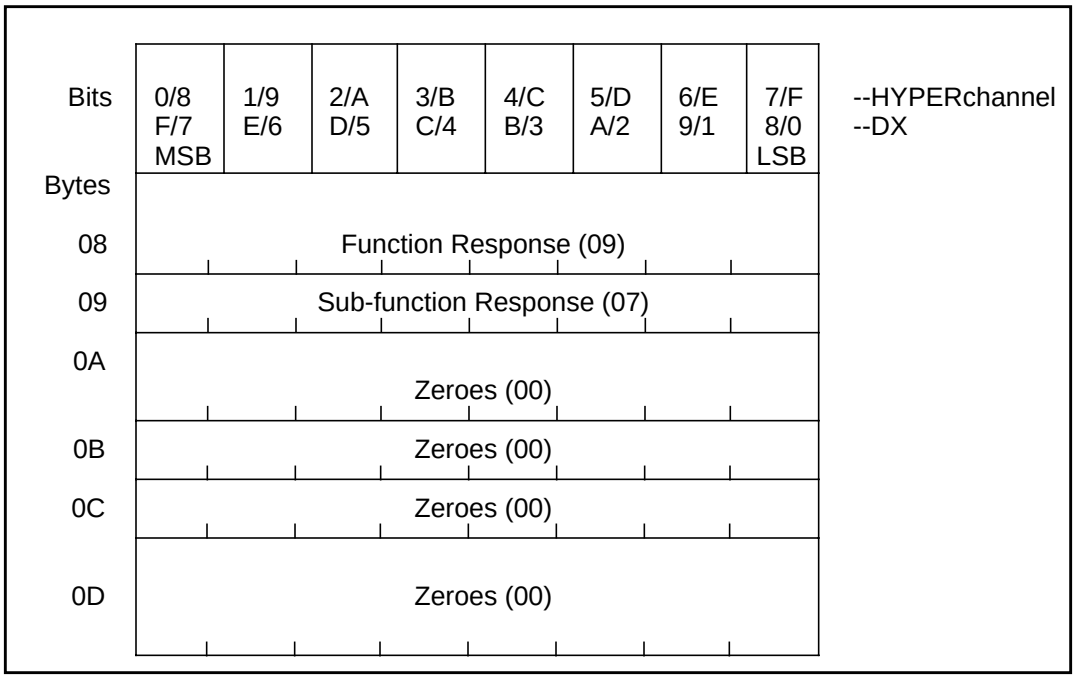


Figure 120. Local Link Exceeded Retries (07)

Remote Contention Fault (08)

The fault message shown in Figure 121 on page 125 is generated whenever the PB753 cancels a nucleus receive operation because of a higher priority link receive operation leaving insufficient data buffers for the nucleus operation to complete.

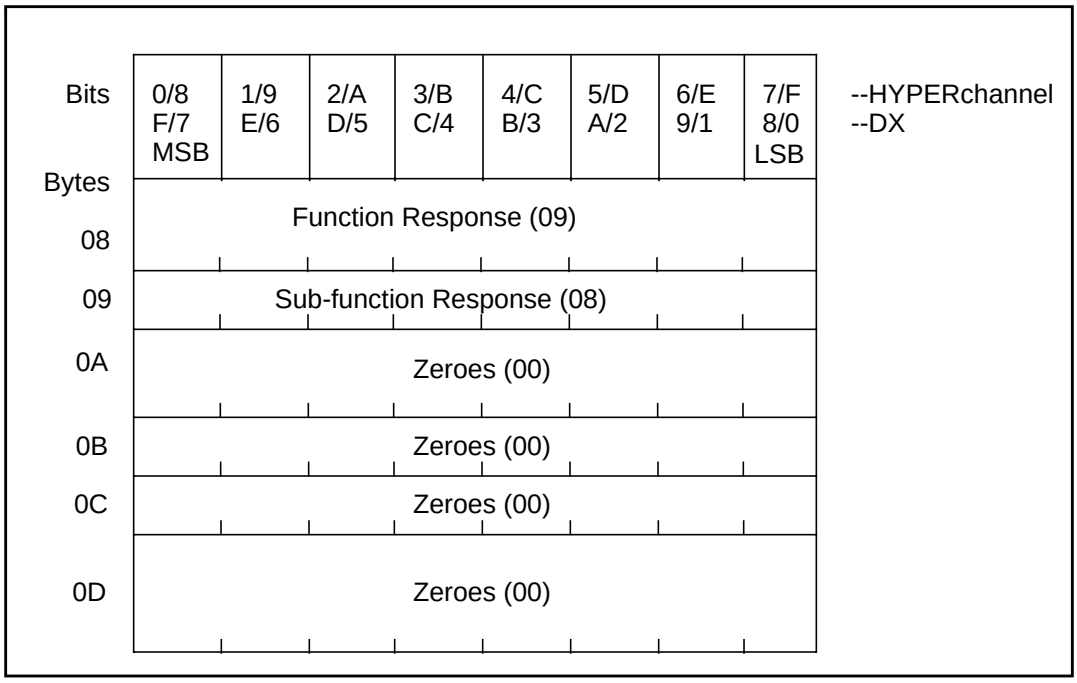


Figure 121. Remote Contention Fault (08)

Illegal Function Message

If an illegal or unsupported message is received, the PB753 firmware generates a Queue Element Reject (see Request Status=02 under Queue Element Function Code).

Appendix C. Console Event messages

The PB703 firmware maintains an internal trace of all major events.

Table 35 describes the trace event categories that can be displayed and references the tables that describe the messages in each category.

Table 35. Event Message Categories

Facility Code Range	Description	Abbreviation	Table Reference
0000-00FF	General Operational Events	Executive	Table 36 on page 128
0100-01FF	Console Task Events	Console	Table 37 on page 129
0200-02FF	Packet Switching Events	Packets	Table 38 on page 129
0300-03FF	Bridging Events	Bridge	Table 39 on page 129
0400-04FF	IP Host Processing Events	LocalIP	Table 40 on page 130
1000-10FF	Interface Management Events	Interface	Table 41 on page 131
1100-11FF	HYPERmedia Events	HYPERmedia	Table 42 on page 133

Table 36. Facility 0000-00FF (Executive) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
INIT_COMPLETE	0001	5	Initialization complete
EXEC_DOWNLOAD	0002	12	Download request completed, status = **trace value 1**
PARITY_ERROR	0003	15	Parity error
GO_TO	0004	2	Received a “GO”
ALLOC_RESP	0005	0	Received **trace value 1** and **trace value 2** pages of buffer memory
CALLOC_RESP	0006	1	Received **trace value 1** and **trace value 2** pages of contiguous buffer memory
RETURN_EXCESS	0007	2	Received a return excess memory request
UNSUPP_PFC	0008	7	Unsupported Primary Function Code (**trace value 1**) to **trace value 2** received from **trace value 3**
UNSUPP_SFC	0009	7	Unsupported Secondary Function Code (**trace value 1**) to **trace value 2** received from **trace value 3**
WATCHDOG	0010	0	Watchdog request received
INT_TIMEOUT	0011	15	Interrupt transmit hardware timeout
UNUSED_MSG2	0012	10	Unused
EEPROM_ERROR	0013	10	EEPROM write error: status = **trace value 1** address = **trace value 2** size = **trace value 3**
QUEUE_FULL	0014	4	Outbound queue full
QUEUE_RELIEF	0015	4	Outbound queue moving again
NULL_WE	0016	10	Null message received to **trace value 1** from **trace value 2**
UNKNOWN_MESSAGE	0017	8	Unknown HYPERchannel message type **trace value 1** received from **trace value 2**
PANIC	0018	15	BSD panic
TIMEOUT_FUNC	0019	0	Function timeout () called
NO_TABLES	0020	15	No memory for statistics tables
NO_INTRFC	0021	7	No interface for message sent to **trace value 1** from **trace value 2**
EXEC_TEST	0022	4	Test message, argument 1 = **trace value 1**, argument 2 = **trace value 2**, argument 3 = **trace value 3**
MAINT_NO_MEM	0023	8	No memory for maintenance message to coprocessor
TASK_ERROR	0024	5	**trace value 1**: reason = **trace value 2**
TASK_MSG	0025	5	**trace value 1**

Table 37. Facility 0100-01FF (Console) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
CONS_CCF	0100	13	Console creation failed, owner = **trace value 1** reason = **trace value 2**
CONS_CIF	0101	13	Console initialization failed, owner = **trace value 1** reason = **trace value 2**
CONS_STARTED	0102	7	Console started, owner = **trace value 1**
CONS_TERMINATED	0103	7	Console terminated, owner = **trace value 1**

Table 38. Facility 0200-02FF (Packet) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
NO_PIT	0200	7	Datagram dropped because no PIT routing tables
BAD_DL	0201	8	Bad DataList processed, datagram dropped

Table 39. Facility 0300-03FF (Bridge) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
BRIDGE_STARTED	0300	9	Bridge initialization complete
BRIDGE_STOPPED	0301	9	Bridge shutdown complete
BRIDGE_PORT_STATE	0302	7	Port **trace value 1** state set from **trace value 2** to **trace value 3**
BRIDGE_BECAME_ ROOT_PORT	0303	3	Port **trace value 1** became root port
BRIDGE_BECAME_ DESIGNATED_PORT	0304	3	Port **trace value 1** became designated port
BRIDGE_BECAME_ BLOCKING_PORT	0305	3	Port **trace value 1** set to blocking state
BRIDGE_REPLY_ SENT	0306	4	Port **trace value 1** sent reply config bpdu
BRIDGE_BECAME_ ROOT	0307	3	Bridge became root bridge
BRIDGE_CONFIG_ RECEIVED	0308	5	Port **trace value 1** received config bpdu
BRIDGE_TCN_ RECEIVED	0309	6	Port **trace value 1** received tcn bpdu
BRIDGE_CONFIG_ SENT	0310	5	Port **trace value 1** sent config bpdu
BRIDGE_TCN_SENT	0311	6	Port **trace value 1** sent tcn pbdu
BRIDGE_MESSAGE_ AGE_TIMER_EXPIRED	0312	7	Port **trace value 1** message age timer expired

Table 39. Facility 0300-03FF (Bridge) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
BRIDGE_TC_ DETECTED	0313	7	Topology change detected
BRIDGE_TC_ ACKNOWL-EDGED	0314	7	Topology change acknowledged
BRIDGE_TC_SET	0315	8	Topology change flag set from False to True
BRIDGE_TC_RESET	0316	8	Topology change flag set from True to False
BRIDGE_FTAB_ EXPIRED	0320	6	Dynamic entry expired, address=**trace value 1**
BRIDGE_SAVESTATE_ FAILED	0321	15	Save state failed, **trace value 1**, status = **trace value 2**
BRIDGE_SAVESTATE_ SUCCEEDED	0322	8	Save state complete
BRIDGE_IPC_ RECEIVED	0323	1	IPC message received, addr=**trace value 1**, fc= **trace value 2**, cmb= **trace value 3**
BRIDGE_IPC_SENT	0324	1	IPC message sent, addr=**trace value 1**, fc= **trace value 2**, cmb= **trace value 3**
BRIDGE_FTU_ RECEIVED	0325	2	ftab update received, type=**trace value 1**, addr= **trace value 2:ehp2, domain=trace value 3**
BRIDGE_FTU_SENT	0326	2	ftab update sent, type=**trace value 1**, addr= **trace value 2**, domain= **trace value 3**

Table 40. Ip Host Processing 0400-0420 (LocalIP) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
IP_FRAG_ABORT	0400	10	Fragment aborted, Src = **trace value 1**, Dst = **trace value 2**, Proto = **trace value 3**, reason = **trace value 4**
IP_PACKET_REJ_PROTO	0401	10	Packet rejected, bad proto, Pe = **trace value 1**, Src = **trace value 2**, Proto = **trace value 3**
IP_FRAG_REJ_FUNCT	0402	10	Fragment rejected, Pe = **trace value 1**, Src = **trace value 2**, Proto/Off = **trace value 3**
IP_NO_HDR_SPACE	0403	10	Bad PE, no space for IP Hdr, Pe = **trace value 1**, Src = **trace value 2**, Proto = **trace value 3**
IP_FRAG_REJ_FULL	0404	10	Fragment rejected, Queue full, Src = **trace value 1**, Dst = **trace value 2**, Proto = **trace value 3**
IP_FRAG_REJ_NOMEN	0405	10	Fragment rejected, No memory, Src = **trace value 1**, **Dst = trace value 2**, Proto = **trace value 3**
IP_REC_PACKET	0406	4	Received packet, Pe = **trace value 1**, Src = **trace value 2**, Proto = **trace value 3**
IP_REC_FRAG	0407	4	Received fragment, Pe = **trace value 1**, Src = **trace value 2**, Proto/Off = **trace value 3**
IP_SENT_PACKET	0408	4	Sent packet, Pe = **trace value 1**, Dest = **trace value 2**, Proto = **trace value 3**

Table 40. Ip Host Processing 0400-0420 (LocalIP) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
IP_LENGTH_ERROR	0409	4	Packet length error, Pe = **trace value 1**, Data_len = **trace value 2**, IP_len = **trace value 3**
IP_ICMP_NO_HDR_SPACE	0480	10	ICMP, no header space, Pe = **trace value 1**, Dst = **trace value 2**, Id = **trace value 3**
IP_ICMP_BAD_CALL	0481	10	ICMP, Bad parameter, Proc = **trace value 1**, Id = **trace value 2**, Mask = **trace value 3**, Func = **trace value 4**
IP_ICMP_BAD_CALL_ID	0482	10	ICMP, Bad parameter, Proc = **trace value 1**, Id = **trace value 2**
IP_ICMP_DUP_REG_REQ	0483	10	ICMP, Register error, REQ in use, Id = **trace value 1**, Mask = **trace value 2**
IP_ICMP_DUP_REG_ID	0484	10	ICMP, Register error, ID in use, Id = **trace value 1**, Mask = **trace value 2**
IP_ICMP_REG_TABLE_FULL	0485	10	ICMP, Registration table full, Id = **trace value 1**
IP_ICMP_DEST_UNREACH	0490	6	ICMP, Destination **trace value 1** unreachable by **trace value 2**, Code = **trace value 3**
IP_ICMP_SRC_QUENCH	0491	6	ICMP, Source quench from **trace value 1**
IP_ICMP_REDIRECT	0492	6	ICMP, Redirect **trace value 1** to **trace value 2** from **trace value 3**, Code = **trace value 4**
IP_ICMP_ECHO_REQ	0493	6	ICMP, Echo request from **trace value 1**
IP_ICMP_TIME_EXCEED	0494	6	ICMP, Time exceeded from **trace value 1** for address **trace value 2**, Code = **trace value 3**
IP_ICMP_PARAM_PROB	0495	6	ICMP, Param prob detected by **trace value 1** in packet from **trace value 2**, Code = **trace value 3**
IP_ICMP_TIME_REQ	0496	6	ICMP, Time request from **trace value 1**
IP_ICMP_INFO_REQ	0497	6	ICMP, Information request from **trace value 1**
IP_ICMP_MASK_REQ	0498	6	ICMP, Address mask request from **trace value 1**
IP_ICMP_RECV	0499	4	ICMP, Receiving from **trace value 1**, Type = **trace value 2**, Code = **trace value 3**, Param = **trace value 4**
IP_ICMP_SEND	049A	4	ICMP, Sending to **trace value 1**, Type = **trace value 2**, Code = **trace value 3**, Param = **trace value 4**

Table 41. Facility 1000-10FF (Interface) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
IM_ON	1000	8	Interface **trace value 1** is on
IM_DISCONNECTED	1001	8	Disconnected circuit **trace value 1**
IM_OFF	1002	8	Interface **trace value 1** is off

Table 41. Facility 1000-10FF (Interface) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
IM_TEST_IF	1003	8	Test if **trace value 1**, pkts sent **trace value 2**, seq errs **trace value 3**, data errs **trace value 4**, **trace value 5**, pkts lost **trace value 6**, blk size **trace value 7**
IM _ENABLE	1004	6	Enabled interface **trace value 1**
IM_DISABLE	1005	6	Disabled interface **trace value 1**
IM_LOOPBACK	1006	8	Interface **trace value 1** is externally looped back
IM_QUERY_IF	1007	4	Query_if **trace value 1** roundtrip **trace value 2** usecs, rem_GNA **trace value 3**, rem_P1_bfrsz **trace value 4**, **trace value 5** lost_xmits **trace value 6**, loc_xmits **trace value 7**lost_recvs **trace value 8** rem_xmits **trace value 9**
IM_NO_RESPONSE	1008	8	Interface **trace value 1** is not responding to startup
IM_TEST_ERRSEQ	1009	8	Test_if **trace value 1** expected seq **trace value 2**, received seq **trace value 3** **trace value 4** frame buffer address **trace value 5**
IM_TEST_ERRWORD	1010	8	Test_if **trace value 1** expected word **trace value 2**, received word **trace value 3** **trace value 4** frame buffer address **trace value 5**, data offset **trace value 6**
IM_TEST_ERRBYTE	1011	8	Test_if **trace value 1** expected byte **trace value 2**, received byte **trace value 3** **trace value 4** frame buffer address **trace value 5**, data offset **trace value 6**
IM_TESTE_ERRLEN	1012	8	Test_if **trace value 1** expected length **trace value 2**, received length **trace value 3** **trace value 4** frame buffer address **trace value 5**
IM_TEST_NO_RESP	1013	8	Test_if **trace value 1** is not receiving test frames. Testing stopped.
IM_WRONG_IP_ ADDRESS	1014	10	Interface **trace value 1** remote IP address does not match IP Coprocessor configuration. expected = **trace value 2** received = **trace value 3**
IM_BUFFER_SIZE_ MIS-MATCH	1015	12	Interface **trace value 1** remote data buffer size (**trace value 2**) does not match local size (**trace value 3**)
IM_DESTINATION_ MIS-MATCH	1016	12	Interface **trace value 1** profiled dest GNA (**trace value 2**) doesn't match remote GNA (**trace value 3**)
IM_SOURCE_ MISMATCH	1017	12	Interface **trace value 1** remote dest GNA (**trace value 2**) does not match our GNA (**trace value 3**)
IM_CIRCUIT_ GROUP_MISMATCH	1018	12	Interface **trace value 1** is not attached to the same destination as interface **trace value 2**
IM_NO_FRAMES_ RECEIVED	1019	8	Interface **trace value 1** has not received any frames for one second, marked off-line
IM_GOOD_QUALITY	1020	8	Interface **trace value 1** line quality is above threshold
IM_BAD_QUALITY	1021	8	Interface **trace value 1** line quality is below threshold
IM_TRACE	1022	15	**trace value 1**

Table 42. Facility 1100-11FF (HYPERmedia) Event Entries

Event Name	Msg No.	Severity	Definition and Traced Values
HYPER_INIT_HYPER	1100	4	HYPERmedia circuit **trace value 1** initialized
HYPER_UP_HYPER	1101	8	HYPERmedia circuit **trace value 1** up
HYPER_DOWN_ HYPER	1102	8	HYPERmedia circuit **trace value 1** down
HYPER_FANIC	1103	6	HYPERmedia fatal error **trace value 1** occurrences **trace value 2**
HYPER_WANIC	1104	4	HYPERmedia warning **trace value 1** occurrences **trace value 2**
HYPER_LOCAL_ FAULT	1105	4	HYPERmedia circuit **trace value 1** local fault mesg., error = **trace value 2**, mesg type = **trace value 3**
HYPER_REMOTE_ FAULT	1106	4	HYPERmedia circuit **trace value 1** remote fault mesg., mesg type = **trace value 2**, gna = **trace value 3**
HYPER_ HYPERMEDIA_MSG	1107	0	HYPERmedia circuit **trace value 1** P1 mesg, id = **trace value 2**
HYPER_FRAME_IN	1108	0	HYPERmedia circuit **trace value 1** frame in, type = **trace value 2**, id = **trace value 3**, length = **trace value 4**
HYPER_CLOSE_RECV	1109	4	HYPERmedia circuit **trace value 1** close recv table, id = **trace value 2**, status = **trace value 3**
HYPER_CLOSE_XMIT	1110	4	HYPERmedia circuit **trace value** close xmit table, id = **trace value 2**

Appendix D. Interface Testing

The interface testing capabilities of the PB703 are used to validate new link installations, isolate “hard” errors to a specific line segment, and isolate intermittent errors. The tests should run error free using various data patterns and block sizes from either side of the link.

Test Interface(s) Command Usage

New Installations

The Test Interface command described under should be run on both the local and remote PB703 during installation to ensure proper duplex mode operation. Set the local and remote PB703 lines to the “on” interface state and execute the Test Interface(s) command using a repeat count large enough to adequately test the line. The Test Interface command causes a response message to be returned to the circuit that originated the command.

If the Test Interface command completes normally, use the Set Interface and Save commands to configure the line according to customer requirements.

Problem Isolation Using Test Command

If the problem appears to be on the link, attempt to isolate each segment. The ability to test each segment is a function of the design and test capability of the DSUs and communications equipment. DSUs typically employ one or more of three standard loopback techniques as shown in Figure 122 on page 136.

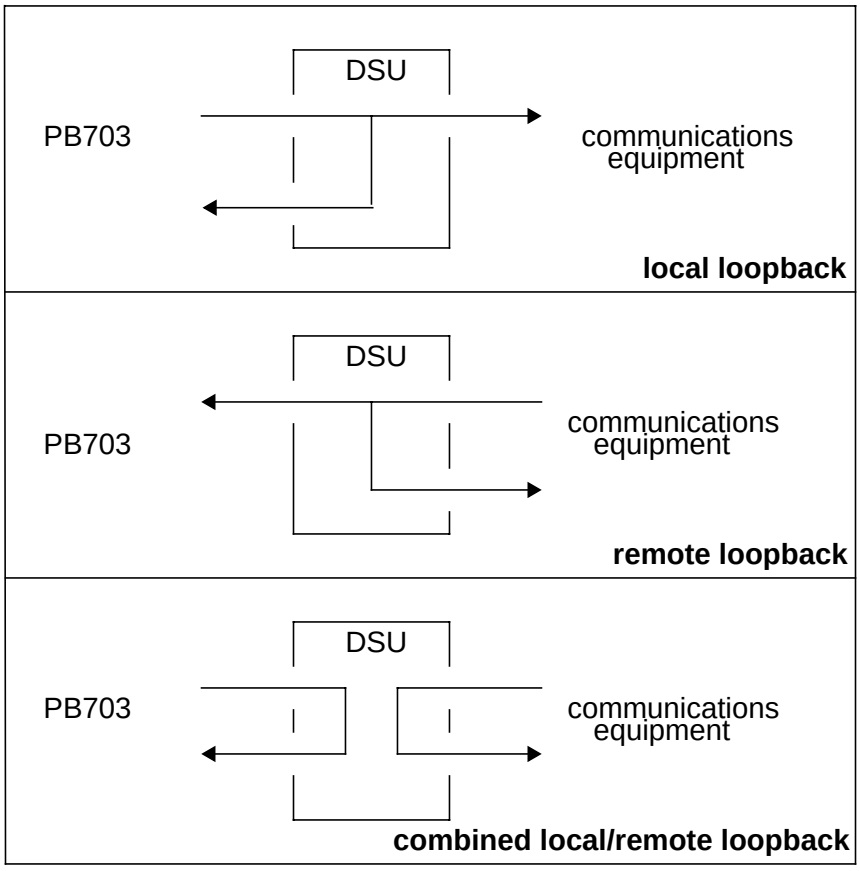


Figure 122. Loopback Techniques

NOTE: Network Systems DSUs use combined local/remote loopback

You must determine the method of loopback testing that can be performed on the DSUs installed on site.

To isolate the DSUs, place each DSU in “local loopback” mode, place the PB703/ line in the “test” interface state, and execute the Test Interface command.

If this testing is successful but the problem is not resolved, place the DSUs in “remote loopback” mode and transmit test data between the communications equipment and each DSU.

When testing is concluded and the problem resolved, re-profile each line for normal operation.

Wrap Command Usage

The nucleus monitor Wrap command can be used to send loopback messages to the nucleus on a remote DX unit as shown in Figure 123 on page 137 as a means of network path verification. The Wrap (W) command is described in the DX Nucleus Reference Manual (460456).

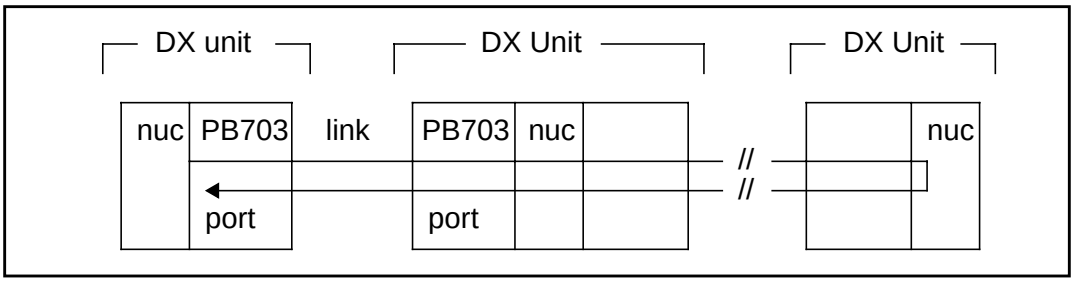


Figure 123. Wrap Testing

Ping Command Usage

The Ping Command executed in the local DX Router Coprocessor or host can be used to send loopback messages to the DX Router Coprocessor on a remote DX unit, or to a remote host as a means of network path verification. Refer to Figure 124. The Ping command is described in the Routing for 64xx and 68xx Series and Other DX Routers Installation and Reference Manual (460390).

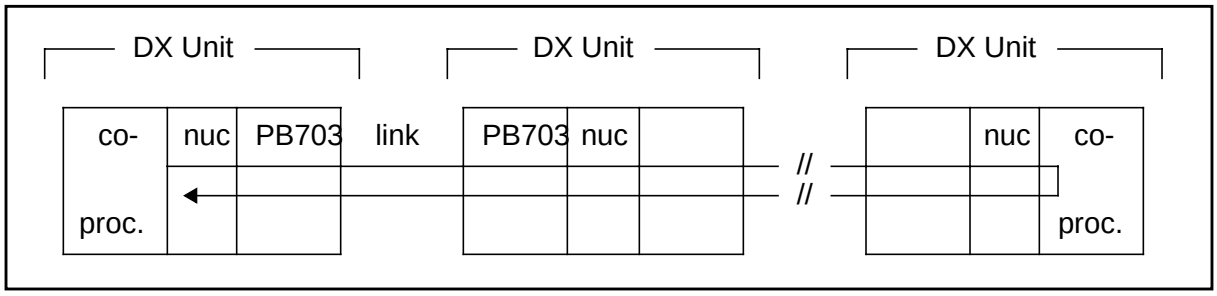


Figure 124. Ping Testing

Unique PB703 Completion Messages

The PB703 stores several unique (non-zero) status error codes in the completion status field of Work Element 0200 network messages. These codes are described in Table 43 on page 138. The WE completion status field is described under “Work Element” in the DX Nucleus Reference Manual (460456).

Table 43. Unique PB703 Completion Messages

Message	Description
04010050	No buffer resource available to process maintenance message
04010051	Remote abort error
04010052	Remote AC730 currently busy
04010054	Link reset from remote link interface occurred
04010055	Link interface not in service
04010056	Attempt too large data transmit
04010057	Link retransmits count exceeded
04010058	Local transmit congestion

Glossary

Appletalk: A network layer routing protocol. This protocol was defined by Apple Computer Corporation to permit communication between MacIntosh computers and associated peripheral products. Appletalk can run over Apple proprietary media, or on Ethernet, FDDI, communications links, or HYPERchannel media.

BCF: Abbreviation for Bridge Control Facility. This facility allows the user to define and apply filters as a means of controlling how bridges forward network packets.

broadcast: The process of sending one or more messages to all addresses on all connected networks.

DCE: Data Communications Equipment. The Data Service Unit (DSU) attached to the PB701/NB701 functions as a DCE.

DECnet: Digital Equipment Corporation's proprietary network protocol.

DSU: Data Service Unit. Provides Data Terminal Equipment (DTE) with access to a digital communications facility.

DTE: Data Terminal Equipment. The PB701/NB701 functions as a DTE.

EEPROM: Electronically Erasable Programmable Read Only Memory (EEPROM). This type of memory may be programmed, electrically erased, and reprogrammed several times.

Ethernet: A network media scheme invented by Xerox and codified as IEEE 802.3.

Ethernet address: A 48-bit address composed of an assigned six-octet manufacturers code and a unique number (such as a serial number) provided by the vendor.

filter: A subroutine for discriminating among packets. Filters are used to decrease traffic or improve security over network interfaces.

Frame Relay: A multi-point connectivity service which operates over conventional point-to-point links.

internet: A "super network" of two or more networks. Usually these networks employ different governing protocols or are administratively or physically separated.

IP: Abbreviation for Internet Protocol. A protocol suite operating within the Internet as defined by the *Request For Comments (RFCs)*. This may also be used to refer to the network layer (level 3) of the ISO model. Level 3 is the layer used to route datagrams between networks.

IPX: Abbreviation for Internetwork Packet Exchange, a proprietary network protocol developed for Novell's NetWare.

ISO: Abbreviation for International Standards Organization

MAC: Abbreviation for Media Access Control. This is a 48-bit address that is unique to a set of vendor supplied control chips. The address is derived from the manufacturers ID and the serial number of the chip set.

Modem: Modulator/Demodulator. The term "modem" may be used within the context of this manual to be equivalent to "DSU".

MRU: Abbreviation for Maximum Receive Unit. This is the largest packet (in bytes) that a bridge, router, or interface can receive.

MTU: Abbreviation for Maximum Transmission Unit. This is the largest packet (in bytes) that a bridge, router, or interface can transmit.

PCF: Abbreviation for Packet Control Facility. This feature allows the user to define and apply filters for IP packets. It is used to determine which packets will be forwarded.

PING: An IP network protocol feature that allows a node to check its ability to communicate with another node. The “Find” and “Echo” features on other protocols perform a similar function.

SMDS: Abbreviation for Switched Multimegabit Data Service. This is a set of standards developed by Bellcore for communication over telephone lines.

SNMP: Abbreviation for Simple Network Management Protocol. This is a network management protocol for TCP/IP networks as defined by RFC1157 and RFC1213.

XNS: Abbreviation for Xerox Network System. A proprietary protocol for distributing network resources.

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T

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