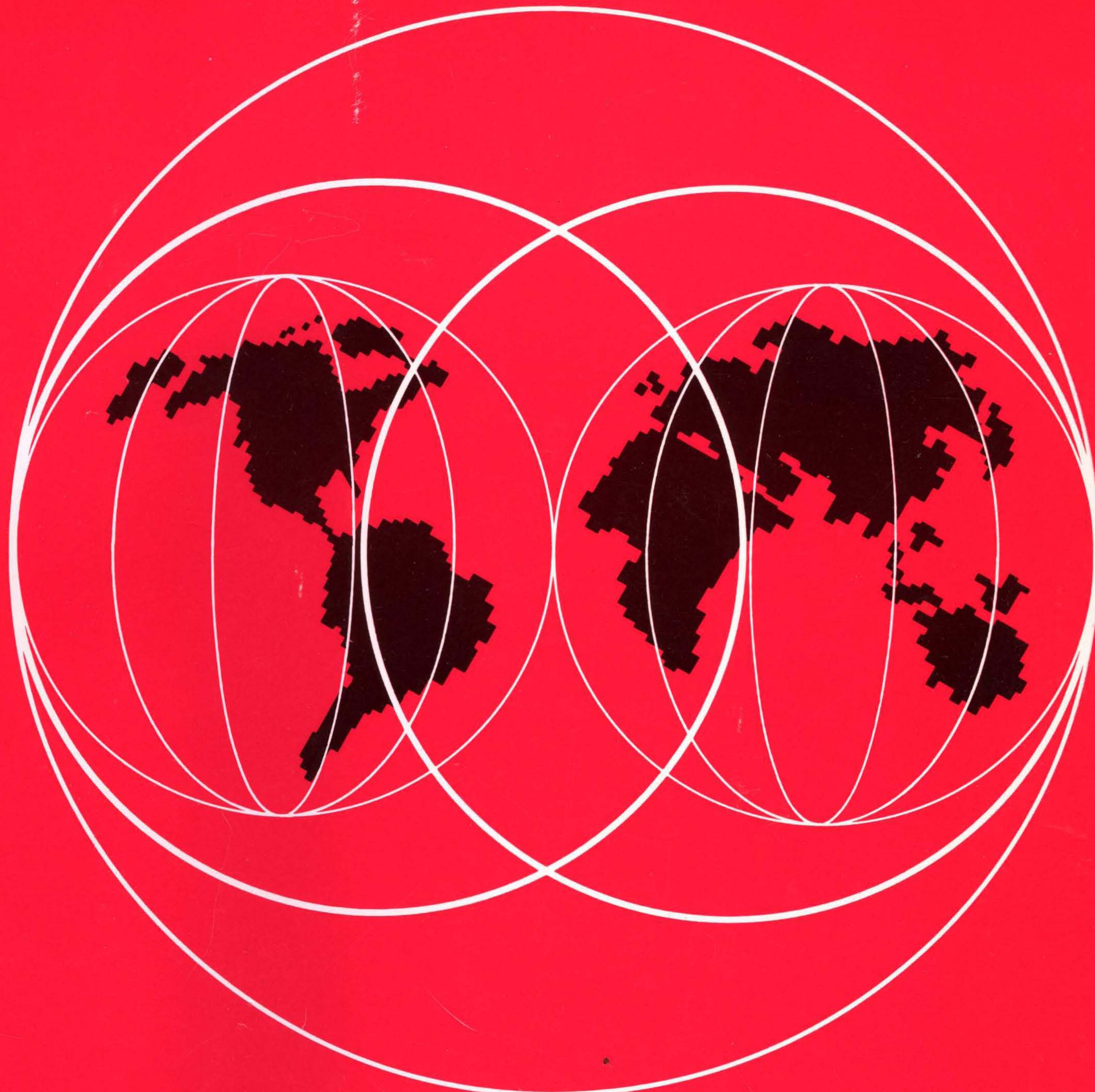

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Abstract

This document is an installation guide for use by IBM systems engineers and customer personnel who are installing an IBM 3745 Communication Controller Models 210 and 410. It is intended to be a technical reference on planning, installation, customization and testing of an IBM 3745 and related software products. It does not replace standard IBM publications, but should be used in conjunction with them.

This edition applies to the IBM 3745 Communication Controller at Engineering Change EC A47013.

The information contained in this document is based on installation experience at the International Technical Support Center - Raleigh, and various IBM publications on the IBM 3745 Communication Controller Models 210 and 410.

CSYS (228 pages)

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Preface

This Technical Bulletin is intended to provide IBM Systems Engineers and Customer Personnel with general information on the IBM 3745 Communication Controller Models 210 and 410, and related software products.

In addition to the general descriptions of the 3745 Communication Controller and the early information based on the installation experience of the 3745 Model 210 and Model 410, which were provided in the first and second edition of this document, this document provides the information based on the experience of the 3745 Release 1.1 and associated software products. The descriptions that have been added or corrected are marked with a bar '|' in the left hand margin.

The document is structured to provide the following chapters:

- *Chapter 1 - Introduction*
- *Chapter 2 - Hardware*
- *Chapter 3 - Software*
- *Chapter 4 - Configuration*
- *Chapter 5 - Physical Planning*
- *Chapter 6 - Migration*
- *Chapter 7 - Operation*
- *Chapter 8 - Twin CCU Considerations*
- *Chapter 9 - Performance Considerations*
- *Chapter 10 - LIC5/6 Configuration and Operation*

The Appendixes are structured as follows:

- *Appendix A - NCP Definition Samples*
- *Appendix B - NCP Generation and Dump Utility JCL*
- *Appendix C - VTAM definitions for NTRI*
- *Appendix D - NCP Load/Dump Considerations*
- *Appendix E - Console Attachments*
- *Appendix F - Bibliography*
- *Appendix G - Abbreviations*
- *Appendix H - Glossary*

Chapter 10 has been newly added. Some corrections and additions have been made in the existing chapters. Also, a sample NCP definition has changed from NCP V5R1 to NCP V5R2.1.

Refer to the bibliography for a list of related publications.

Contents

Figures

1. Introduction

1.1 Overview

The IBM 3745 Communication Controller is the latest in a series of IBM Communication Controllers. It has been designed to meet customer requirements and data communication networking needs into the 1990's.

The IBM 3745 is an evolutionary product derived from the IBM 3725 and 3720 Communication Controllers. By capitalizing on new advanced technology and architecture, the 3745 offers many enhanced and new features. These features contribute to higher availability, higher performance, increased connectivity and improved usability, while preserving coexistence and migration capabilities with existing IBM 3725, 3720, and 3705 Communication Controllers. The 3745 offers price and functional advantages compared to a 3725, especially when a medium to high capacity communication controller is required.

The availability of the IBM 3745 is further improved through highly reliable technology, concurrent maintenance capability, LIC (Line Interface Coupler) "hot" pluggability, automatic scanner re-IML function, two Central Control Units (Twin-CCU) with automatic backup, distributed data buses, and multiple power supplies. The improved maintenance efficiency such as Remote Support Facility and customer access to the 3745 also improves the availability of the 3745.

The IBM 3745 offers significant performance improvements over the 3725. The processing power of the CCU is twice that of the 3725. A cache has been designed in the CCU to improve processing performance. The channel adapters support data streaming, allowing the 3745 to transfer data to channel attached hosts faster than the 3725. Direct Memory Access (DMA) allows the 3745 to transfer data between main storage and high-speed lines attached to High-Speed Scanners with minimum use of CCU cycles. The communication scanner processors are also enhanced to provide improved performance as well as flexibility.

The IBM 3745, in conjunction with the IBM 3746 Expansion Units, offers modular growth for high capacity in terms of line and host connectivity. The IBM 3745 provides more than three times the IBM 3725's capacity, allowing up to 896 low- and medium-speed line attachments, 16 high-speed line attachments (eight lines being active at a time; one per High-Speed Scanner), eight IBM Token-Ring attachments and 16 host channel attachments (8 owning hosts).

Enhanced Maintenance and Operator Subsystem (MOSS) functions provide improved tools for error detection and failure isolation. Unattended operation capability via new operating procedures, such as remote console, scheduled power-on, and automatic CCU switching in case of failure, improves the usability of the 3745. In addition, high configuration flexibility is provided through multiple line configurations on the same scanner, channel adapter control, full control of internal clocks, and customer access areas. The 3745 Release 1.1 provides new types of LIC, which includes two integrated modems or one integrated DSU (Data Service Unit) in addition to the ordinary line interface functions. The new LICs simplify line attachment, saving modem/DSU space and allowing easier customer access.

1.2 IBM 3745 Characteristics

The IBM 3745 has been designed to offer high availability, high performance and a number of functional advantages. The major characteristics focused on the advantages over the 3725 are described in this section.

1.2.1 High Availability

The 3745 offers increased availability to maximize network reliability, minimize network disruption, provide faster resolution of problems, and reduce diagnosis, repair and recovery time. The major characteristics contributing to high availability are as follows:

- The 3745 incorporates "State of the Art" technology proven for its reliability in other IBM products. The Thermal Conduction Module (TCM) is adopted to the 3745 CCU from the IBM 309X and 9370 technology. VLSI significantly reduces the number of cards per functional component. IBM's one megabit storage chip is also utilized.
- One or two Central Control Units (CCUs) can be configured. The twin CCU configuration provides high configuration flexibility for enhanced backup and recovery. Channel and line adapters are switchable from one CCU to the other. The twin CCU configuration allows three modes of operation:
  - In Twin-in-Dual mode, each CCU can have its own control program load module and is active independently with a different subarea , or
  - In Twin-in-Backup mode, each CCU can be active independently with its own control program load module, but either one can be used as a backup in case the other one fails, or
  - In Twin-in-Standby mode, one CCU is active, while the other CCU is in standby in case the active one fails.
- The 3745 disk allows storage of up to two control program load modules and one module dump per CCU. This facility allows for fast IPL (Initial Program Loading) either in normal or backup operations. In addition, a module dump can be automatically saved on the disk before the automatic reload sequence begins.
- Most components and subsystems can be diagnosed and repaired while the 3745 continues to run in a partially degraded mode. Distributed power supplies at subsystem level and power subsystem control allow concurrent maintenance to be performed on all 3745 adapters.
- Automatic scanner re-IML facility further improves the availability of the communication scanner as compared with the 3725. In case of scanner failure, MOSS takes a dump of the scanner memory and IMLs (Initial Microcode Loading) this scanner without operator intervention, and then notifies the appropriate host.
- LIC 'hot' pluggability allows the addition, removal, or replacement of a LIC or a line attachment feature while the 3745 is operational.
- The Remote Support Facility (RSF) is connected to the IBM RETAIN network, and provides faster resolution of problems in many cases.

1.2.2 Connectivity

The IBM 3745 offers new connectivity dimensions, as follows:

- A maximum of 16 Channel Adapters (CAs) or a combination of CAs equipped with a Two-Processor Switch (TPS) provides direct attachment to hosts.
- A maximum of 869 lines can be attached at line speeds of up to 256 Kbps either in duplex or half duplex mode using LIC 1, 3 and 4. As for the new LIC types - LIC 5 and 6, a maximum of 416 lines can be attached at line speeds of up to 56 Kbps.
- A maximum of 16 lines can be physically attached at line speeds of up to 1.536 megabits per second in the US, Canada and Japan, and up to 2.048 megabits per second in other countries. Maximum speed for direct attachment between a 3745 and another communication controller is 1.8 megabits per second.

  Note: Only one high speed line per High-Speed Scanner can be active at a time for a total of eight lines.
- A maximum of eight IBM Token-Ring networks can be attached operating at 4 Mbps or 16 Mbps.

1.2.3 High Performance

In comparison with the IBM 3725, the IBM 3745 provides significant performance improvements. The approximate performance ratio of the 3745 Model 210 to the 3725 is 1.6 to 4 times.

The actual value of the performance ratio is dependent upon line speed, protocols, message lengths, traffic characteristics, and other environmental factors.

- Assuming 9,600 bps full-duplex multipoint SDLC lines with interactive traffic (40 character-input and 1,000 character-output per message), the 3745 Model 210 can support a number of lines equivalent to about 1.6 times the 3725.
- Assuming 56 Kbps full-duplex point-to-point SDLC lines with batch traffic (2,000 character-input/output) to host, the 3745 Model 210 can support a number of lines equivalent to about 2.4 times the 3725.
- Assuming 256 Kbps full-duplex point-to-point SDLC lines with batch traffic (2,000 character-input/output) between NCP nodes, the 3745 Model 210 can support a number of lines equivalent to about 4 times the 3725.
- In the area of high-speed line attachments, the performance improvements can be even greater. Assuming high-speed full-duplex point-to-point SDLC lines with batch traffic (8,000 character-input/output) between NCP nodes, the 3745 Model 210 can process up to 6 times the data traffic of the 3725.

The IBM 3745 Model 410 offers twice the processing power of the Model 210, when working in Twin-in-Dual or Twin-in-Backup mode.

The major contributors to the improved performance are:

- CCU in TCM technology
- 4 or 8 megabytes of main storage per CCU using IBM one megabit storage chip technology
- 16K bytes Cache storage per CCU for fast access

- Two Input/Output Control (IOC) buses and one Direct Memory Access (DMA) bus per bus group for increased throughput
- Microprocessor based channel adapters with data streaming option for reduced channel occupancy
- Selective scanning for improved scanning efficiency
- Use of line weights instead of LIC weights for more efficient use of scanner capacity
- High Speed Scanner with DMA for attachment of high speed lines (T1 and CEPT).

1.2.4 High Configuration Flexibility

One of the remarkable design aspects of the 3745 is the high configuration flexibility of its various components.

- The Selective scanning function ignores LICs that have no lines activated, except for LIC Type 4. As a result, LICs installed on a scanner can far exceed the maximum capacity of this scanner as long as the scanner weight of the active lines does not exceed the capacity.
- Single port LICs such as LIC 3 and LIC 4B can be placed anywhere in the sequence of LICs on a scanner.
- There are two new types of LIC (LIC 5 and LIC 6) which integrate the standard LIC function and the modem or DSU/CSU function into a single coupler. These new LICs are connected directly to non-switched lines. This unique integrating packaging alternative offers opportunity for lower cost, space saving and easier installation.
- Clock values for all types of attachments which require internal clocking, such as asynchronous lines or direct attached terminals, can be specified via the control program (NCP).
- Native and emulation subchannel addresses and channel characteristics are set at the 3745 console.

1.2.5 High Usability

MOSS user functions have been enhanced to provide higher usability either for normal operations or problem determination. The 3745 supports IBM's Communication Network Management (CNM) direction, providing a comprehensive systems approach to network management.

- New operating procedures improve the unattended operation capability.
  - A user-provided control terminal may be used as a remote console to manage a single or multiple 3745s by attaching it to each 3745 via a modem and a switched communication line.
  - Remote power on/off capability allows a remote power on/off sequence for a modem and other equipment attached to the 3745, concurrently with the 3745 itself.
  - Scheduled power-on capability allows definition on a weekly basis power-on times for each day of the week.
- MOSS logs automatically any new Box Event Records (BER) into the BER file stored on the 3745 disk. Records related events and failures are filed. In addition, MOSS analyzes automatically the BERs and provides a reference code

to help identify failing hardware and software components or the environment of a more complex problem.

- Two problem determination mechanisms, Alert and Alarm, are provided to make problem determination easier.
  - In conjunction with NetView, generic alert messages, containing the reference code and a general description of the failure, are displayed on a NetView terminal.
  - Alarm messages are displayed on the 3745 console, providing a method for the 3745 problem determination.

1.3 Machine Organization

The IBM 3745 Communication Controller consists of one Base Frame, up to five optional Expansion Frames, one local console and one optional alternate or remote console.

The 3745 is the Base Frame of the 3745 Communication Controller Model 210 and Model 410. The 3746 is the optional Expansion Frame which provides the 3745 Communication Controller with additional Channel Adapters (CAs), Line Adapters (LAs) and LIC Units (LIUs). The 3746 is offered in five models, Model A11, Model A12, Model L13, Model L14 and Model L15.

3746-L15 Line Frame	3746-L14 Line Frame	3746-L13 Line Frame	3745 - 210/410 Base Frame		3746-A11 Adapter Frame	3746-A12 Adapter Frame
4 LIUs	4 LIUs	4 LIUs	MOSS	8 LAs	16 LAs	8 LAs
				(for LSS or HSS or TRA)	(for LSS)	(for LSS)
			CCU(s)	8 CAs	8 CAs	
				2 LIUs		
Power	Power	Power	Prime Power	Power	Power	Power

Figure 1. 3745 Machine Organization

1.3.1 IBM 3745 Communication Controller Model 210

The 3745 Model 210 contains four functional areas:

- Control Subsystem

  The Control Subsystem contains a single CCU with the associated main storage (4 or 8 megabytes) and Cache (16K bytes). The first Channel Adapter Board contains up to 8 Channel Adapters (CAs) or up to four CAs with a Two-Processor Switch (TPS) or a combination of CAs and CAs with a TPS.

- Communication Subsystem

  The Communication Subsystem contains up to 8 Line Adapters. The Line Adapter may be a Low-Speed Scanner (LSS) for the Transmission Subsystem (TSS), a High-Speed Scanner (HSS) for the High Performance Transmission Subsystem (HPTSS), or a Token-Ring Adapter (TRA) for the Token-Ring Subsystem (TRSS). The number of Token-Ring Adapters is limited to four.

  There are two types of LIC Unit. LIC Unit Type 1 houses LIC Type 1, 3, 4A and 4B, while LIC Unit Type 2 houses LIC Type 5 and 6. The Base Frame provides up to two LIC Units. One comes with the basic configuration and must be LIC Unit Type 1, while the second one can be either LIC Unit Type 1

or Type 2. Each LIC unit can house up to 16 LICs. The maximum line attachment capacity of the base unit is 128 lines.

- Maintenance Operator Subsystem (MOSS)

  The MOSS is the service processor of the 3745. The MOSS contains the MOSS microprocessor with 1 megabyte storage, the diskette drive, the hard disk, the console adapter, the power control, and the control panel.

- Power Subsystem

  The power subsystem consists of the prime power and distributed power blocks. Each power block supplies power to a component or a group of components in the 3745 subsystems.

1.3.2 IBM 3745 Communication Controller Model 410

The 3745 Model 410 contains the same elements as the 3745 Model 210. The difference from the Model 210 is that the Model 410 houses two CCUs with the associated main storage (4 or 8 Mbytes) and Cache (16K bytes).

1.3.3 IBM 3746 Expansion Unit Model A11

The 3746 Model A11 provides up to eight additional channel adapters, or up to four additional channel adapters with a Two-Processor Switch, or a combination of CAs and CAs with a TPS. Also, it provides the second and third Line Adapter Boards with up to eight Low-Speed Scanners (LSSs) each.

1.3.4 IBM 3746 Expansion Unit Model A12

The 3746 Model A12 provides the fourth Line Adapter Board with up to eight Low-Speed Scanners (LSSs).

1.3.5 IBM 3746 Expansion Unit Model L13

The 3746 Model L13 provides up to four LIC Units (Type 1 or 2). Up to 16 LICs can be housed in each LIC unit. The maximum line attachment capacity of the 3746 Model L13 is 256 lines.

1.3.6 IBM 3746 Expansion Unit Model L14

The 3746 Model L14 provides up to four LIC Units (Type 1 or 2). Up to 16 LICs can be housed in each LIC unit. The maximum line attachment capacity of the 3746 Model L14 is 256 lines.

1.3.7 IBM 3746 Expansion Unit Model L15

The 3746 Model L15 provides up to four LIC Units (Type 1 or 2). Up to 16 LICs can be housed in each LIC unit. The maximum line attachment capacity of the 3746 Model L15 is 256 lines.

1.4 Mode of Operation

The most significant advantage of the IBM 3745 may be its operational flexibility.

Machine internal connectivity includes two I/O buses and one DMA bus per CCU. These buses interconnect the channel adapters and line adapters with the single CCU or the twin CCU. The bus switch mechanism switches these adapters from one CCU to the other by the control of MOSS. The bus switching procedure is performed automatically when MOSS detects a CCU failure. Switching can also be performed manually depending upon the mode of operation.

1.4.1 Single Mode

One CCU is installed. All channel adapters and line adapters are attached to CCU-A. There is no CCU backup capability. This operation mode is the same as the former IBM Communication Controllers. However the switch mechanism is included in the 210 model allowing a field upgrade to a Model 410.

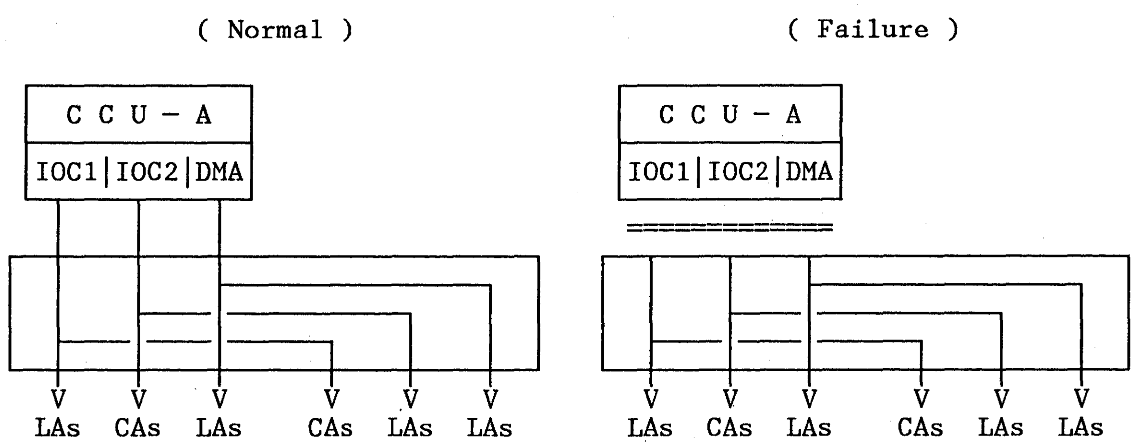


Figure 2. Single-CCU Operation Mode

1.4.2 Twin-in-Dual Mode

Two CCUs are installed. Half of the buses are attached to each CCU. Two different systems can be configured with at most eight channel adapters and 16 line adapters for each system.

Both CCUs are operational simultaneously with different subareas, and each CCU controls its own network.

If one CCU fails, there is no backup for it. The other CCU is not affected by the failed CCU. This operation mode is like having two separate 3745 Model 210 Communication Controllers.

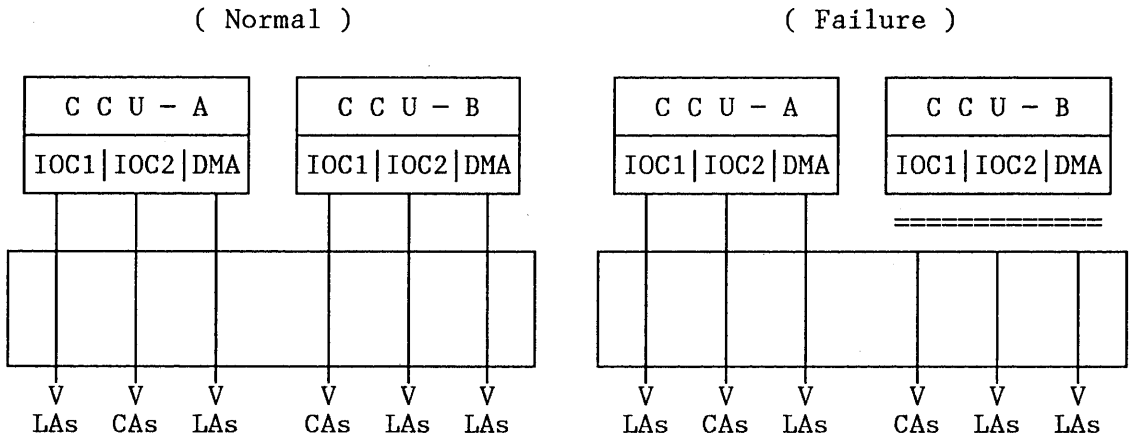


Figure 3. Twin-in-Dual Operation Mode

1.4.3 Twin-in-Backup Mode

Two CCUs are installed. Half of the buses, so at most eight channel adapters and 16 line adapters, are attached to each CCU.

Both CCUs are operational simultaneously with different subareas, each CCU controlling its own network. As long as both CCUs run in normal condition, there is no difference from the Twin-in-Dual mode.

This operation mode requires that each NCP or PEP be generated to be able to backup the other NCP or PEP. Backup may be partial or complete depending upon the network performance requirements.

If one CCU fails, all buses attached to the failed CCU are switched automatically to the other CCU by the MOSS through a fallback procedure, which does not affect sessions on the active CCU. Then, the host operator reactivates selected resources and re-establishes sessions. When the failed CCU is repaired, the host operator may inactivate the backup resources at a convenient time. By switchback at a MOSS console, it is possible to set up the previous network configuration.

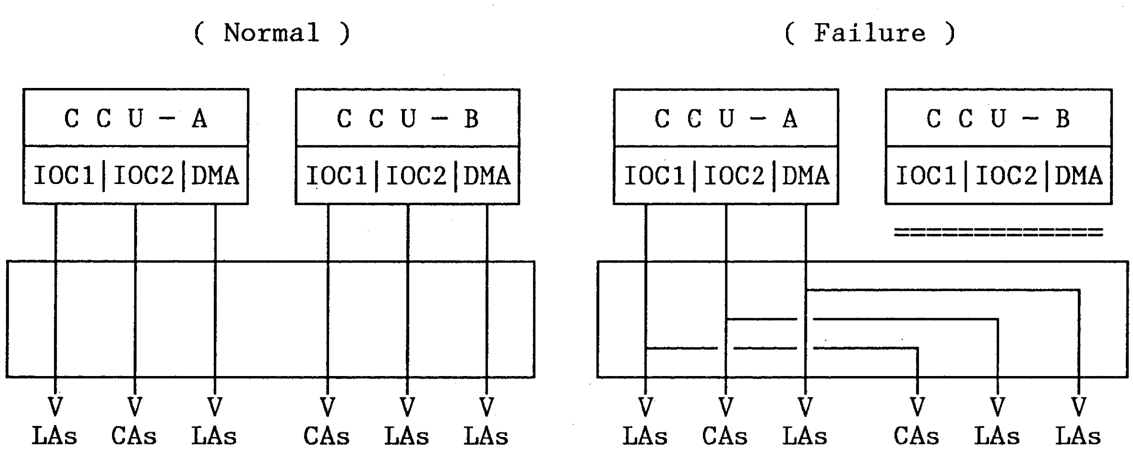


Figure 4. Twin-in-Backup Operation Mode

1.4.4 Twin-in-Standby Mode

Two CCUs are installed. However, only one CCU is active; the other CCU is in standby mode. All of the buses, all channel adapters and line adapters, are attached to the active CCU. The other CCU is powered on, and may or may not have the NCP or PEP module preloaded depending on whether the Hot-Standby is conditioned or not. In case of regular standby, the standby CCU is IPLed and loaded with an NCP or PEP load module right after fallback. The Hot-Standby is supported by the 3745 Release 1.1 in conjunction with NCP V5R2.1.

If the active CCU fails, the MOSS detects it and performs a fallback procedure. All the adapters are switched automatically to the standby CCU. If the standby CCU is already IPLed and loaded and the dump file is empty, Hot-Standby occurs. That is, the standby CCU becomes active immediately after fallback. Otherwise, the MOSS starts IPL procedures and loads the NCP or PEP from the disk or the host. After the standby CCU comes active, VTAM recontacts the NCP or PEP and resources are re-activated without operator intervention. Users or a host operator can then re-establish LU-LU sessions. The failed CCU can go to standby mode after being repaired.

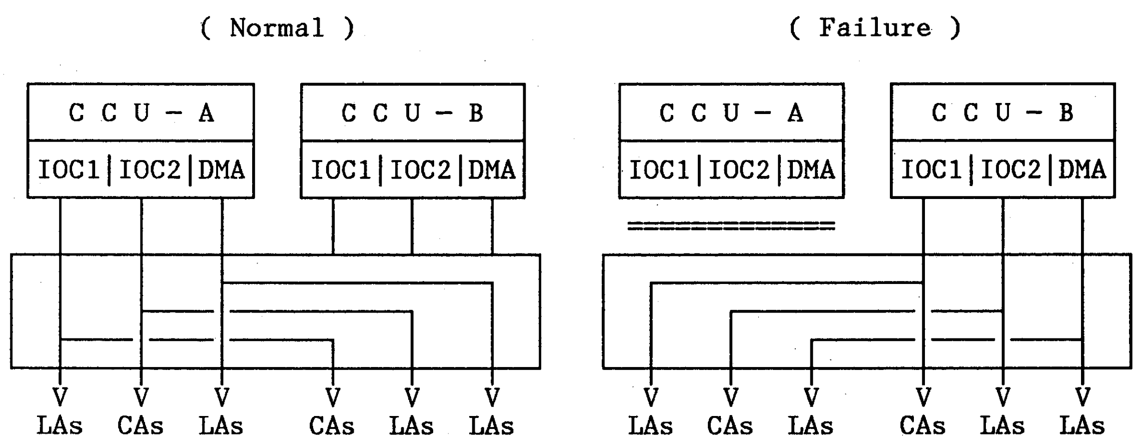


Figure 5. Twin-in-Standby Operation Mode

1.5 Software Requirements

The IBM 3745 Communication Controller requires one of the following releases of the Advanced Communications Functions for Network Communication Program (ACF/NCP Version 5) to support Systems Network Architecture (SNA) requirements.

- ACF/NCP Version 5 Release 1 (MVS only)
- ACF/NCP Version 5 Release 2 (MVS, VM and VSE)
- ACF/NCP Version 5 Release 2.1 (MVS, VM and VSE)

The appropriate level of ACF/SSP Program Product is required to generate, load and dump ACF/NCP Version 5 control programs.

- ACF/SSP Version 3 Release 3 for ACF/NCP V5R1
- ACF/SSP Version 3 Release 4 for ACF/NCP V5R2
- ACF/SSP Version 3 Release 4.1 for ACF/NCP V5R2.1

The co-requisite ACF/VTAM Program Products are as follows:

- ACF/VTAM Version 3 Release 1.1 with the appropriate PTFs or ACF/VTAM Version 3 Release 2 for ACF/NCP V5R1
- ACF/VTAM Version 3 Release 2 for ACF/NCP V5R2
- ACF/VTAM Version 3 Release 2 with the appropriate PTFs for ACF/NCP V5R2.1

The following chart shows the relationship between the new NCP V5 releases, ACF/SSP V3 releases and ACF/VTAM V3 releases.

	ACF/SSP	ACF/VTAM
ACF/NCP V5R1	ACF/SSP V3R3	ACF/VTAM V3R1.1 with PTFs ACF/VTAM V3R2
ACF/NCP V5R2	ACF/SSP V3R4	ACF/VTAM V3R2
ACF/NCP V5R2.1	ACF/SSP V3R4.1	ACF/VTAM V3R2 with PTFs

Figure 6. Software Requirements (NCP)

Also, the 3745 can operate under control of the Partitioned Emulation Programming (PEP) extension to support non-SNA networking requirements. The 3745 cannot run in standalone Emulation Programming (EP) mode. Use of the PEP extension of ACF/NCP Version 5 requires the following releases of EP for the 3745.

- Emulation Program Release 5 (MVS only)
- Emulation Program Release 6 (MVS, VM and VSE)
- Emulation Program Release 6.1 (MVS, VM and VSE)

The following ACF/SSP program products are required to generate, load and dump the above release of EP.

- ACF/SSP Version 3 Release 3 for EP R5
- ACF/SSP Version 3 Release 4 for EP R6
- ACF/SSP Version 3 Release 4.1 for EP R6.1

The levels of EP and NCP which work together must match exactly as specified.

- ACF/NCP Version 5 Release 1 for EP R5
- ACF/NCP Version 5 Release 2 for EP R6
- ACF/NCP Version 5 Release 2.1 for EP R6.1

The following chart shows the relationship between the new EP releases, ACF/SSP program products and ACF/NCP control programs on an 3745.

	ACF/SSP	ACF/NCP
EP R5	ACF/SSP V3R3	ACF/NCP V5R1
EP R6	ACF/SSP V3R4	ACF/NCP V5R2
EP R6.1	ACF/SSP V3R4.1	ACF/NCP V5R2.1

Figure 7. Software Requirements (EP)

For further information on Software Requirements for the 3745, see the 'Software' section in this manual.

1.6 Compatibility

The 3745 offers coexistence and migration capability with other IBM Communication Controllers. The 3745 does not introduce any new compatibility restrictions. Compatibility is only dependent on ACF/VTAM and ACF/NCP releases used in the network.

The following table shows communication relationship between ACF/NCP Version 5 on an 3745 and major host resident programs.

(1) MVS Environment

	ACF/VTAM					NetView			NPM
ACF/NCP	V2R1	V2R2	V3R1	V3R1.1	V3R2	R1	R2	R3	R3
V5R1	L/L/-	L/L/-	L/L/-	C/P/L	C/P/L	X	X	X	X
V5R2	L/L/-	L/L/-	L/L/-	C/P/L	C/P/L	-	X	X	X
V5R2.1	L/L/-	L/L/-	L/L/-	C/P/L	C/P/L	-	X	X	X

(2) VM Environment

	ACF/VTAM				NetView			NPM
ACF/NCP	V3R1	V3R1.1	V3R1.2	V3R2	R1	R2	R3	R3
V5R1	L/L/-	C/L/-	C/L/-	C/P/A	X	X	X	-
V5R2	L/L/-	C/L/-	C/P/L	C/P/L	-	X	X	X
V5R2.1	L/L/-	C/L/-	C/P/L	C/P/L	-	X	X	X

(3) VSE Environment

	ACF/VTAM				NetView
ACF/NCP	V2R1	V3R1	V3R1.2	V3R2	R2
V5R1	L/L/-	C/L/-	C/L/-	C/P/A	X
V5R2	L/L/-	C/L/-	C/L/-	C/P/L	X
V5R2.1	L/L/-	C/L/-	C/L/-	C/P/L	X

Legend: X/Y/Z for VTAM-NCP Compatibility
- X: Physical Connectivity
  - L - Link attachment only
  - C - Channel and Link attachment
- Y: Session Type
  - L - LU-LU session capability only
  - P - SSCP-PU and LU-LU session capability
- Z: Functions over SSCP-PU session
  - A - Activation only
  - L - Load, Activation and Dump

Note 1. For some VTAM-NCP combinations, some PTFs may be required to support the functions. PTF requirements must be investigated on an individual basis.
2. For some VTAM-NCP combinations, Extended Network Addressing or Extended Subarea Addressing requirements and restrictions must be investigated.

Figure 8. Compatibility with Host Resident Programs

The following table shows controller resident programs that can be operated with ACF/NCP Version 5 on an 3745.

	EP			NTO			NRF			NPSI		XI	NSI	
ACF/NCP	R5	R6	R6.1	R4.1	R5	R5.1	R3.1	R3.2	R3.3	V3R1	V3R2	V1R2	R5	R5.1
V5R1	X			X			X			X				
V5R2		X			X			X			X	X	X	
V5R2.1			X			X			X		X (1)	X		X

Note: 1. The appropriate PTF is required.

Figure 9. Compatibility with Controller Resident Programs

The following table shows the NCP-NCP communication capability of ACF/NCP Version 5 on an 3745.

ACF/NCP	V2	V3 Note 2	V4 Sub Note 3	V4R1	V4R2 Note 4	V4R3	V4R3.1	V5R1	V5R2	V5R2.1
V5R1	X Note 1	X	X	X	X	X	X	X	X	X
V5R2	X Note 1	X	X	X	X	X	X	X	X	X
V5R2.1	X Note 1	X	X	X	X	X	X	X	X	X

Note: 1. Communication is possible through NCP V3 gateway.
2. Including ACF/NCP V3 for 3705 and 3725
3. Including ACF/NCP V4 Subset with the ACF/NCP V4 Subset Feature
4. Including ACF/NCP V4R2 with the ACF/NCP V4R2 Feature

Figure 10. ACF/NCP V5 Communication Capability between NCPs

For further information on software compatibility for the 3745, see the "Software" section in this manual.

1.7 IBM Communication Controller Comparison

The 3745 offers significant improvements in performance and connectivity over the existing IBM Communication Controllers.

	3745	3725	3720	3705
Number of CCU	2	1	1	1
Maximum storage (megabyte)	8/CCU	3	2	0.5
Cache (kbyte)	16/CCU	–	–	–
Maximum channel adapters	16	6	2	4
Maximum scanners	32	14	3	4
Max. line attach'ts (Up to 256Kbps)	896	256	60	312
Max. line attach'ts (Up to 2Mbps)	8	1	–	–
Maximum Token-Ring attachments	8	8	2	–
Hard Disk (megabyte)	45	–	10	–
Operator Console – Local	Mand.	Mand.	Opt'n	–
Operator Console – Remote/Alternate	Opt'n	Opt'n	Opt'n	–
Remote Support Facility (RSF)	Opt'n	–	Opt'n	–

Note: 1. All the line attachment maxima of each Communication Controller are not possible simultaneously.
2. The RSF for the 3745 is mandatory in US, Canada, and Japan.
3. The 3725 remote MOSS is available in US only.

Figure 11. IBM Communication Controller Comparison

2. Hardware

2.1 IBM 3745 Hardware Structure

The IBM 3745 architecture makes use of some functional components already used in the IBM 3725 Communication Controller. Therefore, the IBM 3745 has the same basic functional structure and components as the IBM 3725.

The Central Control Unit (CCU) and the scanner have been remapped on the 3725 using new technologies, providing new and modified functional capabilities in order to meet the performance and availability objectives. The Channel Adapter (CA) and the Line Interface Coupler (LIC) are new designs.

Functional enhancements are provided by using some new components such as Direct Memory Access (DMA), High-Speed Buffer Storage (cache), High Performance Transmission Subsystem (HPTSS), bus switch, and serial links between the scanners and the LICs.

The IBM 3745 consists of four major subsystems:

- Control Subsystem
- Communication Subsystem
- Maintenance Operator Subsystem (MOSS)
- Power Subsystem

The following figure illustrates the IBM 3745 machine structure and components.

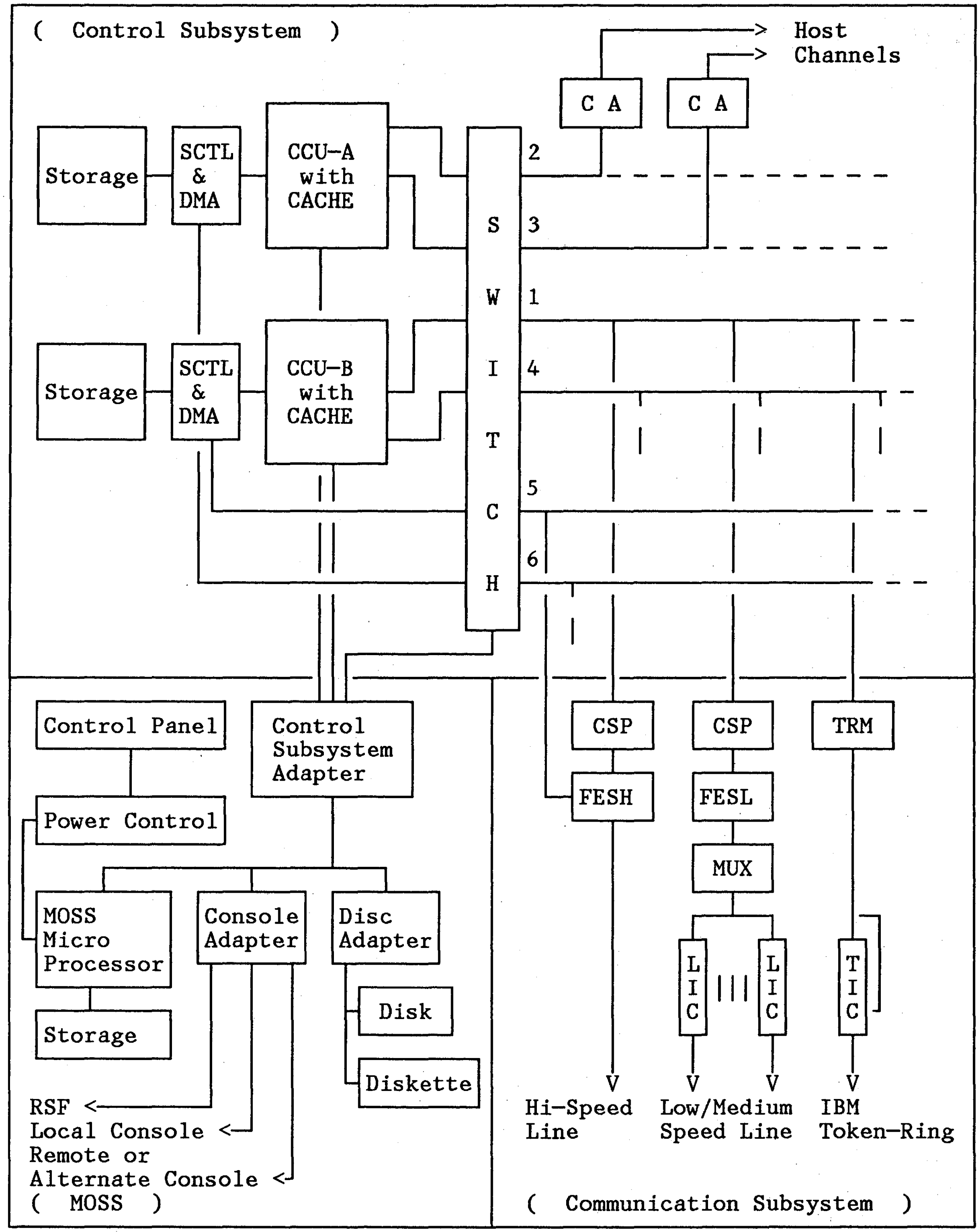


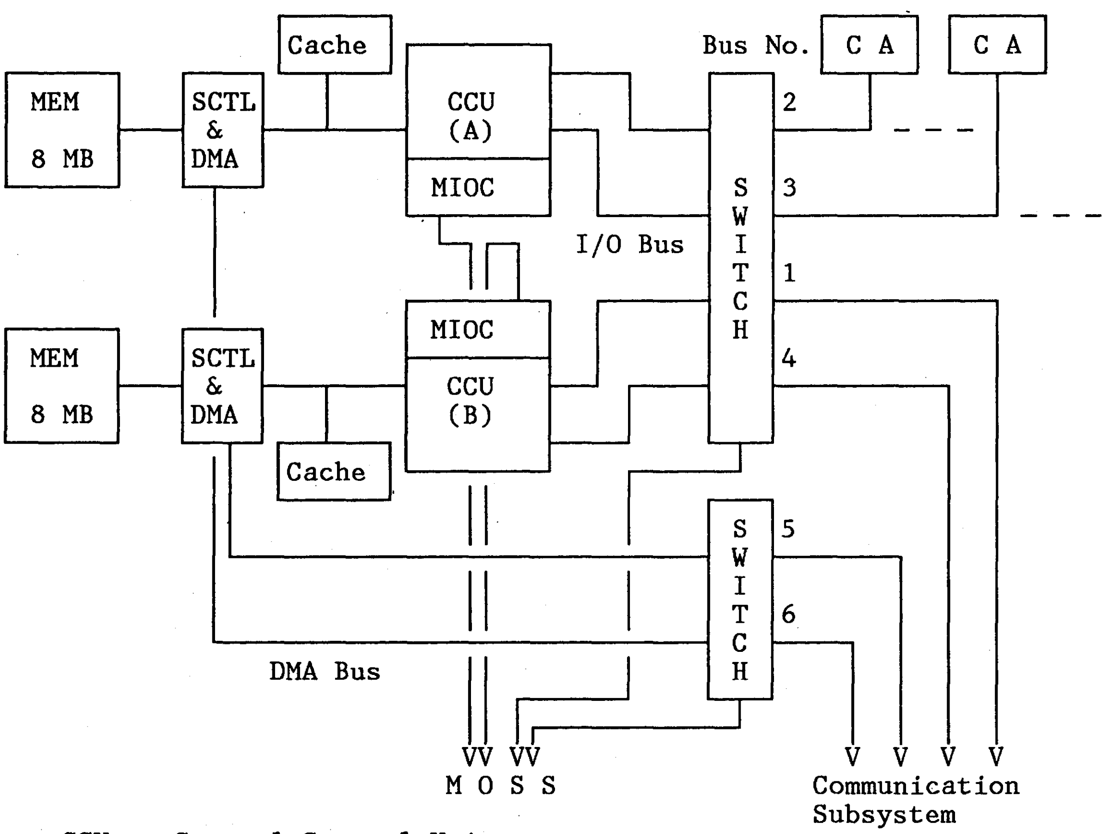
Figure 12. 3745 Hardware Structure

2.2 Control Subsystem

The control subsystem consists of the following components:

- Central Control Unit (CCU) with High-Speed buffer storage (cache)
- Main storage with the storage control and Direct Memory access (DMA)
- Input/Output Adapter (I/O) and DMA buses and Bus Switch
- Channel Adapter (CA) with or without a Two-Processor Switch (TPS)

The control subsystem is located in the 3745 base frame. One or two CCUs can be configured with the associated cache and main storage. The following figure illustrates the control subsystem structure.




```
CCU  : Central Control Unit
MEM  : Main Storage
SCTL : Storage Control
DMA  : Direct Memory Access
I/O  : Input/Output Adapter
CA   : Channel Adopter
MIOC : MOSS Input/Output Control
MOSS : Maintenance and Operator Subsystem
```

Figure 13. 3745 Control Subsystem

2.2.1 Central Control Unit

The Central Control (CCU) is driven by the control program (NCP or PEP). The CCU contains the circuits and the data paths to execute the instruction set and control the storage and the attached adapters.

The CCU can be initialized by loading the control program through a host channel (up to 8 owning hosts), or a host link (up to 8 IPL links per CCU), or from the 3745 hard disk.

The CCU is a remapping of the IBM 3725 CCU, and is equipped with a 16K bytes High-Speed Buffer Storage (cache). The CCU and its cache are both packaged in an air-cooled TCM.

The instruction set is similar to that of the IBM 3725 but is extended where necessary to support the enhanced capability of the 3745.

The major characteristics of the 3745 CCU are as follows:

- Increased CCU inner power due to the remapping in a faster technology. The CCU basic machine cycle time is less than half of that of the 3725.
- Faster storage subsystem by the attachment of a cache. The cache cycle time matches the CCU machine cycle time, which gives an improved Average Instruction Time.
- Higher input/output bandwidth and throughput due to the attachment of two I/O Buses and a DMA Bus per CCU. Data transfers on the DMA Bus do not consume CCU cycles, thus allowing higher throughputs and conserving CCU power.
- Large addressing capability due to the extension of the CCU internal paths and registers to 24 bits. The CCU can now address 16 megabytes of storage, although at the machine level a maximum of 8 megabytes storage will be installed.

2.2.2 High Speed Buffer Storage (Cache)

The High Speed Buffer Storage (cache) interconnects between the CCU and the main storage (Storage Control and DMA). Instructions and data transferred from the main storage at a slower rate are buffered in the cache and provided to the CCU at machine cycle time. As long as requested instructions and data are in the cache, the CCU is not slowed down by storage, and can run at full speed.

Whenever the CCU puts out a storage request on the bus, the address is checked against the addresses in the cache directory:

- In case of a Hit (indicating that the requested data is in the cache), data is either supplied to the CCU (Read command) or written in both cache and storage with the contents of the data bus (Write command).
- In case of a Miss (indicating that the requested data is not in the cache), for a Write command the data is written into only the Storage. In the Read case the request is satisfied in either of two ways. If the request is for an instruction or program data, a segment of storage containing the data is transferred to the cache and to the CCU. If the data is for the Adapters, it is transferred to the CCU from storage, and the cache is not loaded.

Therefore, the CCU internal operation for its storage requests is not changed by the presence of the cache.

Every row of the cache is made of two 16-byte lines. The Least Recently Used (LRU) line (of the two) is subject to replacement during a Read Miss. The LRU information is updated whenever a line is accessed or loaded in the cache.

Because of DMA operation which bypasses the CCU and cache, the SCTL may request the cache to invalidate a line. An invalidation request has priority over a CCU request.

The following table summarizes the various cache data path functions.

Request	Storage User	Cache Function	Management
Read	I-fetch Prog. Read	Hit : Cache Read Miss: Line loaded and Cache Read	LRU Update LRU Update
	MOSS Adapter	Hit : Cache Read Miss: Storage Read	LRU Update —
Write	Any User	Hit : Cache Write and Storage Write Miss: Storage Write	LRU Update —
Line Invalidation	DMA	Invalidate a line in the Cache	LRU Update

Figure 14. Cache Functions

2.2.3 Storage Control and Direct Memory Access

The Storage Control (SCTL) manages memory access for the CCU, cache and Direct Memory Access (DMA) functions.

The main functions of the SCTL are as follows:

- Allocates the main storage access to the different end devices.
- Controls the data transfer between each end device and the storage:
  - CCU Read / Write
  - Cache line loading
  - DMA bursts transfers (Max. 253 bytes).
- Insure data transfer integrity:
  - ECC
  - Address and data parity check.
- Maintain consistency between cache and storage, by controlling cache line invalidations during DMA Write operations.

The DMA allows a High-Speed Scanner in the HPTSS to access the main storage directly saving CCU cycles in order to improve the performance required by new

high-speed line adapters on the DMA bus. The data transfer to the main storage is controlled by the SCTL.

The DMA has a data buffer, which interfaces with the DMA bus during burst transfers. The DMA receives the data transfer request from one or more high speed scanners. The data exchange between main storage and the DMA data buffer then takes full advantage of the storage speed.

2.2.4 Main Storage

The IBM one megabit storage chip is used for the main storage. The base machine is fitted with a 4-megabyte base storage, which can be expanded to 8 megabytes.

The storage control is equipped with enhanced Error Checking and Correction (ECC), in order to meet the new reliability objectives. The correcting capability of the ECC depends on the type of bit error, whether it is a hard error or a soft (transient) error.

The correction coverage is as follows.

Type of Fault	Coverage	Notes
One hard	100%	As in 3725
One soft	100%	As in 3725
One hard and one soft	100%	As in 3725
Two hard	100%	New capability
Two hard and one soft	50%	New capability
Two soft	0%	Not possible

Figure 15. ECC Correction Coverage

2.2.5 Input/Output Adapter Bus

Two pairs of buses are provided in the 3745 base model. Two Input/Output Adapter (I/O) buses are attached per CCU. In the Single-CCU configuration, the two bus pairs are connected together. Depending on the Twin-CCU mode of operation, the two I/O buses can be switched to the other CCU if one CCU fails.

One I/O bus of the bus pair can address a maximum of 8 Channel Adapters (CA) or 4 Channel Adapters with a Two-Processor Switch (CATPS). The other one can address a maximum of 16 line adapters (LSS, HSS and TRA).

The following table shows the maximum adapters that can be attached to an I/O bus, a CCU , and the 3745.

	Per Bus	Per CCU	Per 3745
CA	8	Single-CCU : 16 Twin-CCU : 8	16
CA with TPS	4	Single-CCU : 8 Twin-CCU : 4	8
LSS	16	Single-CCU : 32 Twin-CCU : 16	32
HSS	4	Single-CCU : 8 Twin-CCU : 4	8
TRA	2	Single-CCU : 4 Twin-CCU : 2	4

Note: All maximum configuration cannot be offered simultaneously.
Each HSS takes the place of one LSS. TRA option takes the place of four LSSs or HSSs.

Figure 16. I/O Bus Connectivity

2.2.6 Direct Memory Access Bus

One pair of Direct Memory Access (DMA) buses is provided in the 3745 base model. One bus is attached to each CCU. In the Single-CCU configuration, the two buses are connected together.

The DMA bus directly attaches the high speed line adapters (HSS) to Main Storage via the DMA and SCTL. Depending on the Twin-CCU mode of operation, the DMA bus can be switched to the other CCU if one CCU fails. The DMA bus can address a maximum of 4 HSSs.

The DMA bus is controlled by a serial signal propagating from the SCTL/DMA towards the Front-End Scanner for High-Speed Lines (FESH).

2.2.7 I/O-DMA Bus Switch

Two I/O-DMA Bus Switches allow the CCUs to be set up in the operational configuration (Single or Twin). It also permits the necessary connections in case of CCU failure to allow a backup to the remaining CCU.

The switch is organized in two identical parts, each one related to its associated CCU and SCTL/DMA. The failure of one part does not have an impact on the other.

In Single-CCU configuration, only half of the switch is active. In Twin-CCU configuration, when both CCUs are active, each half of the switch drives the buses corresponding to its CCU. In case of backup, the buses of the failing CCU are connected to the corresponding buses of the active CCU. The switch is controlled by MOSS through a Switching Adapter.

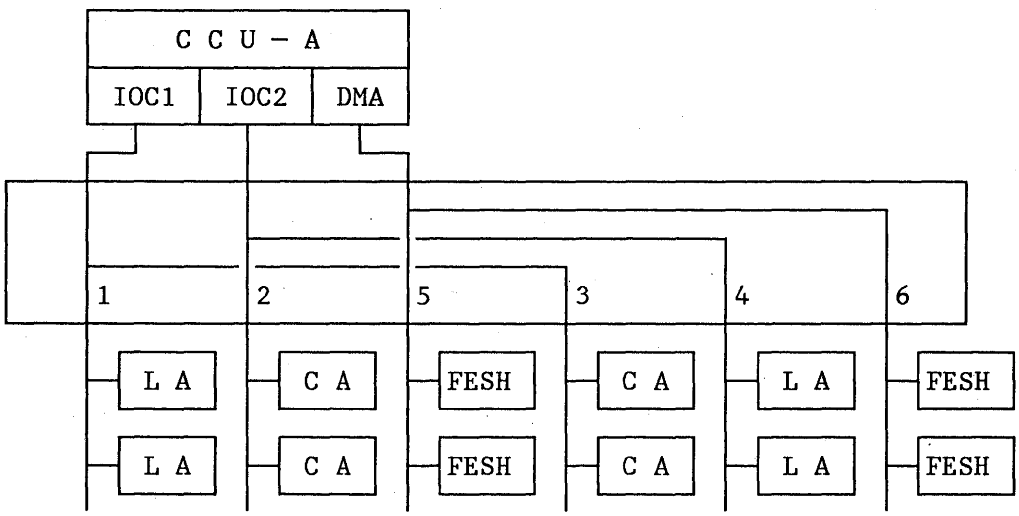


Figure 17. I/O-DMA Bus Switch in Single-CCU Configuration

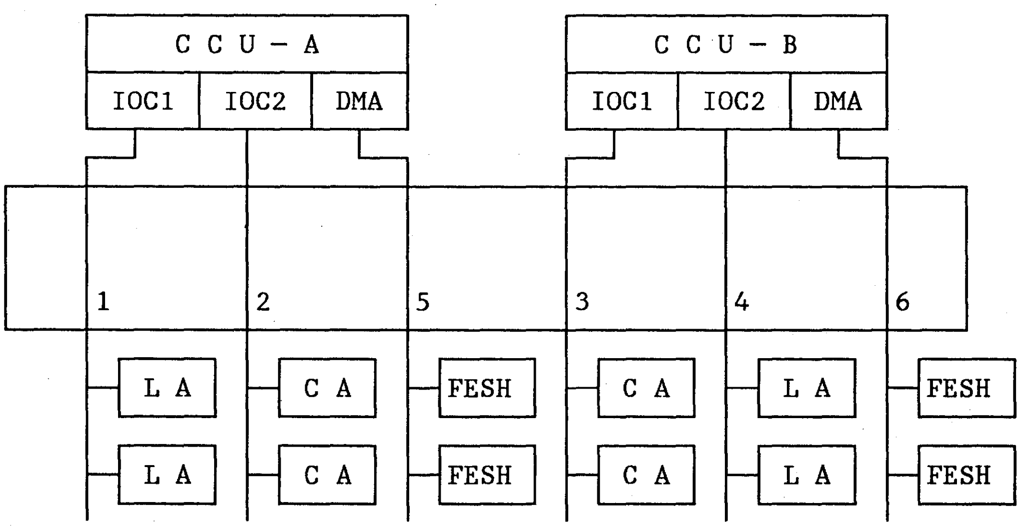


Figure 18. I/O-DMA Bus Switch in Twin-CCU Configuration

2.2.8 Channel Adapter

The Channel Adapter (CA) for the 3745 is a new design microprocessor based on CMOS technology, which provides attachment of the Communication Controller to the IBM 4341, 4361, 4381, 937X, 3033, 308X, and 309X Processors.

A maximum of 16 Channel Adapters provide host connection to the CCU(s) via the IOC buses. Optionally, CAs can be equipped with a Two-Processor Switch (TPS) feature.

The 3745 CAs support the Data Streaming mode in addition to Direct Communication Interface (DCI) and High-Speed Transfer mode. The channel addresses, transfer mode and feature can be defined from the MOSS console at the installation time. Also, CAs are enabled and disabled by the operator from the MOSS console.

The following figure shows the Channel Adapter position.

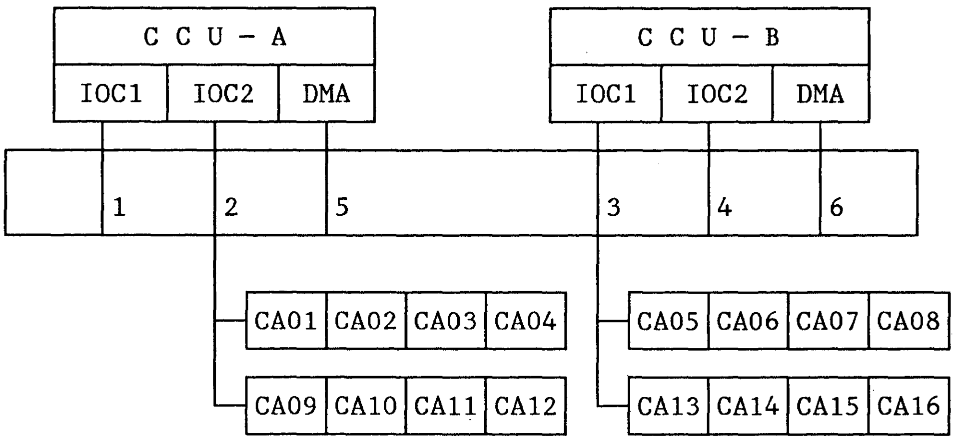


Figure 19. Channel Adapter

2.2.8.1 Channel Interface

Host channels are byte-multiplexer, block-multiplexer, or selector channels. In addition, the IBM 3044 Fiber Optic Channel Extender Link is also supported.

Depending on the programming support, CAs can be operated:

- In native mode under NCP control. Only one channel address is used to transmit all data to a host.
- In partitioned mode under PEP control. PEP operates certain lines in native mode, while operating other lines in emulation mode (EP). In EP mode, one subchannel address is required per line. Host attachment is limited to a byte multiplexer channel.

2.2.8.2 Data Streaming mode

The Data Streaming feature makes it possible to reach a high-speed data rate for a host located up to 122 meters (400 feet) from the controller. Data can be transferred in synchronous mode at a maximum speed of 2.08 megbytes per second.

Channel Adapter with Data Streaming is supported by the IBM 309X and 9370 Processors. In this case, the channel extenders are not supported.

2.2.8.3 Two-Processor Switch

The Two-Processor Switch (TPS) feature provides an additional channel interface, called Interface B, to a Channel Adapter. Attachment of one CA with TPS takes the place of two CAs. Therefore, the maximum configuration can be 16 CAs without a TPS feature, or 8 CAs equipped with a TPS, or some combination of the two. The two interfaces can lead to the same or different hosts.

MOSS commands at the console allow the user to select:

- Interface A only, or interface B only. This connection is used to connect the Channel Adapter to one host channel or to another.
- Both interfaces. This connection is used only to connect both interfaces of the Channel Adapter to two channels on the same host with multi-processor. In this case, the attached host is responsible for activating one interface or the other, alternatively. Both interfaces cannot be active simultaneously.
- Neither interface A nor B. This connection is used to disable a Channel Adapter for test or diagnostic purposes.

2.2.8.4 Channel Feature Definition

CA features and parameters are defined at installation time and saved in the MOSS. They are set up by the MOSS at all subsequent Initial Program Load (IPL).

- Address assignment: At the time of installation, addresses are assigned as follows:
  - Native Subchannel (NSC) Address: Any address in the range of X'00' to X'FF' can be assigned (one address for each interface when the TPS feature is installed).
  - Emulation Subchannel (ESC) Address: A set of contiguous addresses is assigned. The lowest address can be set between X'00' and X'FF'. The highest address must be greater than or equal to the lowest address, and not higher than X'FF'.
- Channel Burst Length: At the time of installation, the number of bytes exchanged with a channel per connection can be assigned the values of even number between 4 and 254.
- Data Transfer Mode: According to the type of channel, the CAs are set to support High-Speed Transfer and Data Streaming (only for Block MPX).
- Select Out/In Priority: According to the attached Control Units on the same channel, the CA is assigned a low or high priority.
- Request In Interval: According to the attached Control Units on the same channel, the CA, once disconnected, cannot request another reconnection before 0, 16, 32, 64, 128, or 256 microseconds.
- I/O Error Alert: According to the type of channel, the CAs are set to support the I/O Error Alert feature.

2.2.8.5 Channel Adapter Performance

The following table shows possible protocol/speed combinations of the 3745 channel adapter:

PROTOCOL	Maximum Data Rate (Mbytes/sec)
Data Streaming	2.08 on 3.00 Mbytes/sec channel
Data Streaming	1.66 on 2.00 Mbytes/sec channel
Data Streaming	0.92 on 1.00 Mbytes/sec channel
DCI	1.50 on 1.50 Mbytes/sec channel
DI/DO or HST	1.50 on 1.50 Mbytes/sec channel

The effective channel throughput is different from the data rate. The best throughput is 620 Kbytes/sec when attached to a 3 Mbytes/sec channel and running at 2.08 Mbytes/sec data rate. This throughput can be observed when the channel burst size is set to be 64 bytes and also NCP/VTAM buffer sizes and PIU size are optimized. With the other channels, data can be instantaneously transferred at their maximum data rate but the effective throughput is less than 620 Kbytes/sec.

2.3 Communication Subsystem

The Communication Subsystem interconnects the IBM 3745 and the network. The Communication Subsystem consists of three kinds of Line Adapters (LA) for the following Communication Subsystems:

- Transmission Subsystem (TSS)
- High Performance Transmission Subsystem (HPTSS)
- Token-Ring Network Attachment Subsystem (TRSS)

The following figure shows the Line Adapter positions. The TSS Line Adapter can be equipped on any position. The HPTSS Line Adapter can be equipped on positions from 1 to 8. The TRSS Line Adapter can be equipped on positions 1, 2, 5, and 6.

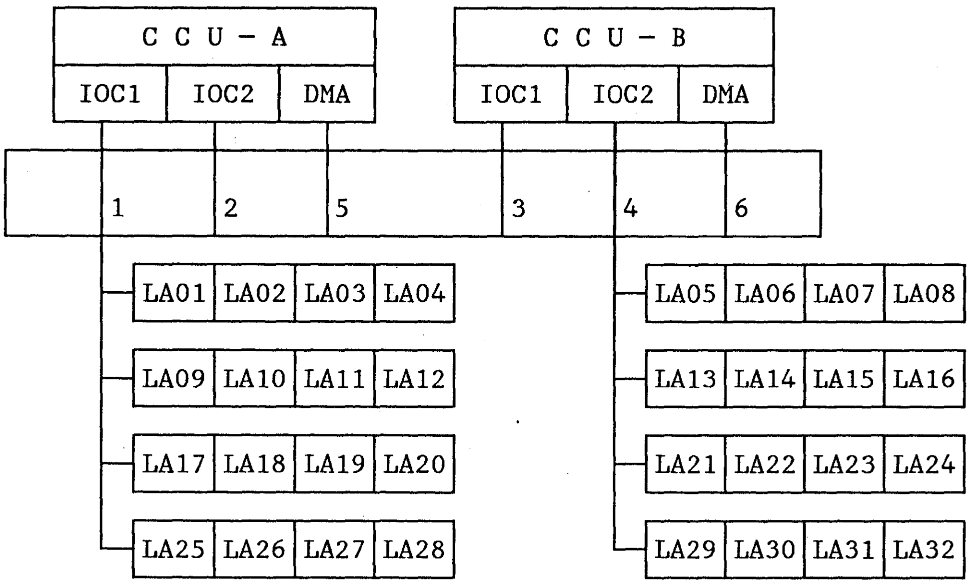


Figure 20. Line Adapter

2.3.1 Transmission Subsystem

The Transmission Subsystem (TSS) consists of two functional areas; a Scanner Unit and a Line Interface Coupler (LIC) Unit. They are interconnected via a serial link.

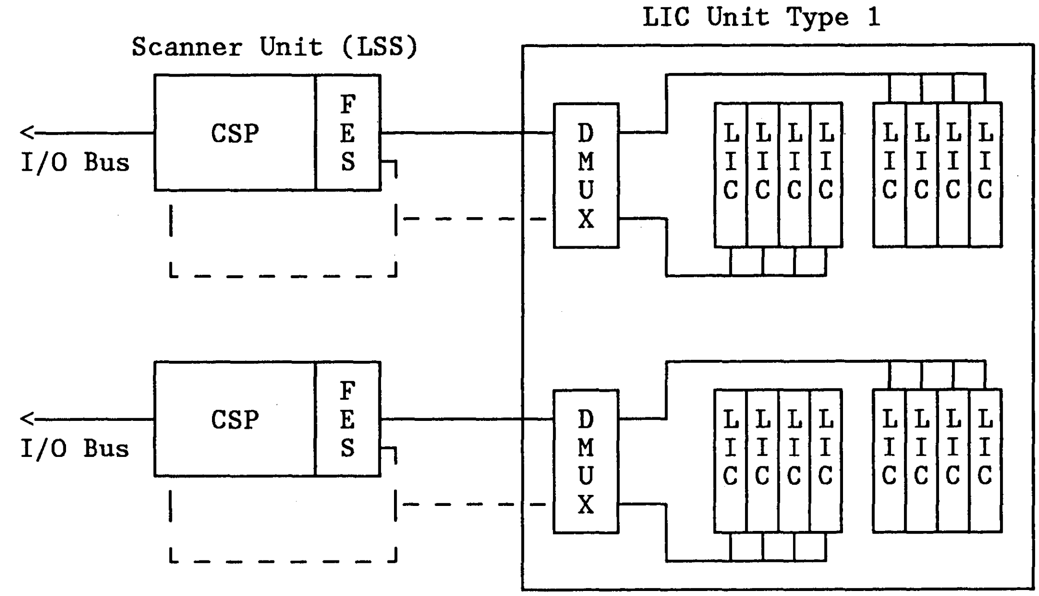
The LICs are plugged into slots in the LIC Unit type. There are two types of LIC Unit; LIC Unit Type 1 which houses LIC Type 1, 3, 4A and 4B, and LIC Unit Type 2 which houses LIC Type 5 and 6.

A line adapter for the TSS is called Low-Speed Scanner (LSS) because it supports lower speed lines than one for the HPTSS. The LSS is connected to the CCU I/O Bus. It can be installed on any Line Adapter position from 1 to 32.

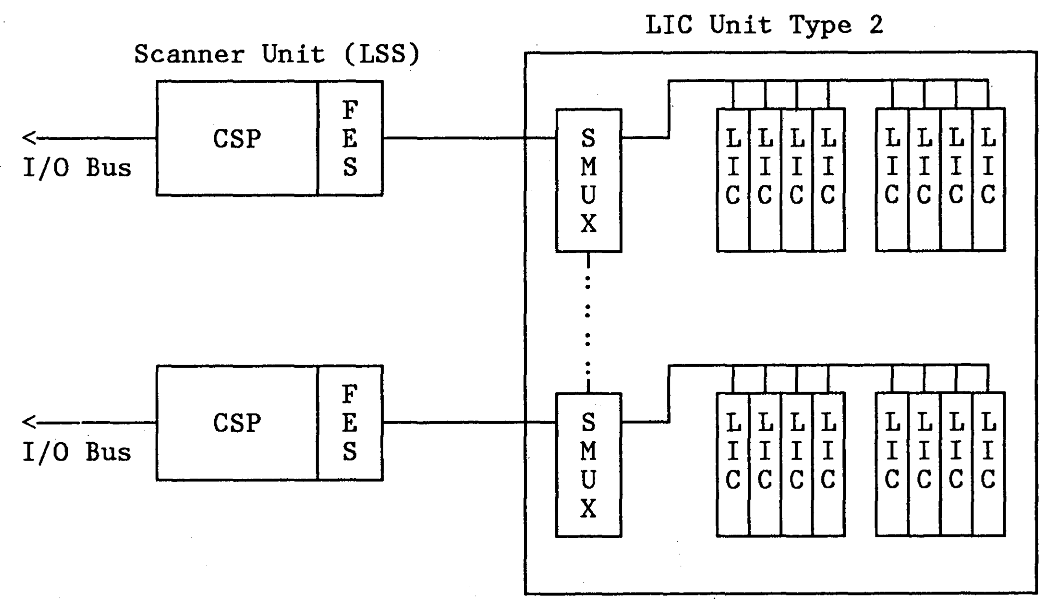
The IBM 3745 can contain a maximum of 32 LSSs and 14 LIC Units. One LIC Unit Type 1 is mandatory as the basic configuration. Consequently, a maximum of 13 optional LIC Units Type 1 or Type 2 can be installed. Each LIC Unit can contain a maximum of 16 LICs. Each LIC can have up to four ports. Therefore, a maximum of 896 lines, working in full duplex or half duplex operation and

synchronous or asynchronous mode, can be connected to the 3745. The maximum speed is 256 Kbps for synchronous protocols and 19.2 Kbps for asynchronous lines.

(1) LIC Unit Type 1: LIC Types can be 1, 3, 4A or 4B.



(2) LIC Unit Type 2: LIC Types can be 5 or 6.



CSP: Communication Scanner Processor
FES: Front End Scanner
DMUX: Double Multiplexer
SMUX: Single Multiplexer

Figure 21. Transmission Subsystem

2.3.1.1 Communication Scanner

The scanner is basically a remapping of the IBM 3725 scanner. The scanner includes the Communication Scanner Processor (CSP) with a 128 Kbtyes memory, an adapter to the I/O Bus, and a Front-End Scanner for Low-Speed Lines (FESL).

The scanner is a microprocessor-based communication scanner. The scanner supports various line protocols and procedures, and provides character buffering and cycle steal transfer into the main storage. Depending on the protocol and the transmission speed, the scanner handles a various number of lines.

It supports the following protocols:

- SDLC
- BSC (EBCDIC and ASCII)
- Asynchronous protocol with 8/5, 9/7, 10/7, 10/8, and 11/8 bits

Three operating modes are provided with NCP and EP.

- A Normal mode: which optimizes the exchange of commands and control information, and interrupts the CCU on a per buffer or block basis for SDLC, BSC, and autocall.
- A Emulation mode: which emulates the operation of the IBM 270X Terminal Control Unit, and interrupts the CCU for each character. It is used for Start/Stop lines and optionally for BSC lines.
- A Burst mode: which transferred data in bursts of up to 4 bytes. It can be used for Start/Stop lines to improve performance.

The FESL provides the interface between the CSP and the LICs. It serializes and deserializes the characters exchanged between the CSP and LICs.

The scanners performs scanning only LICs with active lines so as to increase scanner efficiency (Selective Scanning). As compared to the IBM 3725, where every installed LIC gets scanned, Selective Scanning automatically ignores LICs that have no lines activated. LICs with X.21 lines are scanned even if all the lines are not activated.

The scanners are initialized during the Initial Microcode Loading (IML). Any Scanner can be selectively reinitialized.

2.3.1.2 LIC Unit Type 1

LIC Unit Type 1 contains up to 16 LICs (LIC Type 1, 3, 4A or 4B), two Double Multiplexers (DMUX), and one LIC Unit Type 1 power block. Each slot has four addresses. The DMUX selects the individual the LIC interfaces. It can connect either eight LICs to one scanner or two groups of four LICs to two different scanners.

2.3.1.3 LIC Unit Type 2

LIC Unit Type 2 contains up to 16 LICs (LIC Type 5 or 6), two Single Multiplexers (SMUX), and one LIC Unit Type 2 power block. Each slot has two addresses. The SMUX selects the individual LIC interfaces. It can connect eight LICs to one scanner. Either one SMUX or two SMUXs are connected to one scanner.

LIC Type 5 and 6 can be plugged anywhere inside a LIC Unit type 2. When a LIC Type 6 is working at 56 Kbps, a single LIC Type 6 occupies four addresses. Therefore, the next slot in the LIC Unit Type 2 must be empty.

2.3.1.4 Line Interface Coupler

The Line Interface Coupler (LIC) provides the functions necessary to interface the various external facilities. LIC Type 1, 3, 4A and 4B provide remote and local attachment modes. In remote attachment mode, telecommunication lines are usually terminated by Data Circuit-terminating Equipment (DCE) or modems. In local attachment mode, terminals can be directly attached to the 3745 through LIC cables. LIC Type 5 and 6 provide the functions of modem and DSU/CSU respectively in addition to the ordinary LIC functions. LIC Type 5 combines the LIC Type 1 functions and the functions of IBM 786X modem. LIC Type 6 combines LIC Type 3 functions and the functions of Limited Distance Modem (LDM) or Data Service Unit (DSU)/Channel Service Unit (CSU). Unlike the previous LIC types (Type 1, 3, 4A and 4B), LIC Type 5 and 6 are connected directly to four-wire non-switched lines via an eight pins telephone (PTT) jack. Both LICs have LPDA-2 support.

Any LICs and LIC cables can be plugged or unplugged when the 3745 is in operation (LIC Hot Pluggability). LIC replacement, addition, or removal does not disturb the line adapter or impair the network.

Six types of LIC are available for connecting variable line interfaces. The following table describes the characteristics of each LIC.

LIC Type	LIC Characteristics
LIC 1	No. of lines per LIC : 4 Line speed : Up to 19.2 Kbps Supported Protocols : Asynchronous (Start/Stop) and Synchronous (SDLC,BSC) Supported Interfaces : EIA RS 232 or CCITT V.24 EIA RS 366 or CCITT V.25(Autocall) CCITT X.21 bis No. of LICs per Scanner : Up to 8
LIC 3	No. of lines per LIC : 1 Line speed : Up to 256 Kbps Supported Protocols : Synchronous (SDLC,BSC) Supported Interfaces : CCITT V.35 No. of LICs per Scanner All lines below 32 Kbps : 8 All lines between 32 and 64 Kbps : 4 All lines between 64 and 128 Kbps : 2 All lines above 128 Kbps : 1
LIC 4A	No. of lines per LIC : 4 Line speed : Up to 9.6 Kbps Supported Protocols : Synchronous (SDLC) Supported Interfaces : CCITT X.21 No. of LICs per Scanner : Up to 8

Figure 22. LIC Characteristics

LIC Type	LIC Characteristics
LIC 4B	No. of lines per LIC : 1 Line speed : Up to 256 Kbps Supported Protocols : Synchronous (SDLC) Supported Interfaces : CCITT X.21 No. of LICs per Scanner All lines below 32 Kbps : 8 All lines between 32 and 64 Kbps : 4 All lines between 64 and 128 Kbps : 2 All lines above 128 Kbps : 1
LIC 5	No. of lines per LIC : 2 Line Speeds : 4.8/9.6/14.4 Kbps Backup Speeds : 2.4,7.2/12.0 Kbps Supported Protocols : Synchronous (SDLC,BSC) Integrated Interface : EIA RS 232 or CCITT V.24 No. of LICs per Scanner : 16 LPDA Support : LPDA-2 Compatible Modems : IBM 5865, 5866, 7861 and 7868
LIC 6	No. of Lines per LIC : 1 Line Speed - DSU/CSU : 9.6/56 Kbps Line Speed - LDM : 9.6/19.2/56 Kbps Integrated Interface : CCITT V.24 and V.35 Supported Protocols : (SDLC/BSC) No. of LICs per Scanner All lines below 19.2 Kbps : 16 All lines at 56 Kbps : 8 LPDA Support : LPDA-2 Compatible Modems : IBM 5822 (010 and 018) and 5821

Note: LIC type 4 can be used either as LIC 4A or 4B.
LIC 4A or 4B is selected by the NCP definition.

Figure 23. LIC Characteristics (Cont.)

2.3.1.5 Internal Clock Function

All LICs contain an Internal Clock Function (ICF) which provides a transmit clock for sending data and retrieves a receive clock from received data, when the modem does not provide clocking. When the terminal is connected in direct attachment mode, the ICF also provides the transmit and receive clock to the terminal. Various clock speeds up to 245,760 bps are provided.

Clock values for all types of attachments that require internal clocking such as asynchronous lines or direct attached terminals are specified via the control program. A valid clock speed that a line can gain depends on its type of attachments and its line protocol. Refer to *Resource Definition Reference* for further information.

2.3.2 High Performance Transmission Subsystem

The High Performance Transmission Subsystem (HPTSS) provides a very high speed line adapter for the IBM 3745. The HPTSS is intended to provide support for very high speed links, such as T1 link in the US, CEPT link in Europe, and any links working at a similar rate remotely or directly attached.

The HPTSS supports an SDLC, full duplex, non-switched line at line speed up to 2.048 megabits per second in a point-to-point configuration. In direct attachment

mode, the valid line speeds are 55,855, 245,760, 1,474,560 and 1,843,200 bits per second. It supports unformatted channels only. That is to say, it provides no TDM framing support, but a so-called "Clear Channel" support.

A line adapter for the HPTSS is called High-Speed Scanner (HSS) while one for the TSS is called Low-Speed Scanner.

The HSS is composed of a Communication Scanner processor (CSP) and a Front-End Scanner for High-Speed Lines (FESH).

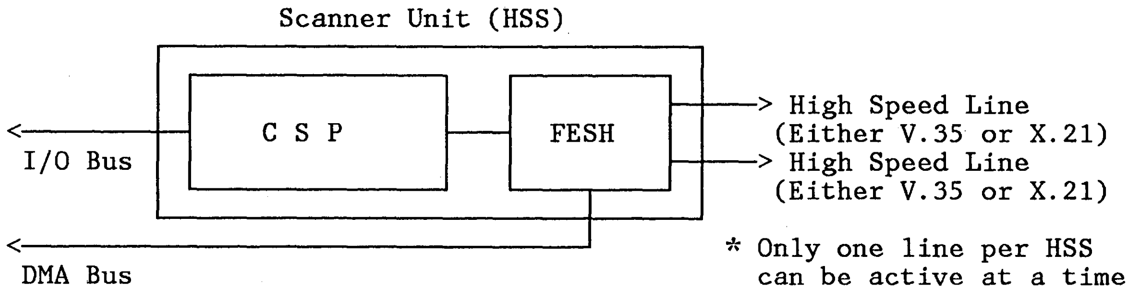


Figure 24. HPTSS Adapter

The CSP is the same as the regular scanners but it operates under a new microcode load module. The CSP is connected to the CCU I/O Bus, which is used for NCP communication with HPTSS. CSP commands and MOSS commands are exchanged through the I/O bus. Also, HPTSS IPL is performed via the IOC bus.

The HPTSS can be installed on the Line Adapter positions of 1 to 8 in the Base Frame Adapter Board.

The FESH interconnects the scanner and the very high speed lines. It is connected to the DMA Bus. This bus is used for data transfer between the line and main storage, and parameter and status exchange between NCP and HPTSS microcode.

The FESH supports V.35 and X.21 interfaces to the DCE network adapter. It provides two distinct ports, but only one can be activated at a time. The following combinations can be chosen.

- One V.35 Interface
- One X.21 Interface
- Two V.35 Interfaces
- Two X.21 Interfaces
- Both V.35 and X.21 Interfaces

When both of the ports are attached to lines, the NCP selects the line by activating one out of two lines. Interface selection, V.35 or X.21, is performed by the FESH. Upon receipt of the line address activation, the FESH automatically recognizes the interface installed on the selected port.

On each DMA Bus, up to four HSSs can be plugged in. Therefore, the IBM 3745 can contain a maximum of 8 HSSs. Each HSS can connect up to two lines, only one being active at a time. Therefore, a maximum of 16 high speed lines can be connected to the 3745, and a maximum of eight lines can work at a time.

2.3.3 Token Ring Network Attachment Subsystem

The Token Ring Network Attachment Subsystem (TRSS) provides the capability of attaching to the IBM Token-Ring network. The TRSS consists of up to four Token-Ring Adapters (TRA). Each TRA is made of a Token-Ring Multiplexer (TRM) and up to two Token-Ring Interface Couplers (TIC).

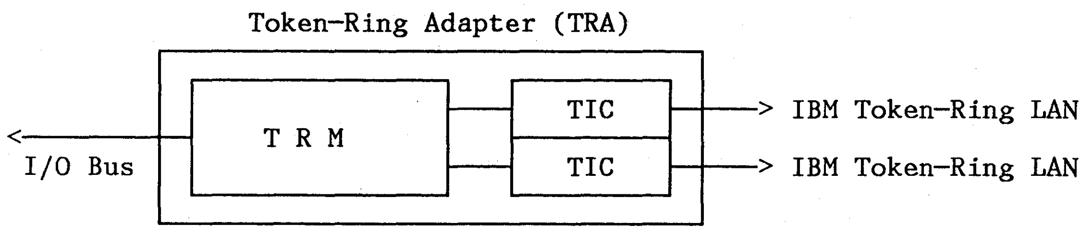


Figure 25. Token-Ring Adapter

Each TIC can access one IBM Local Area Network (LAN). Therefore, the IBM 3745 can provides a maximum of 8 Token-Ring interfaces.

The TRA can be installed on the Line Adapter positions of 1, 2 and 5, 6 in the Base Frame Adapter Board.

Two types of TRA are provided. TRA Type 1 supports attachment to the 4 Mbps IBM Token-Ring Network using standard protocols. TRA Type 2 supports attachment to the 4 Mbps or 16 Mbps IBM Token-Ring Network using standard protocols. Both TRA can coexist in the 3745 configuration.

TRA Type 2 provides the following additional supports:

- Software ring speed selection per port
- Use of larger frame size up to 4 Kbytes at 4 Mbps and up to 16 Kbytes at 16 Mbps
- Early Token Release option at 16 Mbps
- Mixture of INN and BNN traffic on the same TRA Type 2 ports

Each TRA operates under the NCP Token-Ring Interface (NTRI) program. Each physical connection to the Token-Ring network appears to VTAM as a full-duplex, non-switched, point-to-point line. A BNN logical line appears to VTAM as connected a switched, half-duplex, point-to-point line allowing a customer to predefine the system, that is, to add new terminals without having to re-generate a new NCP load module. An INN logical line is defined as a leased, half-duples, point-to-point line instead.

2.4 Maintenance and Operator Subsystem

The Maintenance and Operator Subsystem (MOSS) is the service processor of the 3745, based on a microprocessor with a one megabyte storage, a diskette drive, a 45-megabite hard disk, a power control, a control panel, and a console adapter.

The MOSS logic and all the MOSS components are powered by the MOSS power block so that they can be repaired without interrupting system operations.

The MOSS functions are further improved to provide the high availability, serviceability and usability. Some of the basic functions are similar to the 3725 MOSS. Many advanced functions are provided for problem isolation, determination, and maintenance.

The MOSS operator functions are achieved through the control panel or the operator consoles. Access to the MOSS functions through the console is password-controlled. Also, the 3745 can be connected to the IBM RETAIN database through the Remote Support Facility (RSF).

2.4.1 MOSS Microprocessor

The MOSS Microprocessor operates independently of the main system. The microcode is shipped on five diskettes and loaded from them onto the hard disk. The microcode is automatically loaded from disk into the MOSS storage during Initial Microcode Loading (IML).

The MOSS communicates with both CCUs and controls the switching of the IOC buses and DMA bus from one CCU to the other. The Channel Adapters can be enabled or disabled through the MOSS.

2.4.2 MOSS Diskette and Hard Disk

The diskette drive with removable diskettes and disk drive with one fixed disk are connected to the MOSS microprocessor through the integrated disk adapter. The capacity of the diskette is 1.2 megabytes and the disc capacity is 45 megabytes, with both media formatted to 512 bytes/sector.

The diskettes contain the MOSS microcode, MOSS files, and diagnostic programs. At installation time, the diskettes are copied onto the disk and thereafter used for backup purposes. If the disk fails, IML can be performed from the diskette. Note that it is the customer's responsibility to perform backup and recovery of the files on the disk.

The items listed below are the contents of the hard disk.

- MOSS microcode
- Scanner microcode for TSS and HPTSS
- Diagnostic programs
- Box Event Record file (BER)
- Logon password table
- Configuration data file (CDF)
- Line interface display (LID)

- Maintenance level table (MLT)
- IPL port table
- Microcode fix file (MCF)
- Port swapping status

Also, up to two NCP load modules and one NCP dump per CCU can be saved on the disk. This facility improves the availability of the 3745, allowing fast backup operations in case of CCU, storage, or program failure.

2.4.3 Operator Console

Three type of operator consoles can be attached to the 3745.

- A local console
- A remote console or a alternate console
- A Remote Support Facility (RSF)

A local console and a alternate console can be shared between several controllers by using the IBM 7427 Console Switching Unit.

2.4.3.1 Local Console

The local console is mandatory to install and maintain the 3745. It is directly attached to the 3745 base frame at a maximum distance of 7 meters (23 feet), and communicates with the MOSS in block mode at 2400 bps.

The local console may be one of the following terminals:

- IBM 3151 Display Station running in native or 3101 emulation mode
- IBM 3161 Display Station running in 3101 emulation mode
- IBM 3163 Display Station running in 3101 emulation mode
- IBM PC PS/2 with OS/2 Extended Edition
- IBM 3727 Display Station
- A terminal which is compatible with CCITT V.24 and provides equivalent functions.

2.4.3.2 Remote Console

The remote console is an optional console, which is attached to the MOSS over the public switched network via a modem, and communicates with the 3745 in block mode at 1200 bps.

The remote console may be one of the following terminals:

- IBM 3151 Display Station running in native or 3101 emulation mode
- IBM 3161 Display Station running in 3101 emulation mode
- IBM 3163 Display Station running in 3101 emulation mode
- IBM PC PS/2 with OS/2 Extended Edition
- IBM PC 5150, 5160, 5155, and 5170 running in 3101 emulation mode
- A terminal which is compatible with CCITT V.22 and provides equivalent functions.

2.4.3.3 Alternate Console

Instead of a remote console, an alternate console can be attached at the same port, also as an optional console. These attachments are mutually exclusive. The alternate console is directly attached to the 3745 at a maximum distance of 150 meters (492 feet), and communicates with the MOSS in block mode at 2400 bps.

The alternate console may be one of the following terminals:

- IBM 3151 Display Station running in native or 3101 emulation mode
- IBM 3161 Display Station running in 3101 emulation mode
- IBM 3163 Display Station running in 3101 emulation mode
- IBM PC PS/2 with OS/2 Extended Edition
- IBM 3727 Display Station
- A terminal which is compatible with CCITT V.24 and provides equivalent functions.

2.4.3.4 Shared Console

In multiple-controller installations, it is possible to share one console between several 3745s or other controllers. In this case, the IBM 7427 Console Switching Unit (RPQ) can be used to share a single local console or a single alternate console.

- A maximum of four 3745s and/or other controllers can share a local console. In this case, the shared console must be at a maximum distance of 8 meters (26 feet) from any 3745.
- A maximum of six 3745s and/or other controllers can share an alternate console.

2.4.3.5 Remote Support Facility

The Remote Support Facility (RSF) provides IBM maintenance assistance when required. Use of RSF improves the availability of the 3745 by reducing the total time necessary to analyze a hardware failure and identify a likely failing component.

The RSF is attached to the MOSS over the public switched network via a modem. For US, Canada, and Japan, the RSF communicates with the 3745 in full-duplex mode, with BSC protocol at 2400 bps, with external clocking. For the other countries, the RSF operates in half-duplex mode, with asynchronous protocol at 1200 bps, with internal clocking.

2.4.4 Control Panel

The control panel can be used to perform some of the MOSS functions, if necessary. The control panel consists of:

- A ten-digit alphanumeric display
- A key pad with 7 keys
- An Unit Emergency switch
- An AC power-on green lamp.

```
* * * * * * * * * *                Function          Power On   On
                                    0                  0         0
                   MOSS MSG        Power Control     Reset
                  MOSS INOP         0
                 All CA Disable    Service           Power Off
                Console in Use      0                  0
                 1-Remote/Alternate Valid Option
                 2-RSF              0
                 3-Local           Exit
               Power Control        0
                1-Host
                2-Network
                3-Local
             Service                                 Unit Emergency
              0-Normal
              1-Maintenance 1
              2-Maintenance 1
              3-Maintenance 1
         Status Code
      Function
       0-General IPL
       1-MOSS IML
       2-MOSS Dump
       3-Request Local Console
       4-Force Local Console
       5-Panel Test
       6-Remote Console Link Test
       7-RSF Console Link Test
       8-Local Console Link Test
       9-Load from Diskette
       A-Loop on MOSS Diagnostics
       B-MOSS Power Off
       C-Power Bus Test
```

Figure 26. MOSS Control Panel

2.4.5 MOSS Functions

The MOSS provides many functions, some of which are similar to those provided by the IBM 3725 MOSS. Most of the functions are new or improved ones.

The MOSS functions equivalent to the 3725 MOSS functions include:

- Controller initialization and IPL/IML services for the CCU(s), MOSS, and Scanners triggered from the Control Panel, the console, or from a host
- Recording of controller component errors (BER) with notification to the host (ALERT) and to the operator console (ALARM)
- Permanent display of the machine status on the operator console
- Console driven functions for hardware, microcode, and control program servicing, and for problem determination
- Machine data file recording and display
- Controller diagnostics execution environment
- Machine file and microcode dumps transfer to host
- CNM support for maintenance data requests.

The improved MOSS functions include:

- Control of configuration and operating modes:
  - Single : one CCU installed
  - Twin-in-Dual : two CCU installed and both active
  - Twin-in-Backup : two CCU installed and both active with backup capability
  - Twin-in-Standby : two CCU installed with one active and one in standby
- Control of switching operations:
  - Activation of standby CCU in Twin-in-Standby configuration
  - Activation of backup and switchback operations in Twin-in-Backup configuration
- Service functions for TSS, HPTSS, TRSS, and CA
- Scanner Interface Trace (SIT)
- Standalone IPL/DUMP from/to disk (up to two load module and one dump per CCU)
- Transfer of control program dump from disk to host
- Generic ALERT support
- Scanner multiple load modules support
- Automatic scanner Re-IML
- Concurrent diagnostics
- Channel Adapter Concurrent Maintenance (CACM)
- Time and date management
- Scheduled Power On

- Channel Adapter control and status display from console
- Automatic BER analysis
- Power service
- Tracking of machine availability
- Remote console attachment
- Remote Support Facility

In the twin configuration, the MOSS provides its system functions to both CCUs and the attached adapters simultaneously. These functions include:

- Controller IPL and bus switching functions
- Box Event Recording and ALERT/ALARM generation
- Communication with CNM products

2.5 Power Subsystem

The 3745 powering subsystem is distributed over each function in order to improve availability. The distributed power supply design enables concurrent maintenance of failed components without impairing operation of the rest of the system.

Power blocks are provided as follows:

- One power block per CCU
- One power block for the MOSS
- One power block per pair of Channel Adapters
- One power block per pair of Line Adapters
- One power block per LIC Unit.

All these power blocks are attached to a microprocessor which performs the control functions:

- General power on/off
- Individual power on/off
- Automatic restart in case of AC transient failure
- Power fault reporting and monitoring
- TCM temperature monitoring
- Scheduled power on.

The power subsystem communicates with the MOSS, providing power control capability through the local, alternate or remote console.

The 3745 has just one prime power, but it has been designed not to provide the power to the distributed power blocks but monitor, control and manage the power subsystem. The temporary loss of a prime power function does not affect the system operations. The 3745 design concept does not require two prime powers even in the 3745-410.

3. Software

3.1 3745 Software Environment

The IBM 3745 Communication Controller runs under control of the Advanced Communications Function Network Communication Program (ACF/NCP Version 5) to support Systems Network Architecture (SNA) requirements.

The 3745 requires one of the following releases of the ACF/NCP Version 5 licensed program:

- ACF/NCP Version 5 Release 1

  ACF/NCP V5R1 is generated using ACF/SSP V3R3 for MVS/370 and MVS/XA. Co-requisite VTAM support is provided through ACF/VTAM V3R1.1 for MVS with the appropriate PTFs, or ACF/VTAM V3R2.

- ACF/NCP Version 5 Release 2

  ACF/NCP V5R2 is generated using ACF/SSP V3R4 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP. Co-requisite VTAM support is provided through ACF/VTAM V3R2.

- ACF/NCP Version 5 Release 2.1

  ACF/NCP V5R2.1 is generated using ACF/SSP V3R4.1 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP. Co-requisite VTAM support is provided through ACF/VTAM V3R2 with the appropriate PTF or through ACF/VTAM V3R2 Enhancements.

Also, the 3745 can run under control of the Partitioned Emulation Program (PEP) extension to support non-SNA networking requirements. PEP allows NCP and Emulation Program (EP) coexist in a 3745. Use of PEP extension of ACF/NCP Version 5 requires the appropriate release of EP for the IBM Communication Controllers.

- Emulation Program Release 5

  EP Release 5 is generated using ACF/SSP V3R3 for MVS/370 and MVS/XA. EP Release 5 operates with ACF/NCP Version 5 Release 1 for the 3745.

- Emulation Program Release 6

  EP Release 6 is generated using ACF/SSP V3R4 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP. EP Release 6 operates with ACF/NCP Version 5 Release 2 for the 3745.

- Emulation Program Release 6.1

  EP Release 6.1 is generated using ACF/SSP V3R4.1 for MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP. EP Release 6.1 operates with ACF/NCP Version 5 Release 2.1 for the 3745.

When running with the EP mode of PEP, the 3745 communicates through

the Basic Telecommunications Access Method (BTAM and BTAM/SP), or the Basic Telecommunication Access Method-Extended Support (BTAM-ES), or the Remote Terminal Access Method (RTAM).

The 3745 takes full advantage of the enhanced network management support offered by the Integrated Network Management Product (NetView Release 2 or 3). By monitoring and managing the controller and its resources, and diagnosing problems, NetView contributes to the optimization of 3745.

3.2 ACF/NCP Version 5

The following ACF/NCP Version 5 releases support the 3745 Communication Controller as well as the 3720.

- ACF/NCP Version 5 Release 1

  ACF/NCP Version 5 Release 1 supports the 3745 and 3720 Communication Controllers for MVS/370 and MVS/XA users at generally the functional level of ACF/NCP V4R2 without the ACF/NCP V4R2 Feature, and provides additional functions unique to the 3745.

- ACF/NCP Version 5 Release 2

  ACF/NCP Version 5 Release 2 combines the functions of the ACF/NCP V5R1 and ACF/NCP V4R2 Feature, and offers additional network control capabilities to MVS, VM, and VSE users of the 3745 and 3720 Communication Controllers.

  The functional level of ACF/NCP V5R2 is generally the same as that of ACF/NCP V4R3 for the 3725 Communication Controller.

- ACF/NCP Version 5 Release 2.1

  ACF/NCP Version 5 Release 2.1 provides MVS, VM, and VSE users of the 3745 and 3720 Communication Controllers with the additional capabilities such as the enhanced Token-Ring connectivity, extended subarea addressing, increased explicit route capability, enhanced session accounting capability and so on.

3.2.1 ACF/NCP Version 5 Release 1

ACF/NCP Version 5 Release 1 provides the initial support for the 3745 Communication Controller for MVS/370 and MVS/XA users. Support is also provided for the 3720 Communication Controller.

In addition, ACF/NCP V5R1 introduces the 3745 with minimum migration requirements on the ACF/VTAM and NetView products.

ACF/NCP V5R1 supports the following functions in addition to those provided in ACF/NCP V4R2. Most of these functions are unique to the 3745.

3.2.1.1 Support for 8 Megabytes Storage

ACF/NCP V5R1 supports up to 8 megabytes of storage in 4 megabyte increments as allowed by the 3745.

3.2.1.2 Support for Increased Communications Attachment Capability

ACF/NCP supports the following 3745 communications attachment. Performance criteria (such as line speeds and traffic volumes) also influence these attachments in any given configuration.

- 896 Lines via the Low-Speed Scanners (LSS)

  The Low-Speed Scanner (LSS) provides the capability for the 3745 to attach facilities providing transmission speeds up to 256 Kbps. It supports Full-Duplex or Half-Duplex modes, Asynchronous or Synchronous protocols, and procedures for Automatic Calling Units (ACU).

- 16 High-Speed Lines via the High-Speed Scanners (HSS)

The High-Speed Scanner (HSS) provides the capability for the 3745 to attach facilities providing transmission speeds up to 2048K bps. The 3745 Direct Memory Attach (DMA) function is employed by the HSS to support speeds up to 2048K bps. Only leased full duplex SDLC INN links are supported at these transmission speeds. Up to 8 High-Speed lines can be active simultaneously.

- 8 Token Rings via the Token-Ring Adapters (TRA)

  The NCP Token-Ring Interconnection function (NTRI) provides a basic Boundary Network Node (BNN) interface allowing communication with up to 8 IBM Token-Ring networks.

All the above maximum attachments cannot be achieved simultaneously.

3.2.1.3 Support for 16 Channel Adapters per NCP

ACF/NCP V5R1 supports a maximum of 16 channel adapters which can be attached to an 3745. However, the maximum number of channel adapters which can be attached to owning hosts is limited to eight. The remaining channel adapters must be attached to data hosts which are not owners of the NCP.

3.2.1.4 Support for 2 I/O Buses per CCU

ACF/NCP V5R1 supports two I/O buses per CCU. The 3745 has two I/O buses per CCU to balance the performance load on the controller due to the substantially increased channel and communication subsystem capabilities over the equivalent facilities for the 3725.

3.2.1.5 Support for Switching Buses in Twin-CCU Configuration

ACF/NCP provides the capability of switching buses between CCUs when operating in a Twin-CCU 3745 configuration. Each of the two CCUs has two I/O buses and one DMA bus which can be switched between the CCUs using appropriate procedures.

3.2.1.6 Support for the Data Streaming Mode

ACF/NCP V5R1 supports the new channel adapter on the 3745. ACF/NCP V5R1 Channel Adapter support provides the Data Streaming and and I/O Error Alert capabilities.

3.2.1.7 Support for Line Adapter Concurrent Maintenance

ACF/NCP V5R1 supports the concurrent maintenance of one or more Line Adapters while the NCP is still running with other line adapters. This includes the Low-Speed Scanners (LSS) and the High-Speed Scanners (HSS) as well as the Token-Ring Adapters (TRA).

3.2.1.8 Support for Network Management Vector Transport from MOSS

ACF/NCP provides support for transmitting Network Management Vector Transport (NMVT) RUs from MOSS to the host processor. NMVTs are required to support the new generic alert capability provided in NetView R2.

3.2.1.9 Support for Transient Error Detection and Reporting via BERs

ACF/NCP V5R1 supports transient error detection and reporting by means of Box Event Records (BERs). The line adapter in the 3745 has the added capability to detect transient errors, and user-correctable errors (LIC error).

3.2.1.10 Enhanced Port Swap Support

The port swap capability which was provided in ACF/NCP Version 4 Release 1 was limited to 128 port swaps per NCP load (from IPL to IPL). This restriction is removed in ACF/NCP V5R1. The number of port swaps is now unlimited.

3.2.1.11 Enhanced Problem Determination Facilities

Improvements have been made with regard to the scanner or line adapter dumps and Scanner Interface Trace (SIT) during failure situations. Additional Box Event Record (BER) information is also provided as appropriate for the 3745. In addition, the NCP Token-Ring Interconnection (NTRI) error recovery support is enhanced.

3.2.1.12 Integration of ACF/NCP V4R2 Enhancements

The following ACF/NCP V4R2 enhancements are integrated into ACF/NCP V5R1:

- Support for the following capabilities of the 3720 disk is extended to include the 3745 disk:
  - Support for storing a single NCP load module on the disk
  - Support for automatic load of NCP from the disk, and automatic dump of NCP to the disk
  - Transfer of the NCP dump from the disk to a host data set

  The disk support for the 3745 with a Twin-CCU configuration provides the capability for a single load module and dump for each CCU.
- A usability enhancement for certain switched environments whereby all nodes calling in on a single NCP port may appear to the host as one station. This capability is designed to be used only when the calling nodes share a common set of characteristics or when differences in characteristics are not important to the host application. The function is limited to call-in situations only. Since the identities of the calling nodes are masked from the host, normal security and network awareness facilities are not available, except via user-written application code.
- Enhanced availability of NCP in an X.21 switched environment by changing the designation of link INOP's to station INOP's, and by changing the status of certain INOP codes from "hard" to "soft," in order to retain connectivity through a number of retries.

3.2.2 ACF/NCP Version 5 Release 2

ACF/NCP V5R2 combines the functions of the ACF/NCP V5R1 and ACF/NCP V4R2 Feature, and offers the following additional capabilities to MVS, VM, and VSE users of the 3720 and the 3745.

3.2.2.1 SNA Type 2.1 Node Support

SNA Type 2.1 Nodes have enhanced capabilities for peripheral node communications with SNA host nodes and with other peripheral nodes. They offer the improved connectivity and reduction of user system definition that results if two nodes exchange some of their characteristics and capabilities dynamically during connection establishment.

SNA Type 2.1 peripheral nodes can have independent LUs, dependent LUs, or both, depending on the capabilities of the device. Independent LUs can have more

than one concurrent LU-LU session (including parallel sessions for LU 6.2), can act as a primary logical unit (PLU) as well as a secondary logical unit (SLU), and do not have SSCP-LU sessions. Dependent LUs are limited to one active LU-LU session at a time, can act only as SLUs, and require SSCP-LU sessions. Independent LU capabilities in peripheral nodes are supported only by SNA Type 2.1 Nodes.

ACF/NCP V5R2, in conjunction with ACF/VTAM V3R2 (and with X.25 NPSI Version 3 Release 2 if communicating through an X.25 network) now support peer-to-peer communication between SNA Type 2.1 nodes through an SNA subarea network. These products form the basis for the following enhanced session capabilities and increased configuration flexibility:

Enhanced session capabilities for independent LUs in SNA Type 2.1 nodes:

- Peripheral LUs can act as primary LUs (PLUs) as well as secondary LUs (SLUs), thus allowing peer-to-peer communication without requiring a host application.
- Peripheral LUs can have more than one concurrent LU-LU session
  - with a single session partner (parallel sessions)
  - with multiple session partners
  - with a combination of partners, each capable of one session or multiple sessions
- The number of LU-LU sessions per peripheral node and the number of independent LUs per peripheral node are essentially unlimited (for SNA Type 2.0 nodes, only 254 LUs are allowed and all must be dependent).

Increased configuration flexibility for SNA Type 2.1 nodes:

- SNA Type 2.1 peripheral nodes may be attached directly to ACF/NCP V5R2, or may be indirectly attached via another SNA Type 2.1 node (such as via the S/36 APPN feature).
- SNA Type 2.1 peripheral nodes use the same protocols to connect to an SNA subarea network as they would use to connect to each other.

ACF/NCP V5R2 support for SNA Type 2.1 nodes also includes adaptive session pacing. Session pacing is a means of controlling flow on a session, and may be used to restrict flow when the demands of the session exceed the resource capabilities, or to help prevent specific sessions from monopolizing resources such as lines, buffers, etc., which are shared among many sessions. Current session pacing uses fixed window sizes defined by the user. The adaptive session capability of ACF/NCP V5R2 allows variable window sizes to be determined dynamically by the receiving end of the session stage. Each pacing stage end point determines its own receive window sizes. Only normal flow (non-expedited) request RUs are session paced. Response RUs and expedited request RUs are not session paced.

ACF/NCP V5R2 supports Transaction Processing Facility Version 2 Release 4 as either a Type 2.1 or Type 5 node.

SNA Type 2.1 peripheral nodes that support attachment to the IBM Token-Ring may receive peer-to-peer communication with other SNA Type 2.1 nodes through an SNA subarea network via the NCP Token-Ring Interconnection (NTRI) facility of ACF/NCP V5R2.

3.2.2.2 Enhanced Session Accounting Capability

With the capability of peripheral LUs serving as primary LUs (PLUs), accounting applications relying on the primary LU to be located only in the host may no longer be sufficient. ACF/NCP V5R2 collects byte and PIU counts associated with each half-session component of a session and reports that information, along with session awareness data to NetView Performance Monitor (NPM) Release 3.

If the user selects session accounting, he may specify via NCP generation whether session accounting is required for LUs acting as PLU, SLU, or all LUs; whether accounting collection should begin immediately or be deferred; the session accounting byte and PIU thresholds; whether backup NPM session are defined; and the number of half-sessions for which session accounting will be done.

At LU-LU session set-up time, a session awareness PIU will be sent to NPM as unsolicited information. Byte and PIU counts within NCP will be updated every time there is traffic on the session. When the counts surpass the user-specified threshold, the counters will be sent to NPM. At the end of the session, session awareness data and the last set of counters for the session will be sent to NPM. The user-specified options as well as thresholds can be changed via NPM commands. In addition, transport of accounting data to NPM can be suspended and resumed via NPM commands.

3.2.2.3 Dynamic Path Update

ACF/NCP V5R2 and ACF/VTAM V3R2 together provide the capability to dynamically update NCP and VTAM path definitions, in addition to the currently available function of adding or replacing VTAM's path definitions. This allows subarea topology changes without requiring regeneration or inactivation of the NCP. The path updates are sent from VTAM to each NCP subarea via the SSCP-PU session, thereby requiring that a minimum of one route be defined over which this session can be initially established.

3.2.2.4 Dynamic Reconfiguration Enhancements

ACF/NCP V5R2, in conjunction with ACF/VTAM V3R2, provides the following capabilities:

- Implicit dynamic reconfiguration: PU and LU definitions for peripheral nodes (Type 1, 2.0, and 2.1 nodes) may be added to an existing NCP definition deck and activated without regeneration of the NCP.
- Support for a new VTAM operator command (MODIFY DR) that can be used to dynamically delete PUs (and associated LUs), delete LUs, and move PUs (and associated LUs) without creating a DRDS definition deck.
- Support for a new dynamic reconfiguration function, MOVE, that allows movement of an inactive PU and its associated LUs from one non-switched line to another non-switched line in the same NCP.
- The ability to specify the line capability (Full-Duplex or Half-Duplex) on the switched PU statement and also on the PU statement in a DR definition deck.

ACF/NCP V5R2 also allows specification at system generation time that control blocks in the dynamic resource pools are eligible for collection of performance data. With this support, dynamically reconfigured resources can have the same NPM support as system-defined resources.

3.2.2.5 Enhanced Availability During Loss of SSCP Ownership

ACF/NCP V5R2 in conjunction with ACF/VTAM V3R2 provides several availability enhancements for NCP-attached peripheral nodes when the owning SSCP is lost:

- ACF/NCP V5R2 provides additional information to the takeover SSCP for SNA Type 1, 2, and 2.1 peripheral nodes. This enables the SSCP which assumes ownership to function more nearly as the original owning SSCP.
- Non-disruptive loss of SSCP ownership previously available only to SNA non-switched nodes is enhanced to included SNA switched connections. At the user's option, LU-LU sessions with SNA switched peripheral nodes will not be disrupted by the loss of SSCP ownership.
- Non-disruptive takeover of SSCP ownership previously available only for SNA non-switched connections is now enhanced to include SNA switched connections. This will allow an alternate (or original) SSCP to assume SSCP ownership of an unowned switched SNA peripheral node without disrupting any active LU-LU sessions. As with non-switched connections, this capability can be accomplished only for peripheral nodes that support ACTPU/LU ERP.
- Non-disruptive return of SSCP ownership is a new function that allows ACF/VTAM V3R2 to give up SSCP ownership of all the peripheral nodes attached to SNA switched and non-switched peripheral links without disrupting any active LU-LU sessions. This function may be used by an alternate SSCP to give up ownership so the original owning SSCP may regain ownership of the peripheral node.

3.2.2.6 Non-disruptive Load of the IBM 3720 and 3745 Disk

ACF/NCP V5R2, in conjunction with ACF/VTAM V3R2 and the IBM 3720 or 3745, offers the capability of loading the disk while the NCP is active. In addition, these products support the capability for two load modules to be placed on the disk, thereby allowing increased flexibility in network planning. The disk support for the twin 3745 provides the capability for two load modules and a single dump for each CCU. In addition to NCP, the load module may contain associated NCP products such as EP, NPSI, and NTO.

3.2.2.7 Performance Improvements

- Class of Service priority is extended to include the links to peripheral nodes (route extensions), in addition to that currently available for routes between subarea nodes. With this support, high priority traffic sent to a link station will be given preference over lower priority traffic sent to that station, thereby providing user-controller performance via Class of Service selection.
- ACF/NCP V5R2 path lengths for peripheral node communications have been improved, especially for segmented Path Information Units (PIUs). Depending on the configuration and the user-specified segmentation characteristics, path lengths for peripheral node communications through ACF/NCP V5R2 can be improved over those for ACF/NCP V4R2.

3.2.2.8 Usability Enhancement

ACF/NCP V5R2 provides the capability for the NCP PU name to be different from the NCP load module name, thereby giving the user the flexibility to maintain multiple load modules for a single NCP PU name.

3.2.2.9 Serviceability Enhancements

- The requirement to dedicate a communication controller to the diagnosis and repair of a channel adapter (CA) when a CA fails is disruptive to many elements of a network. ACF/NCP V5R2 in conjunction with the 3745 provides the capability for channel adapter diagnosis and repair to occur concurrently with normal NCP operations on other channels and/or communication links which are unaffected, thus minimizing disruption. This capability is only available on the 3745.
- Session Information Retrieval (or session trace) has been enhanced to cause session pacing data to be collected and sent to NetView. Data collected and forwarded include queue lengths, pacing counts, pacing window sizes, and pacing stage indicators.
- Information has been added to the product set ID (PSID), a vector that identifies certain characteristics of the controller and its resident software. The software information contains the date and time of Link/Edit. Hardware information includes the machine type, model number, serial number, and plant of manufacture.
- The Adapter Control Block (ACB) trace has been expanded from three to eight trace entries, and the trace entries are now aligned on a fullword boundary for easier reading.
- A field has been added to the Adapter Control Block Extension (AXB) to indicate when scanner activity is stopped by a HALT or HALTI scanner command.
- Logic has been added to assure that there is no resource mismatch between NCP and VTAM, regardless of whether the resource has been system-defined or dynamically reconfigured.

3.2.2.10 Integration of Previous Enhancements

The following previous enhancements are integrated into ACF/NCP V5R2:

- The functions provided in the ACF/NCP V4R2 Feature
- The functions provided in ACF/NCP V5R1
- Support for the IBM 4941 Modem, whereby NCP can establish a switched connection via an IBM 4941 Modem using an inline dial capability. Automatic calls may be initiated by the data terminal equipment via the RS232 interface without requiring a separate Automatic Call Unit (ACU).

3.2.3 ACF/NCP Version 5 Release 2.1

ACF/NCP V5R2.1, in combination with ACF/VTAM V3R2 with the appropriate PTF or ACF/VTAM V3R2 Enhancements, provides additional capabilities to MVS, VM, and VSE users of the 3745 and 3720.

3.2.3.1 Subarea Connectivity through NCP Token-Ring Interconnection

ACF/NCP V5R2.1 provides support for Type 4-to-Type 4 or Type 4-to-Type 5 node communication over the IBM Token-Ring Network through the NCP Token-Ring Interconnection (NTRI). This support allows NCP-to-NCP communication through a Token-Ring network and NCP-to-VTAM communication for the IBM 9370 Token-Ring Subsystem Controller. ACF/NCP V5R2.1 may communicate over the Token-Ring network with:

- ACF/NCP Version 4 Release 3.1

- ACF/NCP Version 5 Release 2.1
- ACF/VTAM Version 3 Release 1.2 (VM)
- ACF/VTAM Version 3 for VM/9370
- ACF/VTAM Version 3 Release 2 with V3R2 Enhancements (VM and VSE)

NTRI will support subarea connections as leased, half duplex lines. These subarea connections will be supported as transmission groups with a single line per transmission group. A Token-Ring network may consist of both subarea and boundary connections; however, subarea and boundary connections must communicate with NTRI over separate physical lines (TICs).

NCP Token-Ring Interconnection (NTRI) performance in ACF/NCP V5R2.1 is improved, due to the receive functions being processed in NCP level 3, without going through NCP level 5.

Through a Token-Ring network, VTAM can initiate transfer of a second load module to the controller disk and also initiate transfer of the dump to the host only when the controller runs with an active NCP. Loading, dumping, and activating of Type 4 NCP nodes must continue to be accomplished via leased SDLC links or channel connections.

3.2.3.2 Extended Subarea Addressing

ACF/NCP V5R2.1, in combination with ACF/VTAM V3R2 with the appropriate PTF, provides extended network addressing by allowing the user subarea address limits between the current limit of 255 and the new maximum of 65,535. This capability provides important new connectivity which allows customers to operate a single network with greater than 255 subareas.

Full addressing capability is dependent on the network configuration and controller storage limitations. The amount of storage used to expand subarea routing capabilities is based on the number of subareas and the number of explicit routes allowed for each subarea to which the NCP will route, the largest subarea address to which the NCP will route, and the number of transmission groups. The CF3720 and CF3745 configurators available on HONE should be used to assess the extent of this capability.

3.2.3.3 Increased Explicit Route Capability

ACF/NCP V5R2.1, in combination with ACF/VTAM V3R2 with the appropriate PTF, supports up to sixteen (16) explicit routes between subareas, providing additional connectivity and increased availability between pairs of subareas. Optimal route selection can be aided through use of Network Design and Analysis (NETDA) Version 2. NETDA V1 and Routing Table Generator (RTG) do not support the increased explicit route capability of ACF/NCP V5R2.1.

3.2.3.4 Enhanced Session Accounting

ACF/NCP V5R2.1, in combination with NetView Performance Monitor Release 3 with the appropriate PTF, allows the customer to gather session data for cross-network sessions and present it to the NPM host. As with the support previously available only for peripheral node sessions, data collected includes session start and end, number of text and control PIUs, and number of text and control bytes.

With this release, new accounting statistics are available to both session accounting for peripheral nodes and gateway session accounting. These statistics consist of values that break up the total number of PIUs flowing on a session into certain length ranges. The PIU length ranges are specified by the user during NCP generation; new parameters allow the user to vary these ranges during subsequent NCP operation.

3.2.3.5 Multiple SLU Alias Address Assignment

For SNA Network Interconnect (SNI) environments, ACF/NCP V5R2.1 allows secondary logical units (SLUs) to have more than one alias address per network. With this support, a single application can be the SLU for more than 255 sessions through a single gateway NCP. When the SLU's session limit has been exceeded, a new address will be assigned for it, if it is parallel-session-capable, as is currently done for primary logical units (PLUs).

3.2.3.6 Enhanced Transmission Priority

With this support, class-of-service priority is extended beyond the physical unit (PU) to the SDLC link. Thus, for multipoint links, except for multipoint subarea links, batch traffic on one PU can be prevented through priority selection from slowing down interactive traffic on another PU on the same link.

3.2.3.7 Call Security Verification

ACF/NCP V5R2.1, in combination with ACF/VTAM V3R2 Enhancements, allows the user to ensure that a switched subarea connection is secure by defining a password in the VTAM switched major node. The password is not transmitted outside of VTAM, but rather is used as the basis for an encryption algorithm used by both ends of the switched subarea connection.

3.2.3.8 X.21 Usability Enhancements

ACF/NCP V5R2.1 supports an increased range of values, from 0 to 1632, for the specification of the time interval on the RETRYTO parameter. This offers the X.21 user greater flexibility in coordinating dial retries with the requirements of various network carriers.

ACF/NCP V5R2.1 also supports the Called/Calling-ID function that returns the phone number connected on an X.21 switched link.

3.2.3.9 Enhanced Modem Support

IBM 3745 Integrated Modems and Integrated Digital Service Units: ACF/NCP V5R2.1 supports the error processing, LPDA-2 testing, and NetView error notification capabilities of 3745 integrated modems and data service units. LPDA-2 support is provided in conjunction with NetView Release 3.

Support for the LULLY Modem: ACF/NCP V5R2.1 provides LPDA-2 support for the channelized LULLY modem. LPDA-2 support is provided in conjunction with NetView Release 2 (MVS/370 and MVS/XA) with appropriate PTF, or with NetView Release 3.

Support for Multiple Local Modems: Allows LPDA-2 tests to be run on lines with multiple local modems, regardless of whether they are on a non-tailed line, or on either segment of a tailed line. LPDA-2 support is provided in conjunction with NetView Release 2 (MVS/370 and MVS/XA) with appropriate PTF, or with NetView Release 3.

3.2.3.10 LPDA Test Flexibility

ACF/NCP V5R2.1 allows the user to specify whether or not the LPDA test should be performed when the total number of transmissions reaches its threshold.

3.2.3.11 Support for the 3745 Hot Standby Enhancement

ACF/NCP V5R2.1 supports the 3745 Model 410 operating in standby mode with the NCP preloaded in the backup CCU. Prior to this capability, the control program had to be loaded into the standby CCU before the backup CCU could take control, in the Twin-Standby mode of operation. The result is a reduction in the time required to get the network up and running in the event of outage of the first CCU.

3.2.3.12 Network Asset Management Support

The vital product data added to the product set ID by ACF/NCP V5R2 and V5R2.1, may be collected by the Network Asset Management facilities of NetView Release 3. The software information contains the date and time of linkedit; hardware information includes the machine type, model number, serial number, and manufacturing plant.

3.3 Emulation Programs

The Partitioned Emulation Program (PEP) Extension allows the NCP and the Emulation Program (EP) to coexist in the same Communication Controllers. The following new releases of EP operate only in a PEP environment.

- Emulation Program Release 5
- Emulation Program Release 6
- Emulation Program Release 6.1

With PEP, the 3745 can operate the same communication line under NCP or EP control, alternately. The change from one to the other may be made dynamically during program execution by commands sent from the access method. This method of operation requires that the terminal connected to the line be supported by both NCP and EP. As a matter of fact, the lines must be specified to be able to work in either mode at program generation.

EP allows a channel-attached communication controller to perform most of the functions of the IBM 2701 Data Adapter Unit, IBM 2702 Transmission Control Unit or IBM 2703 Transmission Control Unit.

The new releases of EP for the 3725, 3720 and 3745 supports BTAM, BTAM/SP, TCAM and RTAM.

3.3.1 Emulation Program Release 5

EP Release 5 for IBM 3720 and IBM 3745 operates in the Partitioned Emulation Program (PEP) mode with NCP V5R1 under an MVS environment. The 3745 has to run in a PEP environment as it does not run standalone EP.

EP Release 5 contains the following enhancements for the 3745 in addition to those functions supported by previous releases of EP:

- Support for up to 8 megabytes of storage
- Support for up to 16 channel adapters
- Increased communications attachment capability via the Low-Speed Scanners (LSS) maximum of 896 lines. Performance criteria (such as line speeds and traffic volumes) also influence the maxima in any given configuration.
- Support for 2 I/O Buses per CCU
- Support for switching buses in Twin-CCU configuration
- Line Adapter concurrent maintenance
- Transient error detection and reporting via Box Event Records
- I/O error alert capabilities where appropriate on the new Data Streaming Channel Adapter (CADS).

The following improvements have also been made to EP Release 5 in the areas of Serviceability and Problem Determination:

- A Channel Adapter IOH Trace
- A time stamp has been added to EP Line Trace records

3.3.2 Emulation Program Release 6

EP Release 6 (MVS, VM and VSE) for IBM Communication Controllers operates in the Partitioned Emulation Program mode with NCP V5R2 for the IBM 3720 and IBM 3745 or NCP V4R3 for the IBM 3725 under an MVS, VM, or VSE environment.

In addition to the functions supported by previous releases of EP, this release contains support for the Channel Adapter Concurrent Maintenance (CACM) for the IBM 3745. This function allows users to perform diagnostic and repair functions on the channel in a non-disruptive manner for those elements of the system which are unaffected by these operations.

3.3.3 Emulation Program Release 6.1

EP Release 6.1 (MVS, VM and VSE) for IBM Communication Controllers operates in the Partitioned Emulation Program mode with NCP V5R2.1 for the IBM 3720 and IBM 3745 or NCP V4R3.1 under an MVS, VM, or VSE environment.

EP Release 6.1 provides functions equivalent to previous releases.

3.4 ACF/SSP Version 3

ACF/SSP Version 3 is the recommended SSP for all SSP users in the MVS, VM, and VSE environments using ACF/NCP Version 5 or later. The following ACF/SSP Version 3 releases provide generation and utility functions, such as assembler, load utility, dump utility, dynamic dump utility, configuration report program, and trace analysis program, to the 3745 Communication Controller as well as the existing Communication Controllers:

- ACF/SSP Version 3 Release 3
- ACF/SSP Version 3 Release 4
- ACF/SSP Version 3 Release 4.1

Generation definitions for the 3705, 3725, and 3720 Communication Controllers used with ACF/SSP Version 3 Release 2 can be used with ACF/SSP Version 3 Release 3, 4, and 4.1 with no modification other than JCL.

Generation Definitions for previous ACF/NCP releases (ie. ACF/NCP Version 4 Release 2) require modifications to generate ACF/NCP Version 5 for the 3745.

3.4.1 ACF/SSP Version 3 Release 3

ACF/SSP Version 3 Release 3 provides MVS/370 and MVS/XA users with enhanced generation and utility functions in addition to functions offered by ACF/SSP V3R2.

The enhancements provided by ACF/SSP V3R3 are as follows:

- Adds supports for the 3745 Communication Controller to the existing Communication Controllers support.
- The Advanced Communication Facility Trace Analysis Program (ACF/TAP) provides an X.25 NPSI Line Trace Report and an NTRI Line Trace Report.
- The dump formatter utility provides a sorted index of the dump contents and a sorted copy of the NCP load map.
- The load and dump utilities recognize when a load or dump is in progress on another channel.
- The NCP/EP Definition Facility (NDF) provides a new method for defining Channel Adapters of the 3745 Communication Controller.
- The NDF standard attachment facility provides more flexible means of adding statement groups to the generation definition.
- The NCP/EP Definition Facility allows the file created by NEWDEFN to echo or pack the input generation definition.

ACF/SSP V3R3 is required when running ACF/NCP V5R1, EP R5, NPSI V3R1 or NTO R4.1. The complete list of NCP and EP levels supported by ACF/SSP V3R3 is as follows:

- ACF/NCP Version 3 for the 3705 and 3725
- ACF/NCP Version 4 Release 1
- ACF/NCP Version 4 Release 2

  Note: Without ACF/NCP V4R2 Feature

- ACF/NCP Version 4 Subset

  Note: Without ACF/NCP V4 Subset Feature
- ACF/NCP Version 5 Release 1
- Emulation Program for the 3705
- Emulation Program Release 2
- Emulation Program Release 3
- Emulation Program Release 4
- Emulation Program Release 5

3.4.2 ACF/SSP Version 3 Release 4

ACF/SSP Version 3 Release 4 provides MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP users with the enhanced generation and utility functions in addition to functions offered by ACF/SSP V3R3 for MVS and ACF/SSP Version 3 Release 2 for VM and VSE.

The enhancements provided by ACF/SSP V3R4 are as follows:

- The Advanced Communication Facility Trace Analysis Program (ACF/TAP) is further improved to provide a date selection parameter and handle a wrapped data set when using the date and time selection parameters. The maximum amount of formatted PIU data has been increased and the SDLC Line Trace formatting for the 3725, 3720 and 3745 has been enhanced.
- The machine-readable model network definitions provided with ACF/SSP have been updated to include specific subconfigurations or attachment definitions for supported functions through ACF/NCP V4R3 for the 3725 and ACF/NCP V5R2 for the 3720 and 3745.
- The load utility for VSE now provides an interface to VTAM Version 3 Release 2 (VSE) similar to the existing interface for MVS and VM.

ACF/SSP V3R4 is required when running ACF/NCP V5R2, ACF/NCP V4R3, EP R6, NPSI V3R2, NPSI V2, NTO R5 or NRF R3.1. The complete list of NCP and EP levels supported by ACF/SSP V3R4 is as follows:

- ACF/NCP Version 3 for the 3705
- ACF/NCP Version 3 for the 3725 (MVS and VM only)
- ACF/NCP Version 4 Release 1 (MVS and VSE only)
- ACF/NCP Version 4 Release 2 (MVS and VM only)

  Note: With or without ACF/NCP V4 R2 Feature (MVS only)
- ACF/NCP Version 4 Subset

  Note: With or without ACF/NCP V4 Subset Feature (MVS only)
- ACF/NCP Version 4 Release 3
- ACF/NCP Version 5 Release 1 (MVS only)
- ACF/NCP Version 5 Release 2
- Emulation Program for the 3705
- Emulation Program Release 2 (MVS and VM only)

- Emulation Program Release 3 (MVS and VSE only)
- Emulation Program Release 4 (MVS and VM only)
- Emulation Program Release 5 (MVS only)
- Emulation Program Release 6

3.4.3 ACF/SSP Version 3 Release 4.1

ACF/SSP Version 3 Release 4.1 provides MVS/370, MVS/XA, VM/SP, VM/SP HPO, VM/XA SP2, VSE/AF, or VSE/SP users with the enhanced generation and utility functions in addition to the functions offered by ACF/SSP V3R4. In addition, ACF/SSP V3R4.1 provides support in the NCP/EP Definition Facility and utility functions to MVS, VM and VSE users of ACF/NCP V4R3.1 for the 3725, ACF/NCP V5R2.1 for the 3720 and 3745, and EP R6.1.

The enhancements provided by ACF/SSP V3R4.1 are as follows:

- ACF/TAP correlates SDLC transmit and receive events that occur over a full-duplex line and reports the events on chronological order in the line trace detail report.
- ACF/TAP provides a separate NODE parameter for each of the major trace type.
- Dump formatter utility is enhanced to provide a search string when formatting an abended NCP. The search string prints on the first page of the formatted NCP dump and contains information needed to search for duplicate problems reported on the RETAIN.
- NDF is enhanced to report the storage required by NCP initialization to build NCP control blocks. This number can be added to the NCP load module size to determine if the load module will initialize successfully. The storage needed for initialization control blocks will be reported in the NDF generation listing when either a full generation or NDF keyword validation (FASTRUN) is executed.
- NDF in enhanced to simplify the system generation coding for customers with networks of many similar lines. By specifying the AUTOLINE keyword for a range of line addresses in the system generation deck, NDF will replicate that line structure for the specified range.
- The NDF standard attachment facility supports the Network Routing Facility (NRF). NRF generation statements can be incorporated into the NCP generation deck. This enhancement allows an NCP load module with NRF included to be created in one step.

ACF/SSP V3R4 is required when running ACF/NCP V5R2.1, ACF/NCP V4R3.1, EP R6.1, NTO R5.1 or NRF R3.2. The complete list of NCP and EP levels supported by ACF/SSP V3R4.1 is as follows:

- ACF/NCP Version 3 for the 3705
- ACF/NCP Version 3 for the 3725
- ACF/NCP Version 4 Release 1
- ACF/NCP Version 4 Release 2

  Note: With or without ACF/NCP V4R2 Feature
- ACF/NCP Version 4 Subset

Note: With or without ACF/NCP V4 Subset Feature

- ACF/NCP Version 4 Release 3
- ACF/NCP Version 4 Release 3.1
- ACF/NCP Version 5 Release 1
- ACF/NCP Version 5 Release 2
- ACF/NCP Version 5 Release 2.1
- Emulation Program for the 3705
- Emulation Program Release 2
- Emulation Program Release 3
- Emulation Program Release 4
- Emulation Program Release 5
- Emulation Program Release 6
- Emulation Program Release 6.1

3.5 Software Compatibilities

As the result of new releases of ACF/NCP, EP, ACF/SSP, and the IBM 3745 Communication Controller, the network software environment has changed.

The following charts show the software compatibilities of the SSP, NCP, and related Program Products as they relate to IBM Communications Controllers.

3.5.1 NCP-Communication Controller Relationship

The following matrix shows the relationship between the IBM Communication Controllers and the NCP releases.

	A C F / N C P Releases								
	V3	V4R1	V4R2	V4 Subset	V4R3	V4R3.1	V5R1	V5R2	V5R2.1
3705	X								
3725	X	X	X		X	X			
3720		X	X	X			X	X	X
3745							X	X	X

Note:
1. ACF/NCP V4R1 provides supports for MVS and VSE users.
2. ACF/NCP V4R2 provides supports for MVS and VM users.
3. ACF/NCP V4 Subset for MVS and VM is based on ACF/NCP V4R2.
4. ACF/NCP V4 Subset for VSE is based on ACF/NCP V4R1.
5. ACF/NCP V4R2 may include ACF/NCP V4 Feature or not.
6. ACF/NCP V4 Subset may include ACF/NCP V4 Subset Feature or not.
7. ACF/NCP V5R1 provides supports for MVS users only.

Figure 27. NCP-Communication Controller Relationship

3.5.2 SSP V3 Generation Capability

The following matrices show the ACF/SSP Version 3 support capability.

ACF / NCP	O S	ACF/SSP V3R1	ACF/SSP V3R2	ACF/SSP V3R3	ACF/SSP V3R4	ACF/SSP V3R4.1
V3 for 3705	MVS	X	X	X	X	X
	VM	X	X		X	X
	VSE	X	X		X	X
V3 for 3725	MVS	X	X	X	X	X
	VM	X	X		X	X
V4R1	MVS	X	X	X	X	X
	VSE	X	X		X	X
V4R2	MVS		X	X	X	X
	VM		X		X	X
V4 Subset	MVS		X	X	X	X
	VM		X		X	X
	VSE		X		X	X
V4R3	MVS				X	X
	VM				X	X
	VSE				X	X
V4R3.1	MVS					X
	VM					X
	VSE					X
V5R1	MVS			X	X	X
V5R2	MVS				X	X
	VM				X	X
	VSE				X	X
V5R2.1	MVS					X
	VM					X
	VSE					X

Note: 1. ACF/SSP V3R2 may include ACF/SSP V3R2 Feature or not. ACF/SSP V3R2 Feature supports ACF/NCP V4R2 Feature and ACF/NCP V4 Subset Feature for MVS users in addition to the support capability of ACF/SSP V3R2.
2. ACF/NCP V4R2 for MVS may include ACF/NCP V4 Feature or not.
3. ACF/NCP V4 Subset for MVS may include ACF/NCP V4 Subset Feature or not.
4. ACF/SSP V3R3 does not supports ACF/NCP V4R2 Feature and ACF/NCP V4 Subset Feature.
4. ACF/NCP V4 Subset for VSE is based on ACF/NCP V4R1.

Figure 28. ACF/SSP Support Capability for ACF/NCP

EP	O S	A C F / S S P				
		V3R1	V3R2	V3R3	V3R4	V3R4.1
EP for 3705	MVS	X	X	X	X	X
	VM	X	X		X	X
	VSE	X	X		X	X
R2	MVS	X	X	X	X	X
	VM	X	X		X	X
R3	MVS		X	X	X	X
	VSE		X		X	X
R4	MVS		X	X	X	X
	VM		X		X	X
R5	MVS			X	X	X
R6	MVS				X	X
	VM				X	X
	VSE				X	X
R6.1	MVS					X
	VM					X
	VSE					X

Figure 29. ACF/SSP Support Capability for EP

3.5.3 NCP - NCP Communications Matrix

The following matrix shows the NCP communication capabilities.

	A C F / N C P Releases													
	V1	V2		V3		V4						V5		
	R2.1					Subset		R1	R2	R3	R3.1	R1	R2	R2.1
	3705	3705	3725	3705	3725	3720	3720	3725 3720	3725 3720	3725	3725	3745 3720	3745 3720	3745 3720
ACF/NCP Releases	MVS VSE	MVS VSE	MVS VSE	MVS VM VSE	MVS VM	VSE	MVS VM	MVS VSE	MVS VM	MVS VM VSE	MVS VM MVS	MVS	MVS VM VSE	MVS VM VSE
V1R2.1	Y	Y	Y	Y	Y	G	G	G	G					
V2(3705)	–	Y	Y	Y	Y	E	E	E	E	E	E	E	E	E
V2(3725)	–	–	Y	Y	Y	E	E	E	E	E	E	E	E	E
V3(3705)	–	–	–	Y	Y	E	E	E	E	E	E	E	E	E
V3(3725)	–	–	–	–	Y	E	E	E	E	E	E	E	E	E
V4S VSE	–	–	–	–	–	Y	Y	Y	Y	Y	S	Y	Y	S
V4S MVS,VM	–	–	–	–	–	–	Y	Y	Y	Y	S	Y	Y	S
V4R1	–	–	–	–	–	–	–	Y	Y	Y	S	Y	Y	S
V4R2	–	–	–	–	–	–	–	–	Y	Y	S	Y	Y	S
V4R3	–	–	–	–	–	–	–	–	–	Y	S	Y	Y	S
V4R3.1	–	–	–	–	–	–	–	–	–	–	S	S	S	Y
V5R1	–	–	–	–	–	–	–	–	–	–	–	Y	Y	S
V5R2	–	–	–	–	–	–	–	–	–	–	–	–	Y	S
V5R2.1	–	–	–	–	–	–	–	–	–	–	–	–	–	Y

Legend : Y – Communication possible without qualification.
E – Communication possible, if extended network addressing requirements and restrictions are satisfied. PTF must be investigated.
S – Communication possible, if extended subarea addressing requirements and restrictions are satisfied. PTF must be investigated.
G – Communication possible through pre–ENA Gateway (NCP V3).

Note: 1. For VSE, NCP Subset is based on NCP V4R1.
For MVS and VM, NCP Subset is based on NCP V4R2.
2. NCP V4 Subset may include NCP V4 Subset Feature or not.
NCP V4R2 may include NCP V4R2 Feature or not.

Figure 30. NCP-NCP Communication Matrix

3.5.4 VTAM - NCP Communications Matrix

The VTAM-NCP communication capability can be shown in two ways: SSCP-PU session capability and LU-LU session capability.

For the SSCP-PU session capability, the matrix shows whether a certain VTAM level can load and activate or just activate a certain NCP level.

For the LU-LU session capability, the matrix shows whether an LU residing in the VTAM subarea can establish a session with an LU residing in the NCP subarea.

3.5.4.1 SSCP-PU Session Capability

Basically, within the same operating system environment, any VTAM release of the pre-ENA version can load and activate any NCP release of the pre-ENA version, and so does the combination of any VTAM and NCP release of the ENA version. Also, as long as subarea/element restrictions are not violated, the same capability is provided for some combination of VTAM releases of pre-ENA version and NCP releases of ENA version, or VTAM releases of ENA version and NCP releases of pre-ENA version.

For some combinations, VTAM releases can activate NCP releases that are neither generated on nor loaded from the same operating system as the VTAM releases. This capability is provided by moving a copy of the NCP RRT and a copy of the NCP definition deck to the operating system under which the VTAM releases reside. For further information regarding how to move a copy of the NCP RRT, refer to the *Network Program Products - Planning*.

For combinations of ACF/VTAM V3R1, V3R1.1 or V3R1.2 and ACF/NCP Version 5 releases on the 3745, special considerations should be taken:

- VTAM V3R1 for MVS or VM does not support channel attachment of the 3745. This VTAM release does not have SSCP-PU session with NCP Version 5 releases.
- VTAM V3R1 for VSE can be channel-attached to the 3745 as a data host.
- VTAM V3R1.1 for MVS with the appropriate PTFs can load and activate NCP Version 5 releases.
- VTAM V3R1.1 for VM can be channel-attached to the 3745 but cannot have an SSCP-PU session with NCP Version 5 releases.
- VTAM V3R1.2 for VM with the appropriate PTFs can load and activate NCP V5R2. In addition, this VTAM release can activate NCP V5R2.1. For NCP V5R1, this VTAM release can be channel-attached to the 3745 but cannot have an SSCP-PU session.
- VTAM V3R1.2 for VSE can be channel-attached to the 3745 as a data host.

		A C F / N C P Releases													
		V1	V2		V3		V4						V5		
		R2.1					Subset		R1	R2	R3	R3.1	R1	R2	R2.1
		3705	3705	3725	3705	3725	3720	3720	3725 3720	3725 3720	3725	3725	3745 3720	3745 3720	3745 3720
ACF/VTAM Releases		MVS VSE	MVS VSE	MVS VSE	MVS VM VSE	MVS VM	VSE	MVS VM	MVS VSE	MVS VM	MVS VM VSE	MVS VM VSE	MVS	MVS VM VSE	MVS VM VSE
V1R3	MVS	Y	Y	Y	Y	Y									
	VSE	Y	Y												
V2R1	MVS	Y	Y	Y	Y	Y	A'	Y'	Y'	Y'					
	VSE	Y	Y	Y	Y		Y'	A'	Y'	A'					
V2R2	MVS		Y	Y	Y	Y	A'	Y'	Y'	Y'					
V3R1	MVS		Y'	Y'	Y'	Y'	A	Y	Y	Y	Y 1	Y"1	Y 2	Y 2	Y"2
	VM		A	A	Y	Y	A'	Y'	A'	Y'	Y'1	Y'1	A'3	Y'2	Y'2
	VSE		Y'	Y'	Y'	A'	Y	A	Y	A	Y 1	Y"1	A 4	Y 5	Y"5
V3R1.1	MVS		Y'	Y'	Y'	Y'	A	Y	Y	Y	Y 1	Y"1	Y 1	Y 1	Y"1
	VM		A'	A'	Y'	Y'	A	Y	A	Y	Y 1	Y"1	A 4	Y 5	Y"5
V3R1.2	VM		A'	A'	Y'	Y'	A	Y	A	Y	Y	Y"	A 4	Y 1	Y"1
	VSE		Y'	Y'	Y'	A'	Y	A	Y	A	Y	Y"	A 4	Y 5	Y"5
V3R2	MVS		Y'	Y'	Y'	Y'	A"	Y"	Y"	Y"	Y"	Y 1	Y"	Y"	Y 1
	VM		A'	A'	Y'	Y'	A"	Y"	A"	Y"	Y"	Y 1	A"	Y"	Y 1
	VSE		Y'	Y'	Y'	A'	Y"	A"	Y"	A"	Y"	Y	A"	Y"	Y

Legend:

Y – This VTAM level can load and activate this NCP level. PTF requirements must be investigated on an individual basis.
Y'– This VTAM level can load and activate this NCP level. PTF requirements and ENA restrictions must be investigated on an individual basis.
Y"– This VTAM level can load and activate this NCP level. PTF requirements and ESA restrictions must be investigated on an individual basis.

A – This VTAM level cannot load this NCP level but can activate this NCP by moving a copy of the NCP RRT and a copy of the NCP definition deck to system. PTF requirements must be investigated on an individual basis.

A'– This VTAM level cannot load this NCP level but can activate this NCP by moving a copy of the NCP RRT and a copy of the NCP definition deck to system. PTF requirements and ENA restrictions must be investigated on an individual basis.

A"– This VTAM level cannot load this NCP level but can activate this NCP by moving a copy of the NCP RRT and a copy of the NCP definition deck to system. PTF requirements and ESA restrictions must be investigated on an individual basis.

Note:

1– The appropriate VTAM PTF is required.

2– If this NCP resides in the 3745, this VTAM level cannot be channel-attached to the 3745, and SSCP–PU session capability is not provided. If this NCP resides in the 3720, this VTAM level with the appropriate PTFs can load and activate this NCP level. The 3720 disk functions are not supported by this VTAM level.

3– If this NCP resides in the 3745, this VTAM level cannot be channel-attached to the 3745, and SSCP–PU session capability is not provided. If this NCP resides in the 3720, this VTAM level with the appropriate PTFs can activate this NCP level.

4– If this NCP resides in the 3745, this VTAM level can be channel-attached to the 3745, but SSCP–PU session capability is not provided. If this NCP resides in the 3720, this VTAM level with the appropriate PTFs can activate this NCP level.

5– If this NCP resides in the 3745, this VTAM level can be channel-attached to the 3745, but SSCP–PU session capability is not provided. If this NCP resides in the 3720, this VTAM level with the appropriate PTFs can load and activate this NCP level.

Figure 31. VTAM-NCP SSCP-PU Communications Matrix

3.5.4.2 LU-LU Session Capability

Most of VTAM releases provide LU-LU session capability with most of NCP releases, without any qualification or with some qualifications. For some combinations, only LU-LU session capability is provided.

		ACF/NCP Releases													
		V1	V2		V3		V4						V5		
		R2.1					Subset		R1	R2	R3	R3.1	R1	R2	R2.1
		3705	3705	3725	3705	3725	3720	3720	3725 3720	3725 3720	3725	3725	3745 3720	3745 3720	3745 3720
ACF/VTAM Releases		MVS VSE	MVS VSE	MVS VSE	MVS VM VSE	MVS VM	VSE	MVS VM	MVS VSE	MVS VM	MVS VM VSE	MVS VM VSE	MVS	MVS VM VSE	MVS VM VSE
V1R3	MVS	Y	Y	Y	Y	Y									
	VSE	Y	Y												
V2R1	MVS	Y	Y	Y	Y	Y	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'
	VSE	Y	Y	Y	Y	Y	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'
V2R2	MVS	Y	Y	Y	Y	Y	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'	Y'
V3R1	MVS	G	Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
	VM	Y	Y	Y	Y	Y	Y'	Y'	Y'	Y'	Y'	Y''	Y'	Y'	Y'
	VSE		Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
V3R1.1	MVS	G	Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
	VM	G	Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
V3R1.2	VM		Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
	VSE		Y'	Y'	Y'	Y'	Y	Y	Y	Y	Y	Y	Y''	Y	Y''
V3R2	MVS		Y'	Y'	Y'	Y'	Y''	Y''	Y''	Y''	Y''	Y	Y''	Y''	Y
	VM		Y'	Y'	Y'	Y'	Y''	Y''	Y''	Y''	Y''	Y	Y''	Y''	Y
	VSE		Y'	Y'	Y'	Y'	Y''	Y''	Y''	Y''	Y''	Y	Y''	Y''	Y

Legend:

Y – The VTAM and NCP LUs can establish LU–LU sessions (both LUs reside in an ENA ESA or pre–ENA nodes).
Y'– The VTAM and NCP LUs can establish LU–LU sessions (one LU resides in an ENA or ESA node and one LU resides in a pre–ENA node). PTF requirements and subarea/element restrictions must be investigated on an individual basis.

Y"– The VTAM and NCP LUs can establish LU-LU sessions (one LU resides in an ESA node and one LU resides in an ESA node). PTF requirements and ENA restrictions must be investigated on an individual basis.
G – Communications are possible through pre-ENA Gateway (NCP V3).

Figure 32. VTAM-NCP LU-LU Communications Matrix

3.5.5 Program Products related to NCP Releases

The following matrix shows the relationship between NCP releases and communication controller resident programs.

	A C F / N C P Releases													
	V1	V2		V3		V4						V5		
	R2.1					Subset		R1	R2	R3	R3.1	R1	R2	R2.1
	3705	3705	3725	3705	3725	3720	3720	3725 3720	3725 3720	3725	3725	3745 3720	3745 3720	3745 3720
	MVS VSE	MVS VSE	MVS VSE	MVS VM VSE	MVS VM	VSE	MVS VM	MVS VSE	MVS VM	MVS VM VSE	MVS VM VSE	MVS	MVS VM VSE	MVS VM VSE
EP			R1	R1	R2	R3	R4	R3	R4	R6	R6.1	R5	R6	R6.1
NTO	R1	R2	R2	R2.1	R2.1	R3	R4	R3	R4	R5	R5.1	R4.1	R5	R5.1
NPSI (Note 1)	R2	R3.1	R4	R3.2	R4.1	R4.2	R4.3	R4.2	R4.3	V2R1	V2R1	V3R1	V3R2	V3R2
NRF		R1		R1.5	R1.5	R2	R3	R2	R3	R3.2	R3.3	R3.1	R3.2	R3.3
NSI (Note 2)		R1	R1 R2	R1	R3		R4	R4	R4	R5	R5.1		R5	R5.1
XI (Note 3)							V1R1		V1R1	V1R2	V1R2		V1R2	V1R2

1. NPSI V2R1 with an appropriate PTF runs with NCP V4R3.1, and NPSI V3R1 with an appropriate PTF runs with NCP V5R2.1
2. NSI R4 with NCP V4R2 or NCP V4 Subset supports IBM 3720 and 3725 in a MVS environment. NSI R4 with NCP V4R1 supports IBM 3725 only.
3. In addition, XI R1 (PRPQ) supports IBM 3725 with NCP V4R2 and XI R2 (PRPQ) supports IBM 3720 and 3725 with NCP V4R2. Also, XI R2 (PRPQ) supports IBM 3720 with NCP V4 Subset.

Figure 33. ACF/NCP and Related Program Products

3.6 Network Management Products

The new releases of NetView and NPM (NetView Performance Monitor) are highlighted in this section.

3.6.1 NetView

Netview Release 1, 2 and 3 support the 3745.

3.6.1.1 NetView Release 1

PTF UY90126 (MVS/370) or PTF UY90125 (MVS/XA) must be installed to run NetView with the 3745. The function supplied by these PTFs allows NetView to collect the 3745 Generic Alert and then display one of four screens:

- Permanent Error Alert from MOSS
- Temporary Error Alert from MOSS
- Notification Error Alert from MOSS
- MOSS Failure Alert from the NCP

For a detailed description of the Generic Alert, the user logs onto the MOSS console and examines the alarm which will have been displayed.

3.6.1.2 NetView Release 2

NetView release 2 has full 3745 support of Generic Alerts. The 3745 Alert contains detailed descriptive information about user, installation and failure causes, and there are approximately 100 different types of these alerts. Upon receiving an alert, NetView dynamically builds screens displaying the following information:

- Alerts Dynamic, Static, and History
- Most Recent Events
- Recommended Action
- Event Detail

The descriptive information includes the alert description, probable cause, and recommended actions.

3.6.1.3 NetView Release 3

NetView Release 3 is functionally upward compatible from NetView Release 1 and 2. NetView Release 3 introduces major new automation capabilities and enhancements that are applicable to both network and system automation. This release provides the following significant enhancements:

- Support for the standard languages C and PL/I for use with command processors and user exits
- Network Asset Management to collect vital product data from network resources
- The capability of writing NetView command lists in REXX
- Selective routing of messages to specified operator groups in the network
- Extensive panel management enhancements
- The ability to monitor alerts occurring within its own domain or any adjacent network domain from a focal point.

3.6.2 NPM Release 3

- With NCP V4R3 and V5, NPM users can now generate the NPM RRT simultaneously with the generation of the NCP load module. This is accomplished by specifying USERGEN=FNMNDFGN on the OPTIONS statement in the NCP Stage 1 deck. Within the NDF (ICNRTNDF) JCL concatenate the NPM load library to the STEPLIB DD statement and then execute PGM=ICNRTNDF.
- Is required for the 3745 but also supports 3725, 3720, and 3705
- NPM R3 new support for 3745
  - Data collection for individual CAs when defined as PU Type 5
- Other NPM R3 enhancements:
  - VSCR for MVS/XA
  - Support for VM as well as MVS (RTM not supported in VM)
  - NPM to NPM communications
  - Network response time for TSO
  - Dynamic network collection
  - Twenty-four hour operation
  - Command and event logging
  - Default PF key definitions
  - Multiple screen sizes
  - Fast path through NPM screens
  - National Language support
  - Full data file management
  - Collect session accounting information from the NCP (V5R2).

3.7 NCP Token-Ring Interface

In general, NCP Version 5 support for the NCP Token-Ring Interface (NTRI) is the same as ACF/NCP Version 4 Release 2.

Frame size is the important performance factor on IBM Token-Ring Networks. It is obvious that the larger the frame size, fewer segments (frames) will be sent out by the NCP, thus incurring less overhead. The largest frame that NTRI can send is specified by the MAXTSL parameter; its maximum value is 2044 bytes. NCP will also use MAXDATA in the VTAM Switched Major Node to segment the BIU (Request Header/Request Unit) sent to the ring. This will result in a frame smaller than 2044 bytes sent to the ring, if MAXDATA is smaller than MAXTSL.

The largest frame that NTRI can receive is specified by the RCVBUFC parameter and its maximum value is 4095 bytes. All frame size values are for PIU data, inclusive of the TH and the RH.

The following parameters affects the NTRI performance:

- MAXTSL: Use the largest size possible. Obviously, the best performance is achieved when larger frame sizes are used. Using a value of 2042 will enable NTRI to send the largest frame it can to a 3174-R Down Stream PU (DSPU). If the DSPU is a PC with 3270 Emulation, use MAXDATA=265 to limit the frame size.
- RCVBUFC: Use the maximum size, 4095. This will enable the NCP to receive the largest frames possible from all kinds of DSPUs. (2042 from 3174-R, 265 from PC 3270 Emulation nodes, and more from future DSPUs).
- MAXDATA: This value is specified in the PU definition parameter of the VTAM switched major node. You may not specify here a value which is greater than MAXTSL. Use a value of 265 for a PC 3270 Emulation V3 DSPU, and 2042 for displays attached to 3174-Rs.
- RU SIZE: This value is specified at BIND time, both for outbound and inbound traffic. It is usually specified in the LOGMODE table entry of the secondary LU definition. There are no special considerations regarding this parameter as far as the Token-Ring network is concerned.

4. Configuration

4.1 Configuration Aid

The IBM 3745 provides not only high connectivity but also high configuration flexibility. Additionally, the IBM 3745 architecture allows different configurations with the same components combined differently. This means that it requires global consideration to configure the 3745 system.

The HONE Configurator (CF3745) provides 3745 configurations with features, specify codes, storage estimates, and cable order information based on user responses to questions on communications facilities, traffic and other requirements. Based on these configurations, it also provides estimates of performance capability.

Use of the HONE configurator is mandatory at initial order and MES order entry time, except for those MESs that contain Line Interface Coupler (LIC) features only.

The HONE configurator defines the 3745 configuration according to a set of feature placement algorithms. The features are fitted with specify codes defining which Bus Group they are attached to, and/or the physical position they occupy. The HONE configurator automatically assigns the specify codes to the various features as a default option.

However, if there is a requirement for positioning some or all the features in a particular configuration, the appropriate specify codes are required to configure the 3745. Using the Specified Configuration facility allows a user to overrule some of the HONE placement algorithms.

Also, the IBM 3745 Configurator Program may assist a customer to configure a 3745 prior to performing the HONE Configurator. It works on a PC allowing a customer to define a 3745 configuration in a conversational mode. The resulting configuration must be validated by the HONE Configurator before order entry.

As for a guide to the manual configuring of a number of 3745/3746 units, refer to the *IBM 3745/3746 Communication Controller Configuration Guide* for the further information.

4.2 IBM 3745 Configuration

There are four basic configurations for the IBM 3745 Communication Controller, depending on the number of CCUs installed and the operation mode which has been selected. CF3745 will ask you in which operation mode the 3745 runs.

In Single CCU Configuration, all the line adapters and channel adapters are dedicated to one CCU.

In Twin-in-Dual Configuration, one set of the 3745 can be used as having two separate 3745 Model 210 Communication Controllers. One half of the line adapters and channel adapters are attached to each CCU. A 3745-410 in Twin-in-Dual mode is configured as if you had two different sets of 3745-210.

In Twin-in-Standby mode, only one CCU works at a time. It provides a capability of "Quick Restart", when one CCU fails. All the line adapters and channel adapters are attached to the active CCU. A 3745-410 in Twin-in-Standby mode is configured in the same way as a single 3745-210 is configured.

When the 3745 works in Twin-in-Backup mode, a special consideration may be required. When one CCU fails, the lines that would be taken over from the failed CCU to the active one may be partial or complete. When planning a backup scenario, the network performance should be taken into consideration. A 3745-410 in Twin-in-Backup mode is configured as if you had two different sets of 3745-210, but you need to specify which resources you want to continue to use after fallback.

4.2.1 Frame Organization

The IBM 3745 Communication Controller contains one Base Frame, two optional Adapter Frames and three optional Line Frames. These frames correspond to the following machine types and models.

- Base Frame
  - The IBM 3745 Base Unit Model 210 or Model 410
- Adapter Frames
  - The IBM 3746 Expansion Unit Model A11
  - The IBM 3746 Expansion Unit Model A12
- Line Frames
  - The IBM 3746 Expansion Unit Model L13
  - The IBM 3746 Expansion Unit Model L14
  - The IBM 3746 Expansion Unit Model L15

The 3745 Base Frame contains one or two CCUs, up to 8 Channel Adapters or up to 4 Channel Adapters with a Two-Processor Switch (TPS), and up to 8 Line Adapters. Each CCU can have 4 or 8 MB of Main Storage. The Base Frame can be equipped with any kinds of Line Adapters. The maximum number of TRSS Line Adapters (TRA) is limited to four. The Base Frame have one LIC Unit Type 1 and can have one additional LIC Unit that can be either Type 1 or Type 2.

As for the Adapter Frames, the 3746 Model A11 provides up to 8 additional Channel Adapters and up to 16 additional Line Adapters. The 3746 Model A12

provides up to 8 additional Line Adapters. The 3746 Model A12 requires the 3746 Model A11 to be installed as a prerequisite. A Line Adapter in the Adapter Frame is limited to the TSS Line Adapter (LSS).

The Line Frames provide additional line ports. The 3746 Models L13, L14 and L15 provide up to four LIC Units each. These LIC Units can be Type 1 or Type 2. LIC Unit Type 1 houses LIC Type 1, 3, 4A and 4B, while the LIC Unit Type 2 houses the LIC Type 5 and 6. Up to 16 LICs can be plugged into a LIC Unit regardless of the type. Each Line Frame can have up to 4 LIC Units. Therefore, the 3746 Model L13, L14 and L15 provides up to 256 ports each, when each Line Frame is fully housed with LIC Unit Type 1. In case each Line Frame is fully housed with LIC Unit Type 2, each one provides up to 128 ports. The 3746 Model L14 requires the 3746 Model L13 to be installed as a prerequisite, and the same applies to L14 and L15.

The following table shows the maximum capacity of the IBM 3745 Communication Controller:

3745 or 3746	CCU	CA	Line Adapter			LIC	TIC	Line Port		
			LSS	HSS	TRA			TSS	HPTSS	TRSS
3745-210	1	8	8	8	4	32	8	128	16	8
3745-410	2									
3746-A11	–	8	16	–	–	–	–	–	–	–
3746-A12	–	–	8	–	–	–	–	–	–	–
3746-L13	–	–	–	–	–	64	–	256	–	–
3746-L14	–	–	–	–	–	64	–	256	–	–
3746-L15	–	–	–	–	–	64	–	256	–	–
3745 Maximum Config.	1 or 2	16	32	8	4	224	8	896	16	8

Note: The maximum number of line adapters and line ports in the Base Frame are not possible simultaneously.

Note: The maximum integrated line (LIC Type 5 and 6) capacity is 416.

Figure 34. 3745 Maximum Capacity

4.2.2 Basic Configuration

The 3745 basic configuration offers a minimum configuration comprised of:

- 4 MB Storage per CCU
- 2 TSS Line Adapter (Low-Speed Scanner)
- 1 LIC Unit type 1
- 8 LICs

These features are automatically configured by the HONE configurator, using "Specify Code" to define their positions for Low-Speed Scanners and LICs. They are not ordered by "Feature Codes".

The 8 basic LICs can be any mix of LIC Type 1, 3, 4A, and 4B in compliance with the order. They are available with the same cables as the equivalent LIC feature.

If the total number of requested LICs is less than 8, then the basic configuration is completed with LIC Type 3 and standard DCE cables.

4.2.3 3745 Feature Code

The following table gives feature codes for the 3745 special features:

Feature	Code
Storage Increment 4MB	7100
Channel Adapter	1561
CATPS	1562
Low-Speed Scanner	4720
High-Speed Scanner	4740
Token-Ring Adapter	4760
LIC Unit type 1	4900
LIC Unit type 2	4901
LIC type 1	4911
LIC type 3	4931
LIC type 4A	4941
LIC type 4B	4942
LIC type 5	7865
LIC type 6	7825

Figure 35. 3745 Feature Code

4.3 Channel Configuration

The Channel Adapter provides the logical and physical interface between the 3745 and an IBM 4341, 4361, 4381, 937X, 3033, 308X or 3090 processor. It attaches to a byte multiplexer, block multiplexer, or selector channel, and supports the Data Streaming mode when attached to a block multiplexer channel of an IBM 937X, or 3090 processor.

The Channel Adapter can attach to the IBM 3044 Fiber Optic Channel Extender Link (only with NCP), when not operating in Data Streaming mode. The 3044 does not attach to the 4341.

4.3.1 Channel Adapter without TPS

A maximum of 16 Channel Adapters (#1561) can be equipped in the Base Frame and the Adapter Frame-1.

The Specify Codes for the Channel Attach are as follows:

- Specify Code 9561 : CAs for attachment to Bus Group 1 (I/O Bus 2)
- Specify Code 9562 : CAs for attachment to Bus Group 2 (I/O Bus 3)

Note: Bus Group 1 is composed of I/O Bus 1 and 2, and Bus Group 2 is composed of I/O Bus 3 and 4.

The following chart shows the maximum configuration of Channel Adapters without TPS.

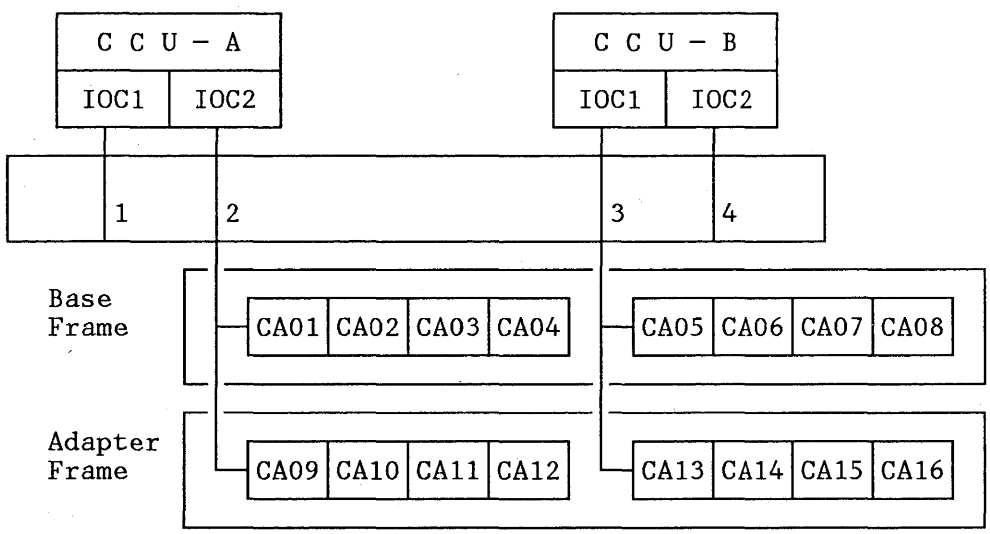


Figure 36. Channel Adapter Configuration (CA without TPS)

4.3.2 Channel Adapter with TPS

The Channel Adapter with Two Processor Switch (#1562) provides the functions of a Channel Adapter fitted with two channel interfaces to be attached to a Multiprocessor System or to two channels of the same or different processor. Each Channel Adapter with TPS is mutually exclusive with two Channel Adapters without TPS attachable to the same bus group (Bus 2 or 3).

The following chart shows the maximum configuration of Channel Adapters with TPS. The CATPS position codes correspond to the individual positions of the CATPS attached to each Bus Group.

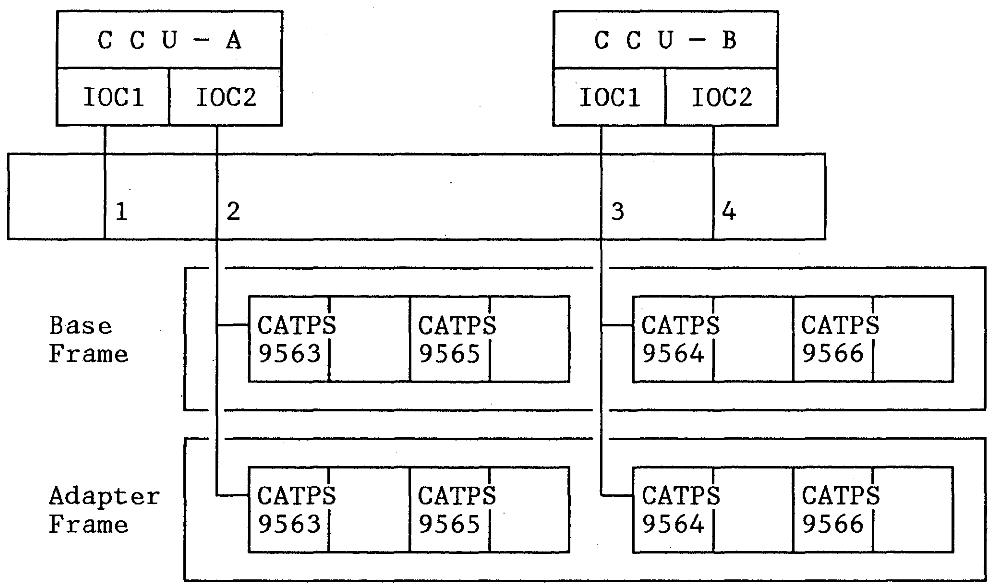


Figure 37. Channel Adapter Configuration (CA with TPS)

4.4 Line Adapter Configuration

In the 3745 Base Unit, the LSS, HSS and TRA can be configured. The number of each line adapter is mutually exclusive. The Line Adapters that can be located in the Adapter Frames are limited to the TSS Line Adapters.

4.4.1 LSS Configuration

A maximum of 32 Low-Speed Scanners (#4720) can be equipped in the Basic Frame, the Adapter Frame-1 and the Adapter Frame-2. The basic configuration provides two Low-Speed Scanners. Therefore, a maximum of 30 Low-Speed Scanners may be ordered with Feature Codes. When TRA Option is specified, the Line Adapter positions of 1, 2, 5, and 6 are not used for LSS positioning.

The Specify Codes for the Low-Speed Scanner are as follows:

- Specify Code 9721 : LSSs for attachment to Bus Group 1 (I/O Bus 1)
- Specify Code 9722 : LSSs for attachment to Bus Group 2 (I/O Bus 4)

Note: Bus Group 1 is composed of I/O Bus 1 and 2, and Bus Group 2 is composed of I/O Bus 3 and 4.

The following chart shows the maximum configuration of TSS.

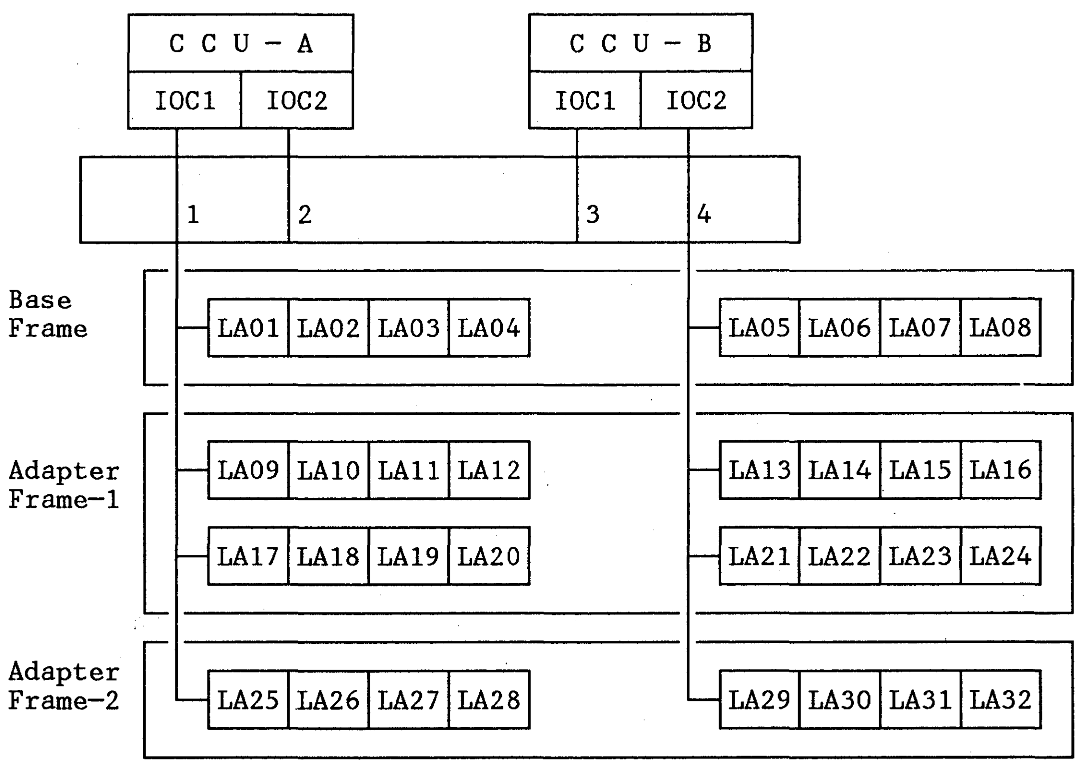


Figure 38. Line Adapter Configuration (TSS)

4.4.2 HSS Configuration

A maximum of 8 High-Speed Scanners (#4740) can be equipped in the Base Frame, if No-TRA Option (9723) is specified. When the TRA Option (9763) is specified, a maximum of 4 High-Speed Scanners can be equipped.

The following chart shows the maximum configuration of HPTSS. The HSS position codes correspond to the individual positions of the HSS attached to each Bus Group (I/O Bus 1 or 4). When TRA Option is specified, the HSS position of 9741, 9742, 9743, and 9744 are not used for HSS positioning.

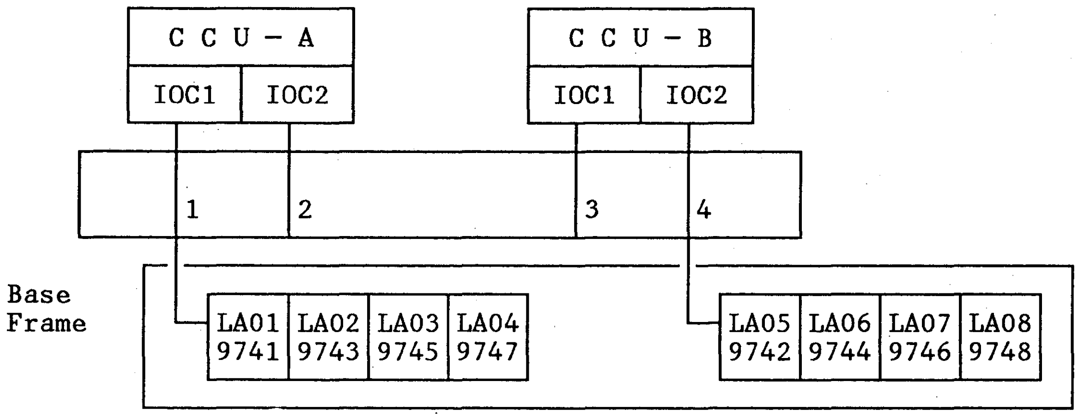


Figure 39. Line Adapter Configuration (HPTSS)

4.4.3 TRA Configuration

A maximum of 4 Token-Ring Adapters (#4760) can be equipped in the Base Frame. The TRAs can be configured on the Line Adapter position 1, 2, 5, and 6.

The support of Token-Ring Adapters requires the use of a specific adapter board which is mutually exclusive with the adapter board used to support the Low-Speed Scanner and High-Speed Scanners only. The TRA Option code (9763) must be specified with the initial order either when TRA features are initially ordered or when they will be ordered later for installation by MES.

The Specify Codes for the Token-Ring Adapter are as follows:

- Specify Code 9763 : TRA Option
  - Specify Code 9761 : TRAs for attachment to Bus Group 1 (I/O Bus 1)
  - Specify Code 9762 : TRAs for attachment to Bus Group 2 (I/O Bus 4)
- Specify Code 9723 : No-TRA Option

Note: Bus Group 1 is composed of I/O Bus 1 and 2, and Bus Group 2 is composed of I/O Bus 3 and 4.

The RPQ 7L1052 allows installation of the hardware provisions of the TRA Option (9763) on the 3745 Base Frame already installed with No-TRA Option (9723). It may cause the reconfiguration of the 3745 and 3746, depending upon the initial configuration.

The following chart shows the maximum configuration of TRSS.

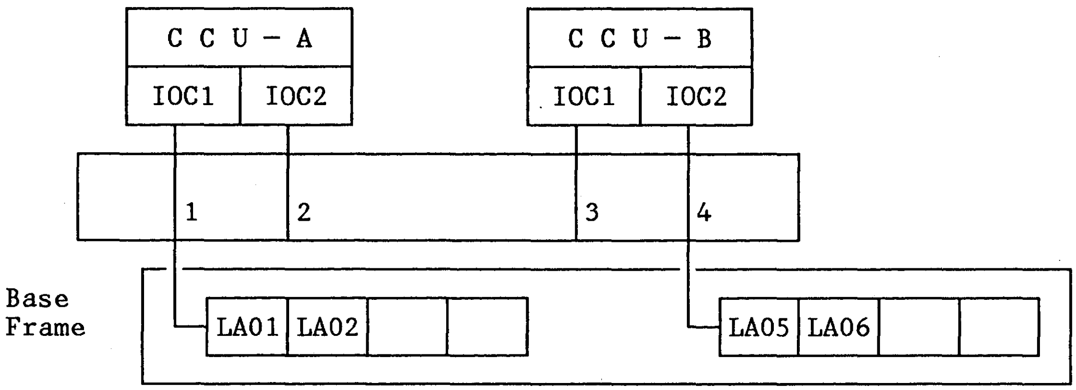


Figure 40. Line Adapter Configuration (TRSS)

4.5 Line Configuration

The restrictions for LIC configuration are further moderated, but Line Weight, instead of LIC Weight, is still applied for active lines. LICs must be configured so that the total line weight of active LICs (LICs with active lines or X.21 interface) will not exceed the maximum scanning capacity, and also that the number of active LICs will not exceed the maximum scanning range.

Selective Scanning allows the connection of several non-concurrent line configurations on the same scanner, which otherwise would require additional scanners and associated hardware. For example, the same scanner can be shared between interactive applications using medium speed lines in day-time and batch applications using high speed lines in night-time.

4.5.1 LIC Units

The LIC Unit Type 1 (#4900) provides an enclosure with 16 slots to plug up to 16 LICs. It is composed of 4 LIC Areas with 4 slots each. Different combinations of LIC Types 1, 3, 4A and 4B may be mixed in the same area. Each slot has 4 addresses.

The LIC Unit Type 2 (#4901) provides an enclosure with 16 slots to plug up to 16 LICs. It is composed of 4 LIC Areas with 4 slots each. Different combinations of LIC Types 5 and 6 may be mixed in the same area. Each slot has 2 addresses. When a LIC Type 6 works at 56 Kbps, it uses 4 addresses. Therefore, the next slot must be empty. Sixteen LICs type 6 at 19.2Kbps (or at lower speed) can be inserted in a single LIC Unit Type 2.

Up to 2 LIC Units can be housed in the Base Frame: one must be LIC Type 1 and the other can be either Type 1 or Type 2. Up to 4 additional LIC Units can be housed in each of the Line Frames L13, L14 and L15.

The basic configuration provides one LIC Unit Type 1 located in the Base Frame. Therefore, a maximum of 13 LIC Units can be ordered by feature codes. A LIC Unit feature is required when the number of LICs exceeds the capacity of the basic LIC Unit.

4.5.2 Line Interface Coupler (LIC)

The LIC Unit can be equipped with six types of LICs in any mixture:

- Line Interface Coupler (LIC) Type 1 (#4911)
- Line Interface Coupler (LIC) Type 3 (#4931)
- Line Interface Coupler (LIC) Type 4A (#4941)
- Line Interface Coupler (LIC) Type 4B (#4942)
- Line Interface Coupler (LIC) Type 5 (#7865)
- Line Interface Coupler (LIC) Type 6 (#7825)

The LIC position codes are used to specify in which LIC Unit a LIC is located. They are automatically generated by HONE configurator as a default option.

Frame	LIC Unit	Area	LIC type 1	LIC type 3	LIC type 4A	LIC type 4B	LIC type 5	LIC type 6
	LIC Unit	1	9101	9301	9401	9421	–	–
	1	2	9102	9302	9402	9422	–	–
	Type 1	3	9103	9303	9403	9423	–	–
	(Basic)	4	9104	9304	9404	9424	–	–
Base								
	LIC Unit	5	9105	9305	9405	9425	9505	9605
	2	6	9106	9306	9406	9426	9506	9606
	Type 1	7	9107	9307	9407	9427	9507	9607
	or 2	8	9108	9308	9408	9428	9508	9608
	LIC Unit	1	9101	9301	9401	9421	9501	9601
	1	2	9102	9302	9402	9422	9502	9602
	Type 1	3	9103	9303	9403	9423	9503	9603
	or 2	4	9104	9304	9404	9424	9504	9604
	LIC Unit	5	9105	9305	9405	9425	9505	9605
L–13	2	6	9106	9306	9406	9426	9506	9606
	Type 1	7	9107	9307	9407	9427	9507	9607
	or 2	8	9108	9308	9408	9428	9508	9608
L–14								
	LIC Unit	9	9109	9309	9409	9429	9509	9609
	3	10	9110	9310	9410	9430	9510	9610
L–15	Type 1	11	9111	9311	9411	9431	9511	9611
	or 2	12	9112	9312	9412	9432	9512	9612
	LIC Uni4	13	9113	9313	9413	9433	9513	9613
	4	14	9114	9314	9414	9434	9514	9614
	Type 1	15	9115	9315	9415	9435	9515	9615
	or 2	16	9116	9316	9416	9436	9516	9616

Figure 41. LIC Position Code

4.5.3 Line Weight

The 3745 uses the line weight instead of the LIC weight. A scanner has a maximum capacity of a total of line weights equal to 100.

The line weights for each LIC can be calculated by dividing the line speed by the appropriate constant from the following table.

Line Type	LIC 1/4A/5		LIC 3/4B/6
	LICs/Scanner are more than 4 (LIC 1/4A) or 8 (LIC 5)	LICs/Scanner are equal to or less than 4 (LIC 1/4A) or 8 (LIC 5)	
SDLC FDX	1536	1920	2560
SDLC HDX BSC EBCDIC (NCP) BSC (EP)	3072	3456	4052
BSC ASCII (NCP)	2016	2420	3041
Start/Stop	43 * (Number of bits per character) (e.g. 430 if 10-bit characters)		

Figure 42. Line Weight Calculation

For example, the line weight of a 14.4 Kbps FDX SDLC line on a LIC Type 1 on a Low-Speed Scanner with 4 LICs total is:

```
Line Weight = 14400 / 1920 = 7.5
```

If the Low-Speed Scanner has 5 LICs, the line weight of the same line is:

```
Line Weight = 14400 / 1536 = 9.375 -> 9.4
```

The line weight of a 4.8 Kbps Start/Stop line with 10-bit characters on any type of LIC is:

```
Line Weight = 4800 / 430 = 11.163 -> 11.2
```

The line weights are given below for the various protocols and line speeds.

LIC Type 1, 4A and 5 (Four- or Two-Port LICs)

(1) More than 4 LICs per Scanner

Line Speed	SDLC		BSC		Start / Stop
	Duplex	Half-D	EBCDIC	ASCII	
19 200	12.5	6.3	6.3	9.6	44.7
16 800 *	11.0	5.5	5.5	8.4	39.1
14 400	9.4	4.7	4.7	7.2	33.5
12 000 *	7.9	4.0	4.0	6.0	28.0
9 600	6.3	3.2	3.2	4.8	22.4
7 200 *	4.7	2.4	2.4	3.6	16.8
4 800	3.2	1.6	1.6	2.4	11.2
2 400	1.6	0.8	0.8	1.2	5.6
1 200	0.8	0.4	0.4	0.6	2.8
600	0.4	0.2	0.2	0.3	1.4
300	0.2	0.1	0.1	0.2	0.7
200	0.2	0.1	0.1	0.1	0.5
150	0.1	0.1	0.1	0.1	0.4
Autocall	–	–	–	–	0.1

Figure 43. Line Weight for Four- or Two-port LIC (1)

(2) Equal to or less than 4 LICs per Scanner

Line Speed	SDLC		BSC		Start / Stop
	Duplex	Half-D	EBCDIC	ASCII	
19 200	10.0	5.6	5.6	8.0	44.7
16 800 *	8.8	4.9	4.9	8.4	39.1
14 400	7.5	4.2	4.2	6.0	33.5
12 000 *	6.3	3.5	3.5	5.0	28.0
9 600	5.0	2.8	2.8	4.0	22.4
7 200 *	3.8	2.1	2.1	3.0	16.8
4 800	2.5	1.4	1.4	2.0	11.2
2 400	1.3	0.7	0.7	1.0	5.6
1 200	0.7	0.4	0.4	0.5	2.8
600	0.4	0.2	0.2	0.3	1.4
300	0.2	0.1	0.1	0.2	0.7
200	0.2	0.1	0.1	0.1	0.5
150	0.1	0.1	0.1	0.1	0.4

Figure 44. Line Weight for Four- or Two-port LIC (2)

Note:
1. For start-stop, the figures in the above table are for 10 bits per character and in half-duplex mode.
2. Start-stop weights include the transmission of parity, start, stop, and data bits.
3. Start-stop lines at speeds with an asterisk (*) are supported only with externally clocked DTEs.
4. LIC 4As support lines using SDLC at speeds of 9600 bps or less.

LIC Type 3, 4B and 6 (One-Port LICs)

Line Speed	SDLC Duplex	SDLC Half-D	BSC EBCDIC	BSC ASCII
256 000	100.0	63.2	N/S	N/S
245 760	96.0	60.7	N/S	N/S
230 400	90.0	56.9	N/S	N/S
128 000	50.0	31.6	N/S	N/S
72 000	28.2	17.8	17.8	23.7
64 000	25.0	15.8	15.8	21.1
57 600	22.5	14.3	14.3	19.0
56 000	21.9	13.9	13.9	18.5
50 000	19.6	12.4	12.4	16.5
48 000	18.8	11.9	11.9	15.8
40 800	16.0	10.1	10.1	13.5
24 000	9.4	6.0	6.0	7.9
20 400	8.0	5.1	5.1	6.8
19 200	7.5	4.8	4.8	6.4
16 800	7.5	4.8	4.8	6.4
14 400	7.5	4.8	4.8	6.4
12 000	7.5	4.8	4.8	6.4
9 600	7.5	4.8	4.8	6.4

Figure 45. Line Weight for One-port LIC

4.5.4 LSS LIC Support Limitations

In addition to the line weight, the hardware scanning capacity has to be taken into account when configuring a LIC configuration. The number of LICs in the scan ring is determined by the highest speed line activated. That is, the number of active LICs on a Low-Speed Scanner is limited by the maximum line speed on the LICs. The maximum quantity of active LICs per Low-Speed Scanner (the maximum scanning range) can be calculated as follows:

1. LIC Types 1 and 4A (Four-Port LICs)

   For four-port LICs, the maximum quantity of active LICs per scanner is given by the following formula:

   ```
   Max Active LICs per Scanner = 307200 / Maximum Line Speed / 4
   ```

   with the physical limitation of eight LICs per scanner. This results in the following table:

Maximum Line Speed	Max. Active LICs/LSS
19200	4
16800	4
14400	5
12000	6
9600	8

Note: Speeds above 9600 bps are not supported by LIC type 4A.

Figure 46. LIC Support Limitations (Four-Port LICs)

2. LIC Type 3 and 4B (One-Port LICs)

   For one-port LICs, the maximum quantity of active LICs per scanner is given by the following formula:

   ```
   Max Active LICs per Scanner = 307200 / Maximum Line Speed
   ```

   with the physical limitation of eight LICs per scanner. This results in the following table:

Maximum Line Speed	Max. Active LICs/LSS
256000	1
230400	1
128000	2
72000	4
64000	4
57600	5
56000	5
50000	6
48000	6
40800	7
24000	8
20400	8
19200	8

Figure 47. LIC Support Limitations (LIC Type 3 and 4B)

3. LIC Type 5

   For LIC Type 5, the maximum quantity of active LICs per scanner is given by the following formula:

   ```
   Max Active LICs per Scanner = 307200 / Maximum Line Speed / 2
   ```

   with the physical limitation of 16 LICs per scanner. This results in the following table:

Maximum Line Speed	Max. Active LICs/LSS
14400	10
9600	16

Note: Speeds above 14400 bps are not supported by LIC type 5.

Figure 48. LIC Support Limitations (LIC Type 5)

4. LIC Type 6

   For LIC Type 6, the maximum quantity of active LICs per scanner is given by the following formula:

   ```
   Max Active LICs per Scanner = 307200 / Maximum Line Speed * 2
   ```

   with the physical limitation of 16 LICs per scanner. This results in the following table:

Maximum Line Speed	Max. Active LICs/LSS
56000	10
19200	16
9600	16

Note: A LIC6 operating at 56 Kbps fits two LIC positions.

Figure 49. LIC Support Limitations (LIC Type 6)

If one- and four-port LICs are mixed on the same scanner, take the one-port LIC with the highest speed and note the indicated number of LICs. Then take the four-port LIC with the highest speed and note the permissible number of LICs. Compare the two figures, and take the lower of the two. This is the maximum number of active LICs supported by the scanner.

In the same manner, if LIC 5 and LIC 6 are mixed on the same scanner, the lower number of LICs is the maximum number of active LICs supported by the scanner.

4.6 External Cables

The external cables are ordered via MES or cable order form, except for some local console cables.

For EMEA countries, specify code '2999' initiates the automatic shipment of the standard length cables with the associated CAs, CATPSs and LICs.

If other cable types or cable lengths are required, they must be ordered separately by exception cable order.

For further cable planning information, refer the following manuals:

- *IBM 3745 Installation Manual - Physical Planning (TNL to IBM System/360, System/370 4300 Processors)*
- *Input/Output Equipment Installation Manual - Physical Planning*

4.6.1 Channel Cables

For each Channel Adapter, a cable group 0185 (a thin blue channel cable) and an EPO cable group 1178 (if required) are ordered via MES or cable order form. For each Channel Adapter with TPS, two cable groups 0185 and one or two EPO cable groups 1178 (if required) are ordered via MES or cable order form.

The Channel Adapter cables are provided at standard length of 12 meters (39 feet), and at maximum length of 122 meters (400 feet). The EPO cables are provided at standard length of 18 meters (59 feet) and at maximum length of 45 meters (148 feet).

A cable group 3920 (an older grey channel cable for the 3725, 3720, and 3705 Communication Controllers) can be reused for the 3745.

Device Type	Feature Code	Specify Code	Cable Group	Qty	Cable Length (m)	(f)	Countries
CA	1561	–	0185	1	12.0	39.0	All
			1178	1	18.0	59.0	All
CATPS	1562	–	0185	2	12.0	39.0	All
			1178	1/2	18.0	59.0	All

Figure 50. Channel Cables

4.6.2 Console Cables

Several console cables are available, depending on the console type selected. Cables that have no cable group number are delivered with the shipping group.

The cables for the local console are shipped at a standard length of 7 meters (23 feet).

No standard cable is supplied for the alternate console and remote console. They are ordered with the corresponding cable group or parts number with the specified

length. The maximum length of the alternate and remote console cable is 122 meters (400 feet).

The RSF modem cable is shipped with the 3745 at fixed length of 13.4 meters (45 feet).

For US, Canada and Japan the RSF modem is also shipped with the 3745.

Operator Console and RSF Attachment		Cable Group
Local Console Attachment	3151/3161/3163 PS/2 3727 3151/3161/3163/PS/2 via a 7427 - 3745 to 7427 - 7427 to 3151/3161/3163 - 7427 to PS/2 3727 via a 7427	Note 1 Note 1 Note 1 5827 5828 8148 Note 2
Alternate Console Attachment	3151/3161/3163 3727 PS/2 3151/3161/3163/PS/2 via a 7427 - 3745 to 7427 - 7427 to 3151/3161 - 7427 to PS/2 3727 via a 7427	6150 6152 8147 5826 5828 8148 Note 2
Remote Console Attachment	3151/3161/3163 PS/2 IBM PC	6153 6153 6153
RSF Attachment		Note 3

Note: 1. Provided with the IBM 3745 base machine, if specified.
2. Provided with the IBM 7427, if specified.
3. Provided with the IBM 3745 base machine automatically.

Figure 51. Console Cables

4.6.3 LIC Cables

The LIC cables are supplied at standard length of 13.5 meters (45 feet), except for direct attached DTEs on LIC Type 4A and 4B, where the standard length is 30 meters (100 feet).

For shorter cables, the corresponding cable group or parts number with the specified length is required. For longer cables, the corresponding parts number with the specified length is required.

The LIC cables are interchangeable with the 3720 cables.

Line Attachment	Feat Code	LIC Typ	Standard Length Cable CG	Shorter or Equal CG or P/N	Longer P/N	Max. Length m / f	Countries
V.24 RS-232C DCE	4911	1	1604	1628/6398643	6398785	100 382	All(Note1)
V.24 RS-232C DTE – for Asynch	4911	1	1607	1612/7837397	7837398	122* 400*	All
– for Synch	4911	1	1611	1627/7837395	7837396	122* 400*	All
V.24 DCE	4911	1		1621/6398662	6398782	100 382	Japan NTT
V.25 RS-366 A/C	4911	1	1616	1610/6398668	6398788	35 115	All
V.25 RS-366 A/C	4911	1		1634/6398664	6398786	35 115	Japan NTT
V.25 RS-366 A/C	4911	1		1622/6398667	6398783	35 115	France
V.25 RS-366 A/C	4911	1		1635/6398670	6398787	35 115	UK
V.35 DCE	4931	3	1613	1618/58X9485	6398665	100 382	All(Note2)
V.35 RS-366 DTE	4931	3	1605	1623/58X9484	6398657	122* 400*	All
V.35 DCE	4931	3	1619	1619/6398671	6398789	35 115	France
V.35 DTE	4931	3	1604	1623/65X9900 (F)	65X9900	122 400	France
X.21 DCE	4941	4A	1606	1624/58X9487	6398658	122* 400*	All(Note3)
X.21 DCE	4942	4B	1606	1624/58X9487	6398658	122* 400*	All(Note3)
X.21 DTE	4941	4A	1608	1625/58X9486	6398660	122** 400**	All
X.21 DTE	4942	4B	1608	1625/58X9486	6398660	122** 400**	All
TRANSFIX	4911	4B	1609	1609/58X9488	6398661	122* 400*	France

Note: 1. Except for Japan NTT.
2. Except for French PTT modem.
3. Except for TRANSFIX (France).
4. The maximum length with an asterisk can be further extended to 150 meters (492 ft.) by an RPQ.
5. The maximum length with two asterisks can be further extended to 600 meters (1969 ft.) by an RPQ.

Figure 52. LIC Cables

Note: LIC types 5 and 6 are plugged directly to the four-wire leased/private line via a PTT type of cable, P/N 65X8471.

4.6.4 TIC Cables

The TIC cables are supplied at standard length of 21.5 meters (70 feet) for US, Canada, South America, and APG, and 9 meters (30 feet) for EMEA.

For shorter cables, the corresponding cable group or parts number with the specified length is required. For longer cables, the corresponding parts number with the specified length is required.

The TIC cables are interchangeable with the 3720 cables.

Line Attachment	Feat Code	Standard Length Cable CG	Shorter or Equal CG or P/N	Longer P/N	Max. Length m / ft.	Countries
Token-Ring	4760	1666	1667/61X3229	61X3229	42.2 / 138	All

Figure 53. TIC Cables

4.6.5 HPTSS Line Attachment Cables

The High-Speed Line Attachment cables are supplied at standard length of 10 meters (33 feet). The default cable is an X.21 DCE cable.

For shorter cables, the corresponding cable group or parts number with the specified length is required. For longer cables, the corresponding parts number with the specified length is required.

Line Attachment	Feat Code	Standard Length Cable CG	Shorter or Equal CG or P/N	Longer P/N	Max. Length m / ft.	Countries
V.35 DCE (Note 1)	4740	5831	5830/58X9344	58X9344	35 / 115	All
V.35 DTE to 37XX (Note 2)	4740	5837	5836/58X9347	58X9347	100 / 328	All
X.21 DCE (Note 3)	4740	5833	5832/58X9345		10 / 33	All
X.21 DTE to 37XX	4740	5839	5838/58X9348		10 / 33	All
TRANSFIX	4740	5835	5834/58X9346		10 / 33	France

Note: 1/2.For the 37XX to 37XX V.35 direct attached connection, join end to end:
- A V.35 DCE cable (5831) and a V.35 DTE to 37XX cable (5837)

3.In France, this cable is replaced by X.21 TRANSFIX.

Figure 54. High-Speed Line Attachment Cables

5. Physical Planning

5.1 Physical Specifications

The physical specifications of the 3745 are provided in this chapter. There is no big difference in physical planning between for the IBM 3745 and the former IBM Communication Controllers. For further information, refer to the *3745 Installation Manual-Physical Planning* which contains common information necessary to plan and prepare the physical site for the installation of any IBM equipment.

Floor Requirement: A raised metallic floor is recommended. However, a raised metallic floor is required:

- when Channel Adapters are connected, or
- when more than 32 lines are connected, or
- when an Expansion Unit is installed.

Physical Dimensions: The 3745 requires less floor space than 3725 with an equivalent line configuration. The reduction of the footprint plus service areas is about:

- 40% at 128 lines
- 50% at 256 lines

		FRONT	SIDE	HEIGHT
Base Unit	mm	1200	750	1800
	inches	47	29.5	72
Expansion Units	mm	600	750	1800
	inches	23.5	29.5	72

Figure 55. Physical Dimensions

Service Clearances: Clearances may have to be reserved on the right and left sides for the installation of 3746 Expansion Units.

		FRONT	REAR	RIGHT	LEFT
Clearances	mm	750	750	0	0
	inches	29.5	29.5	0	0

Figure 56. Service Clearances

Weight

Base Unit	less than 700 Kg (1540 lbs)
Expansion Units	less than 300 Kg (660 lbs)

Figure 57. Weight

Heat Output/Air Flow/Power Consumption

	Base Unit	Max. Configuration
Heat Output	3.3 KW (11 KBTU/h)	6.7 KW (23 KBTU/h)
Air Flow	18 Cube m/min	54 Cube m/min
Power Consumption	4.6 KVA	8.6 KVA

Figure 58. Heat Output/Air Flow/Power Consumption

Machine Environment

Machine Environment	Temperature Range	Relative Humidity	Maximum Wet Bulb
Operating Class B Extended	16° - 38°C (60° - 100°F)	8 - 80 %	23°C (73°F)
Non-operating	10° - 42°C (50° - 110°F)	8 - 80 %	27°C (80°F)

Figure 59. 3745 Machine Environment

Power Requirements: For electrical installation, a Three-Phase Distribution System is required. The existing Communication Controllers requires a Two-Phase Distribution System.

Countries	Freq (Hz)	Nominal Voltage AC (V)	Phase Distribution System	Wiring	Power Factor	Branch Circuit Rating	Phase Load Balance
US and Canada	60	208–240	Three phase Phase to phase (Delta)	4	0.65 lead	30 A	1.2
EMEA and AFE except Japan	60	208–220	Three phase Phase to phase (Delta)	4	0.65 lead	30 A	1.2
	50	200–240					
	60	380–415	Three phase Phase to neutral (Wye)	5	0.65 lead	25 A	1.2
	50	380–415					
Japan	60	200	Three phase Phase to phase (Delta)	4	0.65 lead	30 A	1.2
	50	200					

Figure 60. Power Requirements

5.2 Console Attachment

All the console cables are connected or disconnected by customer personnel. The connectors for operator consoles and RSF are located in the rear side of the base frame (Subarea B0 in Area U).

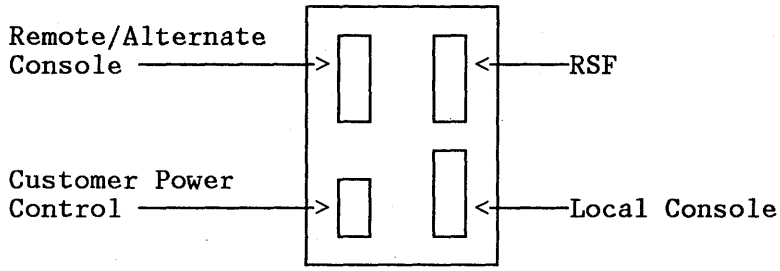


Figure 61. Console / RSF Connectors

5.2.1 Local Console Attachment

A customer-provided terminal is required as a local console, which is attached directly to the 3745. This terminal should be one of the following:

- IBM 3151 Model 310/360 or 410/460 with Feature 8835
- IBM 3161 Model 11 or 12
- IBM PC PS/2
- IBM 3727
- An equivalent terminal running in 3101 emulation mode

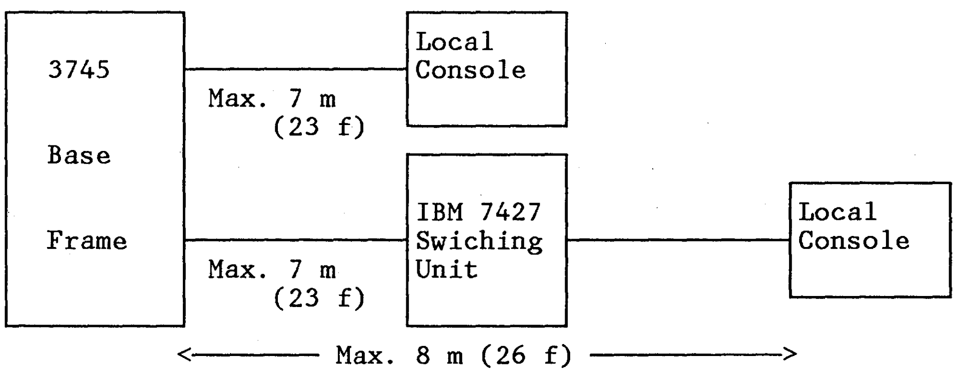


Figure 62. Local Console Attachment

5.2.2 Alternate Console Attachment

An optional Alternate console is attached directly to the 3745. The alternate console is exclusive of the remote console. This terminal may be one of the following:

- IBM 3151 Model 310/360 or 410/460 with Feature 8835
- IBM 3161 Model 11 or 12
- IBM PC PS/2

- IBM 3727
- An equivalent terminal running in 3101 emulation mode

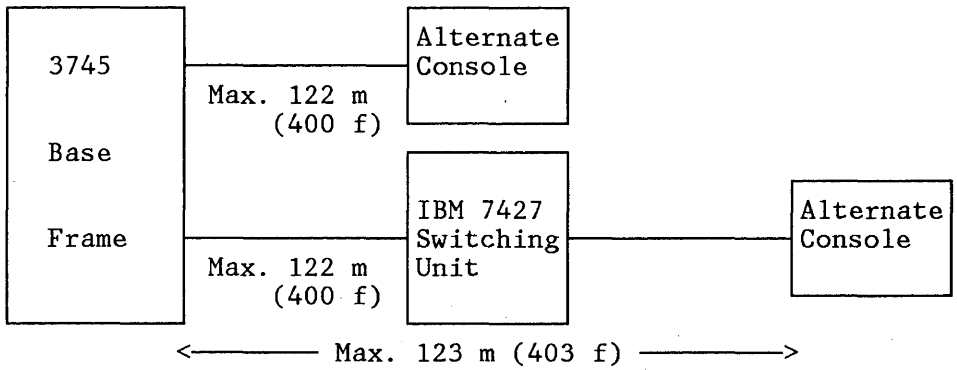


Figure 63. Alternate Console Attachment

5.2.3 Remote Console Attachment

An optional remote console is attached to the 3745 via a modem and public switched network (two-wire line). The remote console is exclusive of the alternate console. This terminal may be one of the following:

- IBM 3151 Model 310/360 or 410/460 with Feature 8835
- IBM 3161 Model 11 or 12
- IBM PC PS/2
- IBM PC 5150, 5160, 5155 and 5170
- An equivalent terminal running in 3101 emulation mode

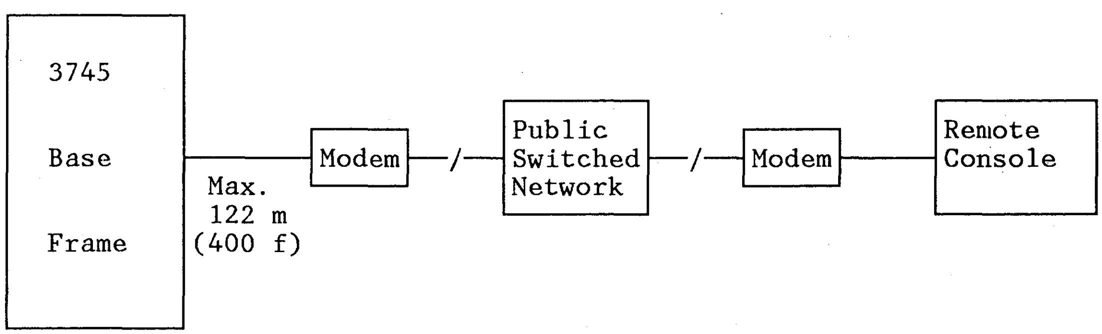


Figure 64. Remote Console Attachment

5.2.4 RSF Attachment

The RSF is attached to the 3745 via a modem and public switched network (two-wire line).

An RSF Modem is automatically shipped with the 3745 for the USA, Canada and Japan. For other countries an RSF modem, which is compatible with CCITT V.23 bis and operating in half-duplex mode, with asynchronous protocol at 1200 bps, without clocking, is required.

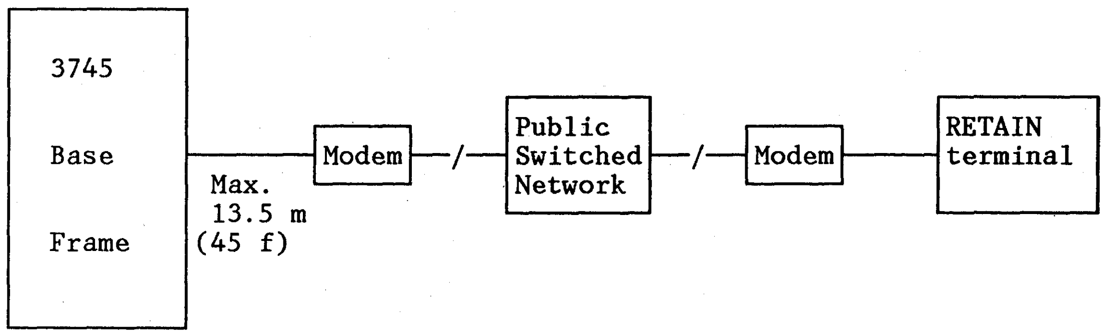


Figure 65. RSF Attachment

5.3 Customer Access Area

The IBM 3745 allows the customer to have access to "Customer Access Area" in order to perform installation, replacement, and removal of LICs and plugging or unplugging line cables.

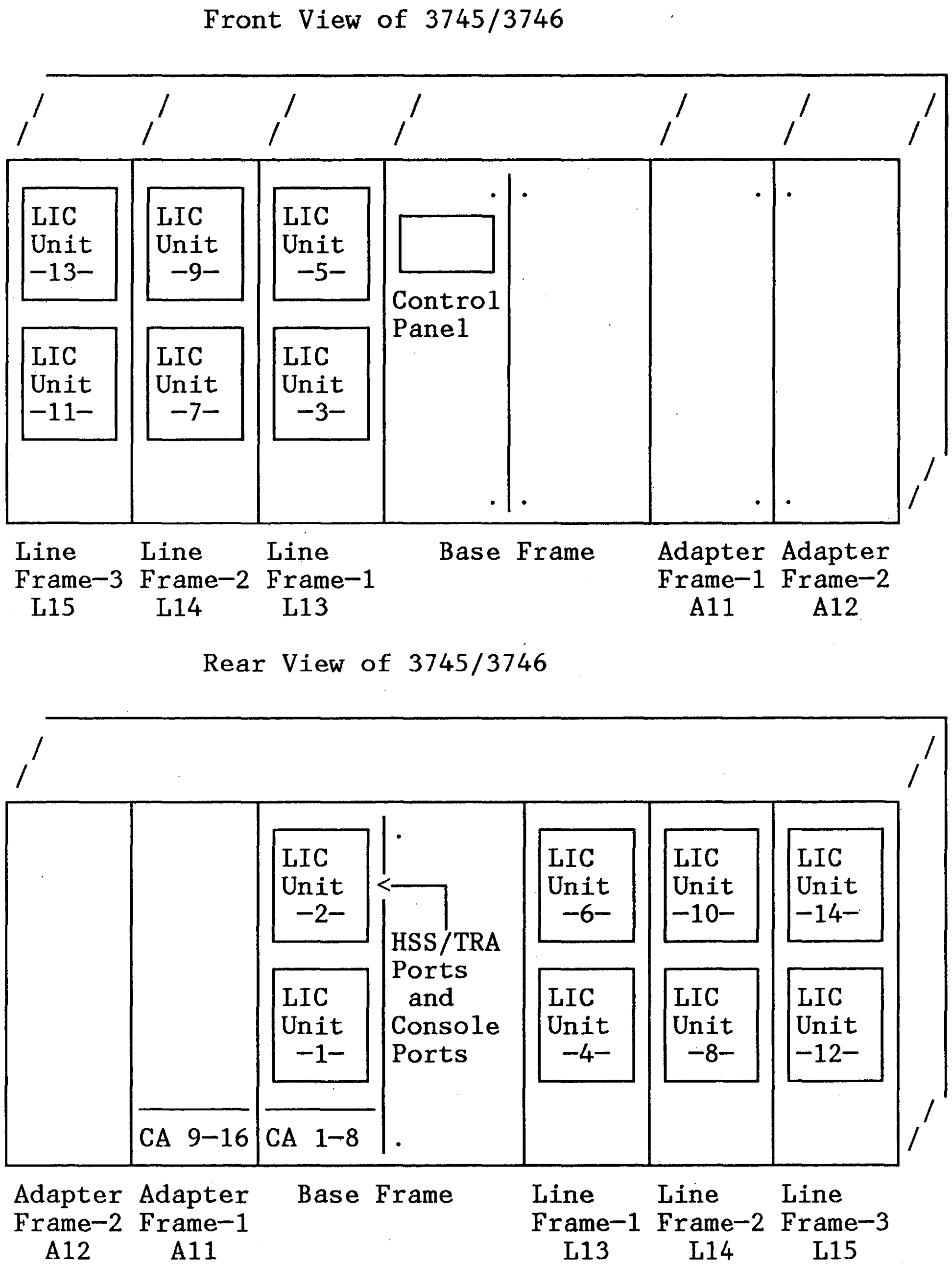
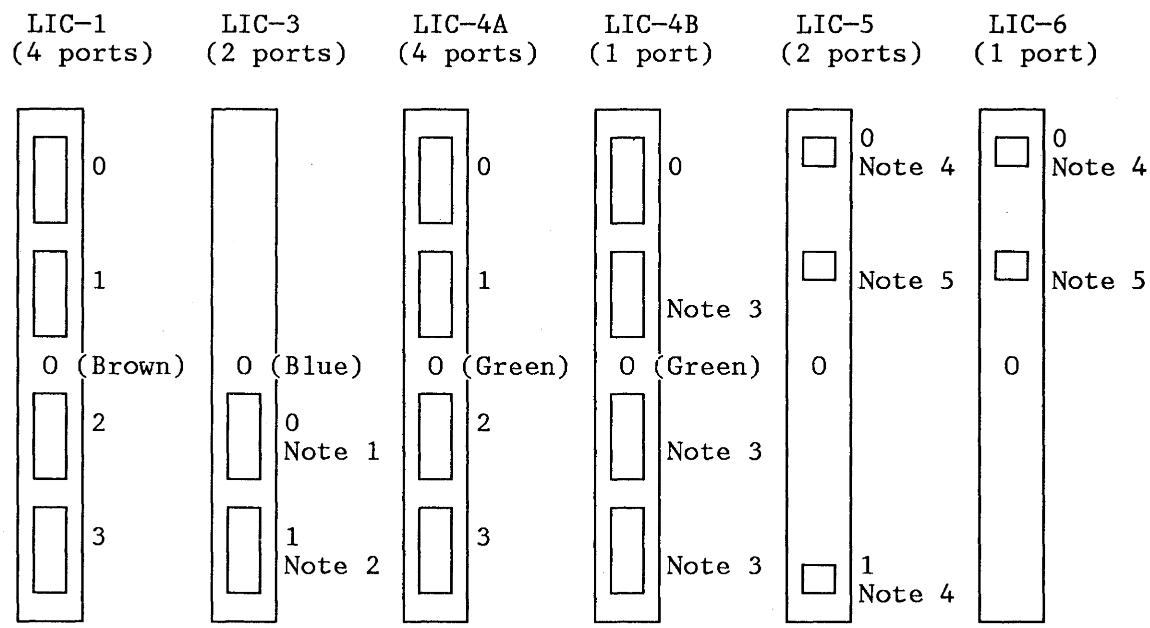


Figure 66. 3745/3746 View

5.3.1 LIC Cables

The low to medium speed lines are packaged in LICs. Characteristics for LIC cabling follow:

- A LIC has one to four ports, numbered 0 through 3.
- One port corresponds to one communication line.
- A line cable can be connected to each port.
- There are six types of LIC:
  - LIC Type 1 --- Four ports can be used.
  - LIC Type 3 --- Only one of two ports can be used.
  - LIC Type 4A -- Four ports can be used.
  - LIC Type 4B -- Only one of four ports can be used.
  - LIC Type 5 --- Two ports can be used.
  - LIC Type 6 --- One port can be used.



Note: 1. Port 0 is for DCE attachment
2. Port 1 is for DTE attachment
3. Physically, LIC 4A and LIC 4B are identical. The LIC type is selected at configuration time. In LIC 4B, only port 0 is used.
4. Attached directly to the 4-wire lease/private line.
5. Plug for Portable Keyboard Display (IBM 5869)

Figure 67. LIC Line Ports

The lines are addressed by the port numbers from 000 through 896. Four lines are numbered for each LIC, regardless of the number of ports available in the LIC Unit Type 1. Two lines are numbered for each LIC, regardless of the number of ports available in the LIC Unit Type 2.

For example, assuming four successive LICs in a LIC Unit Type 1:

- 1st LIC --- LIC-1 : 480, 481, 482, 483
- 2nd LIC --- LIC-3 : 484
- 3rd LIC --- LIC-4B: 488
- 4th LIC --- LIC-4A: 492, 493, 494, 495

LIC positions are numbered from 1 through 128. One DMUX is associated with 8 LICs, thus to 32 ports.

The following table shows the relation of LIC Units, DMUXs, LICs, and line ports.

Frame	LIC Unit	DMUX	LIC	Line Port
Base	1	01/02	001–016	000 – 063
	2	03/04	017–032	064 – 127
Line–1 L–13	3	05/06	033–048	128 – 191
	4	07/08	049–064	192 – 255
	5	09/10	065–080	256 – 319
	6	11/12	081–096	320 – 383
Line–2 L–14	7	13/14	097–112	384 – 447
	8	15/16	113–128	448 – 511
	9	17/18	129–144	512 – 575
	10	19/20	145–160	576 – 639
Line–3 L–15	11	21/22	161–176	640 – 703
	12	23/24	177–192	704 – 767
	13	25/26	193–208	768 – 831
	14	27/28	209–224	832 – 895

Figure 68. Line Port Allocation with LIC Unit Type 1 only

Frame	LIC Unit	SMUX	LIC	Line Port
Base	1	01/02	001–016	000 – 063
	2	03/04	017–032	064 – 095
Line–1 L–13	3	05/06	033–048	096 – 127
	4	07/08	049–064	128 – 159
	5	09/10	065–080	160 – 191
	6	11/12	081–096	192 – 223
Line–2 L–14	7	13/14	097–112	224 – 255
	8	15/16	113–128	256 – 287
	9	17/18	129–144	288 – 319
	10	19/20	145–160	320 – 351
Line–3 L–15	11	21/22	161–176	352 – 383
	12	23/24	177–192	384 – 415
	13	25/26	193–208	416 – 447
	14	27/28	209–224	448 – 479

(LIC Unit Type 1)

Figure 69. Line Port Allocation with LIC Unit Type 2

5.3.2 HPTSS/TRSS Cables

The HPTSS and TRSS line ports are located in the rear side of the base frame (Subarea A0 in Area U).

In each pair of HPTSS positions, two cables can be plugged at the same time, but only one can be active at a time. Both lines corresponding to both cables of a pair can be of different interface types and protocols.

The HPTSS ports are numbered from 1024 through 1039. The HPTSS port locations are differed when the TRA option is specified. When configured with TRAs, the HPTSS ports are numbered from 1028 through 1031 and from 1036 through 1039.

The TRSS ports are numbered from 1088 through 1095.

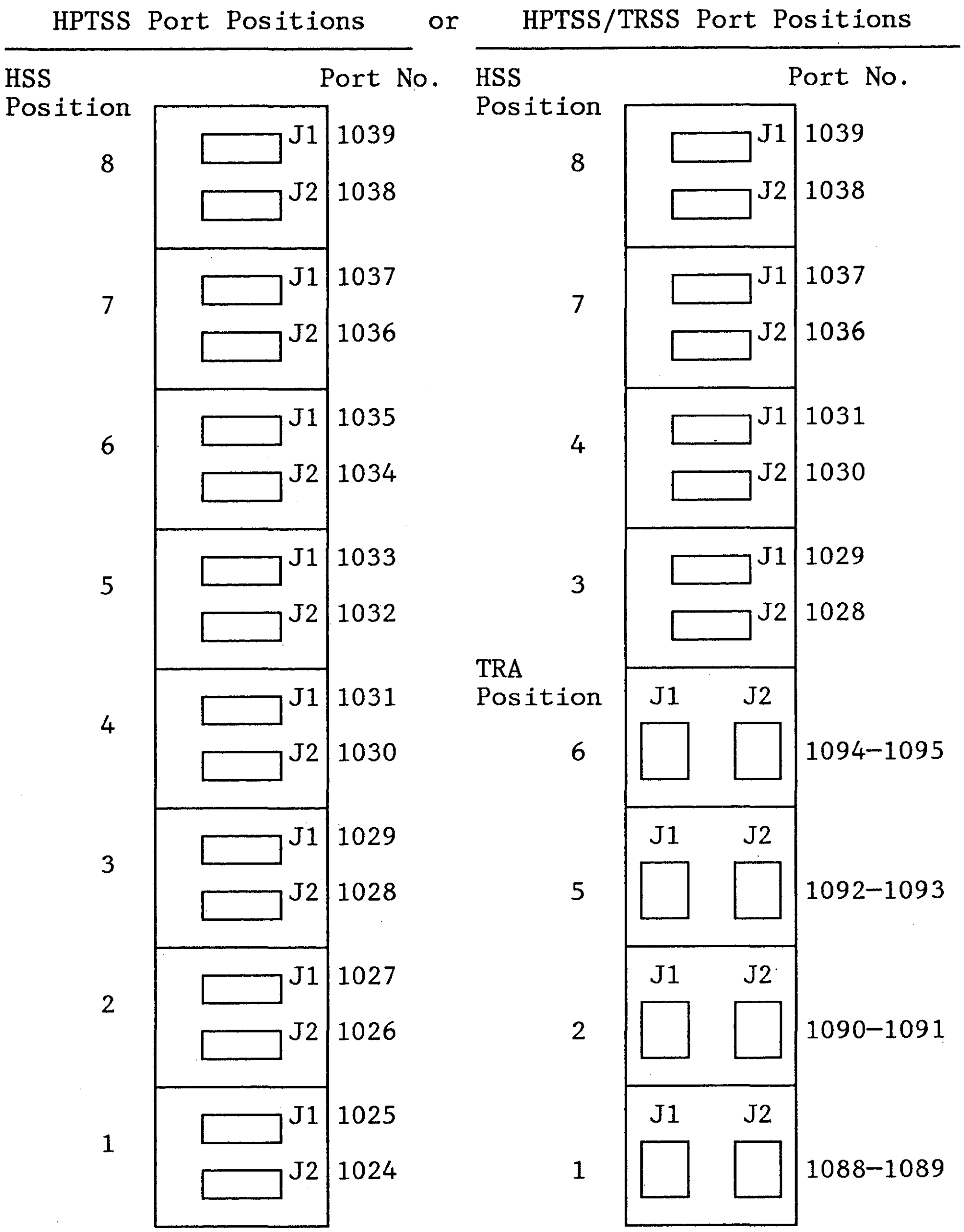


Figure 70. HPTSS/TRSS Ports

6. Migration

6.1 General Migration Steps

The IBM 3745 is positioned to enhance the performance and expand the capacity of the IBM 3725 while preserving compatibility with the IBM 3725, 3720, and 3705. Planning for, and migrating to, the 3745 requires an implementation plan. A useful list of recommended activities to check now follows and differs very little from migration activities used for 3725 installation.

- Do the physical planning, including calculating the physical dimensions, allowing for service clearances, and checking the raised floor requirements.
- Configure and order the 3745. Make use of the 3745 Configurator Program or the HONE Configurator (CF3745). The 3745 Configurator Program allows a user to configure a 3745 in a conversational mode using a PC. Use of the HONE Configurator is mandatory at initial order and MES order entry time, except for those MESs that contain LIC features only.
- Order the external cables. Line Set cables used by 3705s and 3725s are not interchangeable with Line Interface Cables used by the 3745. Only the 3720 line set cables are interchangeable with 3745 cables.
- Order the console(s). Is a remote console required or an RSF connection to IBM Customer Engineering?
- Prepare site for the 3745. Check items like environmental requirements, the weight of the controller, and heat output. The electrical power required for the 3745, and the number of outlets needed are not the same as those required for the other Communication Controllers.
- If there are both 3705s and 3725s in the same network as the 3745, plans should be in place for the maintenance and management of different NCP and EP versions for the 3705, 3725 and 3745.
- Order software:

  Refer to the 'Software Compatibility Section' to make sure the programming requirements for the 3745. For example:

  - VTAM V3R2 (with PTF for Extended Subarea Addressing, etc.)
  - SSP V3R4.1
  - NCP V5R2.1
  - NPM R3 (with PTF for Enhanced Session Accounting)
  - NetView R3 with PTF
  - EP R6.1 (if required)
- Install the software products in the appropriate order.
- Install the 3745.
- Update the MOSS CDF (see "Operation" section of this manual)
- Test the hardware and software components.
- Cut the 3745 and its network over to the production environment.

6.2 Software Migration

The major task for software migration is to install the NCP Version 5 software, create the new NCP definitions, generate the new NCP load module and finally load and test the 3720/3745 controller.

6.2.1 Migrating to NCP Version 5

To migrate from previous releases of NCP to NCP Version 5 requires that specific NCP generation definitions be updated. This section contains these special updates that must be considered for Version 5.

With the 3745, the number of available channel adapters increases from 6 to 16. For this reason, NCP Version 5 channel adapter definitions have been moved from the BUILD statement to the GROUP statement, using the LNCTL=CA keyword.

Below are some considerations an NCP user should be aware of:

- There are no new NCP definition statements associated with this change.
- VTAM V3R1.1 with an appropriate PTF support for the 3745 is the first release of VTAM which supports channel adapter definitions using the GROUP statement with the LNCTL=CA keyword; that is channel adapters defined as channel links. However, VTAM V2R1, and later versions and releases of VTAM, can coexist in the same network with NCP Version 5.
- When channel adapters are defined on the GROUP statement, NCP does not check the PATH statement against the value coded for SUBAREA on the HOST statement. This makes the HOST statement a VTAM-only statement, because NCP no longer needs it.
- The new usage tier keyword is required in the BUILD statement.
- NCP V5 accepts activation attempts for peripheral channel links; however, NCP V5 does not accept activation attempts for subarea channel links (PU Type 5). Therefore, to prevent VTAM from attempting activation of a subarea channel link, do the following:

  1. On the GROUP statement for subarea channel adapter links (that is, PUTYPE=5 and LNCTL=CA), code ISTATUS=INACTIVE to prevent VTAM from automatically attempting activation of the channel link when VTAM is started.
  2. When issuing the VARY ACT command, do not code SCOPE=ALL. SCOPE= ALL on the VARY ACT command overrides the ISTATUS=INACTIVE setting.
  3. The LINE, within the Channel Adapter GROUP, when displayed shows as inactive even though the CA is active.

  If you code ISTATUS=ACTIVE, or if you override the ISTATUS specification, when VTAM is started it will attempt automatic activation of the channel link, and NCP will reject the attempt with a sense code of X'080C0007', meaning that the procedure is not supported.

  Note: Even though the activation attempt is rejected, NCP can still accept line trace commands to activate the NCP channel adapter trace.

6.2.1.1 Channel Adapter Definitions

For the 3745 all 370 I/O channel connections must be defined on GROUP and LINE definition statements. Also it is recommended that the same is done for the 3720 controller.

A channel adapter defined on GROUP and LINE definition statements becomes a channel-link and has an SNA network address.

A channel adapter defined on BUILD and HOST definition statements does not have an SNA network address and is not a channel-link.

- All lines are in GROUP which has LNCTL=CA.
- The GROUP statement must be last in the generation. The order of GROUPs is now:
  - S/S
  - BSC
  - SDLC
  - CA

  Note: User line groups may precede or follow channel-link groups.
- Remove CA references from BUILD and HOST. HOST is now VTAM only.
- A 3745 contains either one or two CCUs each of which is connected by buses to channel and line adapters (scanners). Since each CCU has only 2 bus attachments, the 4 buses are merged into 2 by the 3745 bus switch. This bus arrangement has resulted in a channel adapter's relative position (logic address) being different from its physical position on the 3745. From a software standpoint the NCP has to have the LOGICAL address of each CA specified. As this is not the same as the CA physical location the logical address is best found in the following table:

PHYSICAL LOCATION	LOGICAL ADDRESS	PHYSICAL LOCATION	LOGICAL ADDRESS
1	8	9	12
2	9	10	13
3	10	11	14
4	11	12	15
5	0	13	4
6	1	14	5
7	2	15	6
8	3	16	7

Figure 71. Channel Adapter Addressing

- Code the LINE statements in the generation in ascending order of logical channel adapter address. Special considerations in selecting physical locations are required for a twin CCU with adapters distributed across both CCUs. Read "NCP Resource Definition Guide", SC30-3447, for more information.
- If the 3745 channel adapter has a two-processor switch an even logical address must be specified.
- See Appendix A (Page 196) for an example of channel adapter coding.

6.2.1.2 Direct Attachment Definitions

For directly attached links to the 3745, the NCP sets the speed of the line. The ATTACH keyword has been removed from line definitions in an 3745 NCP and this now leaves the CLOCKNG and SPEED operands to set the attachment mode. There follows a description of the CLOCKNG = EXT/INT/DIRECT keyword:

- CLOCKNG = EXT signifies that the clock pulse is supplied either by a modem or by an attached IBM Communications Controller. The link can use either a direct attachment cable or a modem cable. Coding the SPEED value is optional, but is required if NPM is used.
- CLOCKNG = DIRECT signifies that the clock pulse is supplied by the 3745's scanner to the attached device and is used to time received data. The SPEED value must be coded, and a direct attachment cable used.
- CLOCKNG = INT signifies that the clock pulse is not supplied by the 3745 to the attached device, but is used by the 3745 scanner to synchronize the received data signal. The SPEED keyword must be coded and the link attachment can use either a direct attachment cable or modem cable.

The following table compares the new NCP V5 coding options against the NCP V4R2 equivalents.

NCP V4R2 CODING			NCP V5 CODING	
ATTACH	CLOCKNG	SPEED	CLOCKNG	SPEED
MODEM	EXT	Opt.	EXT	Opt.
MODEM	INT	Req.	INT	Req.
DIRECT	EXT	Opt.	DIRECT	Req.
LODIRECT	INT	Req.	INT	Req.
DIR3725	EXT	Opt.	EXT	Opt.

Note: For NCP V5, if controller is 3720 and CLOCKING=DIRECT is specified, the SPEED parameter is not required.

Figure 72. Coding Options on Link Attachment Definitions.

See Appendix A (page 195) for an example of direct attachment coding.

6.2.1.3 High Performance Transmission Subsystem Definitions

Each High-Speed Scanner can support two ports, however only one may be active at a time. Definitions of lines is very simple in this environment. Lines are defined just as they are for LSS INN links. Naturally the SPEED parameter on the LINE statement must be updated to the correct value. Sample HSS INN link definitions are contained in Appendix A on page 198.

Some parameters for NCP definition of HSS links should be considered carefully from a performance point of view. These considerations are discussed in more detail in the 'HPTSS Tuning Considerations' chapter of this manual.

6.2.1.4 X.21 Network Definitions

The 3725 and 3720 have different LIC types for low speed and wideband X.21 operation (LIC 4A and LIC 4B). The 3745, however, uses the same LIC type for both operations. When displayed by the CDF it is known only as a LIC Type 4. The same cable is used in either case, hence the MOSS cannot detect what mode of operation this LIC will operate in. It is therefore required that the NCP determine which mode of operation a LIC Type 4 will use.

For an X.21 link that is defined as directly attached, the NCP can determine the mode of operation used, as CLOCKNG=DIRECT must be specified and hence SPEED must be specified. The 3745 can then determine whether low speed or wideband operation will be used from the SPEED parameter.

For an X.21 link that is externally clocked (that is attached to an NTU), the CLOCKNG=EXT parameter must be specified. The SPEED parameter is now required for LSS X.21 line definitions so that the mode of LIC 4 operation can be selected. A new parameter has been introduced to the GROUP statement, namely X21NTWK. This has two functions:

- The NCP is forced to pay attention to the SPEED parameter and hence switch the LIC 4 into the correct mode. SPEED must be defined on all X.21 lines in NCP Version 5 for the 3745.
- There now exists a new release of X.21 support, known as the 1984 release. The X21NTWK parameter specifies which level of X.21 network this line is attached to (OLD or 1984). See the *NCP, SSP and EP Resource Definition Reference* for more information.

For an example of an X.21 line definition, see Appendix A, page 197.

6.2.1.5 Miscellaneous NCP Changes

This section discusses the remaining changes that have been made to other NCP Version 5 statements for the 3745 when migrating from NCP V4R2. If migrating from other NCP levels see the *NCP Migration Guide* . A more detailed description of the following operands can be found in the *NCP, SSP and EP Resource Definition Reference* .

- Changes made to the BUILD statement.
  - BFRS= Has a new default of 240 bytes
  - CA= Is removed
  - CANETID= Is removed
  - DELAY= Is removed
  - DYNADMP= Is removed
  - HICHAN= Is removed
  - LOCHAN= Is removed
  - MEMSIZE= Specified in megabytes in multiples of 1M
  - MODEL= Use 3745
  - NETID= Required - the name of the native network
  - NCPCA= Is removed
  - PUNAME= Optional - the name of the Physical Unit
  - RESOEXT= Is removed
  - TIMEOUT= Is removed
  - TRCPIU= The size of the LINE and SIT trace PIUs
  - TRANSFR= Default value for the LINE statement
  - TYPGEN= Code NCP, NCP-R or PEP

- USGTIER= Specified the usage tier at which a NCP will be operated.
- VERSION= Use Version 5 Releases

Note: For a description of usage tier, refer to the NCP, SSP, and EP Resource Definition Guide.

- Changes made to the HOST statement.

  The HOST statement has become a VTAM-only definition statement.

  - BFRPAD= VTAM only
  - INBFRS= Is removed
  - MAXBFRU= VTAM only
  - UNITSZ= VTAM only
  - SUBAREA= VTAM only

- Changes made to the PUDRPOOL statement.

  - MAXLU= Is removed

- Changes made to the GROUP statement.

  - LNCTL= CA now identifies channel adapter definitions
  - REPLYTO= Only one valid value may now be coded
  - X21SW= VTAM only
  - X21NTWK= Level of the X.21 network

- Changes made to the LINE statement.

  - ADDRESS= The CA logical address (relative position) now included
  - ATTACH= Is removed
  - AUTO= New addresses for the 3745
  - CA= Specify TYPE6 or TYPE6-TPS for the 3745
  - CASDL= The CA Slow Down time before INOP signalled
  - CLOCKNG= Now INTernal, EXTernal, or DIRECT
  - COMPOWN= Used for User line control
  - COMPSWP= Used for User line control
  - COMPTAD= Used for User line control
  - DELAY= Channel queue Delay
  - DUALCOM= New 3745 addresses for EP
  - DYNADMP= Dynamic dump address if EP subchannel is used
  - HICHAN= High emulation subchannel address.
  - HISPEED= For lines over 144K bps
  - INBFRS= Channel Adapter buffer allocation
  - LOCHAN= Low emulation subchannel address
  - MODULO= Moved to PU statement
  - NCPCA= Active status of NCP Channel Adapters
  - NPACOLL= Valid for Channel Adapter when defined as PUTYPE=2
  - SPEED= Required for direct attach and NPM use
  - TIMEOUT= Channel Adapter attention timeout
  - TRANSFR= Number of NCP buffers required for largest PIU inbound

- Changes made to the PU statement.

  - MAXLU= Is removed
  - NETID= Now valid for channel adapter definition
  - PUTYPE= Code '5' for a channel adapter

- Changes made to the LU statement.
  - BATCH= Is removed
  - PACING= Only code one value
- Changes made to the GENEND statement.
  - UGLOBAL= Used for user code

6.2.2 NCP Usage Tier

Usage Tiers are provided for ACF/NCP Version 5. They are based on bandwidth as determined by the number of Line Adapters and Channel Adapters.

```
Tier             Usage Limits (Up to ...)
-----  ----------------------------------------------------------
  1      1 LSS/TSS + 1 TRA +  2 CA
  2      2 LSS/TSS + 1 TRA +  2 CA
  3      8 LSS/HSS         +  8 CA  or   4 LSS/HSS + 4 TRA +  8 CA
  4     24 LSS/HSS         + 16 CA  or  20 LSS/HSS + 4 TRA + 16 CA
  5     32 LSS/HSS         + 16 CA  or  28 LSS/HSS + 4 TRA + 16 CA

       LSS = Low Speed Scanner (for 3745)
       TSS = Transmission Subsystem (for 3720)
       HSS = High Speed Scanner (Maximum of eight)
       TRA = Token Ring Adapter
       CA  = Channel Adapter
```

Usage Tiers 1 and 2 support the 3720, 3745 Model 210 and 3745 Model 410 only in Twin-in-Standby mode. Usage Tiers 3, 4, and 5 support the 3745 Model 210 and 3745 Model 410 in any operation mode. Usages Tier 1 and 2 limit the number of CCUs as well as the number of Channel Adapters and Line Adapters. If an NCP generated with Usage Tier 1 or 2 is loaded into a 3745 Model 410 with the CCU mode configured anything other than stand-by, the NCP will fail with ABEND '7000'.

An NCP with a lower Usage Tier than a hardware configuration actually installed will run, but only with the line adapters and channel adapters allowed by the Usage Tier definition.

Usage Tier is checked by both NDF and NCP for the 3745. During the generation phase, NDF checks only the coding of channel adapters and Token-Ring adapters. NCP does all the line adapter and CCU checking at initialization. For the 3720, NDF checks channel adapters, Token-Ring adapters and line adapters.

An activation attempt for a line on an adapter not supported by the usage tier will be rejected with sense X'0801 0006'. "Equipment Check" will be returned for EP lines.

The Usage Tier 1 tape contains all the code and functions of the NCP V5 release, and the usage tier level of 1. If the initial order is for a Usage Tier greater than 1, then the Usage Tier 1 tape and the tape for the Usage Tier desired must be ordered and installed. For example, if a user has a need for the Usage Tier 5, two tapes must be ordered and installed, the Usage Tier 1 and 5 tapes.

6.2.3 NDF Generation Considerations

The following lists some considerations for generating NCP V5R1 for the 3745.

6.2.3.1 NCP Link-Edit

When generating a NCP V5 load module for the 3745 Communication Controller, the ALIGN2 option should not be specified in the link-edit step of the JCL. If neither ALIGN2 nor ALIGN4 is specified, ALIGN4 is used as the default, which is necessary for the 3745. Certain control sections within the load module are aligned on 4K page boundaries. For the 3720 Communications Controller, the ALIGN2 option should be specified in the link-edit step to ensure that certain control sections are aligned on 2K boundaries. If this is not specified, the default is alignment on 4K page boundaries, which may use excessive controller storage.

6.2.3.2 NTRI Generation

NEWDEFN = YES must be specified on the OPTIONS definition statement as the first executable statement in the NCP generation input deck. The NEWDEFN DD statement in the NDF step of the NCP generation JCL must point to the dataset that this NCP definition will be punched to after then NDF step has been executed. This definition should then be used as the VTAM source definition for the NCP. This is required as NDF inserts NTRI definitions into this deck

6.2.4 NPM Generation

NPM R3 requires the NPM RRT for NCP V5 to be generated by NDF at the same time as the NCP generation. An NPM generation cannot be run as a standalone routine anymore with NCP V5. NPM R3 requires PTF UY18842 to support generation for NCP V5.

In order to use the enhanced session accounting function provided by NCP V5R2.1 PTF UY90331 must be installed.

The combined NPM/NCP generation by NDF is accomplished by specifying UESRGEN = FNMNDFGN on the NCP source OPTIONS statement. The NDF JCL must also have the NPM load library concatenated with the SSP library on the STEPLIB DD statement for the NDF step of the generation (PGM = ICNRTNDF). A sample of the NCP source and NDF JCL required to perform a combined NCP/NPM generation can be seen in Appendix B.

6.2.5 Remote NCP Load Considerations

If an NCP is to be loaded into a 3745 over a remote link, then there are some considerations for line timeout values.

If the 3745 is IPLed, and currently in an 'FF4' state, when an IPL request is sent to it over a link, then the 3745 can start loading this NCP immediately, either across the link, or from a load module that had previously been stored on disk.

If, on the other hand, the 3745 already has an NCP loaded when an IPL request is sent across the remote link, the 3745 must IPL itself before the NCP can be loaded either across the link or from MOSS disk. In this situation, the remote 3745 will not send a response to the IPL request until the 3745 has been re-IPLed. This could be approximately 2-3 minutes after the initial IPL request was sent, hence the line timeout parameters must be set correspondingly so that this does not occur. The relevant parameters are:

- REPLYTO

This is specified on the GROUP statement for the link that is loading the NCP. This specifies the time-out value in seconds for a line if no response is received to a message or poll.

- RETRIES

  This specifies the number of attempts to recover from errors after a timeout has occurred.

More information on these parameters can be found in the *NCP, SSP and EP Resource Definition Reference*. These parameters should be set so that the link will not timeout for the duration of the 3745 CCU IPL.

6.3 VTAM Version 3 Release 1.1

The following PTFs have to be installed to VTAM V3R1.1 before it can communicate with NCP Version 5:

- For the support of the hard disk
  - PTF UY90091 (MVS/XA)
  - PTF UY90092 (MVS/370)
  - PTF UY90226 (VM)
- For the support of 3745
  - PTF UY90127 (MVS/XA)
  - PTF UY90128 (MVS/370)
  - PTF UY17659 (MVS/XA)
  - PTF UY17660 (MVS/370)
  - PTF UY12963 (MVS/370)
  - PTF UY12964 (MVS/XA)
  - PTF UV30656 (VM)

Note: The PTFs for the disk support are pre-requisite to the PTFs for the 3745 support.

The cover letter that accompanies these PTFs contain very useful information on using the hard disk, and defining the channel adapter to the NCP Group Definition statement.

In conjunction with ACF/NCP Version 5, ACF/VTAM V3R1.1 supports the following new functions for the 3745:

- 16 channel adapters
- New method of defining channel adapters
- Forwards Network Management Vector Transport (NMVT) messages LOGREC.

6.4 VTAM Version 3 Release 2

The following PTFs have to be installed on VTAM V3R2 before it can communicate with an NCP V5R2.1:

- For the support of the extended subarea addressing and increased explicit route functions
  - PTF UY28217 (APAR OY14996) (MVS/XA)
  - PTF UY28218 (APAR OY14997) (MVS/370)

Note: In addition, users requiring the call security verification or other functions provided in the VTAM V3R2 Enhancement should refer to:

- FMID HVT3204 for VTAM V3R2 - MVS/370
- FMID HVT3205 for VTAM V3R2 - MVS/XA

7. Operation

7.1 MOSS Operations

To perform 3745 operations, the 3745 Control Panel and an Operator Console will be used. The console may be the local, alternate, or remote console; all MOSS functions are available from any console. However, only one console can be active at a time.

MOSS functions are commonly performed at the console. Nevertheless, some of them can also be activated at the control panel if necessary. For example, the control panel allows some vital functions, such as powering on and initializing the controller or stopping controller operation. It offers also some maintenance procedures.

The remote console function will be enabled by MOSS only when:

- The local console is powered off and no wrap block is installed.
- The local console is powered on but left idle for 10 minutes or more.

After the remote console is connected, the following message is displayed on the local console:

Terminal disconnected for remote console

When the remote console is disconnected, the local console will automatically become active again.

7.1.1 Control Panel Operations

The 3745 Control Panel can be used to perform operations such as power on/off, IML MOSS, IPL CCU, and select service mode. It consists of some keys and a display. The keys are used as follows:

- The Function, Service Mode, and Power Control keys allow the user to scroll through the options on the corresponding display window.
- The Validate key enables a selected option.
- The Exit key cancels a selected option.

Note: Refer to Figure 26 on page 38 for the control panel illustration.

The operation procedure to power on and IPL the 3745 from the Control Panel is as follows:

1. Press the SERVICE MODE key repeatedly until 0 (Normal) is displayed, then press VALIDATE.
2. Press POWER CONTROL repeatedly until 3 (Local Mode) or 2 (Network Mode) is displayed, then press VALIDATE.
3. Press FUNCTION key repeatedly until 0 (General IPL) is displayed, then press VALIDATE.
4. Press POWER ON RESET.

The operation procedure to power on and IML MOSS is as follows:

1. Press the SERVICE MODE key repeatedly until 0 (Normal) is displayed, then press VALIDATE.
2. Press POWER CONTROL repeatedly until 3 (Local Mode) or 2 (Network Mode) is displayed, then press VALIDATE.
3. Press FUNCTION key repeatedly until 1 (MOSS IML) is displayed, then press VALIDATE.
4. Press POWER ON RESET.

Figure 73 shows the status codes displayed on the MOSS control panel.

000	IPL has completed; Control Program is loaded and MOSS is ONLINE
F0E	MOSS IML has completed; MOSS is ALONE
F0F	MOSS IML has completed; CCU is connected and MOSS is ONLINE
FD0	Completion of fallback
FD2	Completion of switchback
FD4	Fallback in progress
FD5	Switchback in progress
FD6	Control Program load from disk in progress
FD7	Control Program dump to disk in progress
FD8	Control Program saved on disk
FF0	IPL entered
FF1	IPL Phase 1; CCU initialization has started
FF2	IPL Phase 2; Load and start of control program loader in CCU
FF3	IPL Phase 3; Scanner IML is in progress
FF4	IPL Phase 4; Control Program is to be loaded
FF5	Channel-Attached 3745 only: Control Program is being loaded
FF6	Link-Attached 3745 only: Control Program is being loaded
FF7	Control Program is loaded and initialization has started

Figure 73. Status Code Display of MOSS Control Panel

7.1.2 MOSS Console Operation

The console screens are composed of the initial screen, the logon screen, the general MOSS rule screen, the menu 1 screen, the menu 2 screen, and the function screens provided for each MOSS function.

On all the console screens, the Machine Status Area (MSA) is displayed. It displays permanent information on the 3745 status. It provides the operator with the status of the single CCU or CCU A and CCU B in a Twin-CCU configuration, and also the MOSS status. It displays information on the progress of controller IPL and scanner IML functions.

The initial screen appears on the local or alternate console. It allows the operator to enable and/or disable the channel adapters without entering a password.

On the logon screen, the correct password must be entered. The local password is used for the local console and alternate console. The remote password is used for the remote console. The maintenance password can be used for any console. While

logging the remote console, the remote console is disconnected after three incorrect attempts.

The general MOSS rule screen shows the function selection rules. Each function has a unique three-character ID. All IDs are listed on the menu 1 or menu 2 screen.

The menu 1 screen lists the general set of MOSS functions. Compared with the MOSS functions of the 3725 and 3720, half of the general functions are new or changed for the 3745.

```
                                 MENU 1

* CONFIG DATA FILE.: CDF   IPL CCU(S).......: IPL   PORT SWAP FILE...: PSF
  CONTROL PRGM PROC: CPP   LD LINK TEST REQ.: LTQ * POWER SERVICES...: POS
* DISK FUNCTIONS...: DIF   LD LINK TEST RESP: LTS * SCANNER I/F TRACE: SIT
* DISK IPL INFO....: DII   LINE INTERF DSPLY: LID   STAND ALONE TEST.: SAT
* EVENT LOG DISPLAY: ELD * LINK IPL PORTS...: LKP * SWITCHBACK.......: SBK
* FALLBACK.........: FBK * MACHINE LVL TABLE: MLT * TIME SERVICES....: TIM
  IML MOSS.........: IML * MICROCODE FIXED..: MCF * TRSS INTERF DSPLU: TID
  IML SCANNER......: IMS * PASSWORD.........: PSW   WRAP TEST........: WTT
```

Note: The functions with an asterisk are new or changed for the 3745.

Figure 74. General MOSS Functions

The menu 2 screen lists the available CCU-oriented functions. Compared with the CCU-oriented MOSS functions of the 3725 and 3720, a few of them are new or changed for the 3745.

```
                                 MENU 2

  AC/BT PARAMETERS.: ABP   DISPLAY LONG.....: DLO   RESET I-STEP.....: RIS
  BYPASS CCU CHECK.: BCK   MOSS OFFLINE.....: MOF   SET ADDR COMPARE.: SAC
  BYPASS IOC CHECK.: BIK   MOSS ONLINE......: MON   SET BRANCH TRACE.: SBT
* CA INTERF DISPLAY: CID                            SET I-STEP.......: SIS
  CCU LVL3 INTERUPT: IL3   RESET ADDR COMP..: RAC   START CCU........: STR
  CCU NORMAL MODE..: CNM   RESET BRCH TRACE.: RBT   STOP CCU.........: STP
* CCU SEL/RELEASE..: CSR   RESET CCU........: RST   STOP ON CCU CHECK: SCK
* CCU STATUS.......: CST   RESET CCU CHECK..: RCK   STOP ON IOC CHECK: SIK
* DATA EXCHANGE....: DEX   RESET CCU/LSSD...: RCL
  DISPLAY/ALTER....: DAL * RESET IOC(S).....: RIO
```

Note: The functions with an asterisk are new or changed for the 3745.

Figure 75. CCU-Oriented MOSS Functions

In order to become familiar with the MOSS operations, refer to the following manuals:

- *IBM 3745 Communication Controller Basic Operations Guide*, GA33-0098
- *IBM 3745 Communication Controller Advanced Operations Guide*, GA33-0097
- *IBM 3745 Communication Controller Problem Determination Guide*, GA33-0096

7.1.3 MOSS User Facilities

The operator can display and update information on various machine parameters at the console, and execute the following MOSS functions. For details of these facilities, refer to the *3745 Communication Controller Advanced Operation Guide*, which describes each 3745 MOSS functions.

7.1.3.1 Channel Adapter Display/Control

The channel adapter enable/disable function is always accessible from the operator console. The related screen is displayed immediately after MOSS IML. It is accessible without entering a password, but only the channel statuses can be modified.

7.1.3.2 Configuration Data File

The Configuration Data File (CDF) is created at the manufacturing site and then checked automatically against the current controller configuration at installation time.

The file contents can be displayed and updated for each change in the 3745 configuration. The CDF contains the following information:

- MOSS information including the MOSS microcode EC level, MCF level, and FRU level
- Base Frame and Adapter Frame information including line adapter boards and channel adapter boards
- CCU information with the storage size and FRU levels
- Switch information
- Channel Adapter and Two-Processor Switch information including channel interface and native/emulation subchannel addresses.
- Line Adapter (LSS, HSS and TRA) information
- TSS, HPTSS and TRSS Port information
- Cable information
- CCU operation mode information.

The CDF is used by the MOSS during the initialization process, and by the diagnostic programs.

When a change occurs in the 3745 configuration, the CDF must be updated to reflect this change, as this is used by the MOSS to recognize the machine configuration. If 3745 hardware features are not known by the MOSS, then they will not be able to be used. This could be the case if, for example, a LIC was changed from one line adapter to another.

The easiest way to update the CDF is to use the CDF "Update" function. The MOSS must be ALONE to select this facility. UPDATE will cause the MOSS to investigate the current hardware, and then to update the CDF automatically with the information it finds from each component. This is the simplest and most accurate way to update the CDF.

Another facility is provided by the CDF, known as the "Verify" function. This will investigate the current hardware configuration, and will compare the information provided by the components with current CDF information. If a difference occurs,

then an option is provided to either replace the current CDF definitions with the new definitions, or to keep the existing CDF definitions. Note that the "Update" and "Verify" functions can also update cable information. To perform a CDF verify, you must log on with the CE password, then RESET both CCUs, and select the CDF Update/Verify function.

If a cable or LIC is swapped whilst the 3745 CCU is running, this information can be also be updated in the CDF. This function can be selected by the CDF option of "Display Line Adapters". If an NCP is running in the CCU, then an "Update" function can be selected for a particular line adapter. The following options are then provided:

- Add a LIC

  This option can be used to add a LIC to an existing Line adapter. The only input required is LIC position, and the MOSS will update the CDF with information provided by the machine components, including cable information.

- Delete a LIC

  This option can be used to delete a LIC from a Line Adapter that may have been moved to another Line Adapter.

- Replace a LIC

  This can be used to update existing LIC information if a LIC was swapped with a different type, or it can be used to update cable information and clocking information for a particular LIC.

When modifying a configuration having LIC Type 4's, the scanner must be re-IMLed because the LIC Type 4 personalization (4A or 4B) is defined at IML of the scanner.

7.1.3.3 Line Interface Display

The line interface display (LID) function may be used when modifying the network and installing terminals, and when displaying information about lines.

The following information is displayed for each line:

- Control program (NCP/EP)
- Line parameters
  - Line interface standard
  - Line type
  - Line protocol
  - Cable identification
  - Transmission mode
  - Clock type
  - Line speed
- States of the data set leads (interchange circuits)
- Transmit and receive data
  - Transmit and receive commands and command status
  - 32 bytes of transmitted data
  - 32 bytes of received data

7.1.3.4 Machine Level Table

The machine level table (MLT) contains the following information:

- Control program version loaded in each CCU
- Control program load module name for each CCU
- Control program load ID for each CCU
- NCP level of modifications
- EC level of microcode
- EC message
- The last applied MCF and the date

The MLT can be displayed from the operator console. This file may be transferred to NetView on request. Using ACF/SSP, the MLT can also be printed at the host whenever a microcode dump is requested.

7.1.3.5 Link IPL Port

The Link IPL Port (LKP) table contains information about either the channel links or the communication links used to initialize the controller. An IPL port of a communication line must be a SDLC link of either TSS or HPTSS. The link addresses are initialized at installation time by the user via the operator console. Up to eight Link IPL Ports can be defined per CCU. The IPL Port Table is maintained on the MOSS disk, and contains the parameters of each IPL port.

7.1.3.6 Password Maintenance

Access to the system is controlled by a password defined by the user. The following passwords are required when invoking the logon procedure.

- Management Password

  This password allows access to the password function in order to modify or display the local and remote console passwords.

- Local/Alternate Password

  This password allows access to the local and/or alternate console.

- Remote Password

  This password allows access to the remote console in customer mode.

- Maintenance Password

  This password allows the service representative to use the local, remote, or RSF console in maintenance mode. The maintenance password must differ from the remote password and the local/alternate password.

7.1.3.7 Port Swapping

The port swap function is used to switch one port to another without control program regeneration. If a link to a port is disconnected because of line, LIC, or Line Adapter failure, this failing link can be logically and physically switched from its original port to a spare one.

The Port Swap File (PSF) maintains the information about ports switched logically. Through the port swap function, the operator can display the Port Swap File to verify the ports.

To switch ports, the following rules must be complied with:

- The new port must be a spare, which was not defined at system generation (not known to the NCP).
- The original port and new port must have a compatible line adapter type, LIC type, and cable type.
- The line connected to the port to be switched must be inoperative (deactivated). It must not be an autocall line, or an OEM line.
- The two ports involved in the Port Swapping must belong to the same CCU.
- The spare port must have the LIC cable plugged before swapping port. ″REPLACE LIC″ or ″ADD LIC″ can be used to modify or add the port configuration.

7.1.3.8 Power Services

The power supply connected to each hardware component can be identified at the operator console display and powered on/off by using Power Service (POS) function. The same function allows the display of the error status for each power supply and and each air flow.

7.1.3.9 Time Services

The Time Service function (TIM) allows the operator to:

- Set or modify the data and time, which are permanently displayed on the MSA of the screen
- Define scheduled power on times (one time for each day of the week)
- Activate or deactivate the scheduling function
- Display the scheduling function status and schedule power on time.

Scheduled power on will not occur unless the power control mode is set to ′Network (2)′ on the control panel.

7.1.3.10 Disk Function

The Disk Function (DIF) is used for the following purposes:

- Install new microcode for an Engineering Change (EC).

  To install a new EC, ten diskettes are delivered; two sets of a primary, secondary, third, fourth and fifth diskette. One set is labelled ′Normal′,the other ′Backup′. It is recommended to use the normal set for first installation and then use the backup set for backup the disk.

  A new release (EC) of the microcode also contains microcode fixes (MCF). It is required to apply these MCFs once the new release has been installed.

- Save the disk onto diskettes.

  The function should be used to:

  - Create a backup copy of initial diskettes.
  - Copy the MOSS disk files after new microcode fixed have been applied.
  - Copy the disk after changing configuration and parameters.

- Restore the disk from the diskettes.

  The function should be used if:

- A disk problem is suspected.
- The disk has been replaced.
- A problem is suspected with the new EC that has been installed or the latest EC update in the files.

It is required to use the diskettes that were created using the Save Function.

- Initialize diskettes.

Use PC diskettes with part number 2HC 61069660 or equivalent.

The Disk Function is available only when MOSS is off-line.

7.1.3.11 Disk IPL Information

The Disk IPL Information function is used to display the current status of NCP load or dump modules stored on the MOSS hard disk. This function will display:

- Current 3745 CCU configuration (Single, Twin-in-Dual, Twin-in-Standby or Twin-in-Backup).
- Current Control Program running in each CCU
- Disk Contents for each CCU:
  - Load Modules (up to 2 supported for V5R2 NCP)
  - Dump
- Auto Dump/Load option for each CCU (YES or NO)
- Active Load module for each CCU

The auto Dump/Load option for each CCU can be changed using this facility. Also, it is possible to purge a dump for the specified CCU using this facility.

7.1.3.12 Microcode Fixes

Between two major ECs, modifications may be made to the microcode. The modifications, referred to as microcode fixes (MCF), are transferred on the disk from RETAIN or delivered with a set of new diskettes.

The MCF function is used to:

- Apply (upgrade) all MCFs transferred.
- Restore the microcode, if a problem is suspected with the new microcode.
- Display a history table that contains the latest level of the microcode.
- List all MCFs that have been applied in an earlier upgrade of the microcode.
- List the MCFs that have just been transferred, whether or not applied.
- Transfer the MCFs from the diskettes to the disk.

This function can not be performed if MOSS is online.

7.1.3.13 TRSS Interface Display

The TRSS Interface Display function (TID) provides the information relative to the status and activity of a selected TIC. In addition, a function is provided which will allow an 'active link' command to be performed at the host.

There are three basic functions of the display.

- Display status of the Token-Ring.
- Provide problem determination.
- Give visibility of Token-Ring activity.

The 'activate link' function is needed in the following event:

- An automatic TIC dump is requested by NTRI which causes the Active Link from the host to be inhibited.
- Before the autodump is completed, MOSS goes down or is unable to complete the dump and does not re-enable the Activate Link.

7.1.3.14 Scanner Interface Trace

The Scanner Interface Trace function (SIT) is used to collect the events that occurred on a given line and the checkpoint entries. The host SIT is called External SIT (E-SIT), while this SIT is called Internal SIT (I-SIT).

Traced events are recorded in a TSS internal buffer, and can be sent to the MOSS via the CCU storage area dedicated to MOSS/TSS communication.

The trace buffer size is 8K bytes maximum (K = 1024). According to the line speed, the number of traces that can be started per scanner differs:

- High speed line (230K bps for TSS and 1.5M bps for HPTSS):

  Only one trace in a buffer of 8K bytes.

- Medium speed line (56K bps to 65K bps):

  Two traces maximum in two buffers of 4K bytes each.

- Low speed line:

  Four traces maximum in four buffers of 2K bytes each.

If an E-SIT is running for a given line, an I-SIT cannot be started on this line or vice-versa.

Note: For the details about E-SIT, refer to the ACF/TAP manual, SC30-3143.

7.1.4 3745 Integration

The 3745 integration procedure starts after installation, which includes Initial Microprogram Load (IML) of the MOSS, connection of the Line Adapter cables, and creation of the configuration data file.

The following list provides an overview of the 3745 integration procedure.

1. Connect remaining cables.

   It is recommended to use the Configuration Sheets created by the HONE Configurator and the procedures in the IBM 3745 Communication Controller Line Interface and Coupler and Cable Guide.

2. Power on (if necessary) and IML MOSS.

   When pressing the Power On-Reset key, MOSS dump and IML occur automatically.

3. Customize passwords.

   It is recommended to make the management password unique, make the local and remote passwords the same, define the maintenance password different from the other ones, and activate the maintenance password as permanent.

4. Update CDF for line adapters and, optionally, for operating mode.

   The CDF line adapter Display/Update screen shows whether or not the line adapter is present and what type of line adapter is installed. Also, for each line adapter, the detailed information is provided. It is required to verify and update the line information.

   For the TSS line adapters, the following information can be updated:

   - LIC presence and type
   - Port presence and clock/cable information.

   The updated data becomes effective after the next IML of the LSS (TSS line adapter).

   For the HPTSS line adapters, the following information can be updated:

   - DMA size - length of burst
   - Error sequence
   - DSR Integration Timer

   The updated data becomes effective after the next IML of the HSS (HPTSS line adapter).

5. Update link IPL ports (optional).

   If a 3745 is locally attached to the host and IPL is performed only through the channel adapters, it is not necessary to define a link IPL port. Otherwise, it is required to define at least one link IPL port.

6. IPL and have control program loaded.

   IPL can be performed at an operator console or the control panel. In Twin-CCU configuration, an IPL will be performed on both CCUs or one of them depending on the selection as follows:

   - Available CCU(s) according to operating mode
   - CCU-A
   - CCU-B

7. Save diskettes.

   The Disk Function (DIF) makes backup copies of the diskette. The disk contents, such as CDF, LKP, LDF, MLT, LTH and CPP, will be saved on five diskettes. These diskettes must be compatible with the MOSS disk format, either:

   - The primary, secondary, third, fourth, and fifth backup diskettes for a 3745, or
   - Diskettes formatted with the Diskette Initialization function.

These diskettes will be used to restore the disk in case the disk becomes unusable because of bad information on the disk, or through physical damage to the disk.

7.2 Network Operations

Network Operations can be controlled through a number of VTAM operator commands which affect both VTAM and NCP operations. Network Operations are now further improved through the use of the 3745 MOSS disk, which can be used to improve network availability and flexibility.

NCP V5R1 provides the capability to store one NCP load module (optionally including the PEP feature of NCP) and one dump file per CCU on the MOSS disk. NCP V5R2 and subsequent releases increase this to two load modules that may be stored per CCU.

The following operator commands support loading and dumping storage using the 3745 disk.

- VARY ACT (for a NCP major node)
- DISPLAY NCPSTOR
- MODIFY DUMP

7.2.1 NCP Load Operation

One or two NCP load modules per CCU can be transferred from the host to the local or remote 3745, and stored on the 3745 disk. The capability of loading two NCP load modules per CCU is supported by ACF/NCP V5R2 and later releases. Also, the multiple load module support requires ACF/VTAM V3R2.

The loading of NCP from disk can be initiated either by VTAM operator command from the host, or locally from the control panel or MOSS console. A MOSS initiated load requires an IPL of a particular CCU with the DUMPLOAD=YES option. This will automatically load the NCP from disk at the end of the IPL.

NCP V5R2 and subsequent releases will allow the transfer of NCP load modules from the host without disruption to 3745 operations.

7.2.1.1 VARY ACT command

The VARY ACT command for the NCP major node supports the 3745 disk feature.

```
V NET,ACT,ID=ncpname,LOAD=YES|NO|U,LOADFROM=HOST|EXTERNAL,SAVEMOD=YES|NO,
  DUMPLOAD=YES|NO,LOADMOD=load-module-name
```

The LOADFROM keyword provides the source of an NCP load module to be loaded into a communication controller.

- HOST

  Specifies that an NCP module is to be loaded into a 3745 from a host data set. HOST is the default value.

- EXTERNAL

  Specifies that an NCP module is to be loaded into a 3745 from the hard disk attached to that controller. (This only applies when LOAD=YES is also specified for this command.) EXTERNAL may be abbreviated as EXT.

The SAVEMOD keyword applies to saving an NCP module on the 3745 disk after the controller has been loaded from a NCP load module library at the host. The

save module option is valid only when LOAD is specified with the operand value of YES. NO is the default value.

The DUMPLOAD keyword applies to setting the automatic dump/load switch in the 3745. The switch controls automatic dumping and reloading of an NCP on unrecoverable conditions in the NCP. The DUMPLOAD keyword is valid only when LOAD is specified with an operand value of YES. NO is the default value. YES turns the automatic dump/load switch 'ON' and NO turns it 'OFF'. The default setting of the switch is 'OFF'.

LOADMOD specifies the name of the load module to be activated. Default load module name is ncpname. This must be specified if NCP PU name (PUNAME on BUILD) is different from load module name (NEWNAME on BUILD).

7.2.1.2 Automatic Load/Dump

The function of automatic load/dump of NCP from/to the 3745 disk is assigned to a 3745 by the network operator during the activation of an NCP load module saved on the 3745.

In order to perform the automatic load/dump function, the network operator needs to set the automatic load/dump switch by specifying 'DUMPLOAD=YES' in the VARY ACT command.

```
VARY NET,ACT,ID=name,LOAD=YES, ... ,DUMPLOAD=YES
```

When unrecoverable errors occur in the NCP, the switch is tested. If it is 'ON', a dump of the NCP is stored on the hard disk. After a dump has been successfully stored on the controller's hard disk, the 3745 is reloaded with the NCP load module held on the 3745 disk. If it is 'OFF', the controller is not automatically dumped and loaded from the 3745 hard disk when an NCP abends. The default setting of the switch is 'OFF'.

In case of CCU and storage related failure or microcode error, a dump of the NCP storage is automatically saved on the disk and then the CCU storage is automatically loaded from the disk with the NCP load module which was preselected for activation in this CCU. After a power outage or a CCU power failure, the NCP automatic re-load sequence begins.

In Twin-in-Standby mode, bus switching will automatically take place and the standby CCU will be IPLed in the case of a CCU or storage related failure. If the DUMPLOAD=YES option has been specified, then NCP will be loaded from disk automatically after the CCU has IPLed.

7.2.1.3 Multiple Load Modules Support

In conjunction with ACF/VTAM V3R2 and ACF/SSP V3R4, ACF/NCP V5R2 provides support of multiple load modules on 3745/3720 disk. This support allows:

- Non-disruptive addition, replacement or deletion of load module on the disk
- Selection, at lead time, of which load module on disk will be loaded
- Ability to cancel and in-progress addition or replacement
- Display of disk contents.

In order to perform these functions, the following commands will be available:

- MODIFY LOAD adds, replaces, deletes a load module on the disk non-disruptively, and cancels an in-progress add or replace.

  ```
  F NET,LOAD,ID=ncpname,LOADMOD=load-module-name,ACTION=ADD|REPLACE|PURGE|CANCEL
  ```

  ACTION=ADD adds a load module on the disk, unless already two load modules are there on the disk or unless the load module with the same name is there. Auto dump/load switch is set to "OFF".

  ACTION=REPLACE replaces a load module on the disk with new copy, or adds a load module to the disk if the load module is not there. If two other load modules are already on the disk, the older is replaced. . Auto dump/load switch is set to "OFF".

  ACTION=PURGE purges a load module on the disk.

  ACTION=CANCEL cancels an in-progress add or replace.

- DISPLAY DISK gets information about load modules and dumps on the disk.

  ```
  D NET,DISK,ID=ncpname
  ```

  The information about load module contains load module name, date/time load occurred, auto load/dump switch status, load module status (LOADED, LOADING, SUSPENDED), and active load module name.

  The information about dump contains dump name and date/time dump taken.

7.2.2 Dump Operations

The network operator can request the on-line transfer of a full dump or a partial dump. The NCP dump stored on the 3745 disk must be retrieved and/or erased by the network operator before a new NCP dump can be saved on the 3745 disk for the same CCU. The on-line transfer can be done without deactivating the current NCP loaded in the 3745, but it could impact response time of other network applications.

Also, the operator can display information on the status of NCP load modules and NCP dumps residing on the 3745 disk at one of the 3745 MOSS consoles.

7.2.2.1 MODIFY DUMP command

The MODIFY DUMP command supports the online transfer of a full NCP dump or MOSS files saved in the 3745 disk.

```
F NET,DUMP,ID=ncpname,TYPE=MOSS|NCP|CSP,ACTION=TRANSFER|PURGE|COMP
```

TYPE keyword specifies whether to take a normal NCP dump, or transfer two internal controller dumps to the host.

The ACTION keyword applies to the disposition of a dump stored on the 3745 disk and specifies that the dump indicated by the TYPE keyword is one of the following:

- TRANSFER

  Transferred to a host data set from the 3745 disk. The dump is not automatically purged from the disk.

- PURGE

  Purged from the 3745 disk. No dump is transferred to a host data set.

- COMP

Specifies that the action is compatible with the previous release of VTAM. This is the default value.

Formatting is done with the ACF/SSP Print Dump utility. See Appendix C for details of the JCL used for printing the NCP, MOSS, or CSP dump data.

7.2.2.2 DISPLAY NCPSTOR command

The DISPLAY NCPSTOR command supports the 3745 disk feature. A partial dump can be performed as an alternative to the full dump transfer using this command.

```
D NET,NCPSTOR,ID=ncpname,ADDR=address,LENGTH=nnn,
  STORAGE=MAIN|DUMPVEC|DUMPMAIN
```

The STORAGE keyword applies to the type of NCP storage to be displayed.

- MAIN

  Specifies that a portion of the communication controller main storage containing an NCP is to be displayed. This is the default value.

- DUMPVEC

  Specifies that the communication controller state vector stored on the 3745 disk file is to be displayed. The state vector contains the registers, storage keys, program state, instruction state, instruction addresses, and is also referred to as the dump header.

- DUMPMAIN

  Specifies that a portion of an NCP dump stored on the 3745 disk as a result of an automatic dump is to be displayed. The resultant display refers to the main storage of the controller, starting at address zero and continuing to the maximum storage installed minus one.

LENGTH = 256 is required for STORAGE = DUMPVEC or STORAGE = DUMPMAIN.

7.2.2.3 DISPLAY DISK command

The DISPLAY DISK command provides information about 3745 Communication Controller's disk contents.

```
D NET,DISK,ID=ncpname
```

The information about the load module includes:

- The load module name
- The date and time the load module was stored in the disk
- The status of the load module (store,storing or suspended)
- The status of the AUTO DUMP/LOAD

The information about dumps modules includes:

- The dump name
- The date and time the dump was stored to disk

Note: This command is supported by VTAM V3R2 only.

7.3 Problem Determination

Problem determination for the 3745 is designed so that the information in the Alert/Alarm, in conjunction with additional tests indicated by the Alert/Alarm message, identifies the failing controller component.

Failures are notified through the MOSS at the 3745 console and through the NCP to VTAM and NetView at the host console. The way in which failures are notified to the host console depends on whether NetView is installed in the host or not.

7.3.1 Box Event Records

The MOSS logs automatically any new Box Event Record (BER) into the BER file stored on the 3745 disk. The BER file contains records related to a failure and records related to events. Each BER relating to an error contains relevant details about the environment at the instant of the detected failure.

When the BER indicates a serious fault situation, the MOSS uses the BER to build an Alarm message, and send the pertinent information to NCP. The NCP sends an Alert message to the host. At the same time, an indicator on the 3745 control panel prompts the operator to read an Alarm messages at the 3745 console.

Each BER is analyzed by the automatic BER analysis program to produce a reference code ("refcode"). The "refcode" is included into the Alarm and Alert messages. Analysis of this code helps identify a failing hardware or software component, or the environment of a more complex problem.

7.3.2 Generic Alerts

In conjunction with NetView, the 3745 provides improved network management capabilities.

The 3745 sends error related information to NetView. Alerts generated for the 3745 are displayed on the network control terminal by NetView. Alert support for the Token-Ring Network is provided only through NetView.

Generic Alerts contain a recommendation for further problem determination actions. Alert messages are divided into two parts, a coded part with the "refcode" that contains information about the failure, and a text part that contains a general description of the failure. The coded part is translated by NetView in the host into a displayable message. The "refcode" corresponds to a precise type of error and gives information about the suspected component.

When NetView is not installed, a single message which indicates a reference to an error message displayed at the 3745 console is sent to the VTAM console as a non-generic Alert.

8. Twin-CCU Considerations

8.1 Twin-CCU Planning Considerations

The Twin-CCU operation modes of the 3745 Model 410 provide greater flexibility to meet the requirements of today's networks than has been provided by predecessor products. The Twin-CCU mode of operation will be selected depending upon the network requirements. This section discusses the reasons for selecting the Twin-CCU mode of operation and the network planning considerations for each mode to assist in the Twin-CCU implementation.

8.1.1 Twin-in-Dual Planning Considerations

Twin-in-Dual mode is suitable for users who require a high performance communications controller, as each CCU can serve half of the 3745's line adapters and channel adapters, providing more processing cycles for each resource. A 3745 Model 410 running in this mode can provide a cheaper alternative than that of two individual 3745 Model 210 controllers, while providing the same function.

Twin-in-Dual is the simplest mode of 3745 Twin-CCU configuration, hence it is the easiest mode to implement. There are no special network planning requirements to operate in 'Twin-in-Dual' mode other than those required to operate two different subareas in a standard SNA network. For this reason, it is a good starting point when implementing a new 3745 Model 410 in a network, prior to implementing the other modes of operation.

Twin-in-Dual mode will allow a control program to be defined with more resources than physically available to it. But it is advisable to set the ISTATUS of such resources to INACTIVE. If one tries to activate a resource that has been defined to the NCP, but does not physically exist, because the I/O Bus, on which that resource is attached, is not switched to this CCU, then VTAM will issue the following message:

IST380I ERROR FOR ID=resource name -REQUEST ACTLINK SENSE: 08010006

Thus a control program that is used in Twin-in-Backup mode can be loaded into a 3745 CCU running in Twin-in-Dual mode.

8.1.2 Twin-in-Standby Planning Considerations

The Twin-in-Standby mode of operation offers very high availability providing recovery capability of a full subarea network. All resources can be switched automatically or manually from one CCU to the other. It is suitable for users who may currently be using two communications controllers, one for production network load and the other as a backup controller. Twin-in-Standby may provide a lower cost alternative for such an environment.

Prior to 3745 Release 1.1 and NCP V5R2.1 a 3745-410 operating in Twin-in-Standby mode would load the control program on the standby CCU right after fallback in case of the failure of the active CCU or the control program. This would cause a delay of about two to three minutes in the take-over process. With 3745 Release 1.1 and NCP V5R2.1 the standby CCU has a copy of the control

program already loaded; when the failure comes, no time is wasted in loading. This is called Hot-Standby, and the take-over process takes about 25 seconds, depending on the number of lines with initial status active.

The Twin-in-Standby mode requires only one control program to be defined, hence there are no unique planning considerations, other than those for the addition of a single subarea into an existing SNA network. No special backup considerations are required to recover network resources, as this will be done automatically by VTAM and NCP. LU-LU sessions will be interrupted, however, and will need to be re-established after fallback. A description of the switching operations that take place in Twin-in-Standby mode is provided later in this chapter.

To utilize the Twin-in-Standby mode properly, the control program load module should be stored on the 3745 disk, and the option of DUMP/LOAD should be "YES", so that automatic loading of the control program into the standby CCU will take place after IPL for the active CCU (Hot-Standby) or fallback. For more information on the DUMP/LOAD option, refer to the chapter on operation.

8.1.3 Twin-in-Backup Planning Considerations

The Twin-in-Backup mode of operation offers both high performance and high availability. As long as the machine works in a normal condition, there is no difference between Twin-in-Dual mode and Twin-in-Backup mode. Thus, this mode has the same performance advantages as that of the Twin-in-Dual mode. If one CCU fails, the resources attached to the failed CCU are switched to the active CCU and the network operations on those resources can be taken over by the active CCU and control program.

Each control program should be generated to be able to backup the other control program in the Twin-in-Backup mode. The number of resources that would be taken over by the active CCU and control program may be restricted depending upon the network performance requirements. If the ALU utilization of each CCU at the peak time is more than 50 percent in a normal condition, it might not be possible for each CCU to take over all the resources owned by the other CCU. The backup might be partial and resources that would be taken over should be selected as critical resources. If the ALU utilization is far less than 50 percent, the backup might be complete. The emphasis for using this mode should be on performance for a normal operational condition. It is recommended that the performance analysis be performed for both CCU not only in a normal condition but also in a backup condition using HONE configurator or other methods.

Recovery is more complex in the Twin-in-Backup mode. There are many planning considerations to be taken into account. From host applications point of view, it is near to impossible to define backup resources (Logical Units) with different names. Some host operator intervention will be required to recover resources after one CCU fails. This intervention could be in the form of an automated NetView CLIST.

It is required that the backup resource definition and the network recovery operation be taken into consideration in order to take full advantage of the Twin-in-Backup mode of operation. The detailed discussion on the resource definition and network operation will be provided later in this chapter.

As far as the sessions for the devices attached to the failed CCU are concerned, all of them will be disrupted, and this is true not only for the Twin-in-Backup mode

but also for the Twin-in-Standby mode (even with the Hot-Standby). The main reason for losing the sessions is that each CCU has its own memory (loosely coupled), so at failure time the active CCU does not know what was inside the failed CCU's storage.

8.2 Twin-in-Backup Resource Definitions

In Twin-in-Backup mode, each control program should be generated to be able to backup the resources that are defined in the partner control program. Some special considerations should be taken to define the backup resources.

This section provides some considerations regarding NCP backup resource definition and EP backup resource definition.

8.2.1 NCP Backup Resource Definitions

In Twin-in-Backup mode, it is required to define the same resources (lines, physical units (PUs), and logical units (LUs)) for both NCPs. That is to say, each NCP defines its original resources and the backup resources that are defined in the other NCP as its original resources. Remember that the backup may be partial or complete depending upon the performance requirements. It is possible to manage the line and PU resources, even if they are defined in both NCPs with different resource names. However, the LU resources should be defined in both NCPs with the same resource names from the host applications point of view. Otherwise, host applications are required to manage two different names for a single LU resource.

In order to avoid this complexity, it is recommendable to define backup resources with a pseudo VTAM owner. The backup resources are acquired and activated by a host when one CCU fails and fallback occurs. The following NCP definition statements and respective parameters are NCP definition requirements for Twin-in-Backup mode.

- PCCU Definition Statement

  If both NCPs are owned by the same host, then only one PCCU is allowed to describe that host. If both CCUs are owned by different hosts, then all PCCU macros may be included, so long as no duplicate definitions for the same host occur.

  In addition to PCCU statements for the real owners, a PCCU statement for a pseudo VTAM is required so that it can be the owner of backup resources. The name of the pseudo VTAM must not be a VTAM in the network.

  The following parameters are necessary for back up recovery processing:

  - OWNER = vtam_name
  - AUTOIPL = NO (default)
  - AUTODMP = NO (default)
  - DUMPDS = dump_ddname

- PATH Definition Statement

  If INN links are to be backed up after a CCU failure, then special consideration should be given to path definitions, as after backup INN links will be connected to a different subarea. Routes will need to be defined across these INN links not only to the original subarea but also to the backup subarea. Additional routes through the backup subarea will be normally inactive and are used only after backup.

- LINE Definition Statement

  For the original resources that are usually to be active upon NCP activation, the following parameters should be defined:

- OWNER = vtam_name
- ISTATUS = ACTIVE

The OWNER is a VTAM owner defined in one of the PCCU statements.

For the resources that are to be backup resources when one CCU fails, the parameters must be identical to the definition of the partner LINE which is active in the other NCP except for:

- OWNER = pseudo_vtam
- ISTATUS = INACTIVE

- PU Definition Statement

  The PU definition statement must be identical to the definition of the partner PU statement in the other NCP definition.

- LU Definition Statement

  The LU definition statement must be identical to the definition of the partner LU statement in the other NCP definition.

The following are two typical examples of NCP definition requirements for Twin-in-Backup mode:

1. Both CCUs have channel connections to the same host.

   In this situation, both NCPs have the same VTAM owner. Only one channel adapter should be defined in either NCP. Assuming that CCU-A fails, all the resources attached to CCU-A are switched to CCU-B. Therefore, in the following diagram, CA1 is physically attached to CCU-B after fallback but CA1 cannot be used with CCU-B.

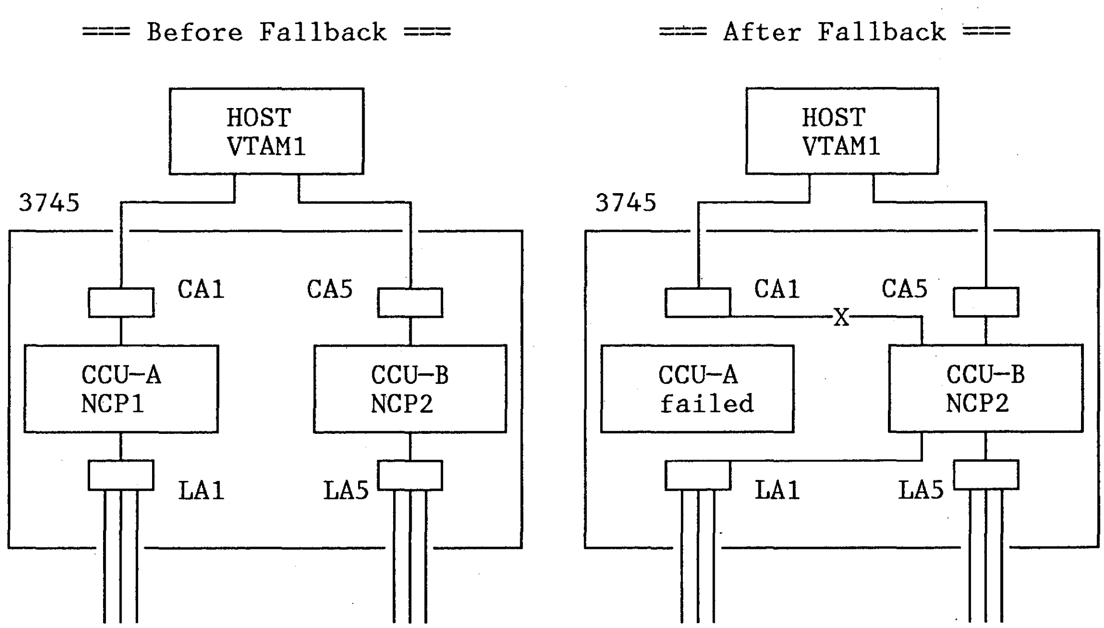


Figure 76. Twin-CCU NCP Backup Sample -1

The following sample definitions show how the resource should be defined in NCP-1 and NCP-2 with the configuration illustrated in Figure 76 on page 135. Both NCPs have a pseudo VTAM owner, namely VTAMX. Each NCP can backup resources of the partner NCP in case of CCU failure. Note that all the required statements and parameters are not coded completely in these examples.

```
              NCP-1                                      NCP-2
 ______________________________________     ______________________________________

PCCU1 PCCU  OWNER=VTAM1                    PCCU1 PCCU  OWNER=VTAM1
            AUTOIPL=NO                                 AUTOIPL=NO
            AUTODMP=NO                                 AUTODMP=NO
            DUMPDS=NCPDUMP1                            DUMPDS=NCPDUMP2

PCCUX PCCU  OWNER=VTAMX                    PCCUX PCCU  OWNER=VTAMX
            AUTOIPL=NO                                 AUTOIPL=NO
            AUTODMP=NO                                 AUTODMP=NO
            DUMPDS=NCPDUMP1                            DUMPDS=NCPDUMP2

      GROUP LNCTL=SDLC                           GROUP LNCTL=SDLC
L1001 LINE  ADDRESS=0                      L2002 LINE  ADDRESS=64
            OWNER=VTAM1                                OWNER=VTAM1
            ISTATUS=ACTIVE                             ISTATUS=ACTIVE
P1101 PU    ADDR=C1,PUTYPE=2               P2201 PU    ADDR=C1,PUTYPE=2
L1111 LU    LOCADDR=2                      L2211 LU    LOCADDR=2
L1112 LU    LOCADDR=3                      L2212 LU    LOCADDR=3

L1002 LINE  ADDRESS=64                     L2001 LINE  ADDRESS=0
            OWNER=VTAMX                                OWNER=VTAMX
            ISTATUS=INACTIVE                           ISTATUS=INACTIVE
P1201 PU    ADDR=C1,PUTYPE=2               P2101 PU    ADDR=C1,PUTYPE=2
L2211 LU    LOCADDR=2                      L1111 LU    LOCADDR=2
L2212 LU    LOCADDR=3                      L1112 LU    LOCADDR=3

      GROUP LNCTL=CA                             GROUP LNCTL=CA
            ISTATUS=INACTIVE                           ISTATUS=INACTIVE
C1001 LINE  ADDRESS=8                      C2005 LINE  ADDRESS=0
            NCPCA=ACTIVE                               NCPCA=ACTIVE
```

Figure 77. NCP Backup Resource Definition - 1

2. Both CCUs have channel connections to different hosts.

   In this situation, each NCP has a single host connection in a normal condition and two different connections in backup condition. Backup channel adapters should be defined in both NCPs. Assuming that CCU-A fails, all the resources attached to CCU-A are switched to CCU-B. Therefore, in the following diagram, CA1 is physically attached to CCU-B after fallback and both CA1 and CA2 are used with CCU-B.

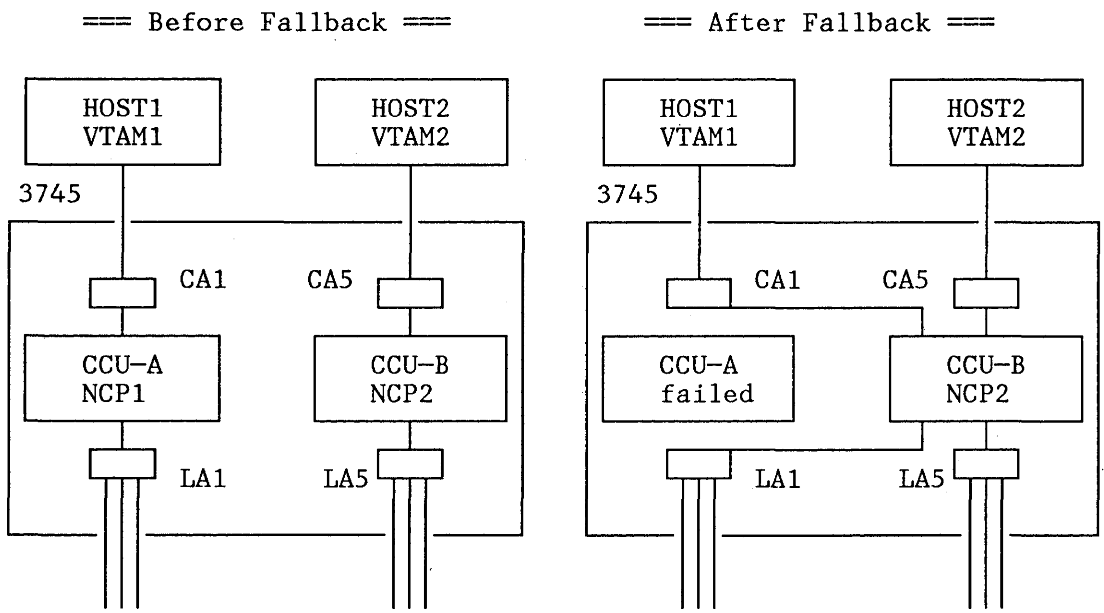


Figure 78. Twin-CCU NCP Backup Example - 2

The following sample definitions show how the resource should be defined in NCP1 and NCP2 with the configuration illustrated in Figure 78 on page 137. Both NCPs have a pseudo VTAM owner, namely VTAMX. Each NCP can backup resources of the partner NCP in case of CCU failure. Note that all the required statements and parameters are not coded completely in these examples.

```
                NCP-1                                 NCP-2
___________________________________   ___________________________________

PCCU1 PCCU   OWNER=VTAM1               PCCU1 PCCU   OWNER=VTAM1
             AUTOIPL=NO                             AUTOIPL=NO
             AUTODMP=NO                             AUTODMP=NO
             DUMPDS=NCPDUMP1                        DUMPDS=NCPDUMP2

PCCU2 PCCU   OWNER=VTAM2               PCCU2 PCCU   OWNER=VTAM2
             AUTOIPL=NO                             AUTOIPL=NO
             AUTODMP=NO                             AUTODMP=NO
             DUMPDS=NCPDUMP1                        DUMPDS=NCPDUMP2

PCCUX PCCU   OWNER=VTAMX               PCCUX PCCU   OWNER=VTAMX
             AUTOIPL=NO                             AUTOIPL=NO
             AUTODMP=NO                             AUTODMP=NO
             DUMPDS=NCPDUMP1                        DUMPDS=NCPDUMP2

      GROUP  LNCTL=SDLC                      GROUP  LNCTL=SDLC
L1001 LINE   ADDRESS=0                 L2002 LINE   ADDRESS=64
             OWNER=VTAM1                            OWNER=VTAM2
             ISTATUS=ACTIVE                         ISTATUS=ACTIVE
P1101 PU     ADDR=C1,PUTYPE=2          P2201 PU     ADDR=C1,PUTYPE=2
L1111 LU     LOCADDR=2                 L2211 LU     LOCADDR=2
L1112 LU     LOCADDR=3                 L2212 LU     LOCADDR=3

L1002 LINE   ADDRESS=64                L2001 LINE   ADDRESS=0
             OWNER=VTAMX                            OWNER=VTAMX
             ISTATUS=INACTIVE                       ISTATUS=INACTIVE
P1201 PU     ADDR=C1,PUTYPE=2          P2101 PU     ADDR=C1,PUTYPE=2
L2211 LU     LOCADDR=2                 L1111 LU     LOCADDR=2
L2212 LU     LOCADDR=3                 L1112 LU     LOCADDR=3

      GROUP  LNCTL=CA                        GROUP  LNCTL=CA
             ISTATUS=INACTIVE                       ISTATUS=INACTIVE
C1001 LINE   ADDRESS=8                 C2005 LINE   ADDRESS=0
             NCPCA=ACTIVE                           NCPCA=ACTIVE

C1005 LINE   ADDRESS=0                 C2001 LINE   ADDRESS=8
             NCPCA=ACTIVE                           NCPCA=ACTIVE
```

Figure 79. NCP Backup Resource Definition - 2

8.2.2 EP Backup Resource Definitions

In order to support EP lines, a 3745 needs to run in PEP mode. Therefore, if it is required to backup EP resources, both CCUs need to run with PEP. Each EP line is assigned its unique EP line address. An EP line address consists of a channel address and an emulation subchannel address (ESC). A range of ESCs (LOCHAN through HICHAN) is defined in the 3745 Configuration Data File (CDF) corresponding to an appropriate channel adapter. ESCs defined in PEP have to be in the ESC ranges defined in CDF. A host processor forms I/O device addresses (UCBs or PCBs) combining a channel address with these ESCs.

In order to backup EP resources, it is required to define the same EP resources (lines) for both PEPs. It is desirable that any EP backup resource be defined with the same ESC as the original one. Whether an EP backup resource can be defined with the same ESC and also the same I/O address depends upon the channel configurations that both CCUs are made up with.

The following are three typical examples of PEP definition requirements for Twin-in-Backup mode:

1. Both CCUs have channel connections to the same host via the same channel.

   In this situation, the ESC address range for each channel adapter should be unique as it is today with any controller. Although the channel adapter owned by the failed CCU has the same address as the other one, the channel adapter can be used after fallback by defining it with NCPCA=INACTIVE in the backup definition. That is, multiple channel adapters can be defined in either PEP. In order to continuously use a backup resource with the same address as the original one, the channel adapters corresponding to the EP backup resources should be defined in the counterpart PEP definition with NCPCA=INACTIVE and the corresponding LOCHAN and HICHAN keywords.

   Assuming that both CCUs are connected to HOST1 via channel "0" and ESC ranges are defined with "40" to "4F" and "50" to "5F" respectively, EP line addresses for PEP1 can be addressed from "040" to "04F" and EP line addresses for PEP2 can be addressed from "050" to "05F". After CCU-A fails, EP line addresses from "040" to "04F" can be used in PEP2 continuously, since CA1 that has an ESC address range of "40" to "4F" is switched to CCU-B.

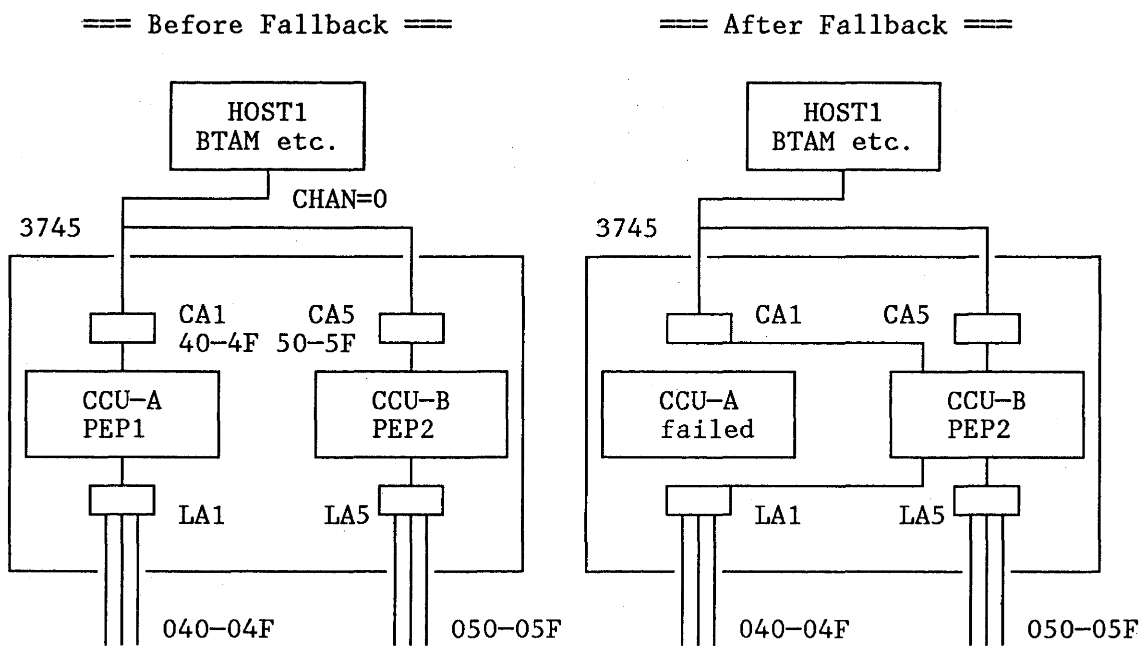


Figure 80. Twin-CCU PEP Backup Sample - 1

The following sample definitions show how the resource should be defined in PEP-1 and PEP-2 with the configuration illustrated in Figure 80. Each PEP can backup EP resources of the partner PEP using the same ESCs in case of CCU failure. Note that all the required statements and parameters are not coded completely and all the NCP definition parts are omitted in these examples.

```
            PEP-1                                   PEP-2
 ______________________________         ______________________________

      GROUP LNCTL=BSC                        GROUP LNCTL=BSC
L1001 LINE  ADDRESS=(0,40-8)           L2003 LINE  ADDRESS=(64,50-0)

L1002 LINE  ADDRESS=(15,4F-8)          L2004 LINE  ADDRESS=(79,5F-0)

      GROUP LNCTL=BSC                        GROUP LNCTL=BSC
L1003 LINE  ADDRESS=(64,50-0)          L2001 LINE  ADDRESS=(0,40-8)

L1004 LINE  ADDRESS=(79,5F-0)          L2002 LINE  ADDRESS=(15,4F-8)

      GROUP LNCTL=CA                         GROUP LNCTL=CA
            ISTATUS=INACTIVE                       ISTATUS=INACTIVE
C1001 LINE  ADDRESS=8                  C2005 LINE  ADDRESS=0
            NCPCA=ACTIVE                           NCPCA=ACTIVE
            HICHAN=(4F)                            HICHAN=(5F)
            LOCHAN=(40)                            LOCHAN=(50)

C1005 LINE  ADDRESS=0                  C2001 LINE  ADDRESS=8
            NCPCA=INACTIVE                         NCPCA=INACTIVE
            HICHAN=(5F)                            HICHAN=(4F)
            LOCHAN=(50)                            LOCHAN=(40)
```

Figure 81. PEP Backup Resource Definition - 1

2. Both CCUs have channel connections to the same host via different channels.

   In this situation, the ESC address range for each channel adapter is not required to be unique. There is no difference between a case wherein they are defined uniquely and a case wherein they are not defined uniquely. The channel adapter owned by the failed CCU can be used continuously after fallback in the same fashion as described in the previous case. Therefore, if one defines the backup channel adapters corresponding to the EP backup resources with NCPCA=INACTIVE and the corresponding LOCHAN and HICHAN keywords, the backup resources can be continuously used with the same address as the original one.

   Assuming that both CCUs are connected to HOST1 via channel "0" with the ESC range of "40" to "4F" and channel "6" with the same address range respectively, EP line addresses for PEP1 can be addressed from "040" to "04F" and EP line addresses for PEP2 can be addressed from "640" to "64F". After CCU-A fails, EP line addresses from "040" to "04F" can be used continuously in PEP2 since PEP2 is now connected via channel "0" in addition to channel "6".

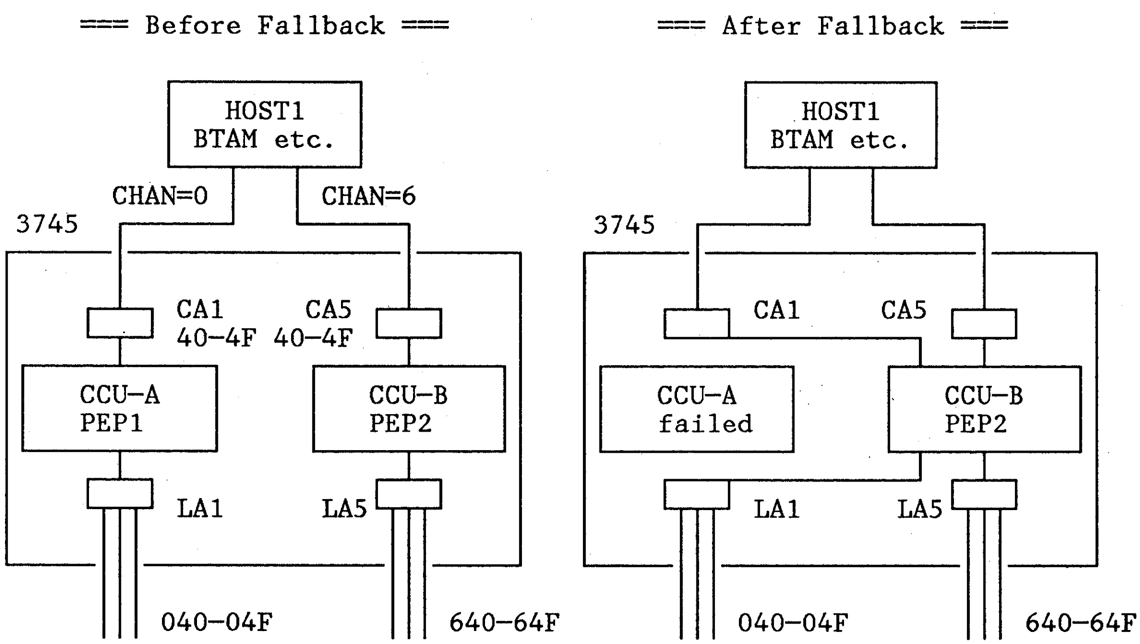


Figure 82. Twin-CCU PEP Backup Sample - 2

The following sample definitions show how the resource should be defined in PEP-1 and PEP-2 with the configuration illustrated in Figure 82 on page 142. Each PEP can backup EP resources of the partner PEP using the same ESCs in case of CCU failure. Note that all the required statements and parameters are not coded completely and all the NCP definition portions are omitted in these examples.

```
             PEP-1                                   PEP-2
      ---------------------------          ---------------------------

      GROUP LNCTL=BSC                            GROUP LNCTL=BSC
L1001 LINE  ADDRESS=(0,40-8)               L2003 LINE  ADDRESS=(64,40-0)

L1002 LINE  ADDRESS=(15,4F-8)              L2004 LINE  ADDRESS=(79,4F-0)

      GROUP LNCTL=BSC                            GROUP LNCTL=BSC
L1003 LINE  ADDRESS=(64,40-0)              L2001 LINE  ADDRESS=(0,40-8)

L1004 LINE  ADDRESS=(79,4F-0)              L2002 LINE  ADDRESS=(15,4F-8)

      GROUP LNCTL=CA                             GROUP LNCTL=CA
            ISTATUS=INACTIVE                           ISTATUS=INACTIVE
C1001 LINE  ADDRESS=8                      C2005 LINE  ADDRESS=0
            NCPCA=ACTIVE                               NCPCA=ACTIVE
            HICHAN=(4F)                                HICHAN=(4F)
            LOCHAN=(40)                                LOCHAN=(40)

C1005 LINE  ADDRESS=0                      C2000 LINE  ADDRESS=8
            NCPCA=INACTIVE                             NCPCA=INACTIVE
            HICHAN=(4F)                                HICHAN=(4F)
            LOCHAN=(40)                                LOCHAN=(40)
```

Figure 83. EP Backup Resource Definition - 2

3. Both CCUs have channel connections to different hosts.

   In this situation, one might or might not specify the same ESC range for both channel adapters and use channels with the same channel address. Like the previous cases, any EP backup resource can be taken over with the same EP line address as the original address. But the backup channel adapter must be defined with NCPCA=ACTIVE instead of NCPCA=INACTIVE, because this channel adapter will be used as a native subchannel by the NCP portion of PEP as well as ESCs by the EP portion after fallback.

   Assuming that both CCUs are connected to the channel "0" of HOST1 and HOST2 respectively, and both ESC ranges are defined with "40" to "5F", EP line addresses for either PEP1 or PEP2 can be addressed from "040" to "05F". After fallback, CA1 would be used in PEP2 continuously for both native and emulation subchannels.

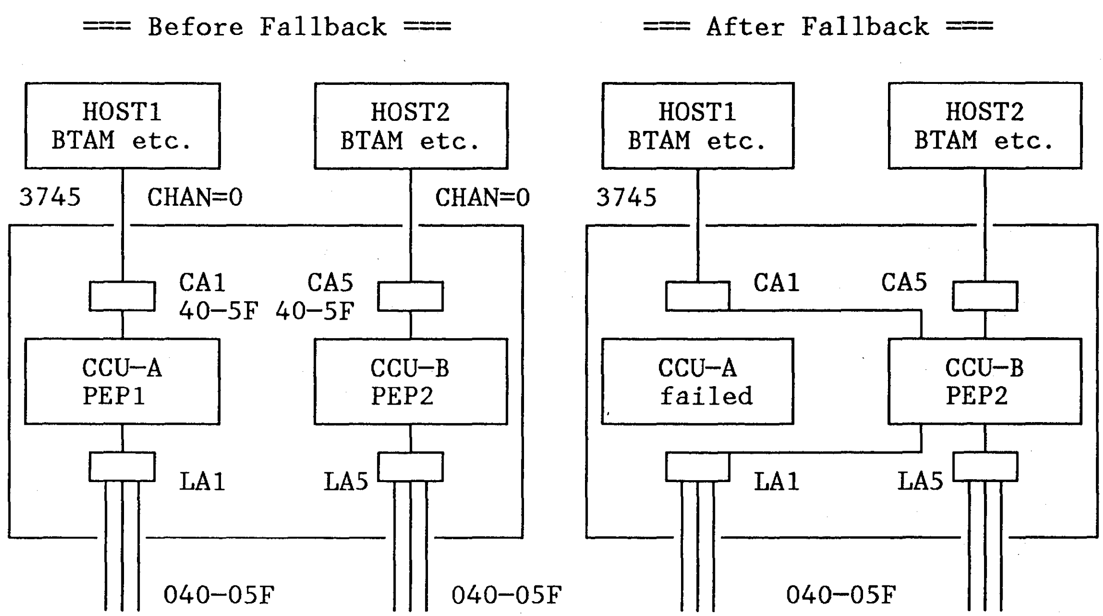


Figure 84. Twin-CCU PEP Backup Example - 3

The following sample definitions show how the resource should be defined in PEP-1 and PEP-2 with the configuration illustrated in Figure 84 on page 144. Each PEP can backup resources of the partner PEP in case of CCU failure. Note that all the required statements and parameters are not coded completely and all the NCP definition portions are omitted in these examples.

```
              PEP-1                                 PEP-2
 ─────────────────────────────────     ─────────────────────────────────

      GROUP LNCTL=BSC                       GROUP LNCTL=BSC
L1001 LINE  ADDRESS=(0,40-8)           L2003 LINE  ADDRESS=(64,50-0)

L1002 LINE  ADDRESS=(15,4F-8)          L2004 LINE  ADDRESS=(79,5F-0)

      GROUP LNCTL=BSC                       GROUP LNCTL=BSC
L1003 LINE  ADDRESS=(64,50-0)          L2001 LINE  ADDRESS=(0,40-8)

L1004 LINE  ADDRESS=(79,5F-0)          L2002 LINE  ADDRESS=(15,4F-8)

      GROUP LNCTL=CA                        GROUP LNCTL=CA
            ISTATUS=INACTIVE                      ISTATUS=INACTIVE
C1001 LINE  ADDRESS=8                  C2005 LINE  ADDRESS=0
            NCPCA=ACTIVE                          NCPCA=ACTIVE
            HICHAN=(5F)                           HICHAN=(5F)
            LOCHAN=(40)                           LOCHAN=(40)

C1005 LINE  ADDRESS=0                  C2001 LINE  ADDRESS=8
            NCPCA=ACTIVE                          NCPCA=ACTIVE
            HICHAN=(5F)                           HICHAN=(5F)
            LOCHAN=(40)                           LOCHAN=(40)
```

Figure 85. PEP Backup Resource Definition - 3

8.2.3 Token-Ring Device Backup

If Token-Ring devices are connected to an NCP then some special considerations apply when operating in Twin-in-Backup mode. Devices on the Token-Ring are customized to communicate through a gateway with a particular Medium Access Control (MAC) address. This address must be unique on the LAN. When Token-Ring Interface Couplers (TICs) are defined to NTRI, the LOCADD parameter on the LINE macro defines the Token-Ring MAC address of the TIC.

A TIC that normally belongs to CCU2 in Twin-in-Backup mode can be defined in the NCP running in CCU1 as a backup resource using the same MAC address, as long as the NCP resource names are different.

If the original NCP fails, TICs originally attached to the failed CCU will be switched to the other CCU. The backup NCP can then activate these TICs, using the original MAC addresses.

Resources that have been customized to communicate through TICs attached to the failed CCU can continue to communicate with the host through the backup NCP. The VTAM switched major node definitions for these resources will need to assign two paths for each resource, one for the normal path through the original NCP, and a second path through the backup NCP. Samples of both the NCP definitions and VTAM switched major node definitions are contained in Appendix B (page &ntricod.) and Appendix D (page 209). These definitions will allow Token-Ring resources to recover connections to the host, once the backup TIC has been activated.

8.3 Twin-CCU Operations

This section is intended to describe special considerations required to take full advantage of Twin-CCU configuration, especially in Twin-in-Standby and Twin-in-Backup operation mode. Also, data flows between a VTAM and NCPs during fallback and switchback are provided for better understanding of Twin-in-Stanby and Twin-in-Backup mode.

8.3.1 Selection of Twin-CCU mode

The 3745 operation mode is selected by the MOSS console function CDF (Configuration Data File). To select operation mode, take the CDF option of the Primary MOSS menu and select 'CCU Operating Mode'. Then select the required operation mode. If Twin-in-Standby mode is selected, then also select which CCU is the operational one normally. Also note that the single CCU operation mode is not valid for a 3745 Model 410.

Some changes to the CCU operating mode can be done while a control program is loaded and active, for example a switch from Twin-in-Dual to Twin-in-Backup and vice versa. This can be done, as no real configuration change takes place to the operating CCU. Only the backup capability changes.

If, on the other hand, you wish to change the operating mode from Twin-in-Dual or Twin-in-Backup to Twin-in-Standby and vice versa, then the active control programs will need to be stopped, the CCUs reset and the MOSS must be alone before this mode can be changed. This is because such a change in operating mode requires a change to the current configuration, and I/O and DMA buses are switched when this change occurs. The appropriate CCU(s) will then need to be IPLed.

It should be noted that a switch from Twin-in-Backup or Twin-in-Dual mode to Twin-in-Standby will cause any NCP load or dump modules and the Link IPL Port table stored on the 3745 disk for the now 'standby' CCU to be purged, as Twin-in-Standby only operates with one CCU at a time. If the mode is switched back to Twin-in-Backup or Twin-in-Dual, any NCP load or dump modules for the inoperative CCU will have been purged, and will need to be loaded and stored on the disk again via host operator command.

8.3.2 Twin-in-Standby Operations

The 3745 Release 1.1 in conjunction with NCP V5R2.1 provides "Hot-Standby" capability. With this capability, the standby CCU can be IPLed and loaded with the control program load module before fallback, while with the regular standby function the standby CCU is IPLed and loaded right after fallback. In addition, the MOSS does not attempt to re-IPL the same CCU any more but the MOSS performs fallback immediately in the event of hardware check and control program ABEND.

8.3.2.1 Twin-in-Standby IPL Procedure

In order to take full advantage of Twin-in-Standby mode, the active load module should be in the disk, no dump module should be in the disk, and the DUMP/LOAD switch should be "YES". To do this, a "VARY ACT" command is required to enter from the host as follows:

```
VARY NET,ACT,ID=name,LOAD=YES,SAVEMOD=YES,DUMPLOAD=YES
```

Note that if a load module is already saved on the disk SAVEMOD=YES is not required but LOADFROM=EXT is required. The DUMP/LOAD switch can be changed also at a MOSS console.

If one attempts IPL at a MOSS console when the active load module is on the disk and the DUMP/LOAD switch is "YES", the MOSS performs the IPL procedures as follows:

- Manual IPL: Option 1 (Select Active CCU)

  The specified CCU will be IPLed as the active CCU and the other one will also be IPLed as the standby CCU. In case the active CCU fails the resource takeover will be done without program loading (Hot-Standby).

  1. Phase 1A/1B on CCU-A or B
  2. Phase 2 on CCU-A or B
  3. Phase 3 on CCU-A or B
  4. Phase 4 on CCU-A or B (Loading from the disk)
  5. IPL complete on CCU-A or B (Active CCU)
  6. Phase 1C on CCU-B or A (Test)
  7. Phase 2 on CCU-B or A
  8. Phase 3 on CCU-B or A (No LAs to IML)
  9. Phase 4 on CCU-B or A (Loading from the disk)
  10. IPL complete on CCU-B or A (Standby CCU)

- Manual IPL: Option 2 (Select CCU-A)

  If both CCUs are not running, CCU-A will be IPLed as the active CCU. CCU-B would work as the standby CCU, but nothing will happen with CCU-B. In this case Hot-Standby will not occur unless the standby CCU is IPLed manually before fallback.

  1. Phase 1A/1B on CCU-A
  2. Phase 2 on CCU-A
  3. Phase 3 on CCU-A
  4. Phase 4 on CCU-A (Loading from the disk)
  5. IPL complete on CCU-A (Active CCU)

  If CCU-B is currently running, CCU-A will be IPLed as the standby CCU.

  1. Phase 1C on CCU-A (Test)
  2. Phase 2 on CCU-A
  3. Phase 3 on CCU-A (No LAs to IML)
  4. Phase 4 on CCU-A (Loading from the disk)
  5. IPL complete on CCU-A (Standby CCU)

- Manual IPL: Option 3 (Select CCU-B)

  Same as Option 2 (swap CCU-A and CCU-B).

If one attempts IPL at a MOSS console when the active load module is not on the disk or the DUMP/LOAD switch is "NO", the MOSS performs the IPL procedures as follows:

- Manual IPL: Option 1 (Select Active CCU)

  The specified CCU will be IPLed as the active CCU, but the MOSS will wait at the IPL phase 4 to have a load module loaded from the host. If one enters a "VARY ACT" command with SAVEMOD=YES and DUMPLOAD=YES, the active CCU will be loaded from the host and then the other CCU will also

be IPLed as the standby CCU and loaded from the disk. Hot-Standby will occur in case of the active CCU failure.

1. Phase 1A/1B on CCU-A or B
2. Phase 2 on CCU-A or B
3. Phase 3 on CCU-A or B
4. Phase 4 on CCU-A or B (Loading from the host)
5. IPL complete on CCU-A or B (Active CCU)
6. Phase 1C on CCU-B or A (Test)
7. Phase 2 on CCU-B or A
8. Phase 3 on CCU-B or A (No LAs to IML)
9. Phase 4 on CCU-B or A (Loading from the disk)
10. IPL complete on CCU-B or A (Standby CCU)

- Manual IPL: Option 2 (Select CCU-A)

  If both CCUs are not running, CCU-A will be IPLed as the active CCU, but the load module will be loaded from the host. CCU-B would work as the standby CCU, but nothing will happen with CCU-B. In this case Hot-Standby will not occur unless the standby CCU is IPLed from the disk manually before fallback.

  1. Phase 1A/1B on CCU-A
  2. Phase 2 on CCU-A
  3. Phase 3 on CCU-A
  4. Phase 4 on CCU-A or B (Loaded from the host)
  5. IPL complete on CCU-A (Active CCU)

  If CCU-B is currently running, CCU-A will not be IPLed but just tested. If an active load module is not on the disk, there is no chance to load a control program to this CCU until CCU-B stops running.

  1. Phase 1C on CCU-A (Test)

- Manual IPL: Option 3 (Select CCU-B)

  Same as Option 2 (swap CCU-A and CCU-B).

8.3.2.2 Twin-in-Standby Fallback Procedure

Bus switching (Fallback) in Twin-in-Standby mode can occur in two ways. Firstly, a MOSS operator command can cause switching to be invoked from the console manually. Secondly, if the operational CCU fails or NCP abends, bus switching will occur automatically under MOSS control. If manual switching is selected by the MOSS console operator, an option is provided to notify the host that switching is about to occur.

When switching occurs either by MOSS operator selection, or by hardware failure detected by the MOSS, the following functions are performed by the MOSS:

1. On manual fallback, if the 'Notify Host Operator' option is selected before performing fallback, the MOSS will generate a generic alert which is sent to all owning hosts on the SSCP-PU session before switching occurs. Details of this alert are described below.

2. When fallback itself occurs, the I/O and DMA buses are switched. If CCU-A was the operational CCU before fallback, then CCU-B becomes the operational CCU. All I/O and DMA buses are now switched to CCU-B.

3. If the standby CCU is already loaded with the control program, after the completion of bus switching the mailboxes are exchanged from the previously

active CCU to the now active CCU and then the active CCU starts running. The now standby CCU will be tested and IPLed from the disk as long as it has no severe problem. On the contrary, if the standby CCU is not loaded, once the CCU and I/O Bus switch is completed, the MOSS will try to IPL the now active CCU. If the active load module is saved on the disk and the DUMP/LOAD option is set to "YES", the CCU will be loaded from the disk. Otherwise, the CCU will be loaded from the host.

4. After the MOSS has finished fallback (Hot-Standby) or after the MOSS has finished IPL and NCP load from the host or the disk (Regular Standby), VTAM can re-contact the NCP. Details of this are covered later in this section. The MOSS then generates another generic alert which is sent to all owning hosts on the re-established SSCP-PU session. The contents of this alert will depend on the reason for the fallback. If the switch was caused by a hardware problem, details of this hardware problem will be contained in the alert.

The following screens show examples of NPDA events generated by Twin-in-Standby switching.

```
N E T V I E W                                    WTCR22    03/25/88 15:10:16
NPDA-45A           * RECOMMENDED ACTION FOR SELECTED EVENT *     PAGE  1 OF  1
 NC320        RA5NCP1
             +--------+
 DOMAIN      |  COMC  |
             +--------+

USER    CAUSED - OPERATOR INTERVENTION REQUIRED
       ACTIONS - I074 - DEACTIVATE RESOURCES ATTACHED TO IBM 3745
                  COMMUNICATION CONTROL UNIT
                 I148 - WAIT FOR ADDITIONAL MESSAGE BEFORE TAKING ACTION
                 I142 - REPORT THE FOLLOWING:
                      IBM 3745 PRODUCT ALERT REFERENCE CODE B0


INSTALL CAUSED - NONE

FAILURE CAUSED - NONE


ENTER  DM  (DETAIL MENU) OR  D  (EVENT DETAIL)

???
CMD==>
```

Figure 86. Sample NetView Event for Operator Notification Alert

```
N E T V I E W                                    WTCR22    03/28/88 14:03:25
NPDA-45A           * RECOMMENDED ACTION FOR SELECTED EVENT *     PAGE  1 OF  1
 NC320        RA5NCP1
             +--------+
 DOMAIN      |  COMC  |
             +--------+

USER    CAUSED - NONE

INSTALL CAUSED - NONE

FAILURE CAUSED - COMMUNICATION CONTROLLER
                 MAIN STORAGE
                 PROCESSOR SWITCH
       ACTIONS - I000 - PERFORM PROBLEM DETERMINATION PROCEDURES
                 I141 - REPORT THE FOLLOWING:
                      IBM 3745 PRODUCT ALERT REFERENCE CODE 21



ENTER  DM  (DETAIL MENU) OR  D  (EVENT DETAIL)

???
CMD==>
```

Figure 87. Sample NetView Event for Hardware Failure Alert

8.3.2.3 Twin-in-Standby Fallback VTAM-NCP Interaction

Figure 88 describes the VTAM-NCP interaction during fallback in Twin-in-Standby mode. For simplicity, it is assumed that one host connection exists to one 3745 operating in Twin-in-Standby. Not all flows are documented, only the major flows are shown to illustrate the VTAM to NCP flows.

```
+--------+                            +-----+
|        | <------NMVT (1)---------   |     |
|        |                            |     |
|        | <------DACTPU (2)-------   |     |
|   V    |                            |     |
|        |       Fallback (3)         |  N  |
|   T    | --------ACTPU (4)------>   |     |
|        |                            |     |
|        | --------DACTLINK-(5)-->    |  C  |
|   A    |                            |     |
|        | --------ACTLINK-------->   |     |
|   M    |                            |     |
|        | --------CONTACT-(6)--->    |  P  |
|        |                            |     |
|        | <------CONTACTD---------   |     |
|        |                            |     |
|        | <------NMVT-(7)---------   |     |
+--------+                            +-----+
```

Figure 88. VTAM-NCP interaction on Twin-in-Standby Fallback

1. This NMVT will only be sent if the 'Notify Host Operator' option is used when Manual fallback is selected from the MOSS console. This alert is sent on all SSCP-PU sessions to hosts before any fallback procedure is started. The MOSS operator will select fallback after this option is taken. This alert will not be sent if automatic fallback occurs due to controller hardware failure.

2. When fallback commences, the NCP sends a DACTPU to the host to notify VTAM of Session Outage Notification and that the VR for the SSCP-PU session is inoperative. This DACTPU is sent at the start of fallback in both manual and automatic fallback.

3. VTAM tries to re-contact the NCP. The VTAM status of this NCP during fallback is PAPU2. The link will remain ACTIVE. The link station will go PCTD1. After the 3745 fallback procedure is complete and NCP has loaded successfully from the MOSS disk, the NCP will raise a channel signal to VTAM to notify that the NCP has been initialized.

4. After the NCP has recovered, VTAM sends an ACTPU to recover the SSCP-PU session. VTAM then sends other commands to complete initialization of the NCP.

5. A DACTLINK is then sent to NCP from VTAM for links attached to the NCP. After all DACTLINK commands are sent, an ACTLINK command is sent to the NCP for each link.

6. A CONTACT is then sent to the NCP from VTAM for each adjacent link station that is to be recovered. When the DLC level contact is made with a station, the NCP sends a CONTACTD to VTAM on behalf of that station.

7. After all NCP resources have recovered, the NCP will send an NMVT on the SSCP-PU session containing the reason for this error situation. If fallback

occurs because of a hardware problem that has caused automatic fallback, then this NMVT will contain information regarding this problem. If manual fallback is selected, however, a different NMVT will be sent. An example of an NPDA event generated by one of these NMVTs was shown earlier in this section.

8.3.3 Twin-in-Backup Operations

Bus switching in Twin-in-Backup mode can occur also in two ways. Firstly, a MOSS operator command can cause switching to be invoked from the console manually. Secondly, if a CCU fails, fallback will occur automatically under MOSS control. If manual switching is selected by the MOSS console operator, then an option is provided to notify the host that switching is about to occur. This option causes the MOSS to generate a generic alert which is sent to all owning hosts on the SSCP-PU session before switching occurs. This is the same alert that is sent by the MOSS in Twin-in-Standby mode.

8.3.3.1 Twin-in-Backup Fallback Procedure

When switching occurs either manually or automatically, the following functions are performed by the MOSS:

1. On manual fallback, if the 'Notify Host Operator' option is selected before performing fallback, the MOSS will send a generic alert to all owning hosts.

2. When fallback itself occurs, the I/O and DMA buses attached to the specified (manual fallback) or failed (automatic fallback) CCU are are switched to the other CCU. All buses are now connected to the active CCU.

3. The MOSS generates another generic alert after fallback which is sent to all owning hosts that have remained in session with the 'active' NCP. The contents of this alert will depend upon how switching has been initiated. If the switch is caused by a hardware problem, then details of this problem will be contained in the alert. An example of an NPDA event generated due to fallback after failure in 'Twin-in-Backup' mode is shown below.

```
 N E T V I E W                                WTCR22    03/25/88 15:24:05
 NPDA-45A        * RECOMMENDED ACTION FOR SELECTED EVENT *     PAGE  1 OF  1
  NC320       RA5NCP1
             +--------+
  DOMAIN     |  COMC  |
             +--------+

 USER    CAUSED - NONE

 INSTALL CAUSED - NONE

 FAILURE CAUSED - PROCESSOR
                  MAIN STORAGE
        ACTIONS - I000 - PERFORM PROBLEM DETERMINATION PROCEDURES
                  I080 - RESUME OPERATION ON BACKUP PU
                  I141 - REPORT THE FOLLOWING:
                       IBM 3745 PRODUCT ALERT REFERENCE CODE 23



 ENTER  DM  (DETAIL MENU) OR  D  (EVENT DETAIL)

 ???
CMD==>
```

Figure 89. Sample NetView Event for CCU Failure Alert

8.3.3.2 Twin-in-Backup Fallback VTAM-NCP Interaction

Figure 90 describes the VTAM-NCP interaction that would occur between the remaining NCP and VTAM owners during fallback in Twin-in-Backup mode. In order to simplify, it is assumed that one host connection exists to one 3745 operating in Twin-in-Backup mode. Not all flows are documented, only the major flows are shown to illustrate the VTAM-NCP flows.

```
+--------+                              +-------+
|   V    |         Fallback             |       |
|        | <------NMVT (1)---------     |   N   |
|   T    |                              |       |
|        |        ..........            |   C   |
|   A    | --------ACTLINK-(2)--->      |       |
|        | --------CONTACT-(3)--->      |   P   |
|   M    |                              |       |
|        | <------CONTACTD---------     |       |
+--------+                              +-------+
                                      (Active NCP)
```

Figure 90. VTAM-NCP interaction on Twin-in-Backup Fallback (1)

1. This NMVT is sent by the MOSS on all active SSCP-PU sessions to notify all hosts that remain in session with the backup NCP, that a failure has occurred. The contents of this alert will depend upon the reason for fallback. This NMVT is sent after fallback is complete, so it can be used to trigger a CLIST to acquire and activate backup resources that are now attached to the active NCP.
2. After the host receives the NMVT, backup resources can be activated by any VTAM owner, depending on how OWNER parameters have been coded on resources defined within the NCP. These resources can be activated by host operator command, or the process can be automated by a CLIST. If requested by operator command or a CLIST, each VTAM can send an ACTLINK command to the NCP for an appropriate link.
3. Once ACTLINKs are successful, a CONTACT can be sent for each adjacent link station that VTAM wants to contact. If the CONTACT is successful, the NCP will send a CONTACTD to VTAM. Then VTAM can start to activate BNN resources.

Meanwhile, the VTAM-NCP interaction between the failed CCU and the VTAM owners during fallback can be illustrates in Figure 91 on page 156. Again, not all flows are documented.

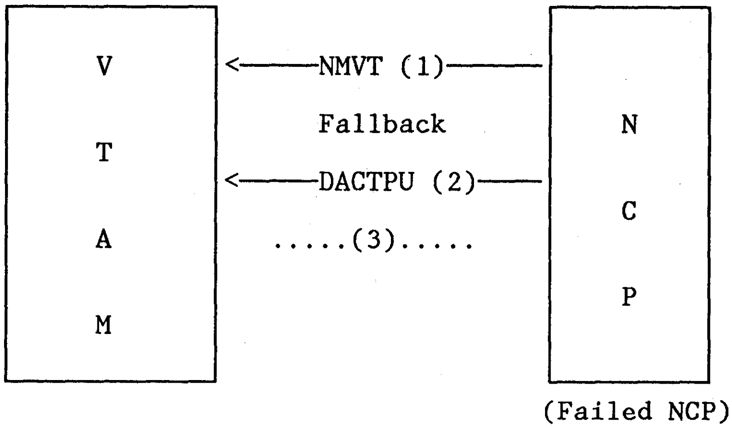


Figure 91. VTAM-NCP interaction on Twin-in-Backup Fallback (2)

1. This NMVT will only be sent if the 'Notify Host Operator' option is used when Manual fallback is selected from the MOSS console. This alert is sent to hosts on all SSCP-PU sessions for notification that fallback is about to occur. This alert will not be sent if automatic fallback occurs.
2. When fallback commences, the NCP sends a DACTPU to owning hosts for Session Outage Notification. This DACTPU is sent right after fallback in the case of manual and after switchback in the case of automatic fallback.
3. VTAM tries to re-contact the NCP. If the channel adapters that have been originally defined in the failed NCP are not defined in the backup NCP, the VTAM status of the failed NCP after fallback is PAPU2. The link remain ACTIVE. The link station will go PCTD1. As long as the failed NCP is not deactivated, it will remain PAPU2 until switchback.

8.3.3.3 Twin-in-Backup Switchback Procedure

The bus switchback

Switchback operation can be initiated only from the MOSS operator console.

When switchback occurs, the following functions are performed by the MOSS:

1. Upon 'Notify Host Operator' option, a generic alert is sent to all currently owning hosts to notify them that backup resources should be deactivated.
2. The actual switchback of buses to the repaired CCU is performed, so that all I/O and DMA channels are now attached to their original CCUs, as they were before fallback.
3. The MOSS now IPLs the failed CCU off disk. The DUMPLOAD=YES option for NCP load modules stored on disk is required to implement this option properly, as it was in Twin-in-Standby mode. This enables the MOSS to load the NCP directly off disk after the CCU IPL has completed.

8.3.3.4 Twin-in-Backup Switchback VTAM-NCP Interaction

Figure 92 shows the VTAM-NCP data flow between the active NCP and its owning hosts during switchback. Note that not all flows are documented, only the major flows are illustrated.

```
+-------+                        +-----+
|   V   | <-----NMVT (1)-------- |     |
|       | <-----INOP (2)-------- |  N  |
|   T   | <-----INOP ----------- |     |
|       |                        |  C  |
|   A   |     .....(3).....      |     |
|       |                        |  P  |
|   M   |                        |     |
+-------+                        +-----+
                               (Active NCP)
```

Figure 92. VTAM-NCP interaction on Twin-in-Backup Switchback (1)

1. This NMVT will only be sent if the 'Notify Host Operator' option is selected from the MOSS console before switchback occurs. NPDA will display this alert as:

   OPER INTERVENTION REQD: NETWORK OPERATOR

   This NMVT could be used as a CLIST trigger to inactivate backup resources on the backup NCP.

2. If any host operator does not inactivate backup resources before switchback occurs, then the NCP will send INOPs for each backup link, as these have now been switched to the original NCP.

3. This NCP now continues to function as it did before the fallback. Note that there has been no interruption to any original resources in this NCP during either fallback or switchback.

Figure 93 on page 158 shows the VTAM-NCP data flow between the recovered NCP and its owning hosts after switchback. Note that the diagram is only valid if the failed NCP has not been deactivated after fallback, and if the channel link station has remained PCTD1.

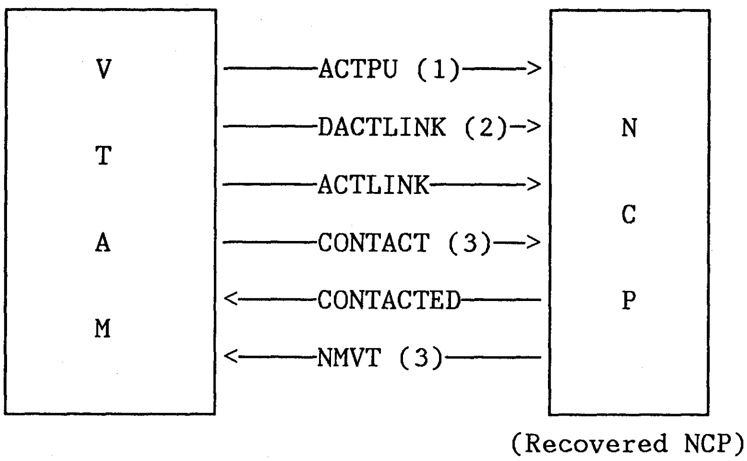


Figure 93. VTAM-NCP interaction on Twin-in-Backup Switchback (2)

1. Prior to switchback, this NCP is in PAPU2 state. VTAM is continuously trying to contact the link station during the backup period. When the NCP recovers, it responds to VTAM via a channel signal. VTAM then knows that the NCP has recovered and sends an ACTPU to re-establish the SSCP-PU session.
2. After the NCP itself has been reactivated, VTAM sends a DACTLINK for an appropriate link and then reactivates with a subsequent ACTLINK.
3. CONTACT commands are then sent to the NCP for each adjacent link station that VTAM wishes to contact. This is the same as recovery in the Twin-in-Standby backup mode.
4. After appropriate control commands are sent by VTAM, the NCP sends an NMVT to notify that recovery is complete. This NMVT produces an event in NPDA which appears as:

   OPER INTERVENTION REQD: NETWORK OPERATOR

   Note that recovery of the failed NCP in this environment has not required operator intervention, other than to perform the switchback, and also to re-establish LU-LU sessions after recovery.

8.3.4 Twin-in-Backup Channel Considerations

It is not necessary to define the backup channel adapters in the partner NCP if it has its own channel connection to the same host. In Figure 94 on page 159, CA1 and CA2 need not be defined in NCP2 because NCP2 already has channel connections to VTAM1 and VTAM2. With the same reason, CA5 and CA6 need not be defined in NCP1.

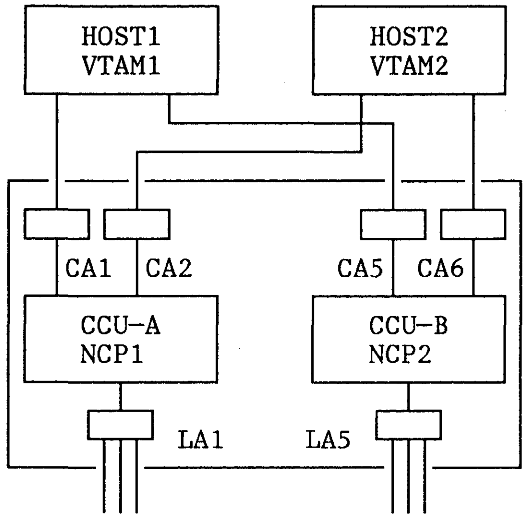


Figure 94. Twin-in-Backup Channel Consideration (1)

In this situation, after fallback, VTAM tries to recontact the failed NCP via the channel adapter that has been used to communicate with this NCP until switchback occurs. The channel link station remains PCTD1 until contact can be established after switchback. This NCP can then recover, and its resources are re-activated. Users can then re-establish LU-LU sessions. This is the simplest environment for fallback/switchback, as no recovery action is required for channel connections. Even after switchback, channel connections can recover automatically.

Meanwhile, backup channel adapters should be defined in the partner NCP if both NCPs have channel connections to different hosts. In Figure 95, CA1 should be defined in NCP2 and CA5 should be defined in NCP1 because each NCP need to communicate with both hosts after fallback.

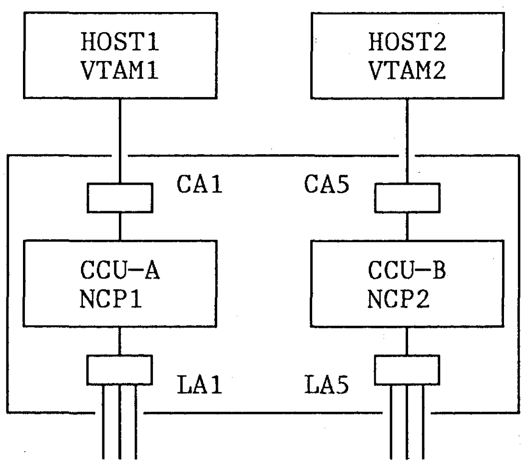


Figure 95. Twin-in-Backup Channel Consideration (2)

In this situation, assuming that CCU-B fails, VTAM2 will try to contact NCP2 across CA5 and will find NCP1 loaded instead. VTAM will then issue the messages:

IST548I SOFT INOP FAILED ....
IST105I ..... NODE NOW INACTIVE

The message IST548I contains the name of the linkstation that tries to contact the NCP2. This message indicates that this link station failed because of a mismatch between information received in the CONTACTED LOADED RU (NCP1) and information the SSCP already had about the contacted adjacent node (NCP2). This mismatch causes the linkstation to be inactivated, however the failed NCP (NCP2) remains PAPU2.

The IST548I message could be used to drive a CLIST to recover from this situation and either activate a CA Majornode from VTAM2 to connect NCP1, or inactivate NCP2 and activate NCP1. The following explains the implications of either course of action:

1. Activate a CA Majornode from VTAM2 for NCP1

   As only the link station of the channel has failed, a CA Majornode for the channel could be activated from VTAM2. This would enable VTAM2 to contact NCP1, but no ownership of resources would be allowed. Other backup resources that are now switched to NCP1 would have to be activated by VTAM1. These resources can then establish cross domain sessions with VTAM2.

   This mechanism provides a simple situation for both backup and switchback. When switchback occurs, the CA Majornode in VTAM2 will lose contact with NCP1. The failed CCU will then IPL and load NCP (NCP2). When this IPL is complete, the CA Majornode can now contact NCP2. As NCP2 was in PAPU2 status during fallback, this NCP can now recover with the assistance of the CA Majornode. NCP2 has now recovered to its previous state before fallback, and LU-LU sessions can be re-established by users or the host operator.

2. Inactivate the failed NCP and activate the backup NCP

   If ownership of backup resources in NCP1 is required by VTAM2, then NCP1 will need to be activated from VTAM2. Before this is done, it is advisable to inactivate the failed NCP (NCP2) as this can not recover once NCP1 is activated. If VTAM2 has been specified as the owner for backup resources in NCP1, VTAM2 can activate these after issuing the activate for NCP1.

   When switchback occurs, the reverse of the above situation will happen. VTAM2 will lose contact with NCP1 and will contact NCP2 after switchback. Due to a mismatch of information, the linkstation will fail, leaving NCP1 in PAPU2 status in VTAM2.

From a recovery point of view, the CA Majornode definition of the backup channel adapter is much simpler to implement than inactivation and activation of the NCPs. The choice of recovery method basically depends on ownership requirements.

8.3.5 Twin-in-Backup Fallback - Automated Recovery

Resources that are switched to the Backup CCU in Twin-in-Backup can be activated to the NCP running in this CCU after fallback is complete, as long as these resources were previously defined to the 'backup' NCP. Normally this procedure would require operator intervention to activate these backup resources. When the owner parameter of the pseudo VTAM is specified on the backup resources in order to use the same resource names as their original ones, acquire operation is also required after fallback.

The intention of this section is to illustrate how automated recovery of resources switched to another NCP after backup can be implemented, via the use of the

NetView Release 2 automated message table and CLISTs. There are many network configuration possibilities that could cause different backup scenarios, each of which may require different automation procedures. Therefore, If you wish to implement your own recovery automation, you need to write your own NetView automation table message entries and CLISTs that meet your particular configuration requirements.

After fallback has completed successfully and all resources are switched to the operational CCU, the remaining NCP sends an NMVT to all its owning hosts. This NMVT contains details of the event, however it also serves as notification that fallback has completed and hence backup resources are ready to be activated. The generic alert sent generates an NPDA message at the host: BNJ146I. The NetView R2 message table can then parse the parameters of this message, and if a certain pre-defined condition is met, then a CLIST can be driven which will activate backup resources.

The BNJ146I message generated in this situation contains a recommended action within the FAIL field of '1410' which means "Resume Operation on Backup PU". A number of other unique fields also occur in this message for CCU failure, hence you have enough unique information to know when the "backup" CLIST needs to be driven.

The following is an sample of BNJ146I message processing and CLIST for resource activation after fallback in Twin-Backup mode:

```
*** 3745 ALERT PROCESSING ***
*
IF   MSGID = "BNJ146I'
 &   TOKEN(4) = 'G'
 &   TEXT = . 'PERM' .
 &   TEXT = . '1410' .
 &   TEXT = . '3745' .
 &   TEXT = . 'NC320' .
 &   TEXT = . 'HIER=' RESTMSG
THEN EXEC (CMD('BNJ146M ' RESTMSG) ROUTE(ONE *)) NETLOG(Y);
*
*** END OF PROCESS ***

BNJ146M CLIST
&CONTROL ERR
&TGLOBAL NCP06
&IDENT = BNJ146M
&WRITE >&IDENT
&IF .&NCP06 = . &THEN &NCP06 = RA6NCP1
&IF .&1                  = . &NCP06 &THEN &EXIT
  . . . . .
  VTAM commands for backup recovery
  . . . . .
&EXIT
```

In the automatic recovery CLIST, acquire and activate operation should be coded for the resources which you want to backup.

9. Performance Considerations

The following is a list of observations and recommendations for the tuning of very high speed links such as T1 or CEPT lines within the 3745, both from the viewpoint of CCU and Channel Adapter Utilization, as well as throughput of the T1 or CEPT link. These recommendations are based on performance test experiences at the ITSC Raleigh, in conjunction with 3745 modeling using the CF3745 configurator. Performance tests on HSS lines were all performed on a direct attached link between two 3745s, operating at 1.8 Mbps. Our results were measured using NPM R3 in conjunction with TPNS.

Tuning recommendations for low speed links within the 3745 are the same as for existing NCP versions in existing communications controllers. Further information on such tuning can be found in: 'Tuning and Problem Analysis for NCP/SDLC devices' (GG24-1629).

We have listed the major factors which affect T1 link utilization, 3745 CCU utilization and link throughput. These are not necessarily listed in order of impact, as this may depend on your particular environment.

9.1 RU Sizes

Our experiences showed that the choice of RU size can have a dramatic effect on link throughput and even the maximum line utilization that is achievable. This is because at high speed, the inter-frame gap between PIUs can waste a great deal of the total available bandwidth, thus optimum throughput and line utilization can not be achieved.

A large PIU size is therefore recommended for very high speed lines to utilize more capacity of the link. If possible, set the RU size for traffic using this link to 8k bytes for best results.

If a mixture of batch and interactive traffic exists, then the interactive traffic can be given higher priority than the batch traffic via the use of different transmission priorities. The TG queue associated with each TP can be defined with different thresholds, thus VR pacing is used to give priority to interactive traffic. The use of session pacing for batch traffic will also help to give priority to interactive traffic, as well as providing better flow control for this link.

9.2 Virtual Route Pacing

For HPTSS, the default Virtual Route pacing window size could be too small. The default minimum window size is the ER length, and the maximum one is three times the ER length. In our case they were 3 and 9 for 1.8 Mbps link, and they were limiting our line utilization to about 11 %. We increased this to the maximum window size, and throughput improved greatly. The maximum VR window size should be chosen carefully in conjunction with the TG threshold defined on the ER. The VR maximum window size should be chosen based on experiences within your own environment.

NetView R2 provides a good facility within the session monitor which can monitor VR pacing window sizes, and whether VRs are held or not. This may be used to determine what the best maximum window size for your environment is.

When considering VR pacing, the TG threshold defined for the ER for this VR must also be considered, as this will determine when the NCP will increase the VR pacing window size or reset the VR pacing indicator. For a very high speed link, the default values of 5000 bytes for each transmission priority and 20000 bytes for total TG threshold are probably too small and should be increased if higher line utilization is required. If the TG threshold is made larger, then more NCP storage will be used for this link.

9.3 MODULO 8 vs MODULO 128

We tested the use of MODULO 128 (with MAXOUT = 127) on the very high speed link (1.8 M bps) and compared it to MOLULO 8 (with MAXOUT = 7) and found significant improvements in using MODULO 128. This will provide improvements if the line error rate is low, as 127 frames can be sent before a response is required. If the line error rate is high, then many re-transmissions will be required, hence no real advantage would be gained. At high speed, frames can be transferred in a short time and sometimes propagation delay may become a large factor compared to transmission time. Thus limiting the number of responses can help improve link throughput.

9.4 PAUSE

The PAUSE parameter is specified on the line macro and defines the time the NCP will wait before polling this line again. If a poll takes longer than specified by PAUSE, then the NCP will poll immediately, otherwise it will wait until the PAUSE time expires before polling again. The purpose of PAUSE is to conserve CCU cycles due to negative polling. We found that the PAUSE parameter had significant impact on throughput of the very high speed link.

For INN links, PAUSE is used at both ends. The primary end uses it to determine how long to wait before the next poll. The secondary end uses it to determine how long it may defer the answer to a poll. The PAUSE parameter specifies two values, one for MODULO 8 and a second one for MODULO 128.

If line utilization is low, then a large PAUSE parameter can be specified to conserve CCU cycles used by negative polling. A different PAUSE value will need to be considered for each different link speed. If line utilization is high due to large volumes of traffic, then a much lower PAUSE value should be used, as data can not get through if the secondary station is not polled often enough. We found the default value of 2.8 seconds for MODULO 128 to be far too large for the Very high speed link (1.8 M bps) when line utilization was increased. We decreased it to 0 on both ends of the link, so that the secondary was polled often enough to get large volumes of data through. We recommend trying a low value of PAUSE to start with, and then increase it later if CCU utilization due to negative polling becomes too high. NPM can be used to investigate the number of negative polls received on a particular link, and hence whether the PAUSE value needs to be changed.

9.5 NCP Buffer Size

The default NCP buffer size of 240 is recommended for use with HPTSS very high speed lines. This larger size is important to decrease the number of interrupts sent to the HPTSS. A larger NCP buffer size will also help to decrease CCU utilization. We changed our NCP buffer size from 128 to 240 and noticed significant improvements in the throughput of our very high speed link, as well as a decrease in CCU utilization.

9.6 TRANSFR

A Transfer value can be coded for each line or channel adapter defined to the NCP, and it defines how many NCP buffers are required to receive the largest PIU on the link. If it is not specified, then the value coded on the BUILD macro is used. This value should be carefully considered for very high speed links to fit the largest PIU that will be received on the link, without wasting NCP buffers. A transfer value that allocates more NCP buffers than needed for the largest PIU will cause excessive NCP overhead.

9.7 Channel Operations

Focus is needed on channel operations if very high speed links such as T1s are used for a high volume of PIU traffic. The tuning of VTAM to NCP channel operations is very important to get maximum throughput of very high speed links. We have listed some of the factors which are relevant to CA operation below.

9.7.1 Channel Connections

If a 3745 channel adapter is used to capacity, the one CA will use essentially all of the capacity of the physical channel it is attached to. Therefore if high volume is expected, it is not a good idea to connect other devices to this channel.

9.7.2 VTAM I/O Buffer Size (UNITSZ)

To make most efficient use of the channel between VTAM and NCP, the VTAM I/O buffer size should be as big as the largest PIU that will be received by the host. This will have an overhead in VTAM CSA usage, as a larger I/O buffer may waste more storage, however VTAM will be able to receive data more efficiently, as PIUs do not need to be split between buffers.

We changed our VTAM I/O buffer size from 152 to 1024 bytes, which enabled each inbound PIU to fit into one VTAM I/O buffer. This drastically reduced channel utilization, hence throughput of our T1 link improved. UNITSZ on the NCP HOST macro needs to be the same as the VTAM I/O buffer size, defined in the VTAM start parameters.

9.7.3 MAXBFRU

MAXBFRU determines the number of VTAM I/O buffers set aside for each channel read. To use the channel most efficiently, multiple PIUs should be transferred to the host in each channel program. This process is known as 'coat-tailing' and is described in more detail in 'VTAM Customization' (SC23-0112).

MAXBFRU should be set so that the PIUs that arrive on average in a channel attention delay period will fit in one channel program. Investigation of VTAM

Tuning Statistic (TNSTAT) will determine whether efficient channel usage occurs. Again, details of this are contained in 'VTAM Customization' (SC23-0112).

9.7.4 Channel Attention Delay

Channel Attention Delay is defined on the line macro which describes each channel adapter. This specifies the elapsed time between the receipt of the first inbound PIU and the presentation of an attention interrupt to the host, for PIUs transmitted with Transmission Priority 0 or 1. This is used to help maximize 'Coat-Tailing'. PIUs with TP 2 prevent channel delay from occurring.

We found that if a high volume of data is sent across a T1 link, there was always data queued for transmission over the channel adapter. In this case, we wish to have a low delay, so that this queuing is reduced, but still allowing 'Coat-Tailing' to occur. This queue was relieved by using a large MAXBFRU so that many PIUs are transmitted to the host in one channel read.

NPM in conjunction with VTAM TNSTATs provides good information for investigation of channel operations. NPM can collect information on each channel adapter to show if many PIUs are being queued, which could be caused by a too large DELAY, MAXBFRU too small, or maybe inefficient NCP and VTAM buffer sizes. VTAM TNSTATs can be used to show the number of PIUs transmitted for each channel read, the number of attentions, and so on.

10. LIC5/LIC6 Configuration and Operation

10.1 LIC5/LIC6 Introduction

LIC Type 5 and LIC Type 6 integrate the standard LIC functions and the modem or DSU/CSU functions into a single coupler. These new types of LICs are connected directly to the 4-wire non-switched lines. This unique integrating packaging alternative offers an opportunity for lower cost, space saving and easier installation.

A LIC Type 5 holds two ports with speeds up to 14.4 Kbps. The line interface circuit is a remapping of the LIC Type 1, while the modem circuit, from the modulation and network management point of view, is compatible with the IBM 586X and 786X modems.

A LIC Type 6 holds a single port with speeds up to 56 Kbps. The line interface circuit is a remapping of the LIC Type 3 port, while the LDM (Limited Distance Modem) and DSU (Data Service Unit) or CSU (Channel Service Unit) circuit is compatible with the IBM 5821 and 5822 LDM-DSU/CSU.

These LICs do not support the Switched Network Backup Unit (SNBU) and neither the Contact Sense/Operate features. However it is always possible to use the Contact Sense/Operate feature on a remote modem (IBM 586X), through a local LIC Type 5.

One of the great advantages of the LIC Type 5 modem is that it uses the Trellis-Coded Modulation at the speed of 14.4 Kbps and optionally at the speed of 9600 bps. This modulation concept improves the signal to noise ratio and reduces the distortion due to second and third harmonics, allowing users to take full advantage of the unconditioned leased lines. The signal to noise ratio and harmonic distortion concepts will be explained later in this chapter.

The integrated modems (LIC 5 and LIC 6) can be configured and operated in two ways. One is right beside the 3745 via Portable Keyboard Display (PKD). The other way gives you the possibility to configure and operate the integrated modems from any remote or local terminal via a NetView console. These integrated modems have to be set up at the installation time. It is recommendable to set up modems with PKD at the first time, and later problem determination and modem configuration can be done from a NetView console once the new NCP has already been generated.

10.2 LIC5/LIC6 Installation

LIC Type 5 and 6 (Figure 96) can be plugged anywhere within a LIC Unit Type 2. The only restriction about LIC position is that when a LIC Type 6 works at 56 Kbps, a single LIC Type 6 occupies four port addresses and since each slot in the LIC Unit Type 2 has only two addresses, then the next slot must be empty.

The integrated modems are configured at installation time using a Portable Keyboard Display (PKD). The PKD cable is inserted in the PKD connector at the integrated modem. For LIC Type 5, the PKD Line Selector Switch allows you to select port 1 or port 2. The IBM 5869 or PKD is a hand held unit (Figure 97 on page 169) that is plugged into the LIC 5 or LIC 6 and gives you the same functional capabilities of the keyboard and display that comes with the IBM 586X stand-alone modem family. This PKD is used in the same way for configuring the IBM rack-mounted modems.

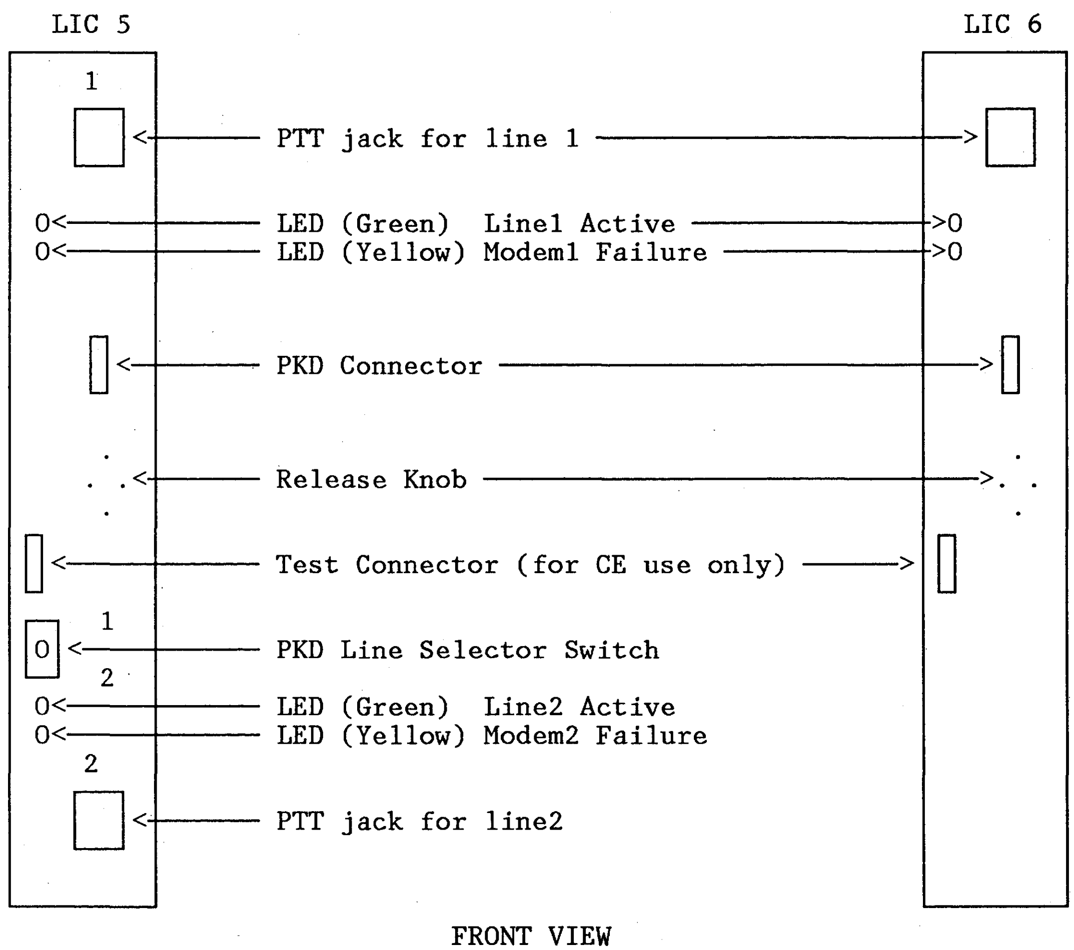


Figure 96. LIC Type 5 and 6 Physical Description

10.2.1 Portable Keybord Display

The PKD consist of a keyboard of 20 keys associated with a 16 character alphanumeric display and an audible alarm.

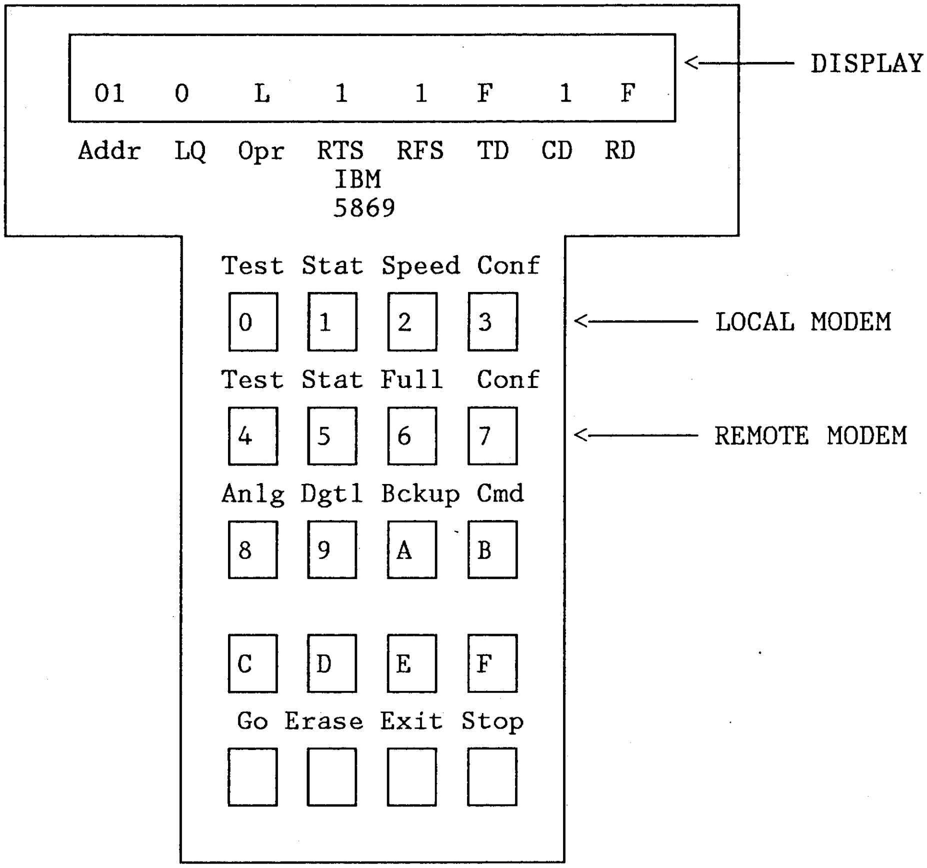


Figure 97. The IBM 5869 Portable Keyboard Display (PKD)

The explanation of each display field of the PKD is shown in Figure ??

Display Position	Meaning
Addr	2 char Modem Address (valid range from 01 to FB)
LQ	Line Quality X There is no signal. 0-8 The line quality is good to marginal for increasing values. 9-F The line quality is marginal to very poor for increasing values.
Opr	Operation Mode 0 The modem is not ready to operate L The modem is ready to operate over a leased line

Display Position	Meaning
RTS	Request To Send 0 Request To Send is OFF 1 Request To Send is ON
RFS	Ready For Sending (Clear To Send) 0 Ready For Sending is OFF 1 Ready For Sending is ON
TD	Transmitted Data F Transmit at Full speed (4.8/9.6/14.4) LIC 5 B Transmit at Backup speed (2.4/7.2/12.0) LIC 5 L Transmit at Low speed (9.6/19.2) LIC 6 H Transmit at High speed (56 Kbps) LIC 6 Flashing is an indication of data transmission activity
CD	Carrier Detected 0 No Carrier Detected 1 The modem is synchronized on the incoming signal (Carrier Detected)
RD	Received Data F Receive at Full speed (4.8/9.6/14.4) LIC 5 B Receive at Backup speed (2.4/7.2/12.0) LIC 5 L Receive at Low speed (9.6/19.2) LIC 6 H Receive at High speed (56 Kbps) LIC 6 Flashing is an indication of data reception activity

Figure 98. Display Field Explanations

Note: Backup speed allows you to select a slower speed when the line condition due to noise and distortion induces many errors in the transmission. Sending data at a slower speed reduces the number of retransmissions, improving the total throughput.

10.2.2 LIC5/LIC6 Customization

The PKD provides functions that are used to customize a LIC 5 and a LIC 6. The following is a list of the PKD functions that will be briefly described here:

- Local self-test
- Local self-test with wrap
- Remote test
- Local status
- Remote status
- Full/Backup speed local
- Full/Backup speed remote
- Local configuration
- Remote configuration
- Analog test

- Digital test.

These functions are terminated if during the middle of a command a certain time passed without pressing any key. If this becomes a problem the time-out duration can be extended by pressing the B key, entering "666", and pressing the "Go" key (see Figure 97 on page 169). The message: LONG TIME OUT should appear at the display. This is valid for LIC Type 5 only. Any of the functions can be terminated at any time by pressing the "Exit" key.

The functions described below are for point-to-point lines. For multipoint lines the procedure is the same except that when doing remote functions the address of the remote modem must be entered.

Local Self-Test: This test checks the hardware of the LIC by performing internal diagnostics. This test runs for approximately 10 minutes, repeating the diagnostics many times. However this test can be interrupted whenever desired. This test is valid for both LIC 5 and LIC 6. Since this test is disruptive, the line will have to be activated after the test.

To start this test:

- Press the "LOCAL Test" key
- Press the "Go" key
- To interrupt the test press the "Stop" key.

If no errors are found you get the message: TEST OK NOWRP.

Local Self-Test with Wrap: This is the same test mentioned above, but includes a test of the line interface as well. To perform this test you need to remove the PTT jack for the line to be tested and insert a wrap plug (IBM P/N 11F4815). This test runs for approximately 10 minutes, repeating the diagnostics many times. However the test can be interrupted whenever desired. This test is valid for both LIC 5 and LIC 6. Since this test is disruptive, the line have to be activated after the test.

To start this test:

- Press "LOCAL Test" key
- Insert the wrap plug
- Press the "Erase" key (WRAP option)
- Press the "Go" key
- To interrupt the test press the "stop" key.

If no errors are found you get the message: TEST OK WRAP.

Remote Test: In this test the remote modem is tested. This test is non-disruptive, so the sessions are not lost. Polling is interrupted for approximately four seconds and it is resumed when the remote modem sends the test results to the local modem. This test can only be initiated from a multipoint control modem using the address of the remote modem, or a point-to-point primary modem. This test is valid for LIC 5 only.

To start this test:

- Press the "REMOTE Test" key

- Press the ″Go″ key.

If no errors are found you get the message: TEST OK.

Local Status: This test gives information about the line quality, and the status of the most important V.24 signals. The V.24 signals checked by this test are: Data Terminal Ready (DTR), Request To Send (RTS), Ready For Sending (RFS), Transmitted Data (TD) and Received Data (RD). When looking at the status of DTR, RTS and RFS the words RAISED or DROP may appear. They mean the signal has been raised or dropped at least once since the last test. This test is valid for LIC 5 only and it is non-disruptive, therefore sessions are not lost.

To start the test:

- Press the ″Status″ key
- Press the ″Go″ key

  The message: ″aa″ LOC LQ GOOD|BAD appears, where ″aa″ is the address of the local modem and the line quality indicator LQ will be either GOOD or BAD depending on the noise and distortion of the line.
- Press the ″Go″ key

  The message: ″aa″ DTR 1|0 appears, where ″aa″ is the address of the local modem. DTR will be 1 if the Data Terminal Ready signal is active, or 0 if it is not. If 1, the line is active.
- Press the ″Go″ key

  The message: ″aa″ LQ ″nn″ RL ″mm″ appears, where ″aa″ is the address of local modem, LQ is the line quality indicator and ″nn″ is the quality number (from 0-4 is GOOD and from 10-14 is BAD). RL ″mm″ is the Receive Level in dB.
- Press the ″Go″ key and wait approximately 30 seconds

  The message: ″aa″ HIT COUNT ″nn″ appears, where ″aa″ is the address of the local modem and ″nn″ is the number of impulses hits (or spikes) detected during the past 15 minutes.
- Press the ″Go″ key

  The message: ″aa″ RTS 1|0 appears, 1 or 0 depending on the state of the Request To Send signal at the local Data Terminal Equipment (DTE). If 1 the line is active.
- Press the ″Go″ key

  The message: ″aa″ RFS 1|0 appears, 1 or 0 depending on the state of the Ready For Sending signal at the local DTE. If 1 the line is active.
- Press the ″Go″ key

  The message: ″aa″ RD ACTIVE|INACTIVE appears. RD is ACTIVE or INACTIVE depending on the state of the Received Data signal.
- Press the ″Go″ key

  The message: ″aa″ TD ACTIVE|INACTIVE appears. TD is ACTIVE or INACTIVE depending on the state of the Transmitted Data signal.
- Press the ″Go″ key

The message: "aa" "ss" appears, where "ss" is the speed of the modem. The word CHANGED can appears beside the speed, this indicates that the speed of the modem has been changed since the last test.

- Press the "Go" key

  The message: END OF REPORT appears.

Remote Status: This test gives you information about the line quality from the remote modem's point of view, as well as the status of the most important V.24 signals. The V.24 signals checked by this test are: Data Terminal Ready (DTR), Request To Send (RTS), Ready For Sending (RFS), Transmitted Data (TD), Received Data (RD) and Data Terminal Equipment (DTE). When looking at the status of DTR, RTS, RFS and DTE the words RAISED or DROP may appear. They mean the signal has been raised or dropped at least once since the last test. This test is non-disruptive, and is valid for LIC 5 only.

To start the test:

- Press the "REMOTE Status" Key
- Press the "Go" key
- Enter the remote port to be tested (A to D, The IBM 586X can handle up to four DTEs)
- Press the "Go" key

  The message: LOC LQ GOOD|BAD appears; This is a line quality indicator from the local modem's point of view.

- Press the "Go" key

  The message: REM LQ GOOD|BAD appears; This is a line quality indicator from the remote modem's point of view.

- Press the "Go" key

  The message: "p" DTR 1|0 appears, where "p" is the port selected (from A to D). DTR will be 1 if the Data Terminal Ready (DTR) is up or 0 if the DTR is down.

- Press the "Go" key

  The message: L LQ "nn" RL "mm" appears, where L stands for local modem, "nn" is the line quality indicators (GOOD from 0-4, BAD from 10-14), and "mm" is the level of the received signal at the local modem, expressed in dB.

- Press the "Go" key

  The message: R LQ "nn" RL "mm" appears, where R stands for remote modem "nn" is the line quality indicators (GOOD from 0-4, BAD from 10-14), and "mm" is the level of the received signal at the remote modem, expressed in dB.

- Press the "Go" key

  The message: HIT COUNT "nn" appears, where "nn" is the number of impulse hits (spikes), that has been detected during the last 15 minutes.

- Press the "Go" key

  The message: "p" RTS 1|0 appears, where "p" is the port selected (from A to D). RTS will be 1 if the Request To Send signal is up or 0 if the RTS is down.

- Press the ″Go″ key

  The message: ″p″ RFS 1|0 appears, where ″p″ is the port selected (from A to D). RFS will be 1 if the Ready For Sending signal is up or 0 if the RFS is down.

- Press the ″Go″ key

  The message: ″p″ RD ACTIVE|INACTIVE appears, where ″p″ is the port selected (from A to D). RD will be ACTIVE or INACTIVE depending on the state of the Receive Data signal.

- Press the ″Go″ key

  The message: ″p″ TD ACTIVE|INACTIVE appears, where ″p″ is the port selected (from A to D). TD is ACTIVE or INACTIVE depending on the the state of the Transmitted Data signal.

- Press the ″Go″ key

  The message: ″p″ DTE 1|0 appears, where ″p″ is the port selected (from A to D). DTE will be 1 if the Data Terminal Equipment signal is up or 0 if the DTE is down. (This signal down indicates that remote cluster is power OFF).

- Press the ″Go″ key

  The message: ″p″ ″ss″ appears, where ″ss″ is the speed of the remote modem, (note that the speed at which the REMOTE modem transmits can de different from the speed at which the LOCAL modem transmits).

- Press the ″Go″ key

  The message: END OF REPORT appears.

Full/Backup Speed Local: This function allows you to change the speed of the local modem to the backup speed when the line condition is bad. This backup speed is some times called ″fall-back″ speed. This function is also used to restore the normal speed (full speed) when the line condition gets improved. This function is non-disruptive, so no sessions are lost. This function is valid for LIC type 5 only.

To change the speed:

- Press the ″LOCAL Speed″ key

  The message: ″aa″ ″old″ TO ″new″ appears, where ″aa″ is the address of the local modem, ″old″ is the current speed and ′new′ is the desired speed. The full speed values for the LIC 5 are 14.4/9.6/4.8 Kbps, and the backup speeds are 12.0/7.2/2.4 respectively.

- Press the ″Go″ key

  The message: ″aa″ NEW SPEED ″new″ appears.

Full/Backup Speed Remote: This function allows you to change the speed of the remote modem, to the backup speed when the line condition is bad. This function is non-disruptive, so no sessions are lost. This function is valid for LIC 5 only. The full speed values for the LIC 5 are 14.4/9.6/4.8 Kbps, and the backup speeds are 12.0/7.2/2.4 respectably.

To change from Full speed to Backup speed:

- Press the ″Bckup″ key

The message: REM SPD BACK appears.

- Press the "Go" key

  The message: NEW SPEED "new" appears, where "new" is the backup speed.

To go back to Full speed:

- Press the "Full" key

  The message: REM SPD FULL appears.

- Press the "Go" key

  The message: NEW SPEED "new" appears, where "new" is the full speed.

Local configuration: This function allows you to change the configuration of the local modem. It is valid for both LIC 5 and LIC 6. The procedure is the same for both type of LICs, but the configuration options are not. Below is the procedure for browsing and changing the configuration, and later the option for each LIC type are described. This function is non-disruptive.

To browse or change the configuration:

- Press the "LOCAL Conf" key

  The message: LOCAL CONFIG appears.

- Press the "Go" key

  The message: -BASIC CONFIG- appears.

- Press the "Go" key

  From now and until the end of the configuration process, one option a time will be displayed every time that the "Go" key is pressed. To change an option keep pressing the "Erase" key until the desired option appears at the display. To interrupt the process press the "Exit" key.

The following procedures describes the configuration options for LIC 5:

- ADDRESS "aa": "aa" specifies the local modem address.
- TYPE "new"_"old": Where "new" is the normal speed and "old" is the backup speed.
- MODE NATIVE/CCITT: NATIVE mode allows you to used the CNM/LPDA-2 functions. CCITT mode allows you to connect an IBM modem with a non-IBM modem that is CCITT compatible. However CCITT can only be changed by an IBM Service Representative. Therefore, it cannot be changed with the PKD.
- Valid network configurations are:
  - PTP PRIMARY: Point-to-point primary is defined for a modem at the central (host) site. This modem controls the speed and testing of the link at the remote modem. A point-to-point primary modem can communicate with another point-to-point primary or secondary modem. A primary-to-primary connection should be used when modems transmit data between sites of equal importance, and also when the speed control and testing are to be initiated from either end. Contentions may happen when the speed is controlled by the DTE.

- PTP SECONDARY: Point-to-point secondary is defined for a modem located at the remote site. This modem is not able to control the link speed or send test commands to the central (host site) modem. Two modems configured as PTP SECONDARY will not work properly.
- MTP CONTROL: A multipoint control modem controls all the other modems connected to a multipoint line. The other modems are called tributary modems. The configuration for these tributary modems can be defined from the multipoint control modem.
- MTP TRIBUTARY: A multipoint tributary modem is controlled by a multipoint control modem. This modem is not able to control the link speed or send commands to the central modem (host site).
- XMIT CLOCK "cc": Determines who provides the transmit clock. Valid values for LIC 5 are INT (internal) or RCV (the local transmit clock is locked to the receive clock). IBM 586X modems allow a third source for the transmit clock (EXT), in which the clock is received from the DTE.

• Press the "Go" key to see the transmit options

- 9600 TCM YES|NO: Allows you to use the Trellis Code Modulation when transmitting at 9.6 Kbps. TCM is always used when working at 14.4 Kbps.
- ADD RFS DLY "nn": Additional Ready For Sending Delay, where "nn" is the delay added for the transition of the RFS signal. Set it to 000 unless there are troubles in a multipoint configuration.
- AUTO TEST YES|NO: A local test is run automatically, if no signal has been received after thirty seconds. This test is not available on a multipoint control modem.
- L XMIT LEVEL "nn": "nn" is a number between 00 and -15 dBm, specifying the transmitted signal power over the leased line.
- CD SENSIT NORM: This specifies normal sensitivity for Carrier Detection. This is an IBM Service Representative only parameter. Therefore, it cannot be changed with the PKD.

• Press the "Go" key to see test options

- LPDA-2 ENABLED|DISABLED
- QUAL THRES "nn": Specifies the Quality Threshold. 8 is a recommended value.
- LEVEL THRES "nn": Specifies the received level threshold below which a warning indication will be reported during LPDA-2 modem and line status operation (see next section for details of how to issue this test from a NetView console). "nn" is a value between 00 to -43 dBm.

• Press the "Go" key to see speed options

- DFLT SPEED: The default speed is the starting speed of the modem when powered on. You can set the backup speed to be the DFLT SPEED when operating at backup speed for an extended period of time.

• Press the "Go" key to see the machine fields

- BUZZER CTL ON/OFF: Enables or disables the PKD buzzer.
- MACH LEVEL #####: Specifies the technical level of the LIC.

The following procedures describes the configuration options for LIC 6:

- ADDRESS ″aa″: ″aa″ specifies the local modem address.
- MODE LDM/DDS: Limited Distance Modem or Digital Data Services.
- INTERNAL/NETWORK CLOCK: Specifies who provides the clock.
- Network Configuration: The only valid modes are PTP PRIMARY and PTP SECONDARY.
- SPEED 9.6/19.2 Kbps: To change to 56 Kbps see Figure 100 on page 179.
- NETWORK SERVICES ON/OFF: On for DDS mode only.
- BUZZER ENABLED|DISABLED: PKD buzzer.
- MACHINE LEVEL: Specifies the technical level of the LIC 6.

Note: A local configuration summary can be obtained by pressing and holding for more than two seconds the ″Erase″ key. This summary gives you the modem speed, the network configuration and the source for the transmit clock.

Remote Configuration: This procedure is valid for LIC 5 only. To start this remote configuration press the ″REMOTE Conf″ key. The procedure is the same for local and remote configuration. See the LIC 5 configuration options for details.

Analog Test: This test is valid for LIC 5 only. Since this test is disruptive, the line must be activated after the test.

To begin the test:

- Press the ″Anlg″ key
- Press the ″Go″ key

  The message: RUNNING appears and stays for several seconds. Then the message: ″aa″ RL L ″nn″ R ″mm″ appears, where ″aa″ is the address of the remote modem, ″nn″ is the power level at the local modem, while ″mm″ is the power level at the remote modem. Values between 0 and -43 dBm are displayed.
- Press the ″Go″ key

  The message: ″aa″ MRL L ″-nn″ R ″-nn″ appears. Minimum Receive Level is the lowest received level, recorded at the local and remote modems during the past 15 minutes, expressed in dBm. The minus signs (-) are replaced by asterisks (**) if the modem has been powered on less than 15 minutes since the test was run.
- Press the ″Go″ key

  The message: ″aa″ S/N L ″nn″ R ″mm″ appears. The Signal-to-Noise ratio of the received signal at the local and remote ends are expressed in dB (values less than 25 db may indicate a line degradation).
- Press the ″Go″ key

  The message: ″aa″ H2 L ″nn″ R ″mm″ appears. The second harmonic distortion at the local and remote modem expressed in dB is shown. Values less than 32 dB may indicate line degradation.
- Press the ″Go″ key

The message: ″aa″ H3 L ″nn″ R ″mm″ appears. The third harmonic distortion at the local and remote modem expressed in dB is shown. Values less than 32 dB may indicate line degradation.

- Press the ″Go″ key

  The message ″aa″ PJ L ″nn″ R ″mm″ appears. The Phase Jitter is shown. Values above 8 degrees may indicate line degradation.

- Press the ″Go″ key

  The message ″aa″ FS 1 ″nn″ R ″mm″ appears. The Frequency Shift is shown. Values above 6 Hertz may indicate line degradation.

- Press the ″Go″ key

  The message: ″aa″ HIT L ″nn″ R ″mm″ appears. The impulse hits (spikes) are shown. These hits are recorded over the past 15 minutes, as seen both at the local and remote end. For a multipoint control modem, the L field is not updated and ″**″ is displayed. Asterisks (**) before the numbers indicate that the results have been accumulated for less than 15 minutes.

- Press the ″Go″ key

  The message: ″aa″ LBK L ″nn″ R ″mm″ appears. The line breaks are short interruptions in the received signal over the past 15 minutes. For a multipoint control modem the L field is not updated.

- Press the ″Go″ key

  The message: ″aa″ RTD ″n.nn″ appears. This is the round trip delay, the time needed for a signal to propagate from the local to the remote end and back. It is expressed in seconds.

Digital Test: During this test the local LIC sends a sequence of 16 blocks of data to the remote modem, which then returns this data to the local LIC. Blocks in error, for each sequence are shown in the PKD display. This test is disruptive, so the line must be activated again after the test. This test will run indefinitely, to finish it press the ″Stop″ key. This test is only possible for a multipoint control, or point-to-point primary LIC. Additionally for LIC 6 this test requires that the Network Services Option is ON.

To start the test:

- Press the ″Dgtl″ key

  The message: * L ″nn″ R ″mm″ appears, where ″nn″ indicate the number of inbound blocks in error for each sequence of 16 messages, while ″mm″ indicates the number of outbound blocks in error. The asterisk flashes to indicate that the test is in progress.

- Press the ″Stop″ key to finish the test.

10.2.3 LIC 5/LIC 6 Line Connection

The connection between the LIC 5 or LIC 6 to the 4-wire leased line is very straightforward. The line must be terminated in a RJ48S data jack, commonly called a PTT jack (Figure 99 on page 179). This connector is inserted into the PTT jack (Figure 96 on page 168). This make line setup very simple. Switching a line from one port to another is then very easy, and combining this with the Port Swapping feature makes hardware problem determination very fast and easy. LIC 5 and LIC 6 are also hot-pluggable.

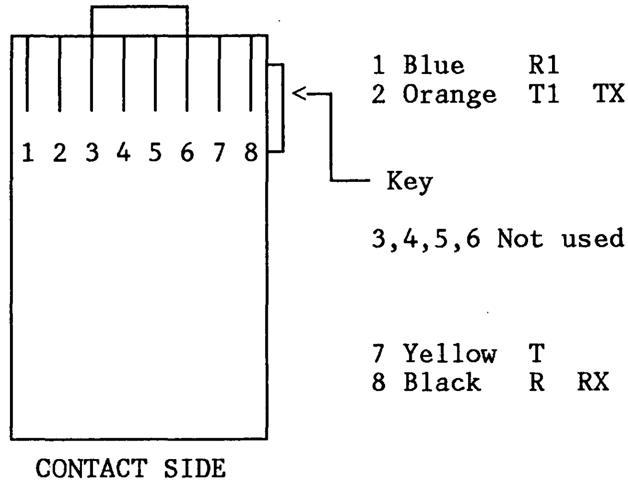


Figure 99. PTT Jack Connector (RJ48S Data Jack)

LIC 6 provides either the V.24 interface or the V.35 interface. When a speed of 56 Kbps is required the V.35 interface must be selected. These interfaces can be changed by switching the micro-switch shown in Figure 100.

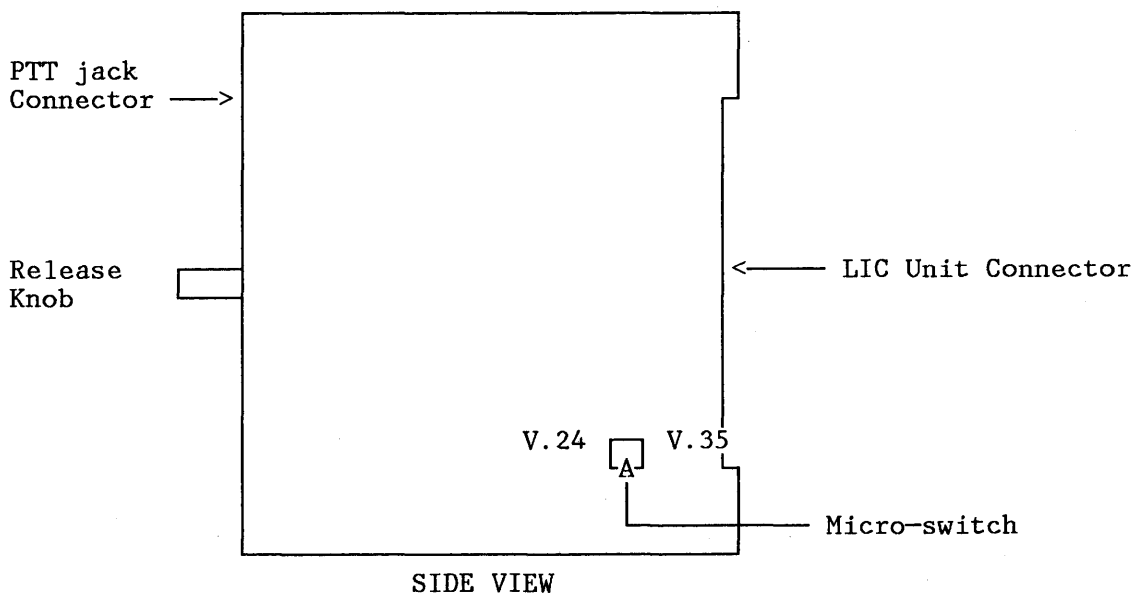


Figure 100. Location of the V.24/V.35 micro-switch for LIC 6

10.3 Link Problem Determination

The Link Problem Determination Aid (LPDA-2) is a host-invoked diagnostic aid that allows you to perform link problem determination at either the local or remote modem. The fact that the tests can be initiated from any NetView console and without any measurement equipment makes LPDA-2 the right tool for fast link problem isolation without requiring a great deal of line transmission knowledge on the person that invokes the test.

The results of the test are presented in panels, which give you abundant line and modem parameters and even give you the expected and acceptable values for those parameters.

One unique advantage of the IBM modems is that LPDA-2 functions allow you to test the line in "mainstream" approach instead of "sidestream" approach. The mainstream approach consists of transmitting either user data or maintenance at a given time, as opposed to sharing the communication channel frequency bandwidth for simultaneous transmission of both types of messages (sidestream). With the mainstream approach, when a line test is going to be performed, polling is momentarily interrupted and the test is done over the entire bandwidth providing accurate results, and eliminating the need for side channel hardware. The mainstream also allows dedicating the full bandwidth of the transmission media to the modulated signals, as well as using the maximum transmit level authorized by common carriers. Next you will see the only change that has to be done in the NCP to enable the use of the LPDA-2 features. Later some sample panels with information about the line and the modems will be shown, and the meaning of the parameters will be explained. Notice however that since the line used for generating this panels was a very short leased line, most of the parameters measured gave numbers that are in most cases better than the expected values for real lines.

Once you have NetView installed, all you need to code in the NCP for using the LPDA functions with the IBM modems is the following keyword in the LINE definition statement:

```
LPDATS=LPDA2
```

Then all you have to do from a NetView console to invoke the tests is type the following command:

```
NPDA TEST ncpname  puname type-of-test
```

LDPA provides three types of test:

- LA for line analysis,
- MLS for modem and line status,
- TRT # for transmit and receive test, where # is the number of test sequences.

10.3.1 Line Analysis

This test gathers information about the quality of the line used between the local modem and the remote modem. Figure 101 on page 182 shows a sample panel for line analysis test.

The parameters in the line analysis panel are explained as follows:

- ROUND TRIP DELAY

The difference in milliseconds between the time a command was sent and the time it was acknowledged. This measurement occurs at the local modem and does not include the modem's pass through delay.

- TYPE-MODEL

  A four-character modem type and two-character modem model. The LIC type 5 TYPE-MODEL is 7865-16, while the LIC type 6 is 7825-18.

- FREQUENCY SHIFT

  It is the difference (measured in hertz) between a signal's frequency at the origination point and its frequency at the destination point.

- 2ND HARMONIC DISTORTION

  This shows the measurement of the nonlinear distortion characteristics of the channel. This ratio is measured by "two tones" methods (860-1380 Hz). Non-linearities in the leased line cause components that are integer multiples of the fundamental frequency to appear as unwanted signals, which are added to the original signal causing nonlinear distortion. These unwanted components of the fundamental frequency are called ***harmonics*** . Harmonic distortion is measured by sending a "pure" tone of a known power level and frequency (fundamental), and measuring the power level of the component that is twice the frequency of the tone sent (second harmonic). The fraction between the power level of the second harmonic and the power level of the fundamental frequency expressed in decibels is the second harmonic distortion. Note that the smaller this number, the better the line.

  Note: dB = decibel = 10 log (Power received/ Power transmitted).

- 3RD HARMONIC DISTORTION

  This shows the same thing expressed above, but related the component that is three times the fundamental frequency. Normally the distortion due to the third harmonic is smaller than the distortion due to the second harmonic.

- SIGNAL TO NOISE RATIO

  Electrical noise is the sum of all the unwanted signals coming from different sources, that are added to the original signal making recovering the information more difficult. The signal to noise ratio is the fraction between the power level of the transmitted signal and the power level of the electrical noise present in the transmission media. The result is expressed in decibels. Note that the bigger this number the better the line condition as far as noise is concerned.

- PHASE JITTER

  This shows a measure of variant shift in the phase of the received signal due to low-frequency phase modulation of small amplitude. The peak to peak phase jitter is measured in a 300 Hz bandwidth.

- RECEIVE LEVEL, LEAST

  This is a measure of the power of the received signal expressed in dBm (decibel based on one milliwatt). The decibel express a ***relative*** measurement, since it is a faction between two power levels. When absolute power levels are wanted the results are expressed in dBm (0 dBm = 1 milliwatt). LEAST means that it is the lowest power level received during the 15 minutes before the command was issued.

- IMPULSE HITS

Impulse hits, also called spikes, are unwanted interfering signals of high energy but of a very short duration. This value represents the number of such impulses that have occurred that are above a threshold of 6 dB, relative to the average signal power at the input of the modem. The number displayed is the number of impulse hits that have occurred within the last 15 minutes.

- RLSD LOSES

  Modems synchronize each other by sending a carrier tone. If the carrier can not be detected (lost), no data flow is possible. As soon as the carrier is detected, data flow is restored. This number represents the number of carrier detect losses which were detected during the last 15 minutes before the line analysis test was issued. Carrier detect loss occurs when noise is the big enough to prevent the detection of the carrier.

- TRANSMIT LEVEL

  This shows the power level of the transmitted signal expressed in dBm (see Receive Level description).

- SPEED, RTM MODEM ADDRESS

  This gives you the speed at which the local and the remote modem are transmitting. The field between parenthesis tells you whether it is FULL speed or backup (BKUP) speed. This also gives you the remote address of the modem (useful in multipoint lines).

```
N E T V I E W                                      WTCR16    11/23/88 16:4 3:03
NPDA-24B           * LINE ANALYSIS-LINK SEGMENT LEVEL 1 *          PAGE  1 OF 1

 RA3AO        RA6NCPA       L06258    C1   P06258A
            +---------+ +-+            +-+ +---------+
 DOMAIN     |  COMC   | |M|--LINE--|M| |  CTRL   |
            +---------+ +-+            +-+ +---------+
 ROUND TRIP DELAY: 0 MSEC
                             LOCAL             REMOTE            ACCEPT ABLE
                             MODEM             MODEM             LIMITS
 TYPE-MODEL:                 7865-16           5865-03
 FREQUENCY SHIFT:             0 HZ              0 HZ             MAX  6  HZ
 2ND HARMONIC DISTORTION:    40 DB             40 DB             MIN 27  DB
 3RD HARMONIC DISTORTION:    40 DB             40 DB             MIN 32  DB
 SIGNAL TO NOISE RATIO:      40 DB             40 DB             MIN 22  DB
 PHASE JITTER:                0 DEG PP          0 DEG PP         MAX 20  DEG PP
 RECEIVE LEVEL, LEAST:        0, 0 DBM         -1, -1 DBM        MIN-32  DBM
 IMPULSE HITS:                0                 0                15 IN  15 MIN
 RLSD LOSSES:                 0                 0
 TRANSMIT LEVEL:              0 DBM             0 DBM
 SPEED, RMT MODEM ADDRESS:   9.6 KBPS(FULL)    9.6 KBPS(FULL), C1

-------------------
```

Figure 101. Sample Panel for Line Analysis

10.3.2 Modem and Line Status

This test can be issued either by the network operator, or can be automatically issued upon detection of a link station failure, or when an error threshold has been reached in the host DTE.

Figure 102 shows the first panel for MLS test.

```
 N E T V I E W                                  WTCR16    11/23/88 16:45:24
 NPDA-22B              * MODEM AND LINE STATUS *                 PAGE 1 OF 3
              * MODEM AND LINE PARAMETERS-LINK SEGMENT LEVEL 1 *
  RA3AO       RA6NCPA      L06258    C1  P06258A
              +--------+ +-+        +-+ +--------+
  DOMAIN      | COMC   | |M|--LINE--|M| |  CTRL  |
              +--------+ +-+        +-+ +--------+


                              LOCAL MODEM        REMOTE MODEM        EXPECTED
 RECEIVE LEVEL, LEAST:      -1 DBM, -1 DBM     -1 DBM, -1 DBM      -16 +/- 7 DBM
 REC LVL THRESH EXCEEDED:    NO                 NO                  NO
 RLSD LOSSES, AGE:           0                  0                   0
 LINE QUALITY, WORST:        GOOD/0, GOOD/0     GOOD/0, GOOD/0      GOOD/0-4
 IMPULSE HITS, AGE:          0                  0                   0-15/15 MIN
 POWER OFF TONE, AGE:        NO                 NO                  NO
 REINITIALIZATION, AGE:      NO                 NO                  NO
 FAILURE TONE, AGE:          NO                 NO                  NO
 BASE MODEM IN ERROR:        NO                 NO                  NO
 FEATURE(S) IN ERROR:        NONE               NONE                NONE
 SEE NEXT PAGE FOR REMOTE DTE INTERFACE SUMMARY

--------------------
```

Figure 102. Sample Panel for Modem and Line Status (1)

The parameters in the modem and line status panel are explained as follows:

- RECEIVE LEVEL, LEAST

  See the same parameter in the Line Analysis test.

- REC LVL THRESH EXCEEDED

  This indicates whether the receive-level threshold specified by your installation has been exceeded. This threshold (default -43 dBm) can be displayed and change using the MDMCNFG NetView command, described in the third part of this chapter.

- RLSD LOSSES, AGE

  See the same parameter in the Line Analysis test. AGE is the age of the last impulse hit (spike) detected by the modem. It is displayed in 8-second increments, up to 112 seconds.

- LINE QUALITY, WORST

  This is a modem-calculated running average that shows the quality of the signal received by the modem. Each of these values can range from 0 to 14. A value between 0 to 4 is considered GOOD, a value from 5 to 9 is considered indeterminate, and a value from 10 to 14 is considered BAD. WORST is the worst line quality measured during the last two minutes before the test command was executed.

- IMPULSE HIT

  See the same parameter in the Line Analysis test. AGE is the age of the last impulse hit (spike) detected by the modem. It is displayed in 8-second increments, up to 112 seconds.

- POWER OFF TONE, AGE

  This is a YES or NO value which indicates whether a power off tone was detected in the adjacent modem of a modem pair (either there was a power fault, or someone turned the remote modem off). AGE is the age of the last power-off tone detected by the modem. It is displayed in 8-second increments, up to 112 seconds.

- REINITIALIZATION, AGE

  This indicator is set to YES when the modem is powered on, when a hard or soft error occurs, or after some configuration command have been issued. If the modem was reinitialized, the age of the last reinitialization is displayed. The modem reinitialization indicator is set to NO after two minutes have elapsed. AGE tells how long ago the modem was reinitializated. It is displayed in 8-second increments, up to 112 seconds.

- FAILURE TONE, AGE

  This is a YES or NO value indicating whether a failure tone was received from the remote modem. This failure tone is sent whenever the modem detects an internal failure. If a failure tone was received, the age of the last detected failure tone is displayed. AGE tells you how long ago the failure tone was detected. It is displayed in 8-second increments, up to 112 seconds.

- BASE MODEM IN ERROR

  This is a YES or NO value that indicates whether or not the modem has detected an error within itself.

- FEATURES(S) IN ERROR

  This indicator does not apply to the integrated modems.

Figure 103 on page 185 shows the second panel for MLS test.

```
N E T V I E W                                   WTCR16    11/23/88 16:48:00
NPDA-22B                 * MODEM AND LINE STATUS *              PAGE 2 OF 3
     * REMOTE MODEM INTERFACE-REMOTE DEVICE STATUS-LINK SEGMENT LEVEL 1 *
 RA3AO        RA6NCPA      L06258    C1 'P06258A
           +---------+ +-+          +-+ +---------+
 DOMAIN    |  COMC   | |M|--LINE--|M| |  CTRL   |
           +---------+ +-+          +-+ +---------+
                              STATUS AT COMMAND       ACTIVITY DURING TWO
                              EXECUTION TIME          MINUTES BEFORE COMMAND
  REQUEST TO SEND:                   OFF                        NO
  CLEAR TO SEND:                     OFF                        NO
  TRANSMIT DATA:                     OFF                        NO
  RECEIVE DATA:                      OFF                        YES
  RECEIVE LINE SIGNAL DETECT:        N/A                        NO
  DATA SIGNALLING RATE SELECTOR:     ON                         NO
  DATA TERMINAL READY:               OFF                        NO
  DTE POWER LOSS DETECTED:           ON                         NO
  TEST CONTROL:                      N/A                        NO
                               REMOTE DEVICE
                      STREAMING DETECTED: NO
SEE NEXT PAGE FOR LINK AND MODEM CONFIGURATIONS

--------------------
```

Figure 103. Sample Panel for Modem and Line Status (2)

This panel is self-explanatory. It gives the same information that you would get by plugging a break-out-box between the DTE and the modem.

Figure 104 shows the last panel for MLS test.

```
N E T V I E W                                   WTCR16    11/23/88 16:50:23
NPDA-22B                 * MODEM AND LINE STATUS *              PAGE 3 OF 3
               * CONFIGURATION SUMMARY-LINK SEGMENT LEVEL 1 *
 RA3AO        RA6NCPA      L06258    C1  P06258A
           +---------+ +-+          +-+ +---------+
 DOMAIN    |  COMC   | |M|--LINE--|M| |  CTRL   |
           +---------+ +-+          +-+ +---------+
    LINK CONFIGURATION: LEASED, POINT-TO-POINT

                                 LOCAL MODEM            REMOTE MODEM
    TYPE-MODEL, TEST MODE:      7865-16, SOLICITED     5865-03, SOLICITED
    SPEED, RLSD STATE:          9.6 KBPS(FULL), ON     9.6 KBPS(FULL), N/A
    NETWORK FUNCTION:           PRIMARY                SECONDARY
    CUSTOMER CONFIG DATA LOST:  NO                     NO
    LPDA MICROCODE LEVEL:       6                      2
    SNBU, TYPE OF CONNECTION:   NO                     NO
    COMMAND RETRIED:            NO                     N/A
    REMOTE MODEM ADDRESS:       N/A                    C1
    DTE INTERFACE CONNECTION:   DTE                    DTE
    FEATURE(S) INSTALLED:       NONE                   FAN OUT


--------------------
```

Figure 104. Sample Panel for Modem and Line Status (3)

Some of the parameters in this panel are also self-explanatory.

- NETWORK FUNCTION

The network function of a modem is related to its placement on a link of a given topology. The possible network functions are primary and secondary on a point-to-point link, and control and tributary on a multipoint link. The network function of a modem governs its transmission characteristics as well as the way it executes LPDA-2 commands. A primary or control modem accepts local commands from the DTE and transmits remote commands over the line to its adjacent modems. A secondary or tributary modem accepts local commands from the line, but does not transmit remote commands over the line to its adjacent modem. The network function can be set up using the PKD, and must match the definition established in the NCP generation parameter for that line.

- CUSTOMER CONFIG DATA LOST

  This indicates whether there has been an alteration in the modem's nonvolatile memory where all of the configuration parameters are stored.

- SNBU, TYPE OF CONNECTION

  The Switched Network Backup Unit feature is not supported by the integrated modems.

- COMMAND RETIRED

  This shows whether the local modem has retired a command to the remote modem because no response or an invalid response was received on the first attempt.

10.3.3 Transmit and Receive Test

In this test the local and remote modem exchange test patterns and report the line quality and transmission errors. When you request this test, a command is sent to the local and remote modem directing them to exchange one or more sequences of predefined bit patterns over the line and to report the results. The results include information about the line quality and the number of data blocks received in error.

Figure 105 on page 187 shows the sample panel for the TRT test.

```
N E T V I E W                                    WTCR16    11/23/88 16:55:19
NPDA-25B        * TRANSMIT RECEIVE TEST-LINK SEGMENT LEVEL 1 *      PAGE 1 OF 1

 RA3AO        RA6NCPA       L06258   C1  P06258A
              +---------+ +-+       +-+ +---------+
 DOMAIN       |  COMC   | |M|--LINE--|M| |  CTRL   |
              +---------+ +-+       +-+ +---------+

                                       LOCAL MODEM          REMOTE MODEM

   TYPE-MODEL:                         7865-16              5865-03
   REMOTE MODEM ADDRESS:               N/A                  C1
   CURRENT TRANSMIT SPEED:             9.6 KBPS             9.6 KBPS
   SPEED IN USE:                       FULL                 FULL
   RLSD LOST:                          NO                   NO
   LINE QUALITY:                       GOOD/0               GOOD/0
   IMPULSE HITS DURING TEST:           0                    0
   NUMBER OF BLOCKS:
    RECEIVED                           32                   32
    RECEIVED WITH ONE OR MORE ERRORS   0                    0


--------------------
```

Figure 105. Sample Panel for Transmit and Receive

10.4 LPDA-2 Commands

The CNM/LPDA-2 commands that can be issued from a NetView console are mentioned and some sample panels are also provided. However the commands will not be described to its full extent. A complete reference can be found in the NetView Operation manual.

The LPDA-2 Commands that can be issued from NetView are:

- MDMCNFG

  This command allows you to retrieve and to update the integrated (and stand alone remote) modem. A sample panel shown in Figure 106 can be obtained by submitting the following command:

  ```
  MDMCNFG ID=RA6NCPA,STATION=P06258A,BROWSE=CONFIG
  ```

  The BROWSE=CONFIG option allows you to browse the actual configuration of the modem. In order to change the actual modem configuration instead of specifying the BROWSE=CONFIG option, you issue the same command with the CHANGE=CONFIG option. This gives you a similar panel (Figure 107 on page 189) that allows you to change the modem's parameters.

```
          N E T V I E W            RA3AO    WTCR16   12/07/88 02:55:31
         * BROWSE CHANGEABLE 7865 CONFIGURATION PARAMETERS *
     ID = RA6NCPA  STATION = P06258A  MODEM = LOCAL    LEVEL = 1

BASIC MODEM CONFIGURATION
  SPEED CONTROL MODE              M          (M=MODEM, D=DTE)
  TRAINING SEQUENCE               S          (L=LONG, S=SHORT)
  CONFIGURATION                   P          (M=MULTI-POINT, P=POINT TO POINT)
  NETWORK FUNCTION                C          (C=CONTROL/PRIMARY, S=SECONDARY)
  ANTISTREAMING                   N          (Y=YES, N=NO)
  TRANSMIT CLOCK OPTION           I          (I=INTERNAL,E=EXTERNAL,R=RECEIVE)
  COMPLEMENTARY RFS DELAY         0   MS     (0 TO 250 IN 10MS INCREMENTS)
  DEFAULT SPEED                   F          (F=FULL, B=BACKUP)
  LOCAL LOOP BACK WRAP            Y          (Y=YES, N=NO)

CUSTOMER INFORMATION                         (10 CHARACTER LIMIT)

ALARM THRESHOLDS
  RECEIVE LEVEL THRESHOLD         -43 DBM    (-43 TO 0)
  IMPULSE HITS THRESHOLD          0          (0 TO 63)
  LINE QUALITY THRESHOLD          8          (0 TO 14)

HIT ENTER TO END COMMAND

--------------------
```

Figure 106. Sample panel for MDMCNFG Command with BROWSE Option

```
             N E T V I E W            RA3AO    WTCR16   12/08/88 11:44:35
                  * CHANGE 7865 CONFIGURATION PARAMETERS *
       ID = RA6NCPA  STATION = P06258A  MODEM = LOCAL     LEVEL = 1

BASIC MODEM CONFIGURATION
  SPEED CONTROL MODE          ===>  M            (M=MODEM, D=DTE)
  TRAINING SEQUENCE           ===>  S            (L=LONG, S=SHORT)
  CONFIGURATION               ===>  P            (M=MULTI-POINT, P=POINT TO POINT)
  NETWORK FUNCTION            ===>  C            (C=CONTROL/PRIMARY, S=SECONDARY)
  ANTISTREAMING               ===>  N            (Y=YES, N=NO)
  TRANSMIT CLOCK OPTION       ===>  I            (I=INTERNAL,E=EXTERNAL,R=RECEIVE)
  COMPLEMENTARY RFS DELAY     ===>  0   MS       (0 TO 250 IN 10MS INCREMENTS)
  DEFAULT SPEED               ===>  F            (F=FULL, B=BACKUP)
  LOCAL LOOP BACK WRAP        ===>  Y            (Y=YES, N=NO)

CUSTOMER INFORMATION          ===>               (10 CHARACTER LIMIT)

ALARM THRESHOLDS
  RECEIVE LEVEL THRESHOLD     ===>  -43 DBM      (-43 TO 0)
  IMPULSE HITS THRESHOLD      ===>  0            (0 TO 63)
  LINE QUALITY THRESHOLD      ===>  8            (0 TO 14)

ENTER CHANGES IN HI-LIGHTED FIELDS, OR ENTER "CANCEL" ON COMMAND LINE
===>
--------------------
```

Figure 107. Sample panel for MDMCNFG Command with CHANGE Option

- MDMCNTL

  This command allows you to change the modem speed. For example if you issued the following command:

  ```
  MDMCNTL ID=RA6NCPA,STATION=P06258A,MODEM=REMOTE,SPEED=BACKUP
  ```

  you will have set the transmit speed of the remote modem to backup speed.

- THRESH

  This command displays or changes the current threshold values. If you issue the following command:

  ```
  THRESH ID=RA6NCPA,STATION=P06258A,QUERY
  ```

  you will get the following data back:

```
 NCCF        N E T V I E W              RA3AO WTCR16    12/07/88 03:33:09
 * RA3AO    THRESH  ID=RA6NCPA,STATION=P06258A,QUERY
 ' RA3AO
DSI332I THRESHOLD DISPLAY FOR ID = RA6NCPA STATION = P06258A
DSI334I   TDT = 32768, TET = 64
DSI333I END OF THRESHOLD DISPLAY
 -----------------------------------------------------------------------------
```

Figure 108. Sample Screen for THRESH Command

TDT represents the "total of transmission" threshold for SDLC devices, and the "traffic count" threshold for BSC devices. TET represent the "total retries" threshold for SDLC devices, and "error count" threshold for BSC devices.

- LPDA

This command allows you to enable or disable the LPDA-2 tests for a particular station. Also gives you information about the type of modem being tested. The Figure 109 on page 190 shows the result of issuing this command:

```
LPDA ID=RA6NCPA,STATION=P06258A,QUERY
```

```
 NCCF        N E T V I E W              RA3AO WTCR16    12/07/88 03:48:46
 * RA3AO    LPDA    ID=RA6NCPA,STATION=P06258A,QUERY
 ' RA3AO
DSI338I LPDA DISPLAY FOR ID = RA6NCPA, STATION = P06258A
DSI339I LPDA FOR STATION = ALLOW
DSI440I LPDA FOR LINE = TYPE3
DSI442I STATION LOCATED ON LINK SEGMENT NUMBER 1
DSI340I END OF LPDA DISPLAY
 ------------------------------------------------------------------------------
```

Figure 109. Sample Panel for LPDA command

- DISPCMD

  This command displays a list of the outstanding commands.

- CANCMD

  This command allows you to cancel any previous outstanding command.

Note: In order to be able to issue any of the following NetView commands the task DSIGDS must be started.

10.5 LIC 5/LIC 6 Network Configurations

The following figures show some basic network configurations using a LIC 5 or a LIC 6.

10.5.1 LIC 5 Network configurations

The following types of network can be configured using a LIC 5:

- A single point-to-point link with another LIC 5

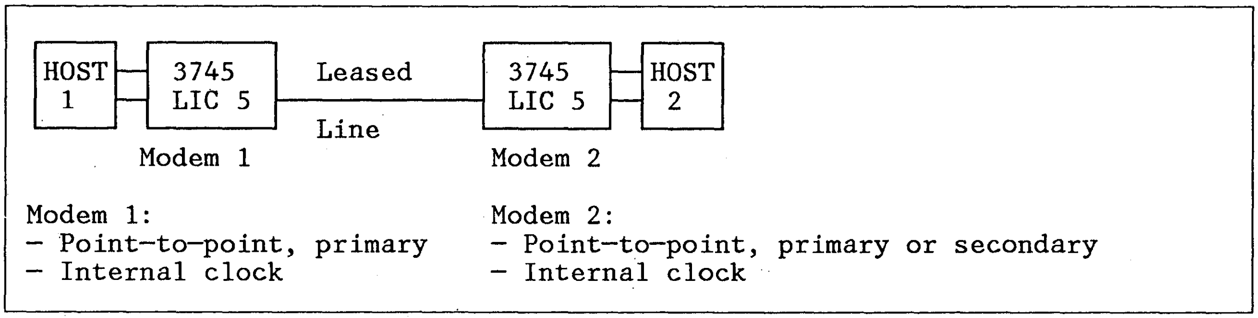


Figure 110. LIC5 to LIC5 Point-to-Point

- A single point-to-point link with an IBM 586X or a LULLI

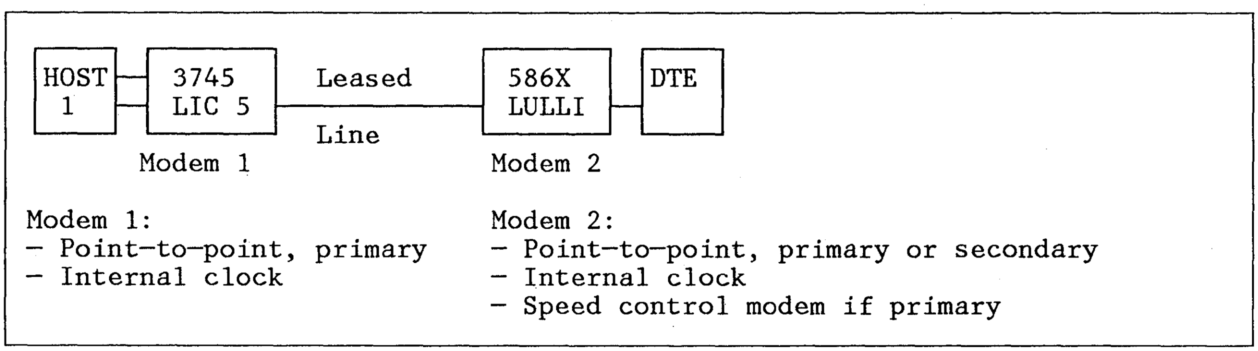


Figure 111. LIC5 to IBM 586X or LULLI Point-to-Point

- A single multipoint link with another LIC 5's

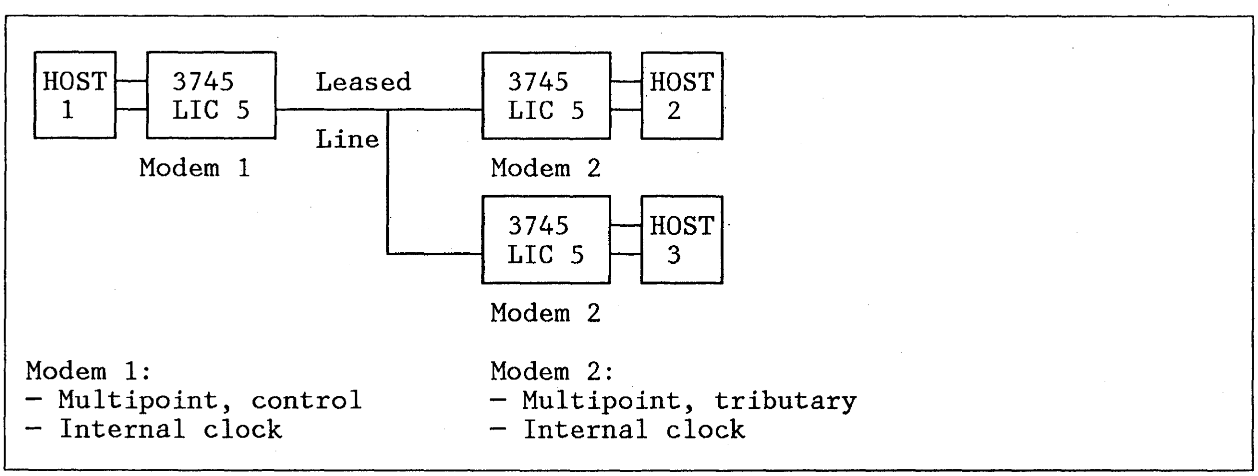


Figure 112. LIC5 to LIC5 Multipoint

- A single multipoint link with IBM 586X's or LULLIs

```
HOST   3745      Leased      586X      DTE
 1     LIC 5                 LULLI
                 Line
       Modem 1               Modem 2

                             586X      DTE
                             LULLI

                             Modem 2

Modem 1:                     Modem 2:
- Multipoint, control        - Multipoint, tributary
- Internal clock             - Internal clock
```

Figure 113. LIC5 to IBM 586X or LULLI Multipoint

Besides the above configuration, the following configuration can be formed with LIC5, IBM 586X, LULLI, and so on:

- A point-to-point link tailed to a point-to-point link
- A multipoint link tailed to a point-to-point link
- Two multipoint links tailed to a point-to-point link
- A multipoint link tailed to a multipoint link
- Two multipoint links tailed to a multipoint link

10.5.2 LIC 6 Network Configurations

The following types of network can be configured using LIC 6:

- A single point-to-point link with another LIC 6

```
HOST   3745      Leased      3745      HOST
 1     LIC 6                 LIC 6      2
                 Line
       Modem 1               Modem 2

Modem 1:                     Modem 2:
- Point-to-point, primary    - Point-to-point, primary or secondary
- XMT clock                  - XMT clock
    For LDM: int. or network     For LDM: int. or network
    For DDS: network             For DDS: network
```

Figure 114. LIC6 to LIC6 point-to-point (LDM or DDS)

- A single point-to-point link with an IBM 5821

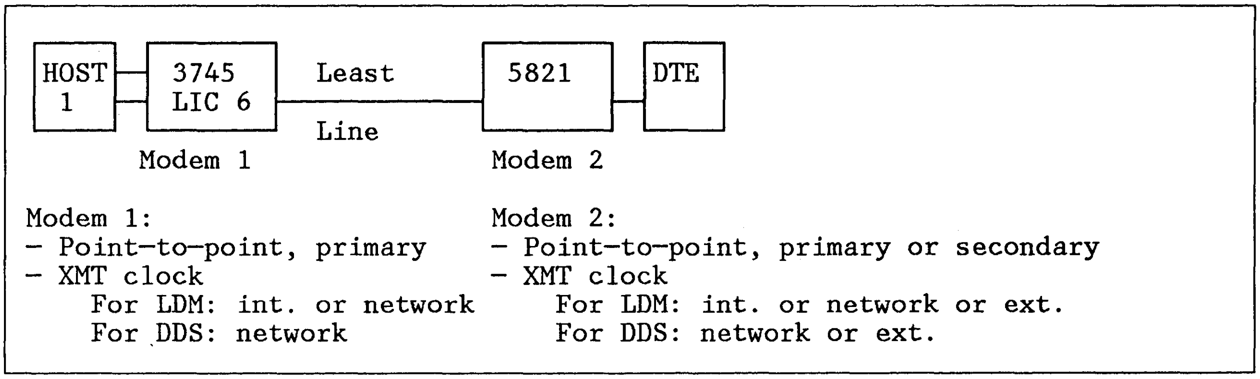
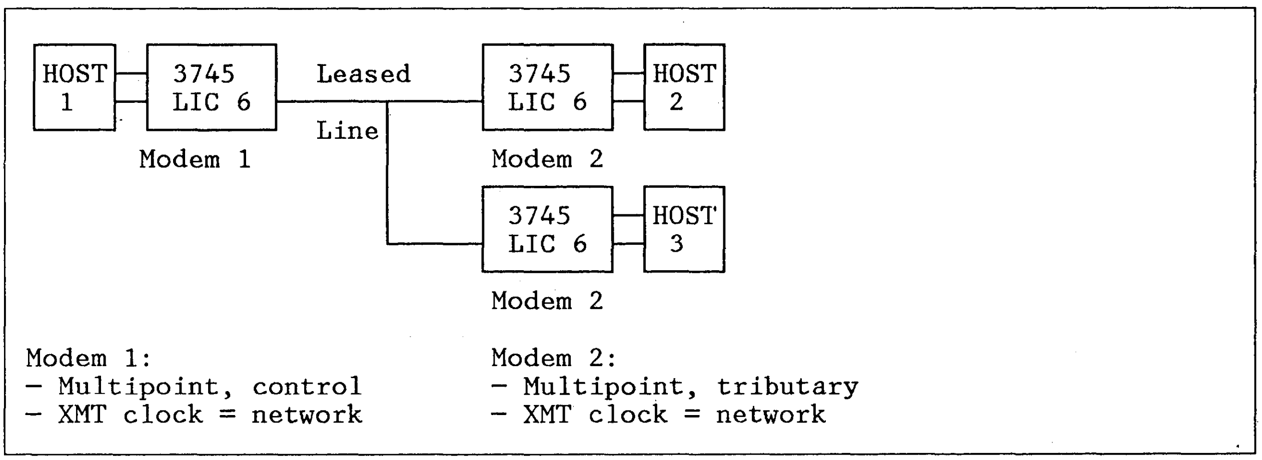


Figure 115. LIC6 to IBM 5821 point-to-point (LDM or DDS)

- A single multipoint link with another LIC 6's



- A multipoint link with IBM 5821's

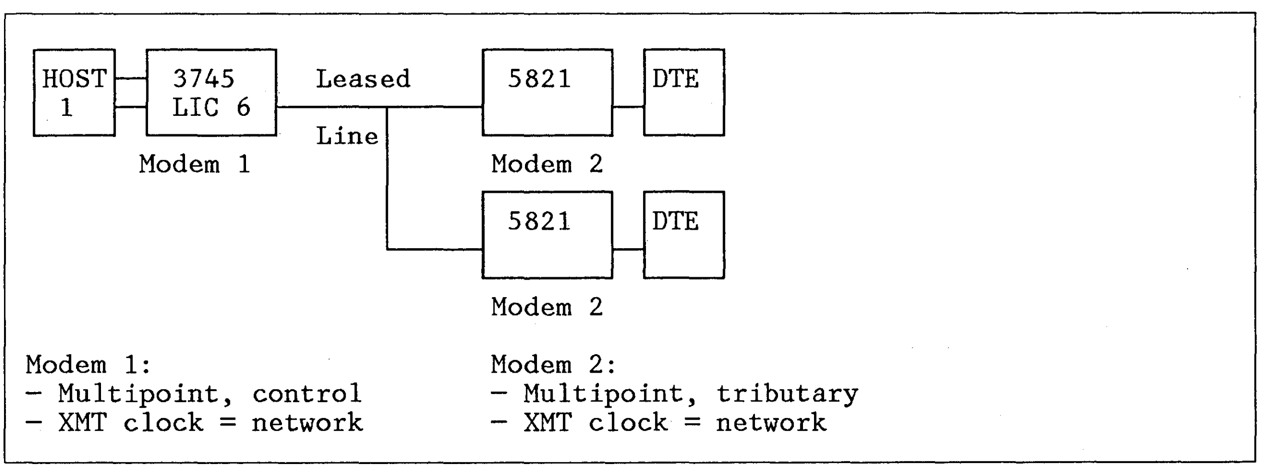


Figure 116. LIC6 to IBM 5821 multipoint (DDS)

Besides the above configuration, the following configuration can be formed with LIC6, IBM 586X, IBM 581X, DEBBUSY, and so on:

- A point-to-point link tailed to a point-to-point link (LDM or DDS)
- A multipoint link tailed to a point-to-point link (LDM or DDS)

- A point-to-point link tailed to a multipoint link (LDM or DDS)
- A multipoint link tailed to a multipoint link (DDS)

Appendix A. NCP V5 Definition Samples

NCP Version 5 provides some new coding conventions and some new capabilities. Here you will find some sample codes of NCP definition through NCP V5R1 to NCP V5R2.1 for the 3745.

This chapter provides the following sample definitions:

- Direct and Modem Attachment Definitions
- Channel Adapter Definitions
- X.21 Interface Definitions
- LIC5/LIC6 Line Definitions
- HPTSS Link Definitions
- Subarea Dial Definitions
- Multi-point Subarea Definitions
- SNA Type 2.1 Node Definitions
- NTRI INN Link Definitions

A.1 Modem and Direct Attachment Definitions

The CLOCKNG keyword of the LINE definition statement specifies how the line is connected and who provides clocking instead of the ATTACH and CLOCKNG keywords in NCP V4. When you specify CLOCKNG=DIRECT, the SPEED keyword is required to provide a line speed to the scanner. Otherwise, the SPEED keyword may be used for performance measurement.

```
***********************************************************************
*   LINE SPECIFICATION FOR 3174 ON PORT 140 (DIRECT ATTACHMENT)      *
***********************************************************************
L06140   LINE  ADDRESS=(140,HALF),   LINE ADDRESS                     X
               CLOCKNG=DIRECT,       DIRECT ATTACHMENT                X
               SPEED=9600,           SCANNER AND NPA USE              X
               DUPLEX=FULL,          RTS SIGNAL IS ALWAYS ACTIVE      X
               NRZI=YES,             MODEM CHARACTERISTICS            X
               SERVLIM=10,           SCAN SERVICE ORDER TABLE         X
               ISTATUS=ACTIVE        INITIAL STATUS
*
               . . . . .

***********************************************************************
*   LINE SPECIFICATION FOR 3174 ON PORT 196 (MODEM ATTACHMENT)       *
***********************************************************************
L06196   LINE  ADDRESS=(196,HALF),   LINE ADDRESS                     X
               CLOCKNG=EXT,          MODEM ATTACHMENT                 X
               SPEED=9600,           NPA USE ONLY                     X
               DUPLEX=FULL,          RTS SIGNAL IS ALWAYS ACTIVE      X
               NRZI=YES,             MODEM CHARACTERISTICS            X
               SERVLIM=10,                                            X
               ISTATUS=ACTIVE
*
               . . . . .
```

A.2 Channel Adapter Definitions

A channel adapter on a 3745 must be defined as a channel link. Therefore, a channel is defined using the GROUP and LINE definition statements instead of the BUILD definition statement.

```
***********************************************************************
*   CHANNEL ADAPTER GROUP SPECIFICATION                               *
***********************************************************************
G06CA    GROUP LNCTL=CA,                                              X
               ISTATUS=INACTIVE      STOP VTAM ACTIVATING CHANNEL LINK
***********************************************************************
*   CHANNEL ADAPTER LINE/PU SPECIFICATION   (CA01)                    *
***********************************************************************
L06CA1   LINE  ADDRESS=8,            CA PHYSICAL POSTION 1            X
               CA=TYPE6,             3745 CHANNEL ADAPTER TYPE        X
               NCPCA=ACTIVE,         NATIVE SUBCHANNEL (NSC)          X
               CASDL=120,            INTERVAL BEFORE CHANNEL SLOWDOWN X
               DELAY=0.2,            CHAN ATTN DELAY                  X
               TIMEOUT=120           INTERVAL BEFORE CHANNEL DISCONTACT
*
P06CA1   PU    PUTYPE=5,             HOST SUBAREA NODE                X
               TGN=1                 MUST BE ONE FOR PU TYPE 5
**
***********************************************************************
*   CHANNEL ADAPTER LINE/PU SPECIFICATION   (CA02)                    *
***********************************************************************
L06CA2   LINE  ADDRESS=9,            CA PHYSICAL POSTION 2            X
               CA=TYPE6,             3745 CHANNEL ADAPTER TYPE        X
               NCPCA=ACTIVE,         NATIVE SUBCHANNEL (NSC)          X
               CASDL=120,            INTERVAL BEFORE CHANNEL SLOWDOWN X
               DELAY=0.2,            CHAN ATTN DELAY                  X
               TIMEOUT=120           INTERVAL BEFORE CHANNEL DISCONTACT
*
P06CA2   PU    PUTYPE=5,             HOST SUBAREA NODE                X
               TGN=1                 MUST BE ONE FOR PU TYPE 5
**
```

When a channel is used for both NCP and EP in PEP mode, the LOCHAN and HICHAN keywords are required to specify the emulation subchannel address range. These address range must agree with the range defined in the Configuration Data File (CDF).

```
***********************************************************************
*   CHANNEL ADAPTER LINE/PU SPECIFICATION   (CA01)                    *
***********************************************************************
L06CA1   LINE  ADDRESS=8,            CA PHYSICAL POSTION 1            X
               CA=TYPE6,             3745 CHANNEL ADAPTER TYPE        X
               NCPCA=ACTIVE,         NATIVE SUBCHANNEL (NSC)          X
               LOCHAN=40,            LOW EMULATION SUBCHANNEL (ESC)   X
               HICHAN=5F,            HIGH EMULATION SUBCHANNEL (ESC)  X
               CASDL=120,            INTERVAL BEFORE CHANNEL SLOWDOWN X
               DELAY=0.2,            CHAN ATTN DELAY                  X
               TIMEOUT=120           INTERVAL BEFORE CHANNEL DISCONTACT
*
P06CA1   PU    PUTYPE=5,             HOST SUBAREA NODE                X
               TGN=1                 MUST BE ONE FOR PU TYPE 5
**
```

If a channel is used just for EP in PEP mode, NCPCA=INACTIVE should be specified, and then the LOCHAN and HICHAN keywords are required to specify the emulation subchannel address range.

```
**********************************************************************
*   CHANNEL ADAPTER LINE/PU SPECIFICATION   (CA01)                   *
**********************************************************************
L06CA1    LINE  ADDRESS=8,           CA PHYSICAL POSTION 1             X
                CA=TYPE6,            3745 CHANNEL ADAPTER TYPE         X
                NCPCA=INACTIVE,      NOT USED AS NATIVE SUBCHANNEL     X
                LOCHAN=40,           LOW EMULATION SUBCHANNEL (ESC)    X
                HICHAN=40,           HIGH EMULATION SUBCHANNEL (ESC)   X
                CASDL=120,           INTERVAL BEFORE CHANNEL SLOWDOWN  X
                DELAY=0.2,           CHAN ATTN DELAY                   X
                TIMEOUT=120          INTERVAL BEFORE CHANNEL DISCONTACT
*
P06CA1    PU    PUTYPE=5,            HOST SUBAREA NODE                 X
                TGN=1                MUST BE ONE FOR PU TYPE 5
**
```

A.3 X.21 Interface Definition

The X21NTWK keyword of the GROUP definition statement defines whether this line group attaches to an X.21 network and if so, the level of the X.21 network. This keyword is invalid for the 3720. The X21SW keyword is a VTAM-only parameter for the 3745. The X21SW keyword is valid only for an X.21 switched line.

The SPEED parameter is required to personalize the attached LIC. The attached LIC will be used as a LIC Type 4A if you specify the line speeds less than 9600 BPS for the lines on the LIC. Otherwise, it will be used as a LIC Type 4B.

```
**********************************************************************
*   GROUP SPECIFICATIONS FOR X.21 INTERFACE BNN LINE GROUP           *
**********************************************************************
G06X21    GROUP LNCTL=SDLC,          SDLC LINK PROTOCOL                X
                ANS=CONTINUE,        CONTINUE LINK SERVICE             X
                DIAL=NO,             NON-SWITCHED LINE                 X
                X21NTWK=1984,        X.21 INTERFACE LEVEL              X
**
**********************************************************************
*   LINE SPECIFICATION FOR 3274 ON PORT 134 (X.21 INTERFACE)         *
**********************************************************************
L06134    LINE  ADDRESS=(134,FULL),  LINE ADDRESS                      X
                CLOCKNG=EXT,         DSU ATTACHMENT                    X
                SPEED=9600,          LINE SPEED (FOR NPA AND LIC TYPE) X
                DUPLEX=FULL,         RTS SIGNAL IS ALWAYS ACTIVE       X
                NRZI=YES,            MODEM CHARACTERISTICS             X
                SERVLIM=10,          SCAN SERVICE ORDER TABLE          X
                ISTATUS=ACTIVE       INITIAL STATUS
*
                . . . . .
```

A.4 LIC5/LIC6 Line Definition

No special specification is required for lines on a LIC5 and a LIC6. Specifying LPDATS=LPDA2 is recommendable for LIC5 and LIC6 lines since the integrated modem of LIC5 and the integrated DSU/CSU of LIC6 support Link Problem Determination Aids (LPDA) and operate in normal mode (LPDA2).

```
***********************************************************************
*   LINE SPECIFICATION FOR 3174 ON PORT 264 (LIC5 ATTACHMENT)         *
***********************************************************************
L06264   LINE  ADDRESS=(264,FULL),   LINE ADDRESS                      X
               CLOCKNG=EXT,          INTEGRATED MODEM - LIC5           X
               SPEED=9600,           LINE SPEED (FOR NPA)              X
               DUPLEX=FULL,          RTS SIGNAL IS ALWAYS ACTIVE       X
               NRZI=YES,             MODEM CHARACTERISTICS             X
               LPDATS=LPDA2,         SUPPORT LPDA2                     X
               SERVLIM=10,           SCAN SERVICE ORDER TABLE          X
               ISTATUS=ACTIVE        INITIAL STATUS
*
               . . . . .
```

A.5 HSS Link Definitions

Valid addresses for HSS lines are from 1024 to 1039 when the 3745 is configured without TRAs. The addresses from 1024 to 1027 and from 1032 to 1035 cannot be used when configured with TRAs. When two 3745s are connected without modems, HSS provides clock speeds of 1843200, 1474560 and 245760 bps.

One of two links on a HSS can be activated at a time. If you specify MONLINK=YES for these HSS links, the NCP tries to activate both links to monitor them for an ACT PU command when the NCP is not in session with an SSCP on this link. This will cause line errors.

```
***********************************************************************
*   GROUP SPECIFICATIONS FOR SDLC INN LINKS (V.35 INTERFACE)          *
***********************************************************************
G06HSS1  GROUP LNCTL=SDLC,           SDLC LINK PROTOCOL                X
               MONLINK=NO,           NOT MONITOR ACT PU                X
               ANS=CONTINUE,         CONTINUE LINK SERVICE             X
               SDLCST=(SDL06PRI,SDL06SEC)
**
***********************************************************************
*   LINE SPECIFICATION FOR HPTSS INN LINK ON PORT 1028                *
***********************************************************************
L061028  LINE  ADDRESS=(1028,FULL),  LINE ADDRESS                      X
               DUPLEX=FULL,          RTS SIGNAL IS ALWAYS ACTIVE       X
               CLOCKNG=DIRECT,       DIRECT ATTACHMENT                 X
               SPEED=1843200,        LINE SPEED (FOR SCANNER AND NPA)  X
               NRZI=YES,             MODEM CHARACTERISTICS             X
               RETRIES=(7,3,5),      TRANSMISSION RETRIES              X
               ISTATUS=INACTIVE      INITIAL STATUS
**
***********************************************************************
*   PU SPECIFICATION FOR THE ADJACENT 3745 (SA07)                     *
***********************************************************************
P061028  PU    PUTYPE=4,             CONTROLLER NODE                   X
               TGN=8,                TRANSMISSION GROUP 8              X
               MODULO=128,           MODULO 128                        X
```

```
                MAXOUT=127,          MAX PIU'S SENT BEFORE RESP REQ    X
                ISTATUS=ACTIVE       INITIAL STATUS
**
************************************************************************
*   GROUP SPECIFICATIONS FOR SDLC INN LINKS (X.21 INTERFACE)           *
************************************************************************
G06HSS2  GROUP  LNCTL=SDLC,          SDLC LINK PROTOCOL                X
                MONLINK=NO,          NOT MONITOR ACT PU                X
                ANS=CONTINUE,        CONTINUE LINK SERVICE             X
                X21NTWK=1984,        X.21 INTERFACE LEVEL              X
                SDLCST=(SDL06PRI,SDL06SEC)
**
************************************************************************
*   LINE SPECIFICATION FOR HPTSS INN LINK ON PORT 1029                 *
************************************************************************
L061029  LINE   ADDRESS=(1029,FULL), LINE ADDRESS                      X
                DUPLEX=FULL,         RTS SIGNAL IS ALWAYS ACTIVE       X
                CLOCKNG=EXT,         DSU ATTACHMENT                    X
                SPEED=1544000,       LINE SPEED (FOR NPA)              X
                NRZI=YES,            MODEM CHARACTERISTICS             X
                RETRIES=(7,3,5),     TRANSMISSION RETRIES              X
                ISTATUS=INACTIVE     INITIAL STATUS
**
************************************************************************
*   PU SPECIFICATION FOR THE ADJACENT 3745 (SA07)                      *
************************************************************************
P061029  PU     PUTYPE=4,            CONTROLLER NODE                   X
                TGN=8,               TRANSMISSION GROUP 8              X
                MODULO=128,          MODULO 128                        X
                MAXOUT=127,          MAX PIU'S SENT BEFORE RESP REQ    X
                ISTATUS=ACTIVE       INITIAL STATUS
**
```

A.6 Subarea Dial Definitions

The Subarea Dial support is an expansion of switched boundary node support. Therefore, the Subarea Dial definition is similar to the switched boundary node definition.

The following shows a sample of VTAM Switched Major Node definition for one end of a Subarea Dial configuration. The value of IDNUM must match one at the other end of subarea link.

```
***********************************************************************
*          VTAM SWITCHED MAJOR NODE FOR SUBAREA DIAL SA03            *
***********************************************************************
SWPSD    VBUILD MAXGRP=5,              REQUIRED                       X
                MAXNO=12,              REQUIRED                       X
                TYPE=SWNET             REQUIRED
**
SW307    PU     SUBAREA=7,             SUBAREA TO BE DIALED           X
                PUTYPE=4,                                             X
                ANS=CONTINUE,                                         X
                IDNUM=0000B,                                          X
                MAXDATA=265,                                          X
                MAXPATH=2,                                            X
                TGN=8
**
SW07PATH PATH   DIALNO=2416,                                          X
                GRPNM=G06SWINN,                                       X
                REDIAL=1,                                             X
                GID=1,                                                X
```

```
PID=1
```

The following shows a sample definition of Subarea Dial corresponding to the VTAM Switched Major Node above.

```
**********************************************************************
*   GROUP SPECIFICATIONS FOR SDLC SWITCHED INN LINKS                 *
**********************************************************************
G06SWINN GROUP LNCTL=SDLC,          SDLC LINK PROTOCOL               X
               DIAL=YES,            MONITOR LINK FOR ACTPU           X
               PUTYPE=4,            REQUIRED FOR SUBAREA DIAL        X
               ACTIVETO=180,        ACTIVE TIME-OUT VALUE (SEC.)     X
               BRKCON=CONNECTO,     ENABLE TIMER AT CONNECTION TIME  X
               REPLYTO=3,           REPLY TIME-OUT VALUE (SEC.)      X
               TYPE=NCP
**
**********************************************************************
*   LINE / PU SPECIFICATION FOR SWITCHED INN LINK                    *
**********************************************************************
L06132   LINE  ADDRESS=(132,HALF),  LINE ADDRESS                     X
               CLOCKNG=EXT,         MODEM ATTACHMENT                 X
               SPEED=9600,          LINE SPEED (FOR NPA)             X
               DUPLEX=HALF,         RST SIGNAL IS NOT ALWAYS ACTIVE  X
               NRZI=YES,            MODEM CHARACTERISTICS            X
               CALL=INOUT,          INCOMING/OUTGOING CALLS          X
               AUTO=(133),          LINE ADDRESS FOR AUTO CALL UNIT  X
               RETRIES=(7,3,5),     TRANSMISSION RETRIES             X
               SDLCST=(SDL06PRI,SDL06SEC)
*
P06132   PU    PUTYPE=4             CONTROLLER NODE
**
```

A.7 Multipoint Subarea Definitions

In a Multipoint Subarea environment a primary or secondary link station should be predefined with the MODE keyword of the GROUP definition statement.

For the secondary station DUPLEX=HALF must be specified to prevent permanent RTS (Request to Send) signal, but either ADDRESS=(...,FULL) or ADDRESS=(...,HALF) can be coded. DUPLEX=HALF is not ignored even if ADDRESS=(...,FULL) is specified.

The following definition shows a sample for the primary station. The ADDR keyword on the PU definition statement specifies the polling address of a physical unit on the multipoint link.

```
**********************************************************************
*   GROUP SPECIFICATIONS FOR MULTIPOINT INN LINK (PRIMARY)           *
**********************************************************************
G06MPINN GROUP LNCTL=SDLC,          SDLC LINK PROTOCOL               X
               MODE=PRI,            PRIMARY NCP                      X
               ACTIVETO=180,        ACTIVE TIME-OUT VALUE (SEC.)     X
               REPLYTO=3,           REPLY TIME-OUT VALUE (SEC.)      X
               TYPE=NCP
**
**********************************************************************
*   LINE SPECIFICATION FOR MULTIPOINT INN LINK ON PORT 140           *
**********************************************************************
L06140   LINE  ADDRESS=(140,FULL),  LINE ADDRESS                     X
```

```
               CLOCKNG=EXT,          MODEM ATTACHMENT                  X
               SPEED=19200,          LINE SPEED (FOR NPA)              X
               DUPLEX=FULL,          RTS SIGNAL IS ALWAYS ACTIVE       X
               NRZI=YES,             MODEM CHARACTERISTICS             X
               NEWSYNC=NO,                                             X
               IPL=NO,               NO IPL PORT                       X
               MONLINK=YES,                                            X
               RETRIES=(7,3,5),      TRANSMISSION RETRIES              X
               SDLCST=(SDL06PRI),                                      X
               ISTATUS=INACTIVE      INITIAL STATUS
*
         SERVICE ORDER=(P06140A,P06140B,P06140C)
**
**********************************************************************
*   PU SPECIFICATION FOR THE ADJACENT SUBAREA - 3745 (SA07)          *
**********************************************************************
P06140A  PU    PUTYPE=4,             CONTROLLER NODE                   X
               ADDR=C1,              POLLING ADDRESS                   X
               TGN=8,                TRANSMISSION GROUP 8              X
               MAXOUT=7,             MAX PIU'S SENT BEFORE RESP REQ    X
               ANS=CONT,             CONTINUE LINK SERVICE             X
               ISTATUS=ACTIVE        INITIAL STATUS
**
**********************************************************************
*   PU SPECIFICATION FOR THE ADJACENT SUBAREA - 9370 (SA16)          *
**********************************************************************
P06140B  PU    PUTYPE=5,             CONTROLLER NODE                   X
               ADDR=C2,              POLLING ADDRESS                   X
               TGN=1,                TRANSMISSION GROUP 1              X
               MAXOUT=7,             MAX PIU'S SENT BEFORE RESP REQ    X
               ANS=CONT,             CONTINUE LINK SERVICE             X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
**
**********************************************************************
*   PU /LU SPECIFICATION FOR THE TRIBUTARY NODE (3174)               *
**********************************************************************
P06140C  PU    PUTYPE=2,             PERIPHERAL NODE                   X
               ADDR=C3,              POLLING ADDRESS                   X
               MAXDATA=265,          MAX DATA LENGTH TRANSMITTED       X
               MAXOUT=7,             MAX PIU'S SENT BEFORE RESP REQ    X
               PASSLIM=7             MAX PIU'S SENT AT ONE TIME        X
               PUDR=YES,             DYNAMIC RECONF                    X
               DISCNT=NO,            (V)                               X
               SSCPFM=USSSCS,        (V)                               X
               USSTAB=US327X,        (V)                               X
               VPACING=0,            (V)                               X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
**
L06140C1 LU    LOCADDR=2,            FIRST LU                          X
               PACING=1,             SET BY BIND IMAGE                 X
               MODETAB=AMODETAB,     (V)                               X
               DLOGMOD=M2SDLCNQ,     (V)                               X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
               . . . . . .
**
```

The following definition shows a sample for the secondary station. The TADDR keyword on the LINE definition statement specifies the polling address of the secondary stations attached to a subarea link. The value for ADDR defined in the primary station definition and the value for TADDR must correspond.

The station address specified in the link IPL port table of the 3745 must be equal to the polling address specified for the TADDR operand.

```
**********************************************************************
*   GROUP SPECIFICATIONS FOR MULTIPOINT INN LINK (SECONDARY)         *
**********************************************************************
G07MPINN GROUP LNCTL=SDLC,            SDLC LINK PROTOCOL             X
               MODE=SEC,              SECONDARY NCP                  X
               ACTIVETO=180,          ACTIVE TIME-OUT VALUE (SEC.)   X
               REPLYTO=3,             REPLY TIME-OUT VALUE (SEC.)    X
               TYPE=NCP
**
**********************************************************************
*   LINE SPECIFICATION FOR MULTIPOINT INN LINK                       *
**********************************************************************
L07140   LINE  ADDRESS=(140,FULL),    LINE ADDRESS                   X
               TADDR=C1,              POLLING ADDRESS                X
               CLOCKNG=EXT,           MODEM ATTACHMENT               X
               SPEED=19200,           LINE SPEED (FOR NPA)           X
               DUPLEX=HALF,           RTS IS REQUIRED HALF           X
               NRZI=YES,              MODEM CHARACTERISTICS          X
               NEWSYNC=NO,                                           X
               IPL=YES,               IPL PORT                       X
               MONLINK=YES,                                          X
               RETRIES=(7,3,5),       TRANSMISSION RETRIES           X
               ISTATUS=INACTIVE       (V) INITIAL STATUS
**
**********************************************************************
*   PU SPECIFICATION FOR THE ADJACENT SUBAREA - 3745 (SA06)          *
**********************************************************************
P07140A  PU    PUTYPE=4,              CONTROLLER NODE                X
               TGN=8,                 TRANSMISSION GROUP 8           X
               MAXOUT=7,              MAX PIU'S SENT BEFORE RESP REQ X
               DATMODE=HALF,          HALF DUPLEX OPERATION          X
               ANS=CONT,              CONTINUE LINK SERVICE          X
               ISTATUS=ACTIVE         INITIAL STATUS
**
```

A.8 Type 2.1 Node Definitions

Type 2.1 nodes can be coded as PUTYPE=2 in the same way as Type 2.0 nodes. The difference is that XID=YES must be specified for Type 2.1 nodes. Logical units within the Type 2.1 nodes can be "Independent LUs" or "Dependent LUs". Independent LUs are defined to VTAM and NCP as an LU with LOCADDR=0. The RESSCB keyword of the LU definition statement optionally reserves a certain number of boundary session control blocks for the independent LU. If you do not specify RESSCB=nn in an independent LU, NCP uses boundary session control blocks from the pool defined by the ADDSESS keyword of the BUILD definition statement.

You do not need to specify the following parameters for a Type 2.1 node, since values are exchanged between NCP and the Type 2.1 node during the XID3 negotiation:

- MAXDATA
- MAXOUT
- MODULO
- DATAMOD

```
*************************************************************************
*   PU SPECIFICATION FOR AS/400 AS A TYPE 2.1 NODE                      *
*************************************************************************
P06168A  PU    ADDR=C1,              POLLING ADDRESS                    X
               PUTYPE=2,             CONTROLLER NODE                    X
               XID=YES,              REQUIRED FOR T2.1 NODE             X
               ANS=CONT,             CONTINUE LINK SERVICE              X
               PASSLIM=7             MAX PIU'S SENT AT ONE TIME         X
               DISCNT=NO,            (V)                                X
               SSCPFM=USSSCS,        (V)                                X
               USSTAB=US327X,        (V)                                X
               VPACING=0,            (V)                                X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
**
*************************************************************************
*   T06168A1  FOR INDEPENDENT LU                                        *
*   T06168A5  FOR DEPENDENT LU - 3270 EMULATION                         *
*************************************************************************
T06168A1 LU    LOCADDR=0,            INDEPENDENT LU                     X
               RESSCB=10,            NUMBER OF LU-LU BOUNDARY SESSION   X
               PACING=7,                                                X
               MODETAB=AMODETAB      (V)                                X
               DLOGMOD=MODS36A,      (V)                                X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
               .  .  .  .  .

T06168A5 LU    LOCADDR=1,            DEPENDENT LU                       X
               USSTAB=USS372X,       (V)                                X
               MODETAB=AMODETAB      (V)                                X
               DLOGMOD=MODS36A,      (V)                                X
               ISTATUS=ACTIVE        (V) INITIAL STATUS
               .  .  .  .  .
**
```

A.9 NTRI Definitions

Valid addresses for TRA lines are from 1088 to 1095. A TIC (port) of TRA Type 1 can be used only for a peripheral link or only for a subarea link. It cannot be shared by both types of link. A TIC of TRA Type 2 can be shared by both types of link in conjunction with the then current NCP.

The second suboperand of ECLTYPE of the GROUP definition statement has been added to specify the link types, SUBAREA or PERIPHERAL. The minimum value of MAXTSL is 266 for physical subarea lines. For physical peripheral lines, it is still 265. PHYPORT is required for logical subarea lines. It remains optional for logical peripheral lines.

For logical subarea lines, the address of the destination subarea is required. The address (ADDR) has the following new format:

```
ADDR=aa4000bcccc
where: - "aa" is a hexadecimal non-zero multiple of 4.
       - "4000" must be coded explicitly.
       - The range of "b" is 0-7.
       - The range of each "c" is 0-9.
```

For physical subarea lines only PUTYPE=1 is valid. If you do not code PUTYPE, NDF adds the appropriate value to the generation definition. PUTYPE=4 should be specified for logical subarea lines, and is the default. and for

```
**********************************************************************
*   SDLC STATION FOR TOKEN-RING INN                                  *
**********************************************************************
TRIST06P SDLCST GROUP=PTRINN06,MODE=PRI
TRIST06S SDLCST GROUP=STRINN06,MODE=SEC
*
               . . . . .

**********************************************************************
*   NTRI SUBAREA PHYSICAL LINE GROUP - TIC #1  PORT=1088             *
**********************************************************************
EG06P00  GROUP ECLTYPE=(PHYSICAL,SUBAREA)
*
EL061088 LINE  ADDRESS=(1088,FULL),                                  X
               PORTADD=0,                                            X
               LOCADD=400001060000,                                  X
               MAXTSL=2044,                                          X
               RCVBUFC=4095
*
EP061088 PU    PUTYPE=1
*
**********************************************************************
*   NTRI PERIPHERAL PHYSICAL LINE GROUP - TIC #2  PORT=1089          *
**********************************************************************
EG06P01  GROUP ECLTYPE=PHYSICAL
*
EL061089 LINE  ADDRESS=(1089,FULL),                                  X
               PORTADD=1,                                            X
               LOCADD=400002060000,                                  X
               MAXTSL=1024,                                          X
               RCVBUFC=2048
*
EP061089 PU    PUTYPE=1
*
EU061089 LU    ISTATUS=INACTIVE
*
**********************************************************************
*   NTRI SUBAREA LOGICAL LINE GROUP - TIC #1  PORT=1088              *
**********************************************************************
PTRINN06 GROUP LNCTL=SDLC,DIAL=NO,MODE=PRI,ACTIVETO=420,REPLYTO=3
STRINN06 GROUP LNCTL=SDLC,DIAL=NO,MODE=SEC,ACTIVETO=420,REPLYTO=3
*
EG06L00  GROUP ECLTYPE=(LOGICAL,SUBAREA)                             X
               PHYPORT=0,                                            X
               SDLCST=(TRIST06P,TRIST06S)
*
LL061088 LINE  TGN=9
*
LP061088 PU    PUTYPE=4,                                             X
               ADDR=04400001070000
*
**********************************************************************
*   NTRI PERIPHERAL LOGICAL LINE GROUP - TIC #2  PORT=1089           *
**********************************************************************
EG06L00  GROUP ECLTYPE=LOGICAL,
               PHYPORT=1,
               CALL=INOUT,
               AUTOGEN=10
**
               . . . . .
```

Appendix B. NCP Generation and Dump Utility JCL

The JCL used to generate the NCP V5R1 load module using the NDF utility is printed in this appendix. Also included is the JCL for printing and dumping NCP, MOSS, and the Communication Scanner Processor (CSP).

The NDF JCL shown below includes the NEWDEFN DD statement which is necessary when generating NTRI support with the NCP. Also the NPM load library is concatenated with the STEPLIB DD statement to allow generation of the NPM RRTs. It is recommended that the PARM='FASTRUN=ON' parameter be added to the EXEC PGM=ICNRTNDF statement on the first run of this job. This specifies to NDF that only the validity and the syntax of the definition statements are checked. The production steps for table and link-edit source are bypassed.

```
//WTCR22A  JOB  (0-778225),BOB,MSGCLASS=O,MSGLEVEL=(1,1),
//              CLASS=I,NOTIFY=WTCR22
//*
//*        NCP GEN FOR NCP V5R1
//*
//NDF51    PROC NCP=,
//              SSPLIB='NCP425.SSPLIB',
//              NCPLIB='NCPGEN.NCPLOAD',
//              NCPSTG1='NCPGEN.INPUT'
//NDF      EXEC PGM=ICNRTNDF,REGION=6000K,PARM='LINECNT=45'
//STEPLIB  DD DSN=&SSPLIB,DISP=SHR
//         DD DSN=NPM13.V1R3M0.SFNMLMD1,DISP=SHR
//GENDECK  DD DSN=&NCPSTG1(&NCP),DISP=SHR
//SYSPRINT DD SYSOUT=*
//PRINTER  DD SYSOUT=*
//TBL1SRCE DD DSN=&&SRCE1,DISP=(,PASS),UNIT=SYSDA,
//            SPACE=(CYL,(6,2)),DCB=BLKSIZE=3200
//TBL1LIST DD DUMMY
//*BL1LIST DD DSN=ITSC.TBL1LIST,DISP=(NEW,CATLG),UNIT=3380,
//*      DCB=BLKSIZE=7260,SPACE=(CYL,(15,5)),VOL=SER=WTL927
//TBL1OBJ  DD DSN=&&OBJ(ICNTABL1),DISP=(,PASS),UNIT=SYSDA,
//            SPACE=(CYL,(1,1,1)),DCB=BLKSIZE=3200
//TBL2SRCE DD DSN=&&SRCE2,DISP=(,DELETE),UNIT=SYSDA,
//            SPACE=(CYL,(1,1)),DCB=BLKSIZE=3200
//TBL2LIST DD DUMMY
//TBL2OBJ  DD DSN=&&OBJ(ICNTABL2),DISP=(MOD,PASS),
//            DCB=BLKSIZE=3200,VOL=REF=*.TBL1OBJ
//SYSUT1   DD UNIT=SYSDA,SPACE=(CYL,(10,10)),DISP=(,DELETE)
//SYSLIB   DD DSN=NCP51.MAC3725,DISP=SHR,DCB=BLKSIZE=12960
//         DD DSN=NCP43725.EXIMAC,DISP=SHR
//         DD DSN=NCP43725.MAC3725X,DISP=SHR
//LNKSTMT  DD DSN=&&LNKFL,DISP=(,PASS),UNIT=SYSDA,
//            SPACE=(CYL,(1,1)),DCB=BLKSIZE=3200
//NEWDEFN  DD DSN=NCPGEN.SYSPUNCH(&NCP),DISP=SHR
//LINK   EXEC PGM=HEWL,COND=(8,LT),REGION=3072K,
//            PARM='LIST,NCAL,MAP,ALIGN4,LET,SIZE=(3000K,20K)'
//SYSLIN   DD DSN=*.NDF.LNKSTMT,VOL=REF=*.NDF.LNKSTMT,DISP=(OLD,DELETE)
//SYSPUNCH DD DSN=&&OBJ,DISP=(OLD,DELETE)
//OBJ3725  DD DSN=NCP51.OBJ3725,DISP=SHR
//EXILNK   DD DSN=NCP43725.EXILNK,DISP=SHR
//SYSLMOD  DD DSN=&NCPLIB,DISP=SHR
//SYSUT1   DD UNIT=SYSDA,SPACE=(2048,(800,100)),DCB=BLKSIZE=3200
//SYSPRINT DD SYSOUT=*
//          PEND
//*
```

```
//*                                CHANGE TO CORRECT     |
//*                                    NCP NAME          |
//*                                                      V
//NDF51     EXEC NDF51,NCPSTG1='NCPGEN.INPUT',NCP=RA6NCP5
//DBWORKFL DD DSN=&&WORKF,DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(1,1))
```

This JCL is used to print the NCP data from the dump data set called 'SA11.NCPDUMP'. In Chapter 7 is a description of the VTAM DUMP command which transfers the NCP dump data from the 3745. Note that the SYSUT2 dump data set is the same one that is specified on the NCPDUMP DD statement in the VTAM startup procedure.

```
//NCPDUMP   JOB (O-778225),'NCPDUMP',CLASS=I,MSGCLASS=O,MSGLEVEL=(1,1),
//          NOTIFY=WTCR22
//DUMP     EXEC  PGM=IFLDUMP
//STEPLIB  DD   DSN=NCP425.SSPLIB,DISP=SHR
//SYSPRINT DD   SYSOUT=*
//* SYSUT1 SPECIFIES THE UNIT ADDRESS OF THE 3745
//SYSUT2   DD   DSN=SA11.NCPDUMP,DISP=SHR
//SYSIN    DD   *
    DUMP   FORMAT=Y,BUF=F
//
```

This JCL is used to print the MOSS data from the dump data set called 'SA11.NCPDMOSS'. In Chapter 7 is a description of the VTAM DUMP command which transfers the MOSS dump data from the 3745. Note that the SYSUT2 dump data set is the same one that is specified on the NCPDMOSS DD statement in the VTAM startup procedure.

```
//NCPMOSS JOB (O-778225),'DMOSS',MSGCLASS=O,CLASS=I,
//              NOTIFY=WTCR22,MSGLEVEL=(1,1)
/* ROUTE PRINT RALYDPD3.WTCR22
//PRINT EXEC PGM=IFLDUMP
//STEPLIB DD DSN=NCP425.SSPLIB,DISP=SHR
//SYSUT2 DD DSN=SA11.NCPDMOSS,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSIN DD *
     DUMP
/*
```

This JCL is used to print the CSP data from the dump data set called 'SA11.NCPDCSP'. In Chapter 7 is a description of the VTAM DUMP command which transfers the CSP dump data from the 3745. Note that the SYSUT2 dump data set is the same one that is specified on the NCPDCSP DD statement in the VTAM startup procedure.

```
//NCPDCSP JOB (O-778225),'DCSP',MSGCLASS=O,CLASS=I,
//              NOTIFY=WTCR22,MSGLEVEL=(1,1)
/* ROUTE PRINT RALYDPD3.WTCR22
//PRINT EXEC PGM=IFLDUMP
//STEPLIB DD DSN=NCP425.SSPLIB,DISP=SHR
//SYSUT2 DD DSN=SA11.NCPDCSP,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSIN DD *
     DUMP
/*
```

Appendix C. VTAM Definitions for NTRI

The following code shows the switched major node definitions used for a downstream 3174-3R connected via a Token Ring LAN to the 3745 TRSS. As can be seen, two paths are defined in this definition for the 3174 to connect to the host, one via SA7 and the other via SA6. The path to SA7 is normally used, however if this path is unavailable, the path through SA6 will be used.

These definitions were tested during fallback of Twin-in-Backup mode, and the 3174 recovered without operator intervention.

```
**********************************************************************
*                                                                    *
*    3745 VTAM SWITCHED MAJOR NODE FOR NTRI TIC 2  (SA07)            *
*                                                                    *
**********************************************************************
E07SW    VBUILD MAXGRP=2,             REQUIRED NUMBER OF PATH GROUPS* X
                MAXNO=5,              REQUIRED NUMBER OF DIALNO     * X
                TYPE=SWNET            REQUIRED
**
**
**
E07PS03  PU     ADDR=04,                                            * X
                IDBLK=017,            3174-03R                      * X
                IDNUM=E0006,          3174-03R                      * X
                DISCNT=NO,                                          * X
                MAXOUT=1,                                           * X
                MODETAB=MODEVR,                                     * X
                MAXPATH=2,                                          * X
                VPACING=0,                                          * X
                PUTYPE=2,                                           * X
                SSCPFM=USSSCS,                                      * X
                DLOGMOD=VR03270,                                    * X
                USSTAB=US327X                                       *
**
E07D0301 PATH   DIALNO=0004400000314006,      CALL-OUT TO 3174-03R  * X
                GRPNM=EG07L03,                FROM TIC 2            * X
                GID=1,                                              * X
                PID=1
E07D0302 PATH   DIALNO=0004400000314006,      CALL-OUT TO 3174-03R  * X
                GRPNM=EG06L03,                FROM TIC 2            * X
                GID=1,                                              * X
                PID=2,                                              * X
                USE=NO                        INITIALLY INACTIVE
**
E07L0302 LU     LOCADDR=2
E07L0303 LU     LOCADDR=3
E07L0304 LU     LOCADDR=4
E07L0305 LU     LOCADDR=5
E07L0306 LU     LOCADDR=6
E07L0307 LU     LOCADDR=7
E07L0308 LU     LOCADDR=8
E07L0309 LU     LOCADDR=9
E07L0310 LU     LOCADDR=10
E07L0311 LU     LOCADDR=11
E07L0312 LU     LOCADDR=12
E07L0313 LU     LOCADDR=13
E07L0314 LU     LOCADDR=14
E07L0315 LU     LOCADDR=15
E07L0316 LU     LOCADDR=16
```

```
E07L0317 LU      LOCADDR=17
E07L0318 LU      LOCADDR=18
```

Appendix D. NCP Load/Dump Consideration

D.1 IPL Performance

The times taken to IPL a 3745 Model 210 are shown here. A single NCP load module that was used for these tests had a size of 760K bytes. The IPL time for a 3745 Model 410 (twin CCU) was found to be approximately twice that of a 3745 Model 210 (single CCU). Please note that this test was done for a particular configuration of 3745. The time taken to IPL is likely to vary for different machine configurations. The test cases are as follows:

- Disk load with power-on from the 3745 control panel

  The NCP was already saved on the 3745 disk and the automatic dump/load switch was 'ON' state.

- Disk load without power-on from the 3745 console

  The NCP was already saved on the 3745 disk and the automatic dump/load switch was 'ON' state.

- Disk load using VARY ACT command

  The NCP was already saved on the 3745 disk and the automatic dump/load switch was 'ON' state. The VTAM command used for load was:

  ```
  V NET,ACT,ID=ncpname,LOADFROM=EXT,LOAD=YES.
  ```

- Host load using VARY ACT command

  The automatic dump/load switch was 'OFF' state. The VTAM command used for load was:

  ```
  V NET,ACT,ID=ncpname,LOADFROM=HOST,LOAD=YES.
  ```

Initialization Phase	Disk Load with P/O at Panel		Disk Load w/o P/O at Console		Disk Load by VTAM		Host Load by VTAM	
	Time/Elapse		Time/Elapse		Time/Elapse		Time/Elapse	
Power on	00:00		–		–		–	
F00–Start of MOSS dump	00:00		–		–		–	
F01–End of MOSS dump	02:15	02:15	–		–		–	
F02–Start of MOSS IML	02:15		–		–		–	
F0E–End of MOSS IML	02:55	00:40	–		–		–	
FF1–CCU Initialization	02:55	00:40	00:00	00:45	00:00	00:40	00:00	00:45
FF2–CLDP	03:35	00:13	00:45	00:13	00:40	00:13	00:45	00:11
FF3–Scanner IML	03:48	00:42	00:58	00:57	00:53	00:55	00:56	00:56
FF4–CP Load and Init.	04:30		01:55		01:48		01:52	
FD6–Load from Disk	04:30		01:55		01:48		–	
000–Load Completion	04:38	00:08	02:03	00:08	01:56	00:08	02:08	00:16
Elapsed Time (mm:ss)		04:38		02:03		01:56		02:08

Figure 117. IPL Elapsed Time

D.2 Improvements for Load/Dump

The time taken to load and dump a remote NCP can be greatly improved by changing a constant value in VTAM 3.1.1. The VTAM constant module (ISTRACON) has the size of the request unit, used by VTAM when taking a static dump or loading a remote NCP, at offset 4E-4F in field named RACBUFSZ. This size is normally 512 bytes. Other values that can be specified are 1024 and 2048. Tests with an RU size of 2048 showed a decrease in loading time of 60%. For further information and restrictions see manual VTAM V3R1.1 Customization (SC23-0112-3), page 3-78. This function can also be implemented by a PTF on VTAM V3R1 for MVS/XA. The APAR number is OZ95756.

Appendix E. Console Attachments

E.1 3101 Emulation Mode

The consoles for the 3745 must operate in the 3101 emulation mode. Any terminal equipments that is compatible with the IBM 3101 can be used as a local console, remote console, or alternate console.

The operation conditions of 3101 emulation mode are as follows:

```
- Operation Mode   : Block
- Transmit Mode    : HDX
- Interface        : RS-232C
- Line Control     : PRTS
- Ending Chara.    : XOFF
- Stop Bit         : One for a local and alternate console
                   : Two for a remote console
- Parity           : Even
- Time Filler      : None
- Null Suppress    : On
- Carriage Return  : CR
- Line Speed       : 2400 bps for a local and alternate console
                     1200 bps for a remote console
```

E.2 IBM 3161 and IBM 3163 as Console

The IBM 3161 and IBM 3163 can be used as a local, remote, or alternate console.

The 'SETUP' and 'SELECT' options are to be set up as follows:

Machine mode	IBM3101
Operating mode	BLOCK
Interface	RS232C
Line Control	PRTS
Line Speed	2400 Local/Alt. 1200 Remote
Parity	EVEN
Turnaround character	DC3
Stop bit	1 Local/Alt. 2 Remote
Word length	7
Response delay (ms)	100
Break signal (ms)	500

Figure 118. 3101/3163 Setup Options

```
SCROLL=OFF RETURN=CR LINE WRAP=ON AUTO LF=ON SEND=PAGE NULL SUPP=ON
```

Figure 119. IBM 3161/3163 Select Options

E.3 IBM 3151 as Console

The 3151 models 310/360 and 410/460 with feature 8235 offer 3101 emulation mode. They can be used as the 3745 local, alternate, or remote console.

When the 3151 is used as a remote console for the 3745, the 3151 must be set up with one stop bit option.

E.4 IBM 3727 as Console

When the IBM 3727 is used as a console, the following key correspondence must be observed:

3745 F-Keys	Correspondent 3727 Key
F1	SELN AREA
F2	CCU FUNCTN
F3	MSG
F4	PF1
F5	PF2
F6	PF3
F7	PF4
F8	PF5

Figure 120. IBM 3727 Key Correspondence

E.5 IBM PC as Console

The following options are to be chosen to use an IBM PC as a console:

```
- Line Speed (Baud Rate) to be used ?    : 2400/1200
  (2400 for local 1200 for remote)
- Block Mode ? (Y=Block N=Character)     : Y
- Parity ? (1=Odd 2=Even 3=Mark 4=Space) : 2
- Stop Bits ? (1 or 2)                   : 1 (Local/Alternate)
                                           2 (Remote)
- Automatic Line Feed ? (Y=Yes N=No)     : Y
- Carriage Return ? (Y=CR N=CR-LF)       : Y
- Null Suppress ? (Y=Yes N=No)           : Y
- Character Sent at End of Message ?     : 4
  (1=ETX 2=CR 3=EOT 4=XOFF)
- Scrolling ? (Y=Yes N=No)               : N
```

Appendix F. Bibliography

F.1 IBM 3745 Documents

GA33-0092 3745 Introduction

GA33-0093 3745 Configuration Guide

GN22-2337 TNL to Physical Planning Manual

GA33-0102 3745 Principles of Operation

GA33-0099 3745 OEM Information

GA33-0094 3745 LIC and Cable Guide

GA33-0098 3745 Basic Operations Guide

GA33-0097 3745 Advanced Operations Guide

GA33-0096 3745 Problem Determination Guide

F.2 VTAM Documents

VTAM V3R1.1 PTF UY90092 documentation (Support for the 3720 disk)

VTAM V3R1.1 PTF UY90127 documentation (Support for the 3745 disk)

SC23-0111 VTAM V3R1 & V3R1.1 Installation and Resource Definition

SC23-0112 VTAM V3R1 & V3R1.1 Customization

F.3 NCP Documents

SC30-3348 NCP V5 Generation and Loading Guide

SC30-3440 NCP V5 Migration Guide

SC30-3447 NCP V5 Resource Definition Guide

SC30-3448 NCP V5 Resource Definition Reference

SC30-3169 NCP V5 Messages and Codes

LY30-5603 NCP V5 Reference Summary and Data Areas

LY30-5606 NCP V5 Customization Guide

LY30-5607 NCP Customization Reference

LY30-5591 NCP Diagnosis Guide

LY30-5605 NCP V5 Reference

F.4 Tuning Documents

GG24-1629 Tuning & Problem Analysis for NCP/SDLC Devices

Appendix G. Abbreviations

Abbrev.	Definition
AIT	Average Instruction Time
ALU	Arithmetic and Logic Unit
BER	Box Error Record
bps	bits per second
BSC	Binary Synchronous Communication
CA	Channel Adapter
CCU	Central Control Unit
CDF	Configuration Data File
CF3745	IBM Configurator and Performance Aid
CLDP	Controller Load and Dump Program
CNM	Communications Network Management
CS	Communications Scanner
CSP	Communications Scanner Processor
CSS	Control Subsystem
CSU	Customer Setup Unit
DCE	Data Circuit-terminating Equipment
DMA	Direct Memory Access
DMUX	Double Multiplexer
DTE	Data Terminal Equipment
EC	Engineering Change
ECC	Error Correcting Code
EP	Emulation Program
EPO	Emergency Power Off
ESC	Emulation Subchannel
FC	Feature Code
FDX	Full-Duplex lines
FESL	Front End Scanner for Low-Speed Scanner
FESH	Front End Scanner for High-Speed Scanner
FRU	Field Replaceable Unit
GCF	Graphical Configuration File
HCS	Hardware Central Support
HDX	Half-Duplex lines
HPTSS	High Performance Transmission Subsystem

HSS	High-Speed Scanner
ICA	Integrated Channel Adapter
ICF	Internal Clock Function
IML	Initial Microprogram Load
INN	Intermediate Network Node
IOH	Adapter Input Output
IPL	Initial Program Load
LDF	Line Description File
LIC	Line Interface Coupler
LPDA	Link Problem Determination Aid
LSI	Large Scale Integration
LSS	Low-Speed Scanner
LSSD	Level Scan Sensitive Design
MES	Miscellaneous Equipment Specification
MIOC	MOSS Input Output Control
MLC	Machine Level Control
MOSS	Maintenance and Operation Subsystem
MPX	Multiplexer
MSA	Machine Status Area
NCCF	Network Communication and Control Facility
NCP	Network Control Program
NEO	Network Expansion Option
NPA	Network Performance Analyzer
NPDA	Network Problem Determination Aid
NPM	NetView Performance Monitor
NPSI	Network Packet Switching Interface
NRF	Network Routing Facility
NSC	Native Subchannel
NSI	Non-SNA Interconnect
NTO	Network Terminal Option
NTRI	NCP Token-Ring Interconnection
PEP	Partitioned Emulation Programming Extension
PIO	Program Initiated Operation
PTF	Programming Temporary Fix
RAS	Reliability, Availability and Serviceability
RECFMS	Record Formatted Maintenance Statistics

RECMS	Record Maintenance Statistics
REQMS	Request Maintenance Statistics
RPO	Remote Power Off
RPQ	Request for Price Quotation - special engineering
RSF	Remote Support Facility
S/S	Start-Stop
SCTL	Storage Control
SDLC	Synchronous Data Link Control
SIA	System Input Area
SIT	Scanner Interface Trace
SSP	System Support Program
TIC	Token-Ring Interface Coupler
TPNS	Teleprocessing Network Simulator
TPS	Two Processor Switch
TRA	Token-Ring Adapter
TRM	Token-Ring Multiplexer
TRSS	Token-Ring Subsystem
TSS	Transmission Subsystem
UEPO	User Emergency Power Off
VTAM	Virtual Telecommunication Access Method
XI	X.25 SNA Interconnection
XI-NSF	XI Network Supervisory Function

Appendix H. Glossary

This glossary defines 3745 terms used in this manual.

adapter-initiated operation (AIO). A transfer of up to 256 bytes between an adapter (CA or LA) and the CCU storage. The transfer is initiated by an IOH/IOHI instruction, and is performed in cycle stealing via the IOC bus.

alarm. A message sent to the MOSS console. In case of an error a reference code identifies the nature of the error.

alert. A message sent to the host console. In case of an error a reference code identifies the nature of the error.

autoBER. A program to automatically analyze a BER file.

automaint. A function that uses autoBER to isolate failing FRUs.

box event record (BER). Information about an event detected by the controller. It is recorded on the disk/diskette and can be displayed on the operator console for event analysis.

block multiplexer channel. A multiplexer channel that interleaves blocks of data. See also byte multiplexer channel. Contrast with selector channel.

byte multiplexer channel. A multiplexer channel that interleaves bytes of data. See also block multiplexer channel. Contrast with selector channel.

central control unit (CCU). In the 3745, the controller hardware unit that contains the circuits and data flow paths needed to execute instructions and to control its storage and the attached adapters.

channel adapter (CA). A communication controller hardware unit used to attach the controller to a host processor.

clear channel. Mode of data transmission where the data passes through the DCE and network, and arrives at the receiving communication controller unchanged from the data transmitted. The DCE or network can modify the data during transmission because of certain network restrictions, but must ensure the received data stream is the same as the transmitted data stream.

communication controller. A communication control unit that is controlled by one or more programs stored and executed in the unit. Examples are the IBM 3705, IBM 3725/3726, IBM 3720, and IBM 3745.

communication scanner processor (CSP). The processor of a scanner.

communication subsystem. The part of the controller that controls the data transfers over the transmission interface.

configuration data file (CDF). A MOSS file that contains a description of all the hardware features (presence, type, address, and characteristics).

control panel. A panel that contains push-buttons and indicators for the use of the customer's operator and service personnel.

control program. A computer program designed to schedule and to supervise the execution of programs of the controller.

control subsystem (CSS). The part of the controller that stores and executes the control program, and monitors the data transfers over the channel and transmission interfaces.

data circuit-terminating equipment (DCE). The equipment installed at the user's premises that provides all the functions required to establish, maintain, and terminate a connection, and the signal conversion and coding between the data terminal equipment (DTE) and the line. For example, a modem is a DCE (see modem.)

Note: The DCE may be separate equipment or an integral part of other equipment.

data terminal equipment (DTE). That part of a data station that serves as a data source, data link, or both, and provides for the data communication control function according to protocols.

direct attachment. The attachment of a DTE to another DTE without a DCE.

high-performance transmission subsystem (HPTSS). The part of the controller that controls the data transfers over the high-speed transmission interface (speed up to 2 million bps).

high-speed scanner. Line adapter for lines up to 2 million bps, composed of a communication scanner processor (CSP) and a front-end high-speed scanner (FESH).

initial microcode load (IML). The process of loading the microcode into a scanner or into MOSS.

initial program load (IPL). The initialization procedure that causes 3745 control program to begin operation.

input/output control (IOC). The circuit that controls the input/output from/to the channel adapters and scanners via the IOC bus.

internal clock function. A LIC function that provides a transmit clock for sending data, and retrieves a receive clock from received data, when the modem does not provide those timing signals. When the terminal is connected in direct attach mode (without modem) the ICF also provides the transmit and receive clocks to the terminal, via the LIC card.

line adapter (LA). The part of the TSS, HPTSS, or TRSS that scans and controls the transmission lines. Also called scanner. For the TSS the line adapters are low-speed scanners (LSSs). For the HPTSS the line adapters are high-speed scanners (HSSs). For the TRSS the line adapters are token-ring adapters (TRAs).

line interface coupler (LIC). A circuit that attaches up to four transmission cables to the controller.

low-speed scanner. Line adapter for lines up to 256 kbps, composed of a communication scanner processor card (CSC).

maintenance and operator subsystem (MOSS). The part of the controller that provides operating and servicing facilities to the customer's operator and the IBM service representative.

NetView. An IBM licensed program used to monitor a network, manage it, and diagnose its problems.

Network Control Program (NCP). An IBM licensed program that provides communication controller support for single-domain, multiple-domain, and interconnected network capability.

operator console. The IBM Operator Console that is used to operate and service the communication controller (CC) through the MOSS. Optionally an alternate console may be installed up to 120 m from the CC, or a remote console may be connected to the CC through the switched network.

scanner. A device that scans and controls the transmission lines. Also called line adapter.

selector channel. An I/O channel designed to operate with only one I/O device at a time. Once the I/O device is selected, a complete record is transferred one byte at a time. Contrast with block multiplexer channel, multiplexer channel.

Systems Network Architecture (SNA). The description of the logical structure, formats, protocols, and operational sequences for transmitting information through a user application network. The structure of SNA allows the users to be independent of specific telecommunication facilities.

token-ring subsystem (TRSS). The part of the controller that controls the data transfers over an IBM Token-Ring Network. The TRSS consists of one token-ring adapter (TRA).

token-ring adapter (TRA). Line adapter for an IBM Token-Ring Network, composed of one token-ring multiplexer card (TRM), and two token-ring interface couplers (TICs).

transmission subsystem (TSS). The part of the controller that controls the data transfers over low and medium speed, switched and non-switched transmission interfaces. The TSS consists of:

- Up to six low speed scanners (LSSs) associated with
- LIC boards (LIBs), through
- Serial links (SLs).

two-processor switch (TPS). A feature of the channel adapter that connects a second channel to the same channel adapter.

V.24, 25, 35. EIA/CCITT recommendations on transmission interfaces

X.20 bis, 21, 21 bis, 21 native, 25. CCITT recommendations on transmission interfaces

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