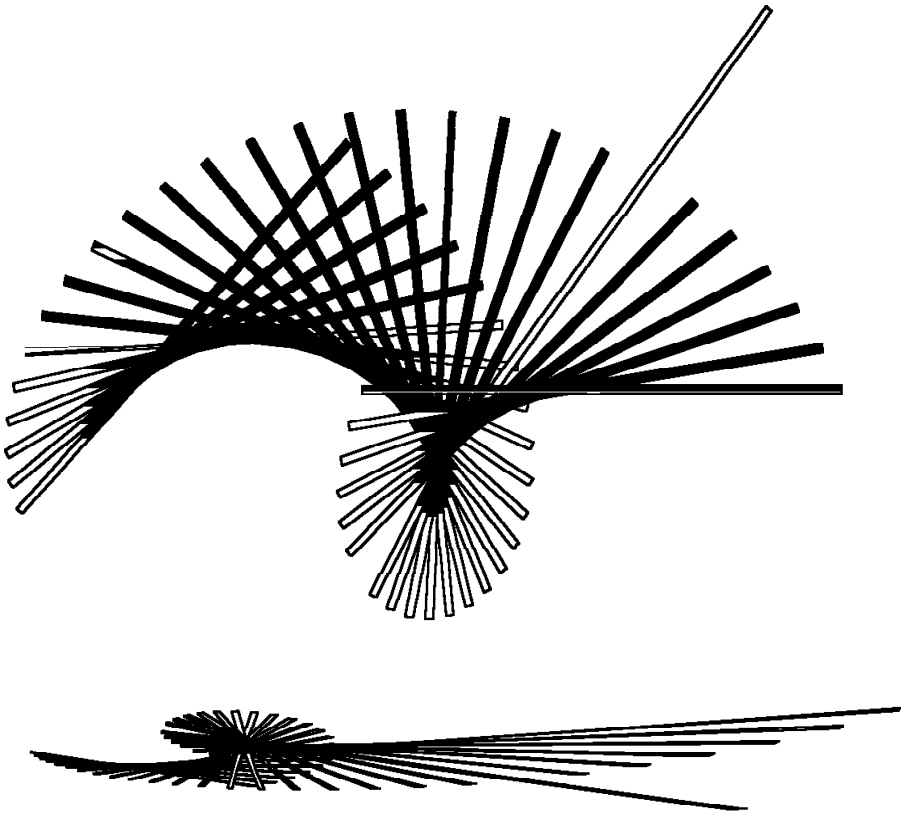
IBM 3745 Communication Controller
Models 130, 150, and 170

Introduction



GA33-0138-2

IBM 3745 Communication Controller
Models 130, 150, and 170

Introduction

GA33-0138-2

Third Edition (June 1991)

This major revision obsoletes and replaces GA33-0138-1. It reflects new enhancements to the IBM 3745 Communication Controller Models 130, 150, and 170. Changes or additions to the text and illustrations are showed by a vertical line to the left of the change.

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- The phrase *instruction manual* means this manual and:

  IBM System/360, System/370, 4300 Processors: Input/Output Equipment Installation Manual - Physical Planning, GC22-7064

  IBM 3745-130/150/170 Preparing for Connection, GA33-0140.

  IBM 3745 Communication Controller: Connection and Integration, SA33-0141.

  For Canada, Canadian Department of Communication Statement, GX27-3883 applies.

IBM 3745 Communication Controller Model 130, 150, or 170 with an IBM 3151 Display Station as Operator Console.

Note: This picture shows the design model only.

About This Book

How to Use This Book

This book has been written to help you understand the basic concepts of IBM communication controllers, and especially the key advantages and capabilities of the IBM 3745 Communication Controller Models 130, 150, and 170 for your network. These controllers and the appropriate programming support are described; as well as the powerful problem determination mechanisms and the controller maintenance philosophy. *The text in color is for fast reading and understanding the main functions of the product.* The smaller black text describes details for specialists to help them plan their network.

The charts at the back of the manual can be removed to make foils for presentations when required.

Who Should Use This Book

This book is for network specialists, data processing managers, and planners who want to learn about and evaluate the capabilities of the IBM 3745 Communication Controller Models 130, 150, and 170 in their data communication network.

The reader is assumed to be familiar with data communication networks

Terms Used in This Book

A list of abbreviations is provided at the back of the book.

The term 3745 applies to the 3745 Models 130, 150, or 170. Sometimes the model numbers are added to 3745 when a precise discrimination between 3745 models 210/310/410/610 and 130/150/170 is necessary.

The term Network Control Program (NCP) stands for Advanced Communications Function for the Network Control Program (ACF/NCP) when used alone.

The terms DCE and DTE used throughout this book stand for:

DCE Data circuit-terminating equipment (such as modems, data service units, or auto-call units)

DTE Data terminal equipment.

What is New in This Book

The additional text, showed by revisions bars to the left, describes the latest enhancements:

- Attachment to Ethernet** Version 2 and IEEE 802.3 local area network (LAN).
- Timed initial program load (IPL).
- Rename load module function.

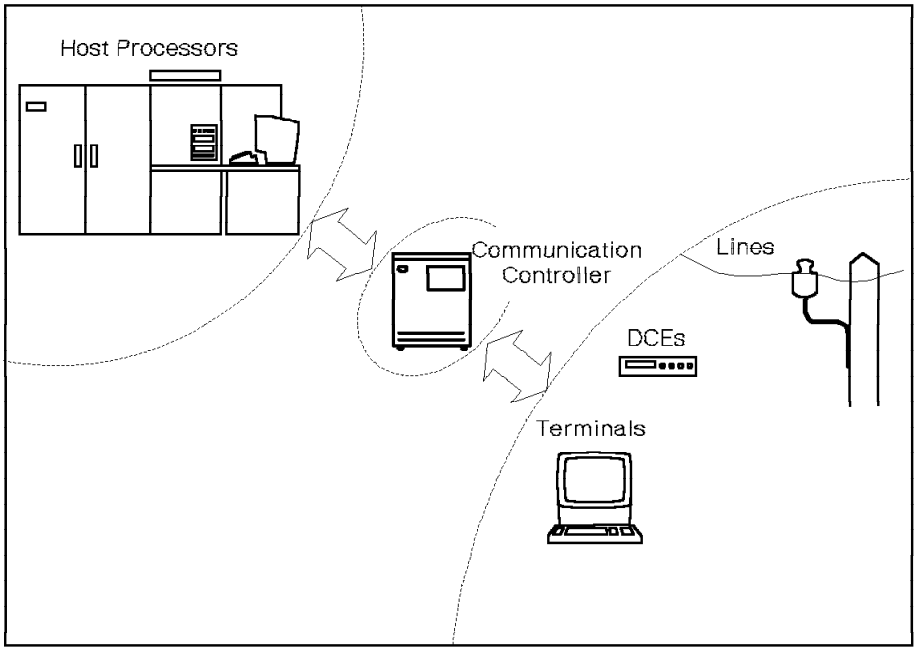
- 3745 installation and reconfiguration improvements.

Where to Find More Information

The “Bibliography” on page X-11. lists 3745 manuals according to the user tasks they describe.

Contents

Chapter 1. Highlights



In today's communication networks, the communication controllers save much data processing power by handling sophisticated functions to control the data flow between host processors and the network of terminals.

The IBM communication controllers are intelligent and multifunctional systems dedicated to communications. They are able to serve as nodes (data processing center nodes, distributed data processing center nodes, concentrator access nodes, intermediate routing nodes) in the network.

Intelligent *refers to their ability to dynamically alter certain characteristics of the network, like routes.*

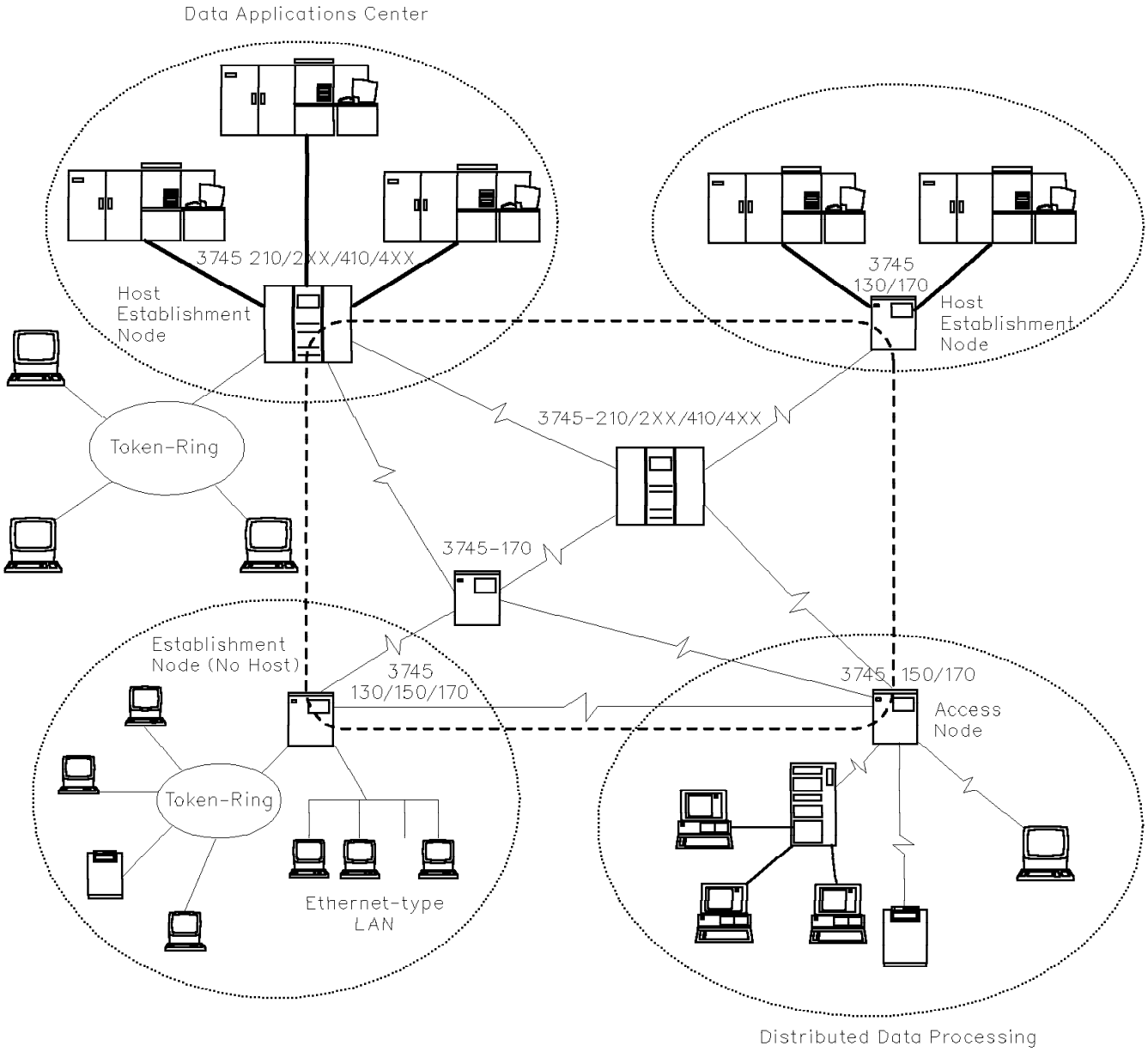
Multifunctional *refers to their capability of taking advantage of the SNA software facilities stored in the IBM communication controllers to perform functions such as:*

- *Route selection*
- *Multihost access*
- *Data switching*
- *Network management*
- *Message sequencing*
- *Pacing*
- *Flow control.*

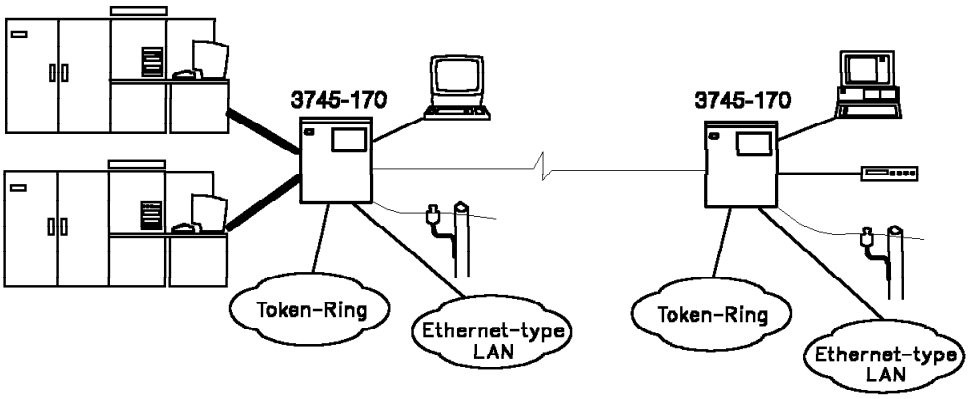
in addition to the physical transmission and reception of data.

The IBM communication controllers run under control of the Network Control Program (NCP) stored in their own storage and generated in the host using the System Support Programs (SSP).

IBM 3745 Communication Controllers in a Typical Network



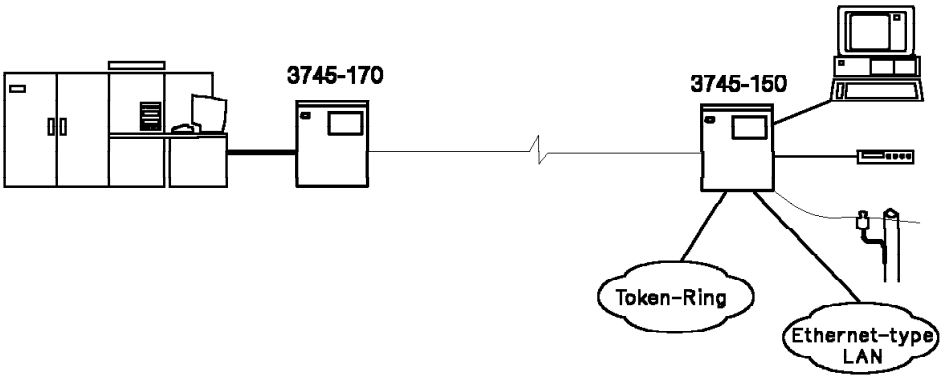
3745 Model 170 Environment



4 Channel adapters
96 Low/medium-speed lines
32 Integrated DCEs (Modems/DSUs)
4 High-speed lines (2 active at a time)
2 Token-rings
| 4 Ethernet-type LANs

| *NOTE:* ***All the above connection capabilities might not be present at the same time as some items are mutually exclusive (see*** IBM 3745 Configuration Program, ***GA33-0093).***

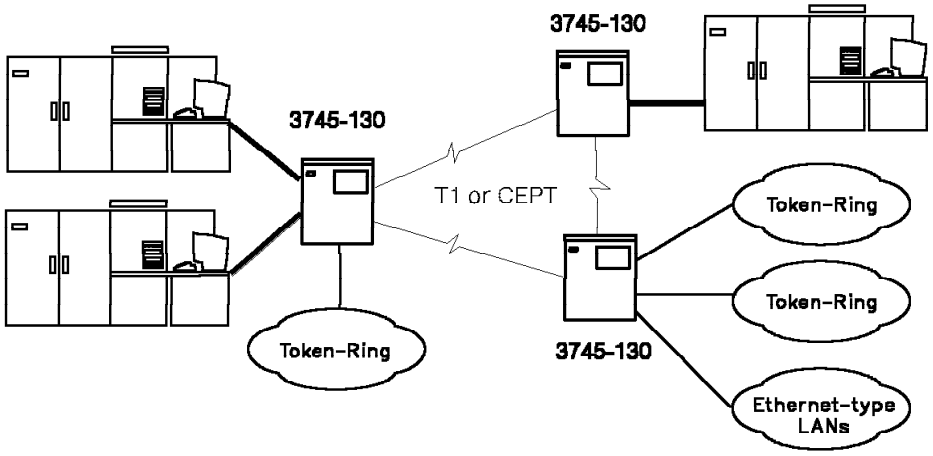
3745 Model 150 Environment



32 Low/medium-speed lines
16 Integrated DCEs (Modems/DSUs)
2 High-speed lines (1 active at a time)
2 Token-rings
| 2 Ethernet-type LANs

NOTE: ***All the above connection capabilities might not be present at the same time as some items are mutually exclusive (see*** IBM 3745 Configuration Program, ***GA33-0093).***

3745 Model 130 Environment



- 4 Channel adapters
- 4 High-speed lines (2 active at a time)
- 4 Token-rings
- 4 Ethernet-type LANs

NOTE: ***All the above connection capabilities might not be present at the same time as some items are mutually exclusive (see*** IBM 3745 Configuration Program, ***GA33-0093).***

IBM 3745-130/150/170 Communication Controller Connectivity

The following figure shows that, a 3745-130/150/170 can be:

1 **Channel-attached** *(via a channel adapter) to one or more hosts.*

2 **Link-attached** *(via telecommunication facilities) to a host through another IBM communication controller (allowing a 3745-130/150/170 to be used as a remote concentrator).*

Then, the 3745-130/150/170 allows simultaneous connection to:

a *Other IBM communication controllers, via high-speed lines (such as T1 or CEPT) and their associated DCEs.*

b *Other IBM communication controllers, via medium or high-speed lines and their associated DCEs.*

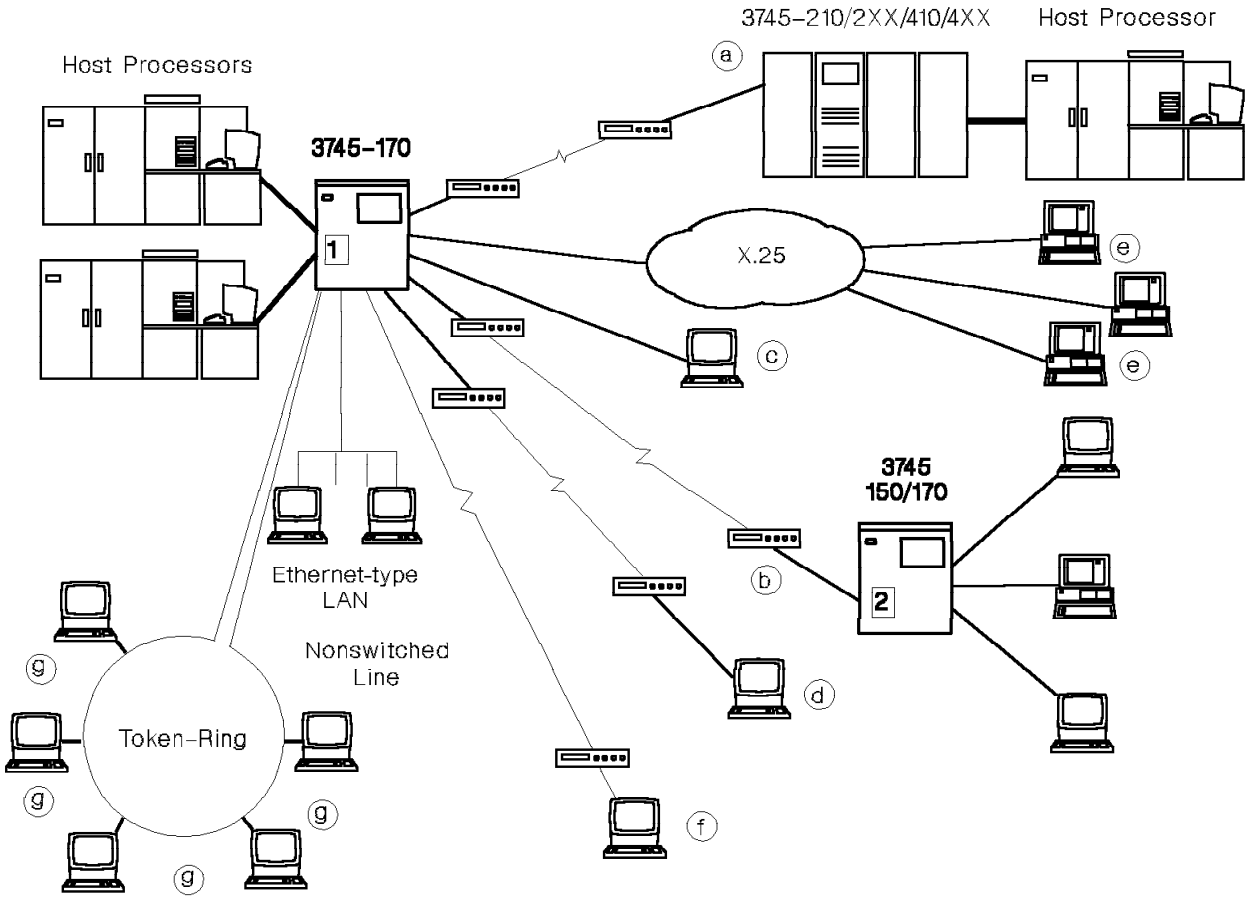
c *Local clusters and terminals, directly attached without DCE.*

d *Remote clusters and terminals, via stand-alone DCEs and telecommunication facilities (switched or nonswitched).*

e *Remote communication controllers, clusters, and terminals, via X.25 public data networks.*

f *Remote communication controllers, clusters, and terminals, via integrated DCEs and 4-wire nonswitched telecommunication facilities or DDS network in U.S.A.*

g *Communication controllers, clusters, and terminals on IBM token-ring local area networks or on Ethernet-type local area networks.*



These capabilities allow network growth by permitting combinations of 3745-130/150/170 with other IBM communication controllers.

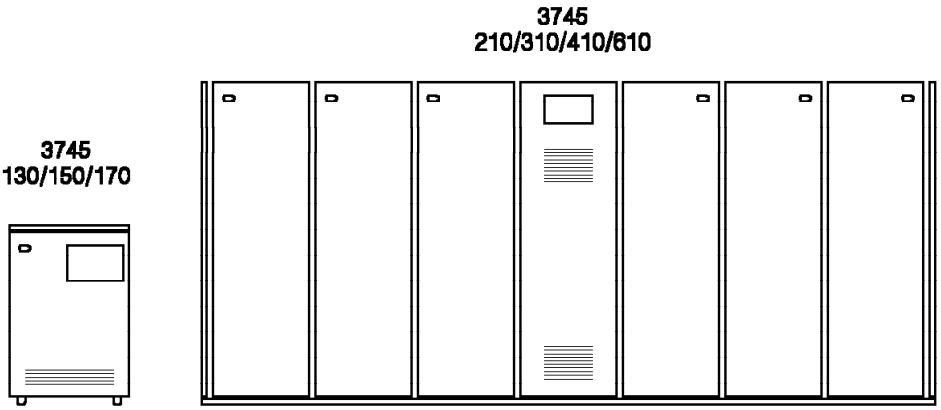
Different combinations of channel, transmission line, Ethernet-type network, and token-ring network attachments are possible.

The modularity of the 3745-130/150/170 hardware and control programs provides a high degree of flexibility in configuring and reconfiguring the networks.

The host processors connected to a 3745-130/150/170 can be the IBM 4341, 4361, 4381, 937X, 308X, 3090*, or ES/9000* Processors.

IBM 3745 Models 130, 150, and 170

The 3745 Communication Controller Models 130, 150, and 170 complement the IBM 3745 communication controller family and are compatible with IBM communication controllers: 3705, 3725, 3720, 3745 models 210, 310, 410, and 610.



	3745 130	3745 150	3745 170	3745 210	3745 310	3745 410	3745 610
CCU	1	1	1	1	1	2	2
Main storage (MB)	8	8	8	8	8	2 x 8	2 x 8
Channel adapters	4	0	4	16	16	16	16
Low/medium-speed lines	0	32	96	896	896	896	896
Integrated DCEs (Modems/DSUs)	0	16	32	416	416	416	416
High-speed lines	4*	2*	4*	16*	16*	16*	16*
Token-rings	4	2	2	8	8	8	8
Ethernet-type LANs	4	2	4	16	16	16	16

* Half are active at one time

NOTE: ***All the above connection capabilities might not be present at the same time as some items are mutually exclusive (see*** IBM 3745 Configuration Program, ***GA33-0093).***

Chapter 2. IBM 3745 Models 130, 150, and 170 Highlights

Like the IBM 3745 models 210, 310, 410, and 610 the IBM 3745 models 130, 150, and 170 contribute to improved availability, performance, usability, *and* connectivity *of the network. IBM 3745 models 130, 150, and 170 also provide a high degree of reliability and an advantageous* price/performance ratio.

Availability

The IBM 3745 models 130, 150, and 170 offers increased availability characteristics. Some of them enhance the operational aspect of managing local or remote controllers. Also, the LSI technology ensures higher reliability.

The main characteristics contributing to high availability are:

- Hot pluggability, which allows the user to remove, add, or replace a LIC while the 3745 is operational. Plugging or unplugging does not affect the other line operation.
- External cable plugging/unplugging by the user.
- Concurrent diagnostics. Most components and subsystems can be diagnosed while the 3745 continues to run.
- Remote support facility.

The following capabilities also enhance the availability of the controller operation:

- Scheduled power on.
- Concurrent and scheduled IPL in all network communication controller nodes (Timed IPL function)
- Up to two control program load modules stored on the communication controller's integrated hard disk. This allows fast and nondisruptive control program loading.
- One central control unit (CCU) dump module, also on the integrated hard disk. This allows fast dumping after CCU failure.
- Remote access to the maintenance and operator subsystem (MOSS).
- Improved error messages and error checking and correction (ECC).

Performance

The system performance of a 3745 model 130, 150, or 170 is higher than for a 3720 or a 3725.

The main elements contributing to higher performance are:

- Increased CCU performance: about 1.5 times the 3725; about 4 times the 3720.
- "Cache" high-speed buffer (HSB) with a capacity of 32KB (KB equals 1024 bytes). This lets the transfer of instructions and data from main storage match the CCU cycle time.
- Main storage of 4 or 8MB (MB equals 1 048 576 bytes).

- Configuration of channel adapters (CAs) for a maximum of four host connections, optionally with data streaming protocol.
- High-performance transmission subsystem (HPTSS) with SDLC high-speed lines (1.5 Mbps with T1 clear channel or 2 Mbps with CEPT clear channel).
- Direct memory access (DMA) with DMA bus, allowing the high-performance transmission subsystem (HPTSS) to work efficiently by transferring data directly to or from main storage.
- Selective scanning, ensuring increased flexibility for LIC configurations and reduced scanning load. Only the LICs with active connected lines are scanned.

Usability

The 3745 design contains a user access area. Access to such areas enables the user to install, remove, or repair devices (line interface couplers and cables) while the controller is operating (hot pluggability). The LIC can be plugged or unplugged without disturbing the scanner or impairing the network.

At 3745 initial installation, IBM service will do the standard cable installation, connection, and testing. IBM service will also install LIC MES cables at user request. After 3745 initial installation, the user can install and connect external cables, except channel cables.

Network IPL operations are now easier with a shorter execution time. The timed IPL function allows restarting a large network, or part of it, including several nodes, at a scheduled time, from one port of this network. See also “Automatic Control Program Load” on page 3-4.

Enhanced load module operation allows the operator to transfer and save the control program load modules on the hard disk. This operation and the replacement or purge of a load module already stored on disk are executed in a nondisruptive manner. The controller will continue to run and the currently-running load module will not be affected. The user can select the load module to be used for controller initialization from the host or from the 3745 console. The rename load module function allows renaming of the MOSS disk active module and the standby module. This renaming can be initiated from any VTAM console in the network.

More usability is offered for channel adapter control. The channel adapters can be enabled or disabled from the 3745 operator console at any time. Also, the native and emulated subchannel address range can be set from the 3745 operator console. This capability avoids the need to use hardware jumpers to set these options.

Increased usability is available for setting the speed of direct-attached lines. The MOSS uses the speed defined in the control program load module.

Enhanced MOSS functions provide the user with improved tools for error detection and failure isolation. Problem determination facilities and controller services under user control contribute to better serviceability and usability. The menu design of the MOSS functions at the 3745 console eases using the MOSS functions.

Serviceability

Error handling is improved by:

- Tracking of all detected incidents
- Box event records (BERs), relating to hardware or microcode, stored on controller hard disk
- Automatic BER analysis (autoBER)
- Alarms
- Generic alerts via the NetView* program
- Controller resource reactivation, for example: automatic control program loading, MOSS and scanner microcode loading
- Line wrap test
- Internal scanner interface trace (SIT) trace stacked on controller hard disk
- Concurrent NCP and scanner dumps on controller hard disk
- Continued operation avoiding controller shutdown in various failure situations.

The error-handling procedures and improved problem determination lead to better serviceability.

Connectivity

The architecture of the 3745 models 130, 150, and 170 has been designed to cope with constant changes in communication facilities:

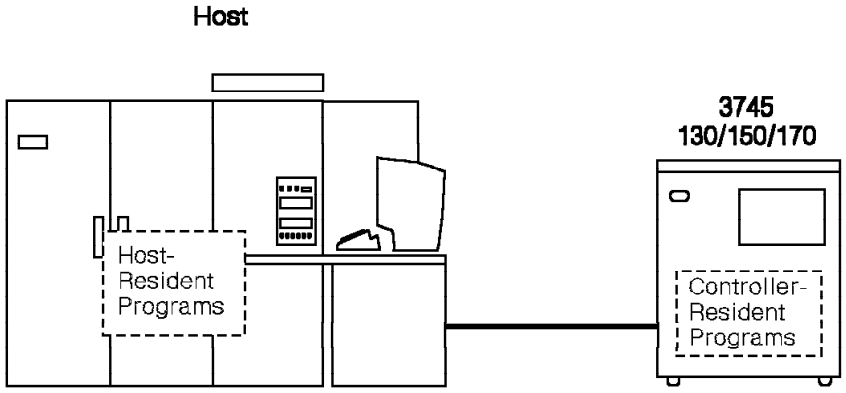
- *Rapid network growth*
- *Added complexity*
- *New applications*
- *Additional communication facilities.*

See “IBM 3745 Models 130, 150, and 170” on page 1-8 and Connectivity on page 1-6 for detailed channel and communication interface capabilities.

The configuration initially defined at installation (generation) can be upgraded at any time to meet growing network requirements.

Chapter 3. Program Support and Network Management

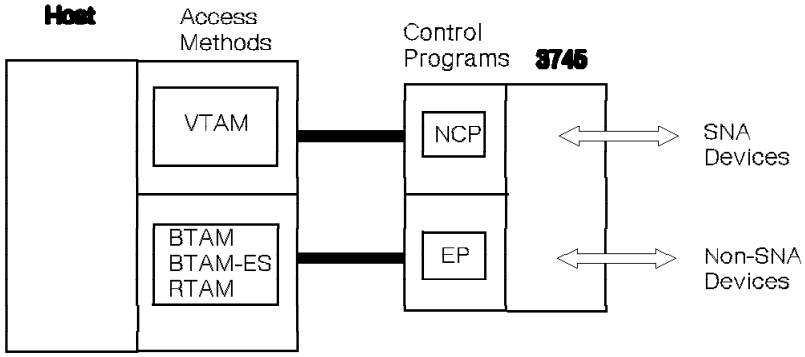
The 3745 operates under the control of various IBM licensed programs:



Controller-Resident Programs

The 3745 runs under control of one of the following:

- *Advanced Communications Function for the Network Control Program (ACF/NCP), abbreviated NCP in this book, to support SNA devices, or*
- *Emulation Program (EP) in partitioned emulation programming (PEP) mode to support non-SNA devices.*



Network Control Program (NCP)

NCP Version 5 provides major capabilities for SNA networks with synchronous data link control (SDLC). The 3745 operates with:

- *NCP Version 5 Release 2.1 under MVS, VM, and VSE*.*
- *NCP Version 5 Release 3 under MVS, VM, and VSE.*
- *NCP Version 5 Release 3.1 under MVS.*
- *NCP Version 5 Release 4 under MVS, and VM.*

NCP Version 5 Release 4 or any previous NCP releases do not support the Ethernet LAN adapter. The functions support will be provided with a then current NCP and SSP.

Start-stop and binary synchronous terminals can be migrated to a 3745 with the IBM Network Terminal Option (NTO) program. For start-stop protocols, NCP supports a variety of transmission codes including ASCII, EBCDIC, EBCD, and BCD. Further, it supports a correspondence code for which it provides translation from and to EBCDIC. For the BSC protocol, this support and translation operation is performed by the scanners.

NCP provides the controller flexibility to meet the demands of an expanding network. It works with the host access method to control networks, from the simplest single-domain network with a single controller, to complex multiple-domain networks using the Advanced Communications Function, in accordance with the concepts of SNA.

NCP includes the following functions:

- *Token-ring interface*
- *Airline Line Control Interface (ALCI) (optional/feature).*

NCP coexists with the following IBM licensed programs:

- *Network Routing Facility (NRF)*
- *Network Terminal Option (NTO)*
- *Non-SNA Interconnection (NSI)*
- *X.25 NCP Packet Switching Interface (NPSI)*
- *X.25 SNA Interconnection (XI)*
- *X.21 Short Hold Mode/Multiple Port Sharing (X.21 SH/MPS).*

Partitioned Emulation Programming Extension

The partitioned emulation programming (PEP) extension of NCP allows the NCP and the EP to coexist in the same 3745. PEP lets NCP operate certain lines in network control mode while operating others in emulation mode.

PEP can run only in a channel-attached controller. Channel attachment must be a byte multiplexer channel, where one emulated subchannel address is specified per EP line. Buffer chaining process does not support EP traffic under PEP.

PEP emulates most of the functions of the IBM 2701 Data Adapter Unit, IBM 2702 Transmission Control, or IBM 2703 Transmission Control and can communicate with various access methods running in the host. Most programs written for these machines can operate in a 3745 without modification. However, programs that involve timing or special hardware considerations may have to be changed.

Generating and Loading the Control Program

We use SSP elsewhere on the owning host to generate the control program load module (up to 6MB) and to load it into the controller storage. The control program for the controller is generated from standard program modules of the NCP library using the NCP/EP definition facility (NDF). The control program must reflect the required controller configuration. Several control programs can be generated to handle different subsets of lines attached to the same controller.

Multiple Load Module

The network operator can transfer and save either one or two CCU load modules (up to 6MB per load module) on the integrated hard disk. Either load module can be selected for loading at controller initialization.

When initiating a control program load request at the host, the network operator can designate the disk-resident load module that will be *active* for later automatic control program loading and dump.

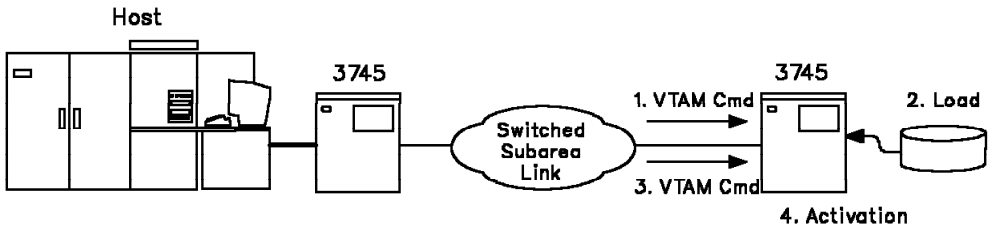
The network operator can change the external name of a communication controller load module on the MOSS disk. The rename load module function is started by a modified VTAM command (load command).

A control program load request that is initiated automatically by MOSS uses the load module last loaded in the CCU if it was saved to the disk or loaded from the disk during IPL. This load module is displayed specified as the *active* load module at the 3745 console (see "Disk IPL Information" on page 4-32).

Remote Loading and Activation

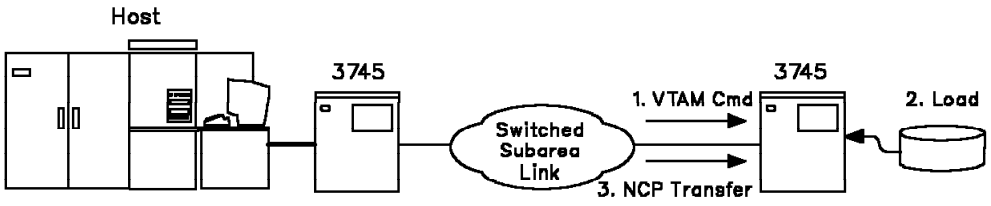
For a remote 3745 connected to a channel-attached 3745 via a switched subarea link (NTRI, X.21 switched or X.25 leased and switched), the remote loading and activation capability allows the host (through VTAM commands) to load and start the remote NCP:

- *From the remote disk to the remote CCU storage*.



As the loading of the NCP load module on the remote 3745 hard disk is done via a 1MB diskette written from the local 3745 hard disk, this option is used when the NCP load module size does not exceed 1MB. (See "MOSS Functions" on page 4-27 for local disk to diskette and remote diskette to disk NCP transfer):

- *From the host storage to the remote CCU storage*.



This option is used when the NCP load module size exceeds 1MB and cannot be transported from the host to the remote 3745 via a 1MB diskette.

In this case a *reduced NCP load module* is generated in the host, the size of which is less than 1MB thus fitting onto a diskette. It is then transferred from this diskette to the remote 3745 hard disk. On receipt of appropriate VTAM commands, this reduced load module is loaded from the remote disk to the remote CCU storage and there, handles the transfer of the complete NCP from the host storage to the remote 3745 storage via the switched subarea link. (See “MOSS Functions” on page 4-27 for local disk to diskette and remote diskette to disk transfer).

Automatic Control Program Load

VTAM and the 3745 MOSS allow the automatic IPL and dump capabilities. For an automatic IPL from the controller disk, the network operator must have specified this option during NCP loading.

This capability can also be selected for any IPL operation. In that case:

- The CCU initialization automatically uses the active disk-resident load module after power-on or in case of CCU failure.
- After an NCP abend or a hard CCU failure, there is an automatic dump of the controller storage before the control program reloading. The dump is saved on the controller disk. MOSS capabilities include transfer of the full or partial dump, printing at the host, and purge of the dump.

See also “Automatic IPL and Dump” on page 4-29.

Timed IPL

The timed IPL function allows controllers in a large network to automatically reload at a scheduled time. The operator can send an IPL request to any part of the network, from a VTAM console to define the IPL time. At the prescribed time all of the selected controllers will automatically reload without any operator action.

The new loaded NCP module can be:

- A new module sent from VTAM
- A standby module already loaded on the MOSS disk.

Coexistence and Migration

The NCP Version 5 operating the 3745 can coexist in a given network with other IBM communication controllers with NCP levels described in the table below:

IBM 3705	IBM 3725	IBM 3720	IBM 3745 210/410	IBM 3745 130/150/170	IBM 3745 310/610
NCP V2 NCP V3	NCP V2 NCP V3 NCP V4 R1 NCP V4 R2 NCP V4 R3 NCP V4 R3.1	NCP V4 R1 NCP V4 R2 NCP V4 Subset NCP V5 R1 NCP V5 R2 NCP V5 R2.1 NCP V5 R3	NCP V5 R2.1 NCP V5 R3 NCP V5 R3.1 NCP V5 R4	NCP V5 R2.1 NCP V5 R3 NCP V5 R3.1 NCP V5 R4	NCP V5 R4

NCP allows 3745 to support networks based on the earlier IBM 2701 Data Adapter Unit, IBM 2702 Transmission Control, or IBM 2703 Transmission Control, and networks in which these units are emulated on a 3720 or on a 3725 via an Emulation Program (EP 9). PEP permits migration from the 2701, 2702, 2703, and from IBM 3704, 3705, 3720, and 3725 communication controllers that run EP. The 3745 Models 310 and 610 have no EP stand-alone support.

Stand-alone Emulation Program Release 8 operates in 3745 Model 210 or Model 410. The 3745 Models 310 and 610 have no EP stand-alone support.

Communication controllers configured with EP only, IBM Network Extension Facility (NEF), or IBM Non-SNA Interconnection (NSI) can coexist with the 3745 in the same network.

The IBM Transaction Processing Facility host program is supported by NCP Version 5 Release 3 in the 3745.

The 3745 offers a path for conversion from existing systems and for continuing growth. A system designed for the IBM 3725 or 3720 may be applied to the 3745 after regeneration of the control program. The control program resource definition input to the 3725 or 3720 program generation can be used with some modifications to statements (if the controller has the same line configuration).

Host-Resident Programs

Operating Systems

- *MVS*
- *MVS/XA**
- *MVS/ESA**
- *VM/SP*
- *VM/SP HPO*
- *VM/XA**
- *VSE/AF*
- *VSE/SP.*

Access Methods

Normal Mode:

- *Virtual Telecommunications Access Method (VTAM) Version 3 Release 1.1, Release 1.2, Release 2, Release 3, Release 4, or Release 4.1.*

Emulation Mode:

- *Basic telecommunications access method (BTAM)*
- *BTAM extended storage (BTAM-ES)*
- *Remote terminal access method (RTAM).*

System Support Programs

Advanced Communications Function for System Support Programs (SSP)

- *Version 3 Release 4.1 or Release 5 in MVS, VM, or VSE environments,*
- *Version 3 Release 5.1 in MVS environment,*
- *Version 3 Release 6 in MVS and VM environments.*

SSP is used to generate the 3745 control program.

In addition, SSP provides utilities for loading, dumping, and tracing the 3745 control program. It also supports:

- Dump transfer of the 3745 storage to the host.
- Dump printing at the host.
- 3745 disk file transfer to the host.

Network Management

The 3745 network management is supported by the NetView program Releases 2 and 3. By monitoring and managing the controller and its resources, and by diagnosing problems, this program contributes to the optimization of the 3745.

For example:

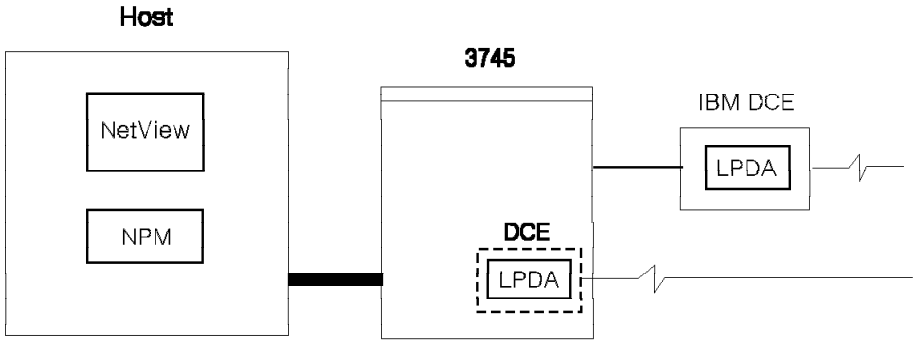
- A command facility, which lets the user control, record, and automate various operator tasks. It can be used as an operator's interface to VTAM in a data communication network.
- A session monitor, which enables the user to examine, from a central control point, information related to the SNA network and to identify network problems.
- A hardware monitor, which helps the user to get problem determination information that is generated at resources that are either link-attached or channel-attached to the host system.

As a cohesive set of SNA host network management services, the NetView program offers:

- *Consistency and usability in its support for network management*
- *Easy installation procedure*
- *Device support*
- *Operator usability.*

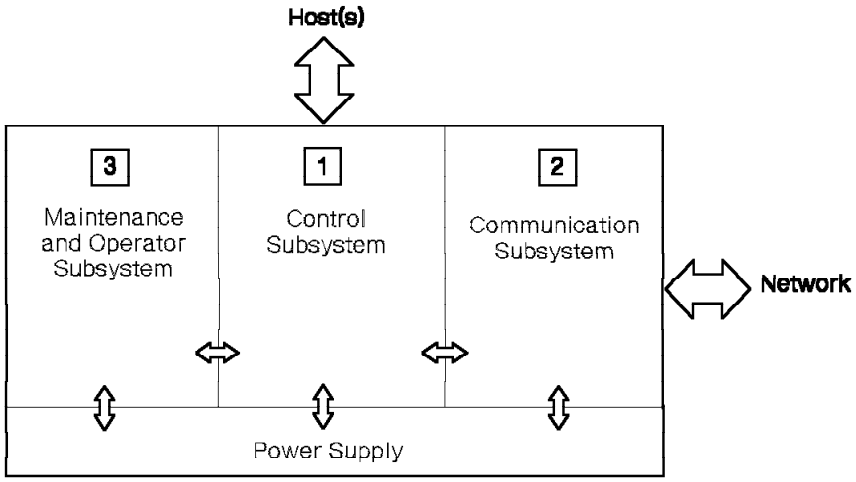
The 3745 supports:

- *Link Problem Determination Aid (LPDA*) facilities provided by IBM DCEs.*
- *NetView Performance Monitor (NPM) under VM and MVS.*



Chapter 4. Controller Description

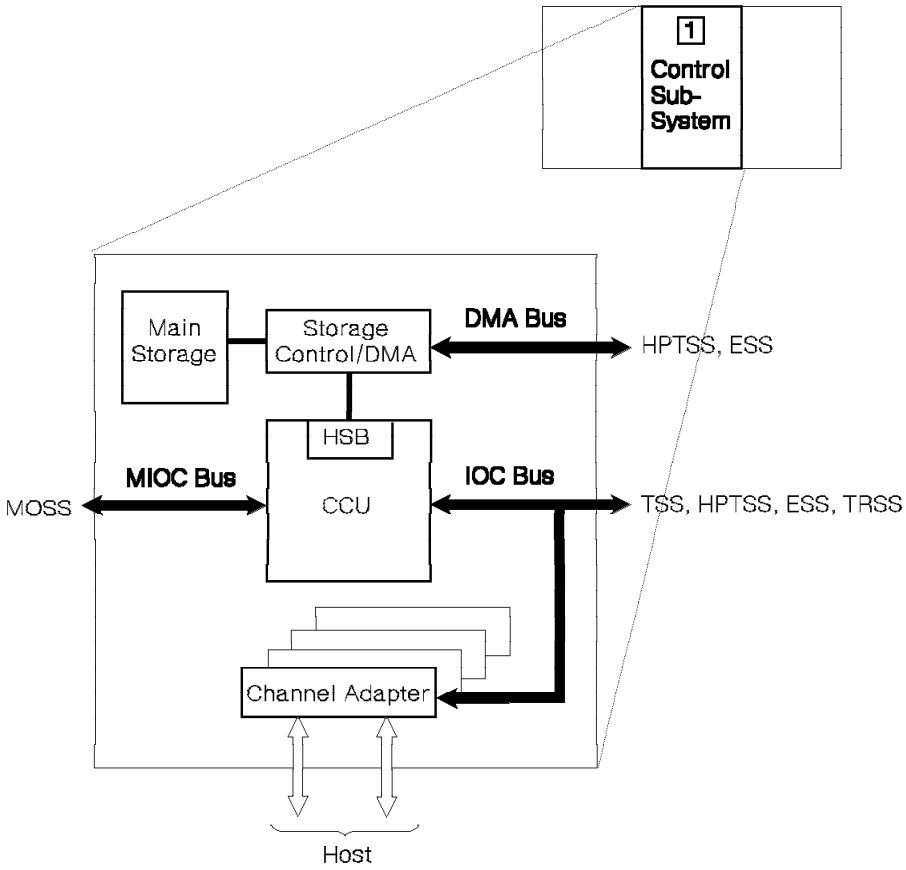
The 3745-130/150/170 consists of three main functional areas:



The following is a functional description of the main components and available features of the 3745-130/150/170.

The overall data flow of a maximum 3745-130/150/170 configuration is shown on page 6-6.

Control Subsystem



The control subsystem contains:

- *The central control unit (CCU), with its associated CACHE high-speed buffer (HSB).*
- *The main storage.*
- *The storage control, equipped with a direct memory access (DMA).*
- *The input/output control bus (IOC bus).*
- *The DMA bus.*
- *The MOSS input/output control bus (MIOC bus).*
- *The channel adapters, possibly associated with two-processor switches (TPS).*

Central Control Unit

The CCU can be initialized by loading the control program through a host channel or a communication link, or from the controller hard disk. Data transfer between the CCU and the main storage is achieved by the storage control and enhanced by the high-speed buffer. Data is also transmitted directly between the main storage and the high-speed line adapters via the DMA. The CCU utilization including cycle stealing is measured by a cycle utilization counter. The instruction set is similar to that of the IBM 3745-210/310/410/610.

For details, see *IBM 3745 Communication Controller: Principles of Operation, SA33-0102*.

High-Speed Buffer

The CACHE HSB is packaged with the CCU and has a capacity of 32KB. It connects the CCU and the storage control and DMA. Data and instructions transferred from the main storage at a slower rate are buffered in the high-speed buffer and provided to the CCU at the CCU cycle rate. Thus, the CCU is not slowed down by the main storage and can run at full speed.

Main Storage

The main storage is available in two sizes of 4 or 8MB.

Storage Control and DMA

The storage control allocates the main storage access and controls the data transfer between each controller component and the main storage. The storage control is equipped with enhanced error checking and correction (ECC). The ECC enables the correction of a double-bit hard error, and the detection and correction of a triple-bit error.

The DMA receives the data transfer requests from one or two very high-speed lines or Ethernet LAN lines. The data transfer to the main storage is achieved by cycle stealing. DMA takes full advantage of the storage speed during data burst transfers from the high-speed scanners (HSSs) or from the Ethernet LAN adapters (ELAs).

Input/Output Control Bus

The IOC bus allows the data, address, and control information to be exchanged between the CCU work registers and the channel and line adapters.

DMA Bus

The DMA bus allows data transfer only (in cycle steal) between the CCU storage and the high-speed scanners, or the Ethernet LAN adapters.

MIOC Bus

The MIOC bus provides a dedicated connection between the CCU work registers and the MOSS registers.

Channel Adapters

There are two types of channel adapters, the regular channel adapter (CA) and the buffer chaining channel adapter (BCCA). Both types will be called channel adapters (CAs) in this book unless otherwise specified.

A maximum of four channel adapters (CAs) provide connection between four hosts and the CCU via the IOC bus. Optionally, CAs can be equipped with a two-processor switch (TPS) feature in that case, the maximum number of CAs is two.

Each channel adapter is equipped with a microprocessor. The channel adapters attach the CCU to the host data channels. The hosts supported include the IBM 4341, 4361, 4381, 937X, 308X, 3090, and ES/9000 Processors. Host channels are byte multiplexer, block multiplexer, or selector channels. Further, the IBM 3044 Fiber-Optic Channel Extender Link can also be supported when operating in high-speed data transfer or in direct-current interlock mode.

The 3745 channel adapters support data transfer in three modes:

- Direct-current interlock (DCI)
- High-speed transfer
- Data streaming.

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 mode). One subchannel address is required per line. Channel attachment is byte-multiplexed.

CAs also support I/O error alert. They use self-checking routines. CA features and parameters are defined at installation time and saved in the MOSS. They are set up by the MOSS at each initial program load (IPL) afterwards. Channel adapters can be enabled and disabled by the operator from the attached operator console at any time without having to log onto the console.

The channel interface cable allows attachment of the 3745 to a host located at up to 61 m (200 ft) in direct-current interlock or high-speed transfer mode.

Channel Adapter with Data Streaming

The data streaming feature makes it possible to reach a high-speed data rate for a host located at up to 122 m (400 ft) from the controller. Data can be transferred in synchronous mode. The instantaneous data rate can reach a maximum speed of 3MB per second.

Channel adapter with data streaming is supported by the IBM 937X, 3090, and ES/9000 Processors. The host connection can only be a block multiplexer channel. The channel extenders are not supported.

Buffer Chaining Channel Adapter

The buffer chaining process makes it possible to increase high speed data rate for a host and provides higher channel efficiency than data streaming. Data can be transferred in synchronous mode. Buffer chaining process is only supported by channel adapter of the BCCA type.

The buffer chaining process is available under NCP or PEP control. The buffer chaining channel adapter supports NCP only. The EP traffic under PEP is not supported. The host connection can only be a block multiplexer channel. When buffer chaining process is not set, the buffer chaining channel adapter works in data streaming mode. The channel extenders are not supported.

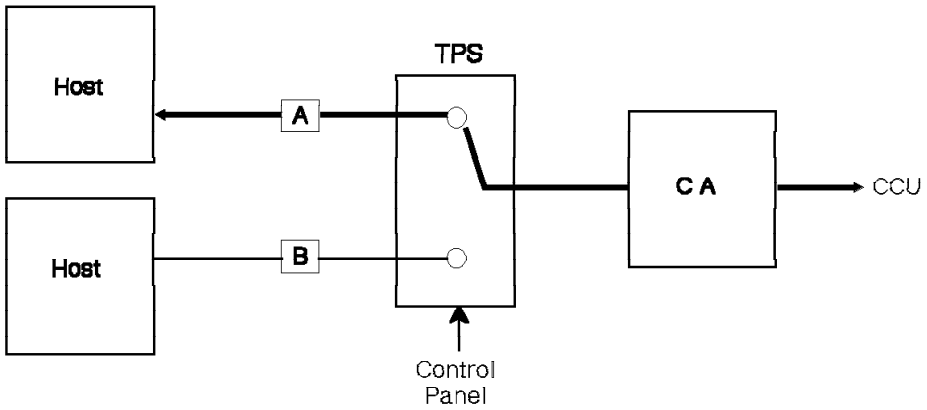
Two-Processor Switch

In addition to the basic interface (A), a two-processor switch (TPS) provides an additional channel interface, called interface B, to a channel adapter. The two interfaces can connect to the same host or to different hosts.

MOSS commands issued at the console allow the user to enable, through a two-processor switch, either one interface (A **or** B) or both interfaces (A **and** B).

1. **Only one interface (A or B) enabled:**

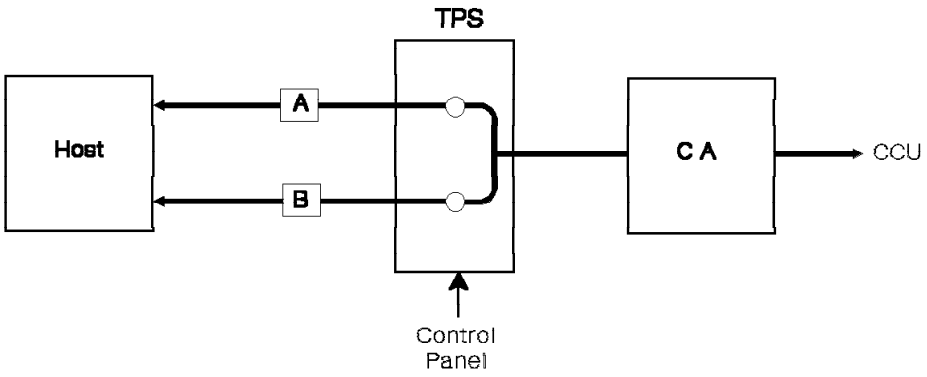
   The host attached to that interface activates the channel as required by the application.



2. **Both interfaces (A and B) enabled:**

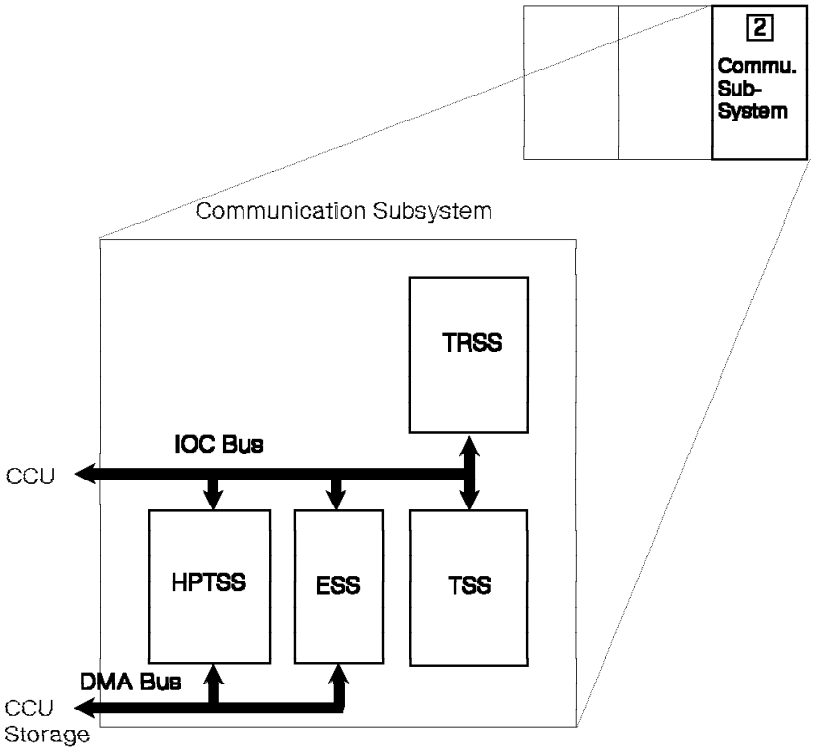
   Both interfaces A and B are connected to two channels of the *same* host.

   Both interfaces cannot be active simultaneously, and the host is responsible for activating them alternately and dynamically. This maximizes the availability of the host connections.



The operations to activate a two processor switch mode are described in the *IBM 3745 Communication Controller: Advanced Operations Guide,* SA33-0097.

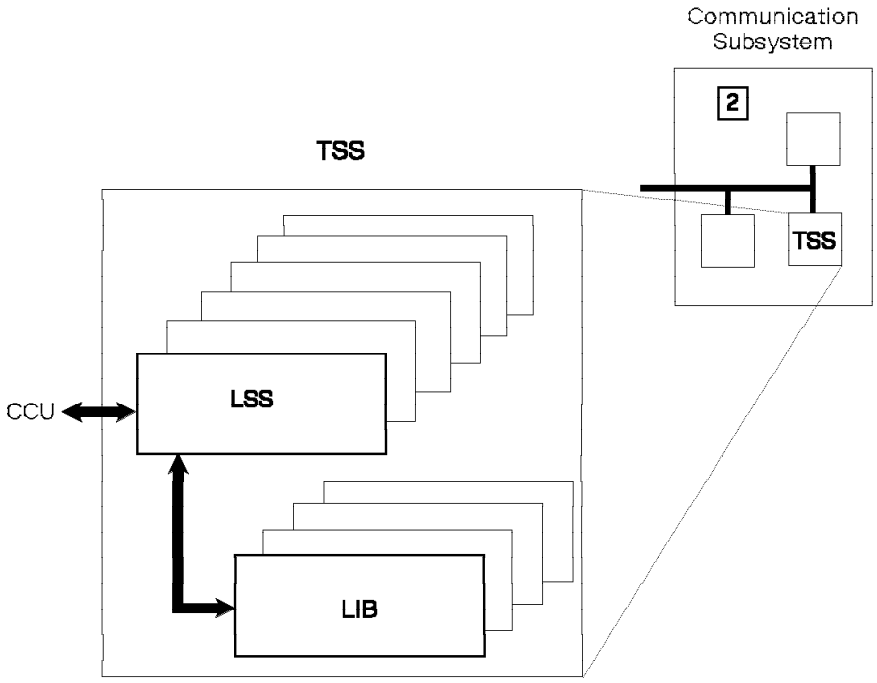
Communication Subsystem



| *Four types of line connection are used to connect data communication lines:*

- *The transmission subsystem (TSS)*
- *The high-performance transmission subsystem (HPTSS)*
- *The Ethernet-type LAN subsystem (ESS)*
- *The token-ring subsystem (TRSS).*

Transmission Subsystem (TSS)



The TSS consists of:

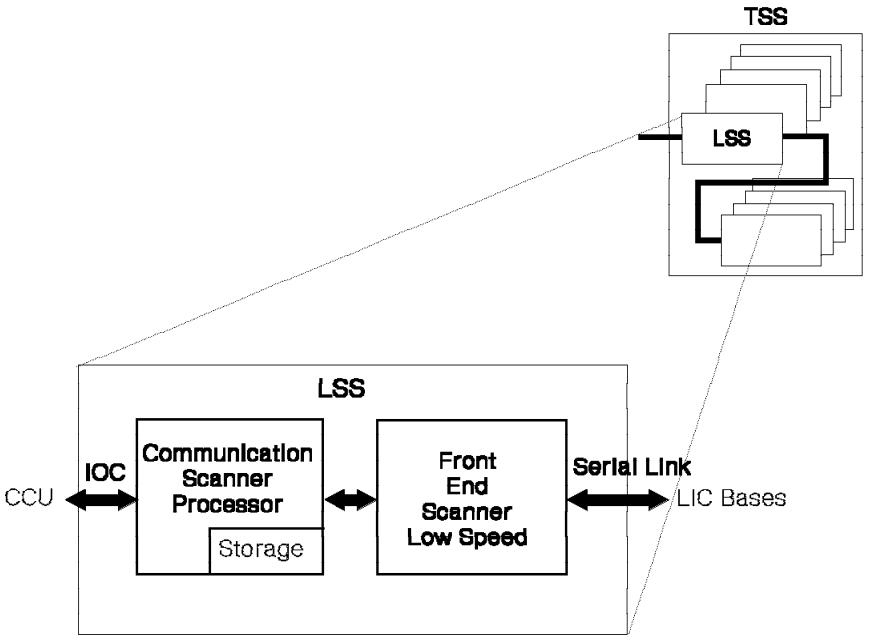
- *Up to six low-speed scanners (LSSs) or*
- *Up to four low-speed scanners (LSSs) if two HSSs or ELAs are installed.*

And:

- *Up to four LIC bases (LIBs).*

Note: A LIB is functionally equivalent to a LIC unit (LIU) of the 3745-210/310/410/610.

Low-Speed Scanner



A low-speed scanner consists of a communication scanner processor (CSP) associated to a front-end scanner low-speed (FESL).

Communication Scanner Processor

The 3745 uses a microprocessor-based communication scanner. The CSP supports multiple line protocols, and provides character buffering and cycle steal data transfer into main storage. The CSP also does other repetitive operations such as ASCII/EBCDIC translation for BSC lines.

Front-End Scanner Low-Speed

The FESL provides 'bit service' (serialization/deserialization) and 'line service' (supports link protocols and line interfaces).

Serial Link

The serial interface link between the FESL and LICs provides an easier adaptation to configuration changes. The twisted-pair interface eliminates the fixed positional relationship between scanner and LIC. The flexible nature of the serial link allows the CSP and the connecting LICs to be in any of their positions within the 3745. Depending on the model, the 3745 can have scanners and LICs independently added to support performance or connectivity requirements.

This design provides effective use of scanner resource.

Selective Scanning

As in the 3745-210/310/410/610, a new logical addressing technique allows scanning of only the activated lines. When all the lines of a LIC are deactivated, it is removed from the scanning sequence (except for X.21 lines). This increases the number of LICs that can be attached to the CSP. It is possible to exceed 100% line weight when configuring the 3745. The only constraint is that the weight of **activated** *lines must not exceed 100%.*

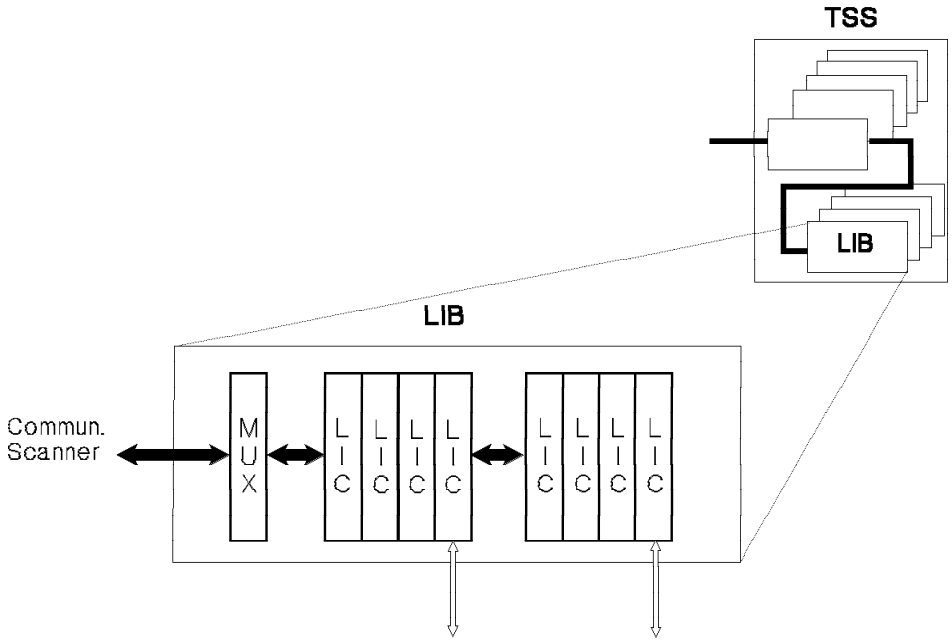
Logical addressing improves the flexibility of LIC attachment. LICs can be placed anywhere without regard to the scanning sequence or LIC weight. High-speed LICs can come before or after low-speed LICs and there can be open LIC positions.

Selective scanning allows an LSS to run multiple line configurations at different times. It also simplifies configuration and installation of LICs attaching higher-speed lines (256 kbps) with other LICs.

Notes:

1. It is the user's responsibility to ensure that the currently-active line configuration does not overload the scanner processing capability. See the explanation of line weights on page 4-11 and also in the *IBM 3745 Configuration Program,* GA33-0093.
2. A scanner cannot recognize a change in line configuration, and is likely to become overloaded. It is necessary that an active configuration is completely deactivated before another configuration is activated, for example, changing from night operation to day operation.

LIC Base (LIB)

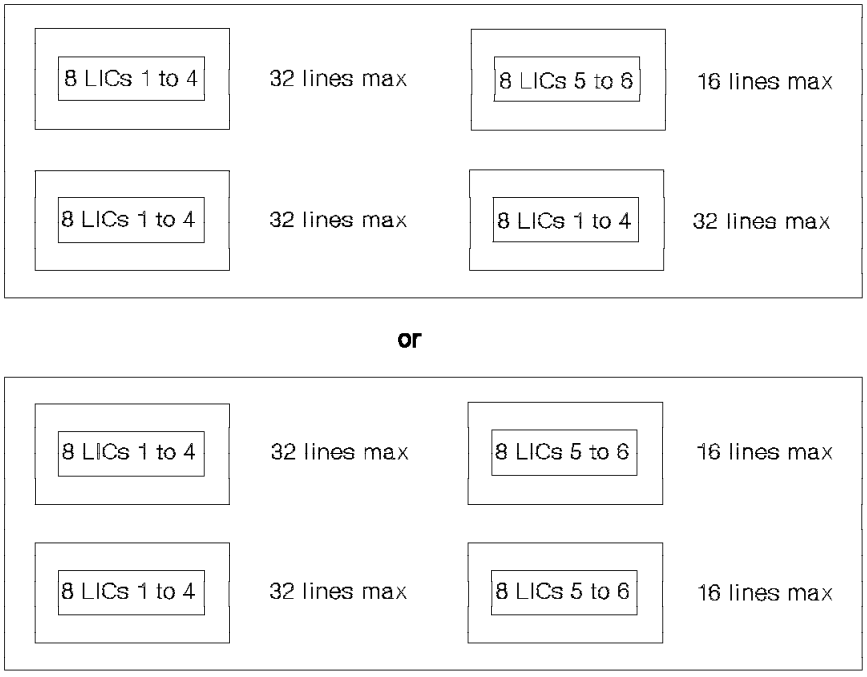


There are up to four LIC bases (LIBs).

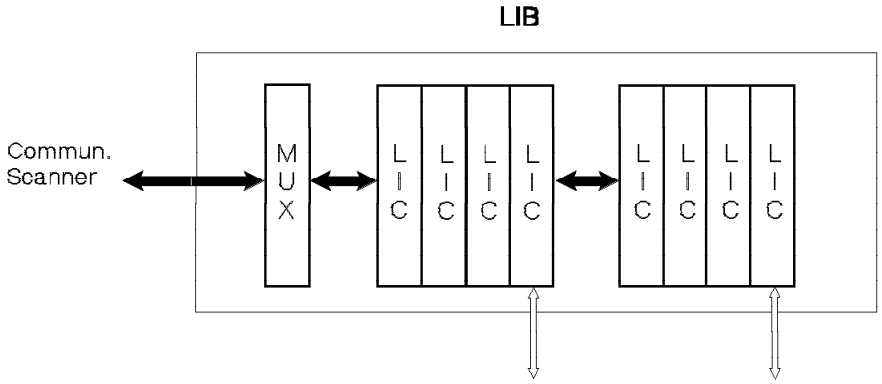
Each LIB houses:

- *One multiplexer (MUX) and*
- *Up to eight line interface couplers (LICs).*

The figure below shows a maximum configuration for a 3745-170.



Line Interface Couplers (LICs)



There are six types of LIC, namely:

- **LIC1, LIC3, LIC4A** *and* **LIC4B** *for attaching:*
  - *Local direct-attached DTEs (not attached through DCEs)*
  - *Remote DTEs attached via stand-alone DCEs and telecommunication facilities.*

  An internal clock function (ICF) is available on these LICs to provide clocking signals to nonclocked DTEs or DCEs (see Appendix A for details).
- **LIC5** *and* **LIC6**, *both housing integrated DCEs, providing direct access to the telecommunication facilities for attaching remote terminals.*

  The clocking of lines attached to these LICs is provided by the integrated DCEs (see Appendix A for details).

LIC Weights

The weight of a line is a value (0.4 through 100) that represents the percentage of scanner occupation. The weight of a line depends on its speed (bps), the protocol (SS, BSC, SDLC), the mode of transmission (HDX, FDX), and the characters code (ASCII,
EBCDIC, ...). The total weight of active lines connected to a scanner must be equal to or less than 100.

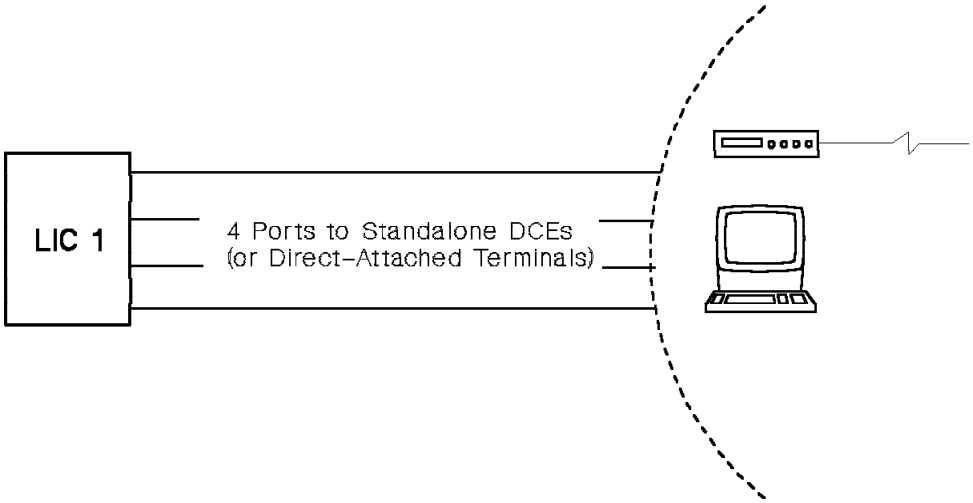
LIC User Access

User access to LICs eases upgrading of the 3745 and repair in case of failure. Hot pluggability allows plugging and unplugging when the 3745 is in operation. Thus, LIC replacement, addition, or removal does not disturb the scanner nor impair the network.

Then, the LICs have been designed to accept snap-on cables: this allows quick cable attachment of telecommunication lines.

LIC Characteristics

Following are the main characteristics of the LICs 1 through 6.



Speed : Up to **19.2** kbps

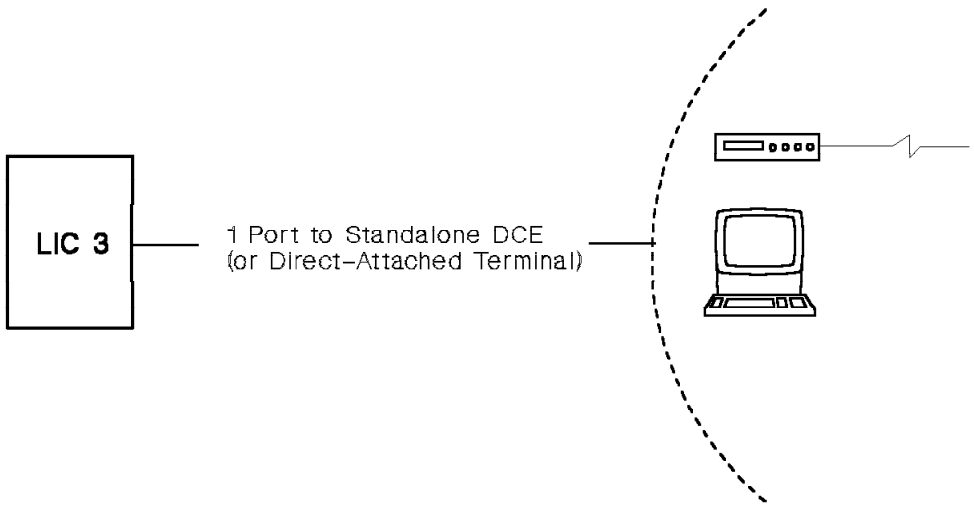
Protocol : Start-Stop, BSC, SDLC

Interface : CCITT **V.24** and **V.25** (EIA 232D and 366), CCITT **V.25 bis (see Note)**,
CCITT **X.20 bis** and **X.21 bis**

Number of LIC1s per scanner: Up to 8.

Note: ***CCITT Recommendation V.25 BIS for switched connections allows call establishment and data transfer to take place over the same port. This eliminates the need for a second physical port (on a LIC1) and its associated Automatic Calling Unit (ACU). The 3745 supports the following CCITT V.25 BIS options:***

- ***Call establishment in SDLC or start-stop mode,***
- ***Data transmission in SDLC, BSC, or start-stop mode,***
- ***Call request with number to be dialed (CRN command), optionally accompanied by the identification number of the caller (CRI command),***
- ***"Call Failure Indication" and its associated two-character failure condition (if provided by the DCE),***
- ***"Delayed Call Indication" (if provided by the DCE) and its associated parameter (up to three characters specifying the minimum time before next call attempt),***
- ***"Invalid Indication" from the DCE (a command sent to the DCE cannot be processed),***
- ***Auto-answer controlled by the 3745 and based on the "calling indicator" circuit.***



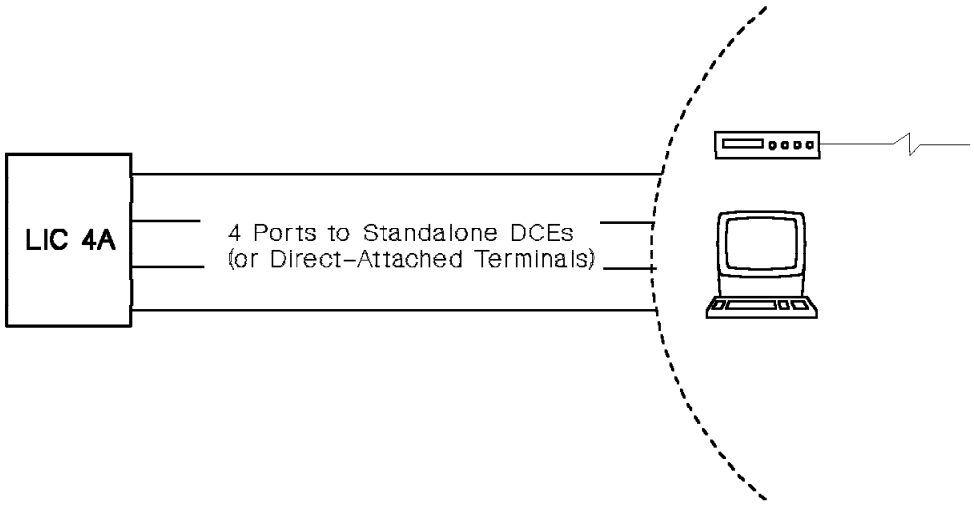
Speed : Up to **256** kbps

Protocol : BSC, SDLC

Interface : CCITT **V.35**

Number of LIC3s per scanner:

<32 kbps	32 to 64	>64 kbps
8	4 to 8	1 or 2

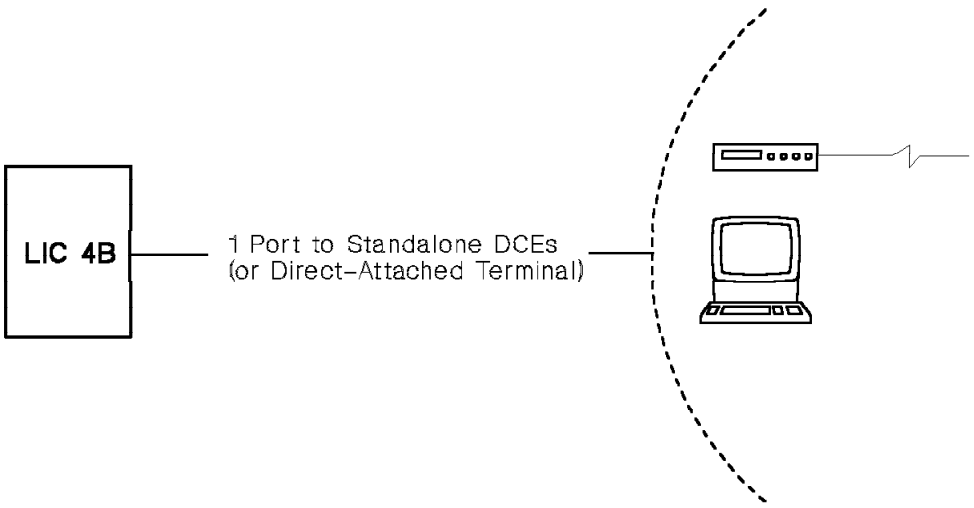


Speed : Up to **9.6** kbps

Protocol : SDLC

Interface : CCITT **X.21**

Number of LIC4As per scanner: Up to 8.



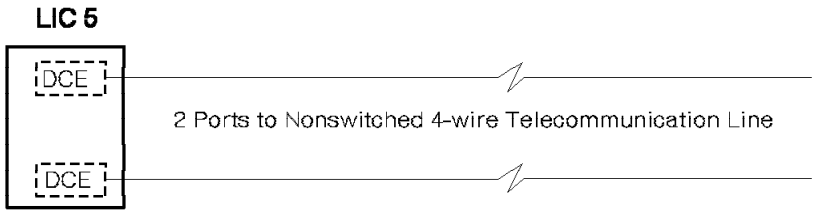
Speed : Up to **256** kbps

Protocol : SDLC

Interface : CCITT **X.21**

Number of LIC4Bs per scanner:

<32 kbps	32 to 64	>64 kbps
8	4 to 8	1 or 2



Speed : **4.8**, **9.6**, or **14.4** kbps

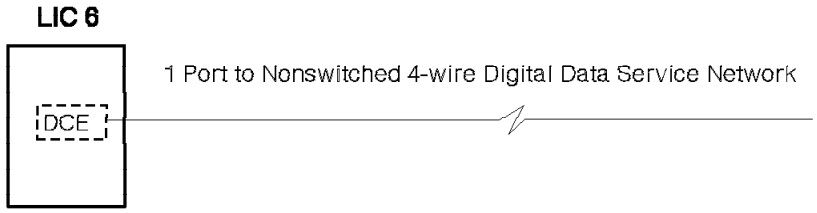
Protocol : BSC, SDLC

Interface : **Voice-grade telecommunication network**

Number of LIC5s per scanner: Up to 16

Configuration: Point-to-point, multipoint.

The LIC5 integrated DCEs are compatible with the stand-alone and rack-mounted IBM 586x and 786x DCEs.



Speed: **9.6**, **19.2**, or **56** kbps.

Protocol : BSC, SDLC

Interface : **Digital Data Service Network**

Number of LIC6s per scanner:

Speed = 56 kbps : Up to 4
Speed = 19.2 kbps : Up to 8
Speed = 9.6 kbps : Up to 8

Configuration: Point-to-point, Multipoint.

The LIC6 integrated DCE is compatible with the IBM 5822 Model 10 or 18 Data Service Unit/Channel Service Unit (DSU/CSU).

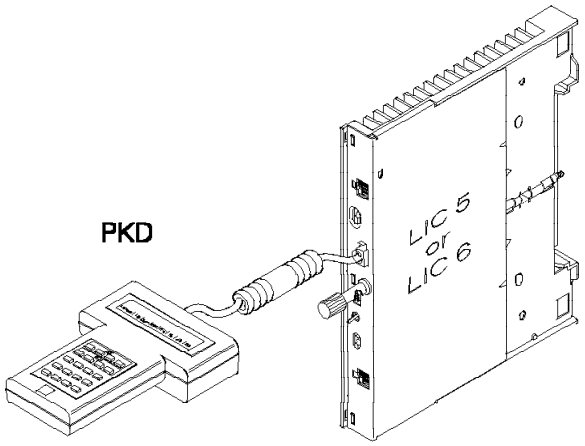
Notes:

1. LIC5 and LIC6 integrated DCEs can stand poor line conditions or temporary line problems. For this, the operator can select a slower speed, called the backup speed. When normal line conditions resume or the line problems are corrected, the normal transmission speed is set again.
2. LIC5s and LIC6s provide a port and a cable adapter for connection of an external monitoring equipment.

Portable Keypad Display

An IBM 5869 Portable Keypad Display, pluggable at LIC5s or LIC6s, is used to:

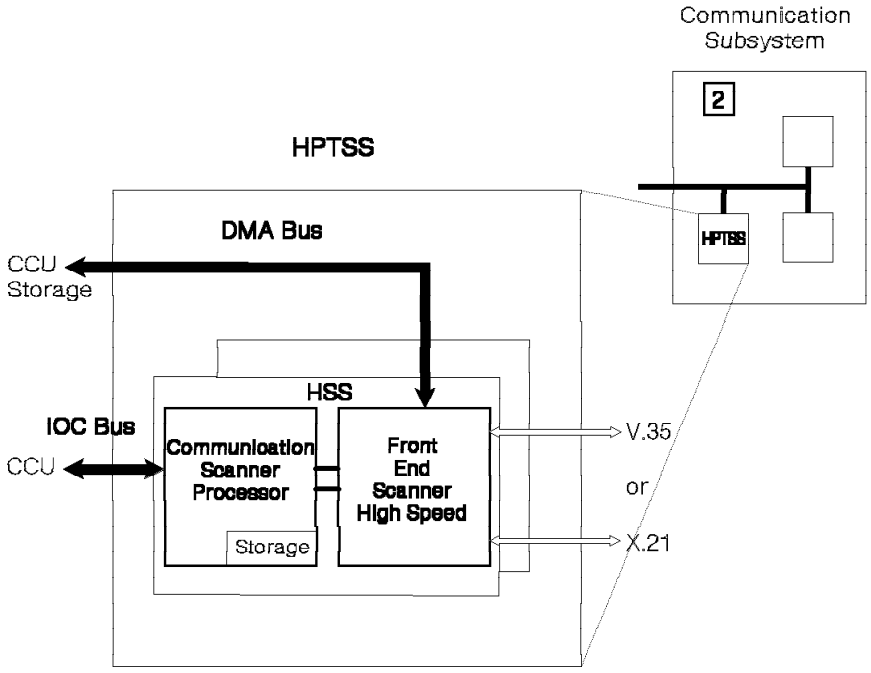
- Configure.
- Set operational options.
- Display line status.
- Invoke manual tests of the integrated DCEs (see Chapter 5, Problem Determination). Various parameters are stored in a nonvolatile random access memory (RAM).



Details on LIC5 DCEs can be found in the *IBM 786x Modem: Description and Planning Guide,* GA33-0122.

Details on LIC6 DCEs can be found in the *IBM 5822-18 CNM DSU/CSU: Guide to Operations,* GA33-0136.

High-Performance Transmission Subsystem (HPTSS)



The HPTSS consists of up to two high-speed scanners (HSSs).

A HSS consists of one communication scanner processors (CSP), associated with a front-end scanner high-speed (FESH).

Communication Scanner Processor

The HPTSS CSP is the same as the LSS CSP, but is loaded with different microcode.

The high-speed scanner accepts a clear channel (without channel and subchannel TDM framing) at speeds up to 1544 megabits per second for T1 and up to 2048 megabits per second for CEPT. The high-speed scanner is used for intermediate routing node (IRN) support of high-speed line to another communication controller. This connection must be SDLC, duplex, point-to-point, nonswitched line traffic. This high-speed scanner can also be used for boundary network node (BNN) support.

The HPTSS supports CCITT V.35 and X.21 interfaces, but only one interface may be activated at a time (the NCP load module determines which interface is to be activated).

Front-End Scanner High-Speed

The FESH provides 'bit service' (serialization/deserialization) and 'line service' (supports link protocols and line interface).

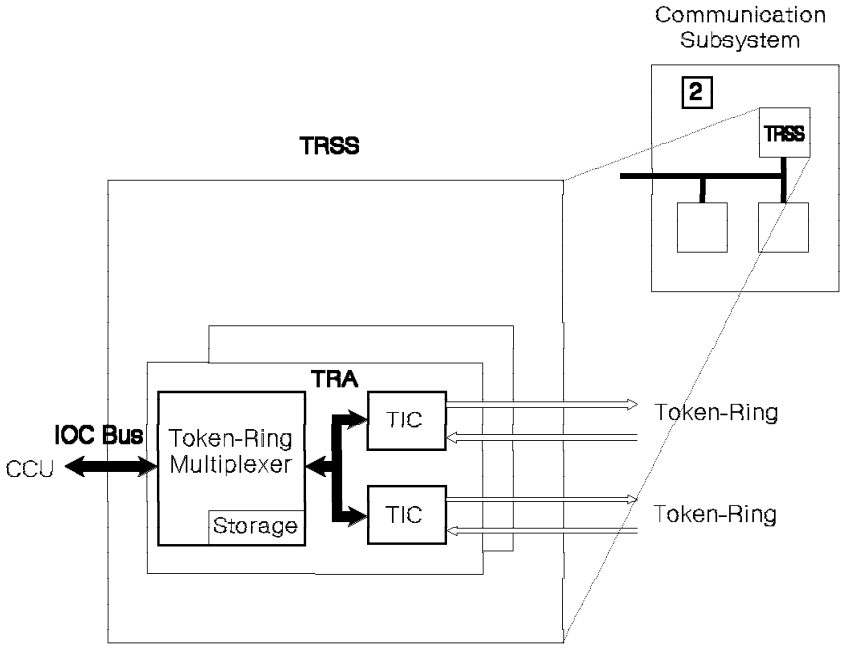
The FESH may interface with:

- Network channel terminal equipments (NCTEs)
- Data service unit/channel service units (DSU/CSUs)
- Limited-distance modems (LDMs)

- Other local direct-attached IBM communication controllers. The maximum speed is then 1.8 Mbps and the maximum distance is 10 m (33 ft.) via X.21 interface and 100 m (328 ft.) via a V.35 interface.

For direct-attachment, the FESH provides data clocking (see Appendix A).

Token-Ring Subsystem (TRSS)



The TRSS consists of up to two token-ring adapters (TRAs).

A TRA consists of one token-ring multiplexer (TRM) driving two token-ring interface couplers (TICs) providing access to two IBM token-ring local area networks (LANs) operating at speeds of either 4 or 16 Mbps.

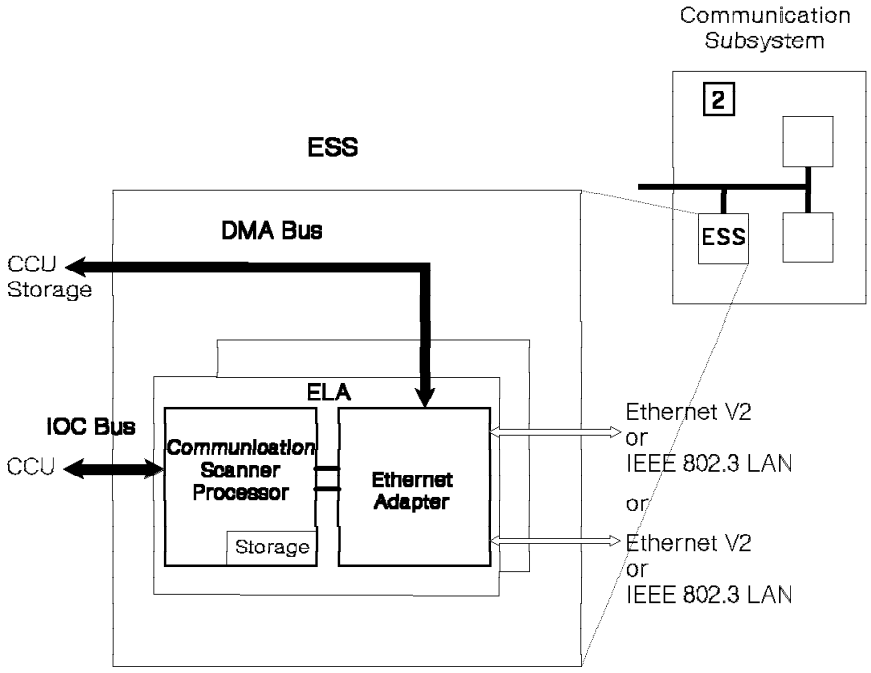
Token-Ring Multiplexer (TRM)

The TRM handles operations between the NCP running in the CCU and the two TICs.

Token-Ring Interface Coupler (TIC)

Each TIC contains a microprocessor operating under control of resident microcode. The coupler transmits and receives at a speed of 4 or 16 Mbps using protocols conforming with IEEE 802.5 and ECMA 89 standards. However, the throughput of the 3745 depends on transaction characteristics, NCP path length, and 3745 utilization. Token-ring devices can be predefined to the system, allowing terminals to be added or deleted nondisruptively and without having to generate a new NCP load module.

Ethernet-Type LAN Subsystem (ESS)



The ESS consists of up to two Ethernet LAN adapters (ELAs).

A ELA consists of one communication scanner processor (CSP), associated with an Ethernet adapter.

Communication Scanner Processor

The ESS CSP is the same as the HPTSS CSP, but is loaded with different microcode.

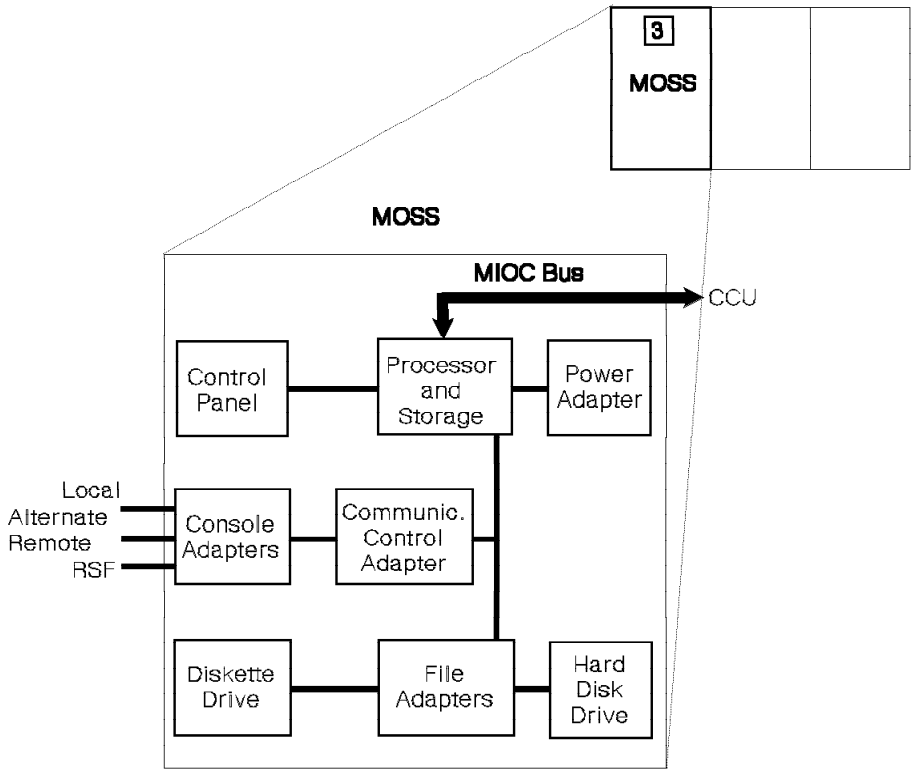
Ethernet Adapter

The Ethernet adapter supports two transceiver ports connected to Ethernet V2 or IEEE 802.3 LAN. Both ports can be active at the same time to the NCP.

The ELA interface to the external equipment is a IEEE 802.3 15-pin D-type female AUI connector. The AUI transceiver cable is not provided by IBM. The ESS uses the tail gate location of the corresponding HPTSS.

The tail gate contains also a DC/DC converter which provides + 12v DC with up to 500 mA per port for an external transceiver.

Maintenance and Operator Subsystem (MOSS)



The MOSS provides:

- *Powerful procedures for the 3745 initialization and IPL functions*
- *Host-independent product maintenance and rapid isolation and repair of failures within the controller*
- *Easy problem determination procedures for the operator.*

The MOSS also provides:

- Automatic IPL and dump operations
- Line configuration management
- Controller supervision
- Controller concurrent diagnostic
- Online event recording and error notification including for the integrated DCEs
- Problem determination (error in the network including the controller)
- Failure isolation and repair (error in the controller)
- Remote support facility link management.

The MOSS continuously monitors the status of the communication controller. Abnormal conditions are analyzed and reported via alarms to the 3745 console(s) and alerts to the network control console.

Among the components of the communication controller, multiple adapters allow the MOSS to monitor the status of the CCU, to control the DMA and IOC buses, and to enable and disable channel adapters.

A power control adapter with a dedicated microprocessor monitors the 3745 power.

A file adapter provides MOSS storage control. A 72MB hard disk, in addition to a 1.2MB diskette, provides extensive capacity for file and data storage.

The MOSS interfaces to the control panel indicators and switches. These provide an alternative method for controlling the primary power subsystem, activating MOSS functions, and for notifying the operator.

A console adapter allows the 3745 to be controlled from a local console located within 7 m (23 ft.), or an alternate console located within 120 m (400 ft.), or a remote console connected via a 1200 bps DCE to the controller. Only one console may be active at a time. If the remote support facility (RSF) is used, it allows communication between the MOSS and the IBM RETAIN system. The RSF terminal can be used as an operator console and for transferring microcode patches to the MOSS if required.*

MOSS Microprocessor and Storage

The MOSS microprocessor operates independently of the CCU. The microcode is automatically loaded from disk into the MOSS storage during IML at power-on time. MOSS storage capacity is 2MB.

MOSS Power Control Adapter

The MOSS power control allows various automatic actions without any operator intervention, such as:

- Reporting power fault to the MOSS
- Powering on/off the machine
- Reset
- Time function
- AC line survey
- Power diagnostics
- Monitoring thermal sensors.

MOSS Disk/Diskette Drive and Adapter

The diskette drive and disk drive are connected to the MOSS bus via the disk adapter, and consist of:

- An integrated disk drive with one hard disk that provides 72MB.
- A diskette drive with removable diskettes. Each diskette provides 1.2MB.

The diskettes contain the MOSS microcode, MOSS files, and diagnostic programs. At installation time, the diskettes are copied onto the controller integrated disk. Then, the latter becomes the only disk system used by the MOSS. If the disk fails, MOSS IML can be performed from the diskette at the control panel.

The hard disk contains the following:

- Scanner microcode (LSS, HSS, ELA)
- MOSS microcode
- Diagnostic routines
- One or two control program load modules
- Information relating to the 3745 operation contained in the following files:
  - Event log file
  - Configuration data file
  - Machine level table
  - Microcode fix file
  - Port swap file
  - One control program dump file
  - One scanner dump file
  - One TIC dump file
  - One MOSS dump file
  - Trace buffer areas for the scanner.

Control Panel

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

The control panel is located on the 3745 communication controller. It is always powered on. When the 3745 is powered off, the control panel display gives information on power control and service mode.

The ten-digit alphanumeric display shows the operator progress and errors during initialization. It also displays progress of the MOSS diagnostic programs to IBM service personnel.

Indicators notify operation and service status. For example, the MOSS Msg and MOSS Inop indicators prompt the operator to take an appropriate action, as described in the *IBM 3745 Communication Controller: Problem Determination Guide, SA33-0096*. MOSS functions and services are started with the keys.

A reference card (packaged in the 3745) lists the MOSS functions and services available at the control panel.

Operator Consoles and Remote Support Facility

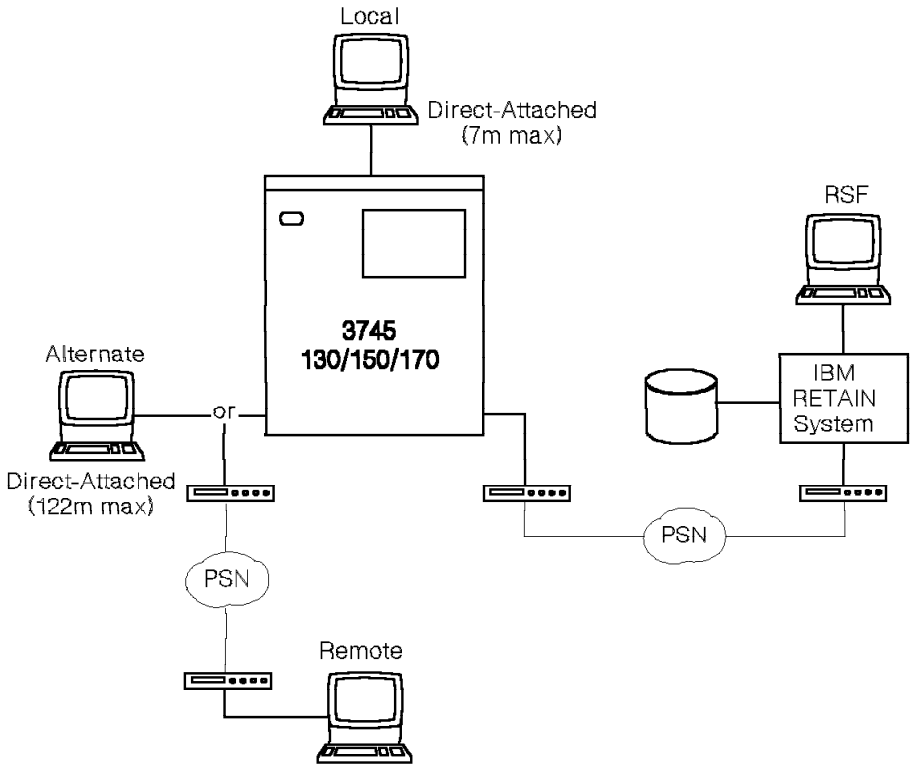
An operator console is required for:

- *Installation*
- *Operation*
- *Maintenance.*

The 3745 provides attachment for three different types of consoles:

- *A* **local** *console, which is mandatory, and*
- *A* **remote** *or an* **alternate** *console.*

It also provides attachment for the **remote support facility** *(RSF). The consoles and RSF are connected to the MOSS via a common communication adapter.*



Only one console can be active at a time.

There is a separate password for each of the following:

- The local console
- The remote or alternate console
- The RSF.

For details of the console or RSF connection, refer to the *IBM 3745 Connection and integration Guide*.

Local Console

The local console is mandatory. It is directly attached (no DCE) to the 3745 at a maximum distance of 7 m (23 ft.).

This console, which is compatible with CCITT V.24, communicates with the 3745 in duplex start-stop mode at 2400 bps.

The local console can be:

- An IBM 3151 Display Station running in native mode
- An IBM 3161 Display Station running in IBM 3101 emulation mode
- An IBM 3163 Display Station running in IBM 3101 emulation mode
- A PS/2* (models 50 and above) with OS/2* extended edition running in IBM 3101 emulation mode
- An IBM 3727 Operator Console (a keyboard overlay is provided with the controller)
- Any equipment providing equivalent functions.

Remote Console

The remote console is attached to the 3745 over the public switched network via a DCE.

The console, which is compatible with CCITT V.24, communicates with the 3745 in duplex start-stop mode at 1200 bps.

The remote console can be:

- An IBM 3151 Display Station running in native mode
- An IBM 3161 Display Station running in IBM 3101 emulation mode
- An IBM 3163 Display Station running in IBM 3101 emulation mode
- An IBM Personal Computer AT* or Personal Computer XT* Model 286 with OS/2 extended edition running in IBM 3101 emulation mode
- A PS/2 (models 50 and above) with OS/2 extended edition running in IBM 3101 emulation mode
- Any equipment providing equivalent functions.

Alternate Console

Instead of a remote console, an alternate console can be directly attached (no DCE) at the same 3745 port at a maximum distance of 122 m (400 ft.). These two attachments are mutually exclusive.

The alternate console, which is compatible with CCITT V.24, communicates with the 3745 in duplex start-stop mode at 2400 bps.

The alternate console can be:

- An IBM 3151 Display Station running in native mode
- An IBM 3161 Display Station running in IBM 3101 emulation mode
- An IBM 3163 Display Station running in IBM 3101 emulation mode
- A PS/2 (models 50 and above) with OS/2 extended edition running in IBM 3101 emulation mode
- An IBM 3727 Operator Console (a keyboard overlay is provided with the controller)
- Any equipment providing equivalent functions.

Console Sharing

In multiple-controller installations, instead of having one operator console per controller, it is possible to share one console between several IBM communication controllers. In this case, the shared console is attached to an IBM 7427 Console Switching Unit. The IBM 7427 is an RPQ.

- A maximum of four IBM communication controllers can share a local console. In this case, the shared console must be at a maximum distance of 7 m (23 ft.) from any communication controller.
- A maximum of six IBM communication controllers can share an alternate console.

Remote Support Facility

The remote support facility (RSF) is connected to IBM RETAIN and provides IBM maintenance assistance when requested. The RSF is attached to the 3745 over the public switched network via a DCE.

The MOSS-to-RETAIN connection is made with a BSC protocol at 1200/2400 bps (V.22/V.22 bis interface, or V.23 HD 1200 bps, depending on the country), via a duplex external modem with the auto-answer feature.

In selected countries an RSF modem is supplied with the controller.

MOSS Functions

Startup and Management

- Controller initialization including CCU IPL, scanner IML, and CA IPL.
- Initial configuration and reconfiguration management.
- Scheduled power on.
- Permanent display of the machine status on the 3745 operator console.
- Functions that maintain machine files defining the configuration of the lines attached to the controller, machine details of the controller, and parameters of the lines and channels used in the initialization process. See “MOSS User Facilities” on page 4-30.
- Port swap operations on LSS, HSS, ELA, and TRA lines.
- Console password management.
- Automatic retry of failing controller hardware or microcode (including MOSS microcode).

Event Notification

- Automatic logging of box event records (BERs) in the BER file on the controller hard disk.
- Generation of:
  - A reference code by the autoBER program for each new BER.
  - Alert messages for display at the host console via NCP or PEP (using the alert support provided by the NetView program).
  - Alarm messages for display at the 3745 operator console.

Dumps

- Automatic control program dump and re-IPL.
- Manual control program dump on disk from VTAM operator and re-IPL.
- Automatic or manual channel adapter dump.
- Automatic or selective scanner dump and IML after unrecoverable failures.
- Automatic or manual TIC dump.
- Automatic or manual MOSS dump and re-IML.
- Automatic dump of power control processor.

Problem Determination by the User

The user can participate to troubleshooting and repair through:

- CCU functions
- NCP or EP functions
- Display of BERs and alarms through the event log display (ELD) and by maintenance personnel through:
  - Channel adapter services
  - TSS services

  - TRSS services
- Scanner SIT trace (of LSS, HSS, ELA)
- Wrap tests on LSS and HSS lines
- Power services.

Utility Programs

Through the utility programs, the operating and maintenance personnel can:

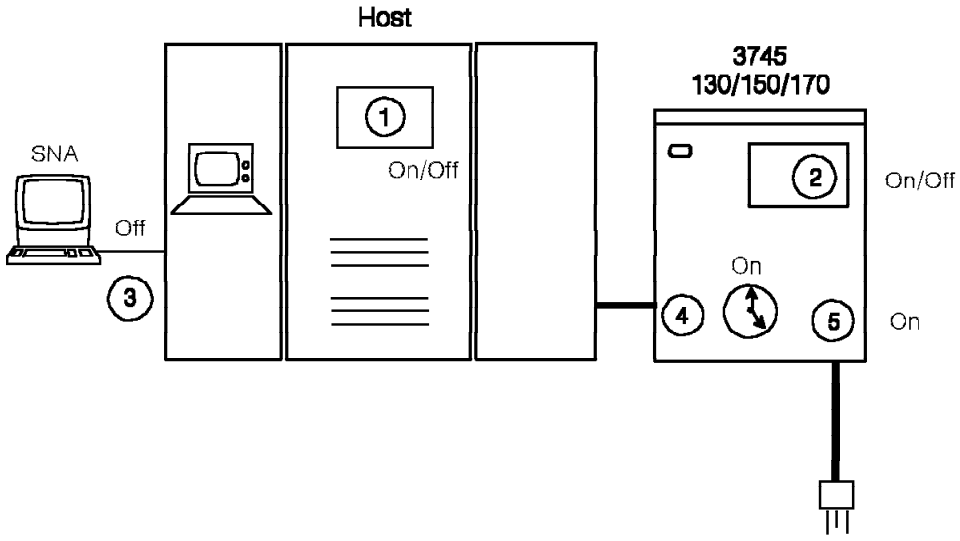
- Display the control program, scanner, TIC, or MOSS dump
- Transfer dumps to the host for printing
- Modify the control code (microcode fix function)
- Save vital files from the disk to diskette when installing a microcode engineering change (disk functions)
- Restore the disk from the diskettes (disk functions)
- Copy NCP load module from disk to diskette and from diskette to disk for Remote Loading and Activation.
- Isolate hardware faults in the controller
- Isolate faults on lines and token-ring adapters
- Manage the remote support facility.

Power On/Off

The 3745 can be:

1. *Powered on and off by a channel-attached host*
2. *Powered on and off locally by the operator*
3. *Powered on by the operator and off by a remote SNA command*
4. *Powered on through the scheduled power-on MOSS function*
5. *Repowered on automatically by the auto-restart function after a power outage.*

These operations are described in the *IBM 3745 Communication Controller: Basic Operations Guide, SA33-0146*.



Initializing the Controller

The initialization of the controller includes MOSS initial microprogram load (IML), scanner IML, channel adapter initialization, and control program load.

It can be invoked under the following conditions:

- Automatically, at power-on, or at auto-restart
- Automatically, at a scheduled time without any operator action (Timed IPL).
- At the request of the host via a host channel or a telecommunication line (in this case, the MOSS IML is not invoked)
- At the request of the MOSS operator from the control panel
- From the controller hard disk. This allows automatic re-IPL, for example in case of CCU failure. Assume that:
  - The required load module has been saved onto the disk, after transferring it from the host to the controller storage.
  - The automatic IPL from disk option has been chosen (see "Disk IPL Information" on page 4-32).

The various procedures for initializing the controller are described in the *IBM 3745 Basic Operations Guide,* SA33-0146.

Automatic IPL and Dump

The IPL with automatic control program loading capability is obtained by saving the control program load module on the controller hard disk. When two control program load modules are stored on the disk, the load module designated for automatic loading is used. See "Generating and Loading the Control Program" on page 3-2.

The MOSS can re-IPL the controller by using a disk-resident control program load module specified as *active* at the operator console:

- When the operator requests IPL either at the control panel or at a 3745 console.
- At a scheduled time, controllers in a network can be automatically reloaded (Timed IPL).
- After a hard stop of the CCU or an NCP abend. In this case, there is an automatic dump of the controller storage, and then an automatic control program reloading. This dump is saved on the MOSS disk. The network operator can request transfer of either a part or all of the saved dump to the host.

Diskette Management for Remote Loading and Activation

As described on page 3-3, the remote NCP load modules are:

1. Generated in the host
2. Transferred from the host storage to the local 3745 disk
3. Copied from the local 3745 disk to one diskette (for each remote 3745).

Then, the diskettes are mailed or hand-carried to the remote locations, and there, each NCP load module is:

4. Copied from the diskette to the remote 3745 disk

5. On receipt of appropriate VTAM commands, loaded from the disk to the remote 3745 CCU storage.

The disk IPL information (DII) function allows all these copy operations from disk to diskettes and from diskettes to disk.

Supervising the Controller

Normal operations are supervised by the control program. The operator supervises the controller from the attached operator console. At any time, the screen displays the status of the controller components. Refer to “Machine Status Area” on page 4-31. It also presents the operator with the MOSS menu of services. The operator proceeds through the screen, and is prompted and given assistance by the system. See “MOSS User Facilities.”

MOSS User Facilities

The user can display and change various machine parameters at the 3745 operator console through the MOSS functions.

Some of these functions are described below. For other functions and more details of the following ones, refer to the *IBM 3745 Advanced Operations Guide*.

Configuration Data File

The configuration data file (CDF) contains information about the CCU, the main storage size, the MOSS storage, disk and diskette capacity, the channel adapters and two-processor switches, the line adapters, the line interface couplers, the Ethernet adapters, the cables and the clocking modes.

The configuration data file is created at manufacturing time. It is then completed and checked against the current controller configuration at installation time. The user can use the configuration data file to:

- Change native subchannel and emulated subchannel addresses including protocols and data speed
- Display and update the line characteristics for each change in the 3745 configuration, when adding, removing, or replacing line cables or LICs.

This file is used by MOSS during the initialization process, and by the diagnostic programs.

Line Interface Display

The line interface display (LID) provides various parameters on lines (control program, line type, protocol, interface standard, speed, clocking speeds, transmission mode, and cable identification).

The display includes data set leads, sampling of transmitted and received data, transmit and receive commands, and command status. The user can also use this function for error and fault isolation.

Ethernet Interface Display

The Ethernet interface display (EID) provides information on line parameters, protocol (V2 or 802.3), port address, and statistics counters (transmit, receive, and errors counters).

Machine Level Table

The machine level table (MLT) contains information such as the microcode level of the machine, the type and version of control program (NCP or PEP), and the load module being used.

This table provides information required by the maintenance personnel. The machine level table can be displayed from the operator console. Using SSP, this file may be transferred and printed at the host whenever a microcode dump is requested.

IPL Port

An IPL port is any communication link (LSS or HSS) used to transfer the control program from the host to the controller. The user uses the link IPL port (LKP) function to define the communication link addresses for each IPL port at installation time, or to update them. This function is not supported by ESS.

The parameters of each IPL port that are used to initialize the controller are maintained on the MOSS disk.

Machine Status Area

The machine status area (MSA) is an area of the console screen. It displays permanent information on the 3745 status.

This area is divided into fields respectively dedicated to various status information. It provides the operator with the MOSS, scanner, token-ring adapter, and TIC status. It displays information on the progress of controller IPL and scanner IML functions.

Password Management

Access to the system is controlled by passwords defined by the user.

The password management (PSW) function enables the user to update the passwords.

The password is required when logging on from a local, remote, or alternate console. A temporary or permanent maintenance password enables IBM service personnel to access the system through the RSF link.

Channel Interface Display

The channel adapter enable/disable *function is always accessible from the attached console.*

The related menu is displayed immediately after the console power-on and MOSS IML. For this function only, no password is necessary. The user can also display additional information relating to the host(s) to which a channel interface is attached.

Port Swapping

The port swap function (PSF) is used to switch one LIC or TIC port to another without control program regeneration.

If a link to a port is disconnected (line, LIC, or scanner failure), this failing link can be logically and physically switched from its original port to a spare one. Through

the port swap function, the operator can display, create, or delete port swap definitions.

Power Services

The power services (POS) are used to:

- *Dump the power control microcode*
- *Change the control panel batteries.*

Scheduled Power-On

The scheduled power-on function provides, on a daily basis, one 3745 power-on time for each day of the week. The scheduled time can be updated.

The scheduled power on is part of the time services (TIM) function. The latter allows the user to activate or deactivate the scheduled power-on capability.

Disk IPL Information

The disk IPL information (DII) function displays the current operation mode with the names and statuses of the control program load modules, the name of the currently stored dump, and the setting of the automatic IPL or dump option for each load module.

The date and time of each load module are displayed on the MOSS display.

The user can also set the automatic IPL or dump option for the required load module, and purge the control program dump file.

Event Log Display

The event log display (ELD) function contains the box event record (BER) file (see "Box Event Records" on page 5-3). The display of the summary of all BERs and alarms or of a detailed BER helps the user in a problem determination process. The BER file may be printed at the host.

Wrap Test

The wrap test (WTT) function allows the user to check a communication line (LSS or HSS) in a problem determination process.

On lines connected to low-speed scanners, the wrap test can be performed at LIC (internal or external), cable, and DCE level. Wrap tests of the integrated DCE include all LIC wrap test levels plus the DCE wrap test. In the latter case, the integrated DCE is considered as a stand-alone DCE. A DCE wrap plug is provided with the LIC5/6s.

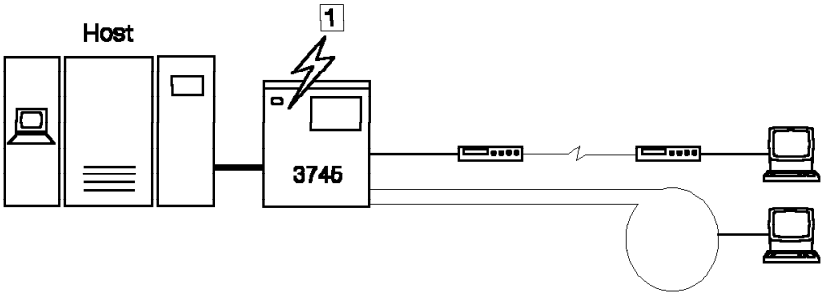
Chapter 5. Problem Determination

Hardware, microcode, or software failures may occur in a data network. These errors are identified and notified to the host by the 3745. They are handled differently depending on whether the host is equipped with:

- *The VTAM access method along with the NetView program, or*
- *The VTAM access method only.*

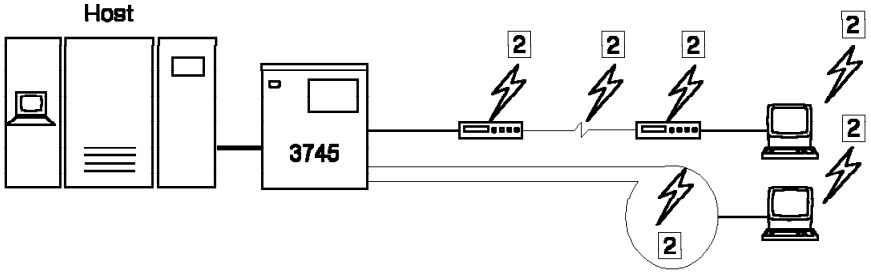
Two types of error are considered:

1. *Controller errors (component of the 3745 itself)*



These errors are detected by the MOSS, and can be fixed either by the customer or by the IBM service organization (see pages 6-2 and 6-3).

2. *Network errors (DCEs, lines, stations, token-rings, Ethernet-type LANs, and so on).*



These errors are detected by the NCP or PEP. The appropriate service organization should be called (DCE or DTE maintainers, PTT, common carrier, and so on).

Error Detection and Reporting

The 3745 is equipped with several error detectors implemented in the:

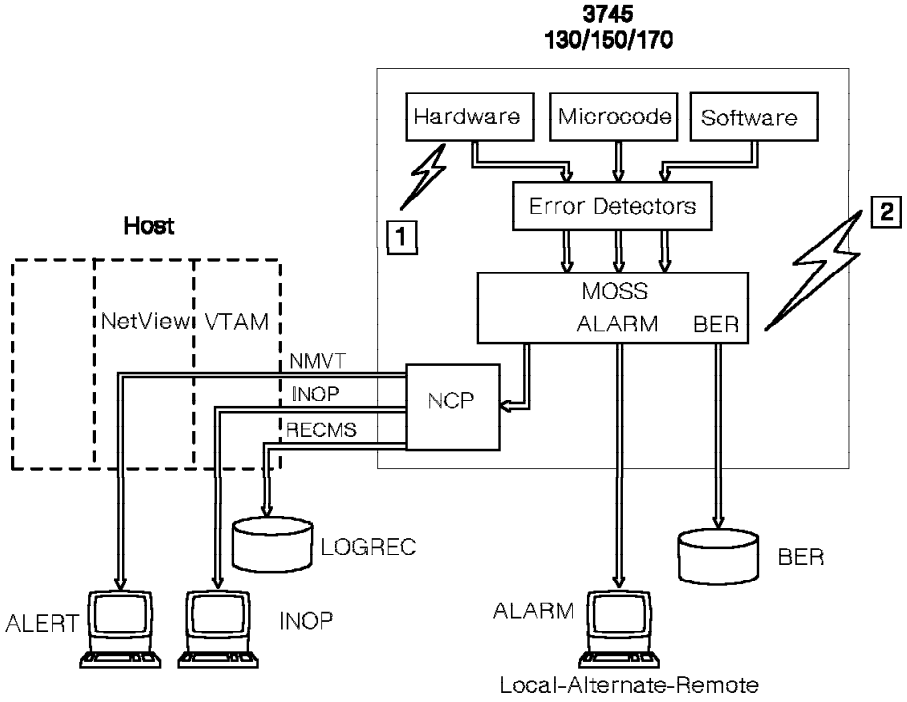
- Hardware
- Microcode
- NCP or PEP.

Any abnormal condition detected either:

- By these 3745 error detectors, or
- In the network

is signalled to the MOSS. Then, the MOSS:

- Builds a BER and stores it on the disk for future use
- Depending on the severity of the event, builds an ALARM message for the 3745 console(s)
- Depending on the severity of the event, sends relevant information to the host through NCP or PEP which, in turn, builds:
  - An ALERT message for the NetView console, or
  - An INOP message for the VTAM console, if NetView is not installed, along with a logging record (Logrec) for the VTAM log file.



Errors detected in the integrated DCE can be handled as:

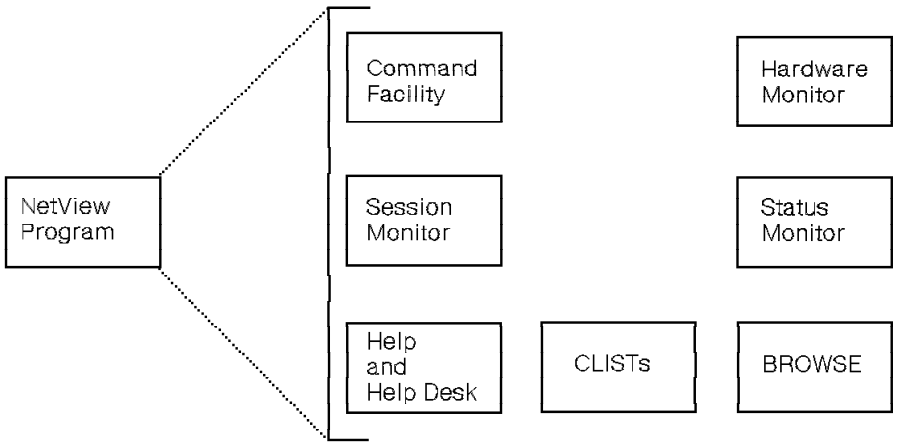
1. An error of a controller component
2. A network error.

A failure of the integrated DCE is also notified by an indicator on the LIC 5 or 6. The local operator can then investigate the source of failure using the 5869 Portable Keypad Display. The automatic fault isolation procedure, triggered by pressing the *Diag* key, helps identify the faulty element, for example:

- The local DTE or DCE
- The line
- The remote DTE or DCE.

NetView Program

The NetView program and VTAM work together to provide easy problem determination facilities such as generic alerts, session flow tracing, and network recovery (through user written CLISTs for activation/deactivation of a failing component in the network), and monitoring facilities. The NetView program collects information for problem determination and determines reasons for failures so that the network continues operating while detecting possible failures.



The NetView program takes advantage of the LPDA problem determination facilities to isolate an error affecting a DCE. Under control of these programs, the DCE accepts commands and initiates tests that help isolate problems to the line, local DCE, remote DCE, or other part of the network. They provide the network operator with the most probable cause of network problems.

INOP messages, RECMS (or RECFMS) for network problems, and NMVT for controller problems are reported to the host via VTAM. The NetView program presents NMVTs as generic alerts. Other data is also collected from VTAM and NCP, and stored in a data base to be displayed on request.

Online information is provided at the NetView console through a series of menu-driven command screens which help to diagnose, isolate, and solve problems in a network. For example, the NetView program helps determine a failure on an attached 3745 or other communication controller.

Box Event Records

The MOSS automatically logs any new BER in the BER file stored on the MOSS disk. The BER file contains two types of record:

- *Records related to a failure, and*
- *Records related to other events, for example IML or IPL complete.*

Each BER relating to a failure contains relevant data about the environment at the instant of the detected failure.

AutoBER Program and Refcode

The automatic BER analysis program (autoBER) is a facility for problem source identification. Each BER is analyzed by the autoBER program to produce an eight-character reference code (refcode). The latter is included in the alarm and alert messages. This refcode helps identify a failing hardware or software component, or some user error (NCP generation, CDF upgrade, and so on).

When the problem determination action provided for the alert is not sufficient to isolate the problem, the user should provide the refcode to the IBM maintenance organization for failure analysis and isolation.

Generic Alerts

Alert messages contain generic information formatted by the NetView program. They contain a recommendation for further problem determination actions (tests or calling the appropriate service organization).

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 the NetView program in the host into a message displayable at the host console. The refcode corresponds to a precise type of error and gives information about the suspected component.

When the NetView program is not supported or not active, the error is reported as a record to the VTAM log file (Logrec) and an alarm message is displayed at the 3745 operator console.

Alarms

Alarm messages displayable at the 3745 console provide the user with an entry point into the IBM 3745 Problem Determination Guide, *SA33-0096. It is recommended that the 3745 operator review the alarms as a chronology of events before taking action on any specific alarm. MOSS records all alarms on the disk.*

Retry and Recovery

Error handling in the 3745 includes extensive recovery and retry for intermittent failures. On detection of a failure, the information on the error environment is logged and a retry or recovery attempt is invoked.

Retries allow the controller to recover from intermittent hardware and transmission failures. In most cases, the controller remains available to the rest of the network while the retries are being executed. The controller provides recovery from intermittent hardware failures. The host access method provides network error recovery.

The failed operation is retried the number of times defined by the function or component threshold value.

According to the level of error, retries are performed by:

- NCP
- Scanner microcode
- MOSS microcode.

If the retry is successful, a recovery is used to reactivate the resource. Error recovery attempts performed by the MOSS are:

- Automatic scanner dump and re-IML
- Automatic CCU dump and re-IPL
- Automatic MOSS dump and re-IML
- Automatic TIC dump.

For example, if the MOSS is operational and a failure occurs in the CCU or its storage, or if there is a control program abend, the MOSS triggers an automatic re-IPL of the 3745. There is an automatic dump and an automatic loading of the active load module stored on the MOSS disk if the automatic IPL option has been chosen. Otherwise, the network operator can reload the control program from the host and, if required, take a dump.

If the MOSS is disabled and remains disabled, all communication functions of the 3745 continue, but no maintenance functions can be run. The 3745 control program cannot be reloaded.

If a line adapter is disconnected, the controller continues to operate with the other adapters. The MOSS provides an automatic dump of the disconnected adapter and attempts to re-IML it. If it remains inoperative, the user can move the lines to another adapter via the port swapping function.

If a channel adapter is disabled, that route to a host is inoperative.

When the line status given by the portable keypad display or host messages indicates poor condition of the lines connected to a LIC 5 or 6, the LIC 5 or 6 can run at its backup speed. This applies also in the case of temporary line problems. The impact of line degradation is reduced at slower speed. When normal line conditions resume, the full speed can then be reset. In the case of continuous line problems, the lines should be disabled.

After a power off/power on, the LIC 5 or 6 will operate at its default speed, which is usually the full speed. Thus, if the LIC 5 or 6 is running at its backup speed, the operator should redefine it at the next power on.

The retry is not successful when the failing function cannot be corrected or when the retry threshold is exceeded. The error is analyzed and notification is sent to the operator (by an alarm or alert). In this case, there is a hardware or microcode error or a faulty element. The failed resource is inhibited, or the faulty element is repaired or replaced.

Controller Retry/Recovery	**Network-Level Action**
Automatic CCU re-IPL	Dynamic reconfiguration
Automatic or selective scanner IML	Network resource reactivation (NetView program)
MOSS IML	None

Problem Determination Facilities Summary

The following problem determination facilities are available. Most of them can be used by both the user and the IBM service representative. The service representative may, however, have access to a more complex level of some facilities, for example, the configuration data file.

Host Facilities

- Alert content (NetView program)
- Record in logrec
- Host-initiated LPDA-2 commands, tests and diagnostics (integrated DCE)
- Host-initiated traces
- Tests such as OLTs[1]
- Dumps and dump printouts
- NetView facilities
- Refcode[1]
- Host-initiated link tests.

Controller Facilities

- Control panel functions
- Alarm content
- Event log file
- Refcode[1]
- Machine status display
- Diagnostics[1]
- Dumps and dump transfer to host
- Dump and trace transfer to RETAIN[1]
- Tests on LSS lines such as:

  Internal wrap test

  External wrap test with wrap connector

  Stand-alone link test (between two controllers)
- Data wrap tests on HSS lines (X.21 only)
- Internal and external wrap test on HSS lines[1]
- 5869 portable keypad display executing

  Self-tests and commands

  Automatic diagnostics

  for the integrated DCEs
- Control program procedures
- CCU functions

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[1] For IBM service representative only.

- MOSS files (CDF, MLT)
- Line and token-ring interface display
- Ethernet interface display
- Port swapping
- LSS and TRA services[1]
- Channel adapter services[1]
- Power services
- Automatic CCU, scanner, and TIC dump
- Internal and external trace on LSS lines
- TIC trace
- Internal trace on HSS and ELA lines[1].

[1] For IBM service representative only.

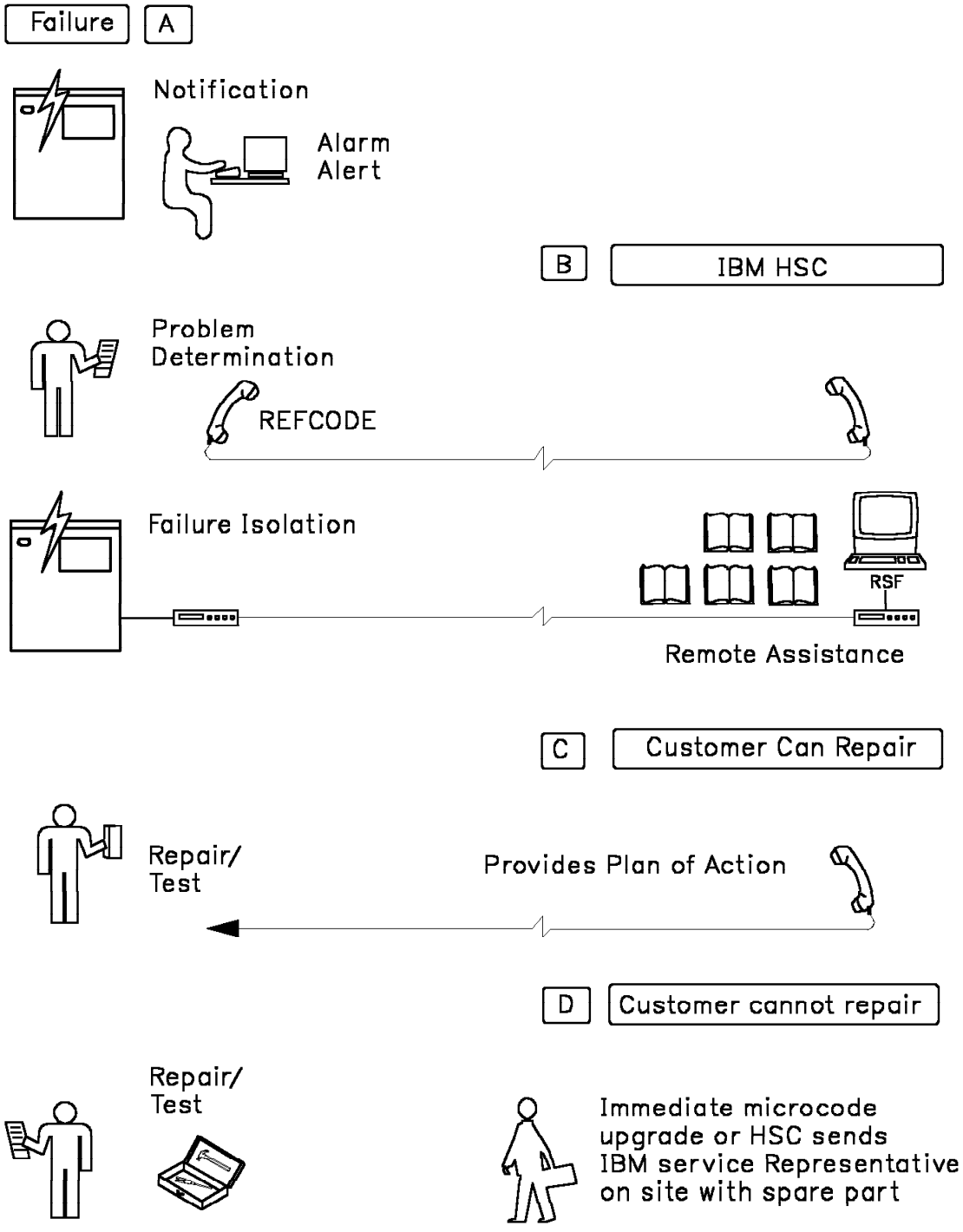
Chapter 6. Controller Maintenance

Depending on the faulty controller element, problem determination takes place at the system level, controller level, or both.

Diagnostic programs, *stored on the MOSS disk, are used to detect and isolate hardware failures in the controller. They also help verify the controller after repairs and engineering changes, or after controller configuration changes. Controller maintenance is independent of the host, except for dumps, some types of traces, CA online tests (OLTs), and the Logrec file.*

The following figure shows the main actions done either by:

- *The customer, or*
- *The IBM service organization.*


Failure
A
Notification
Alarm
Alert
B
IBM HSC
Problem
Determination
REFCODE
Failure Isolation
RSF
Remote Assistance
C
Customer Can Repair
Repair/
Test
Provides Plan of Action
D
Customer cannot repair
Repair/
Test
Immediate microcode
upgrade or HSC sends
IBM service Representative
on site with spare part

A When the failure occurs, it is notified to the operator via ALARM or ALERT messages which explain:

- The nature,
- The area, and
- The probable cause

of the failure.

The message content can be used as an entry in the problem determination documentation. Accordingly, the user can take the appropriate corrective action by replacing the suspected element if within the user access area. In the case of a failing LIC or TIC, the user can perform a wrap test to isolate the failing element, and bypass the failure by performing either:

- A LIC or TIC swap with a spare LIC or TIC, or
- A line port swap.

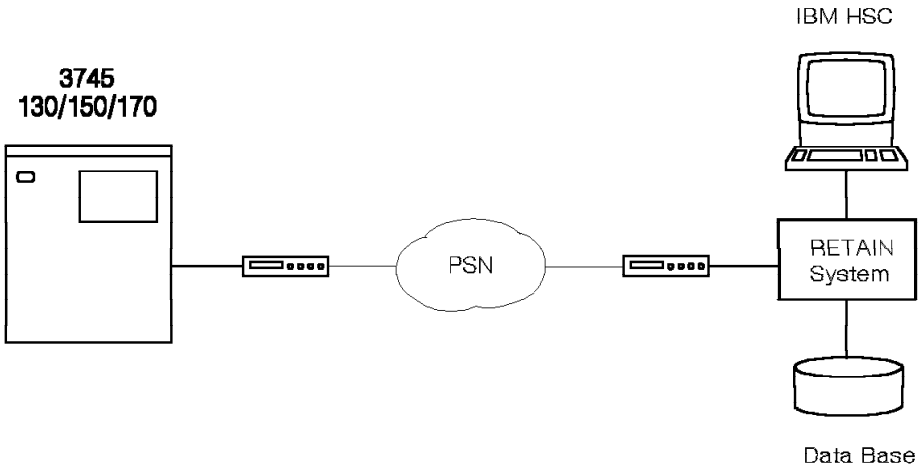
B When a controller or integrated DCE problem cannot be solved through this process, the user should call the appropriate maintenance organization, for example, the IBM Hardware Support Center (HSC) in the U.S.A. or the IBM Hardware Central Service (HCS) in world trade. When calling the HSC, the user provides the REFCODE that eases the problem isolation process, and enables any required spare part to be ordered faster. The HSC coordinates remote assistance via the RSF link.

C If the customer can perform the repair (as described in **A** above), the IBM HSC provides him with the appropriate plan of action.

D If the customer cannot perform the repair (because the failing element is not in the customer access area), the HSC sends an IBM specialist for on-site intervention with the appropriate spare part if necessary.

Remote Support Facility

The remote support facility (RSF) allows communication through public switched network between the MOSS and the IBM Remote Assistance Information Network (RETAIN). Such a connection is temporarily or permanently authorized through a password defined by the user.



RSF is a helpful mechanism for solving problems without on-site intervention of an IBM service representative. It allows:

- *The RETAIN terminal to be used as a remote 3745 console for remote problem determination by an IBM service representative.*
- *MOSS-to-RETAIN and RETAIN-to-MOSS data file transfers.*

Installation and Upgrade

The installation of the 3745-130/150/170 includes a planning phase, physical installation, and the setting of line and integrated modem characteristics.

The configuration definition and the site preparation are done by the user with the assistance of IBM. The necessary information is provided in the *IBM 3745 Configuration Program,* GA33-0093, in *S/360, S/370, 4300 I/O Equipment IM-PP,* and in the *IBM 3745 Preparing for Connection*.

IBM is responsible for installing the 3745. Installation can be performed when the planning requirements are met.

| *At initial 3745 installation IBM service will perform external cable installation. This*
| *operation includes cable labelling, cable laying, and cable connection.*

Once the 3745 has been installed by IBM, the user will perform the network integration procedure according to the instructions contained in the IBM 3745
| Communication Controller: Connection and Integration Guide*. IBM can provide on*
| *request assistance to the user for starting the network.*

These instructions include the following steps:

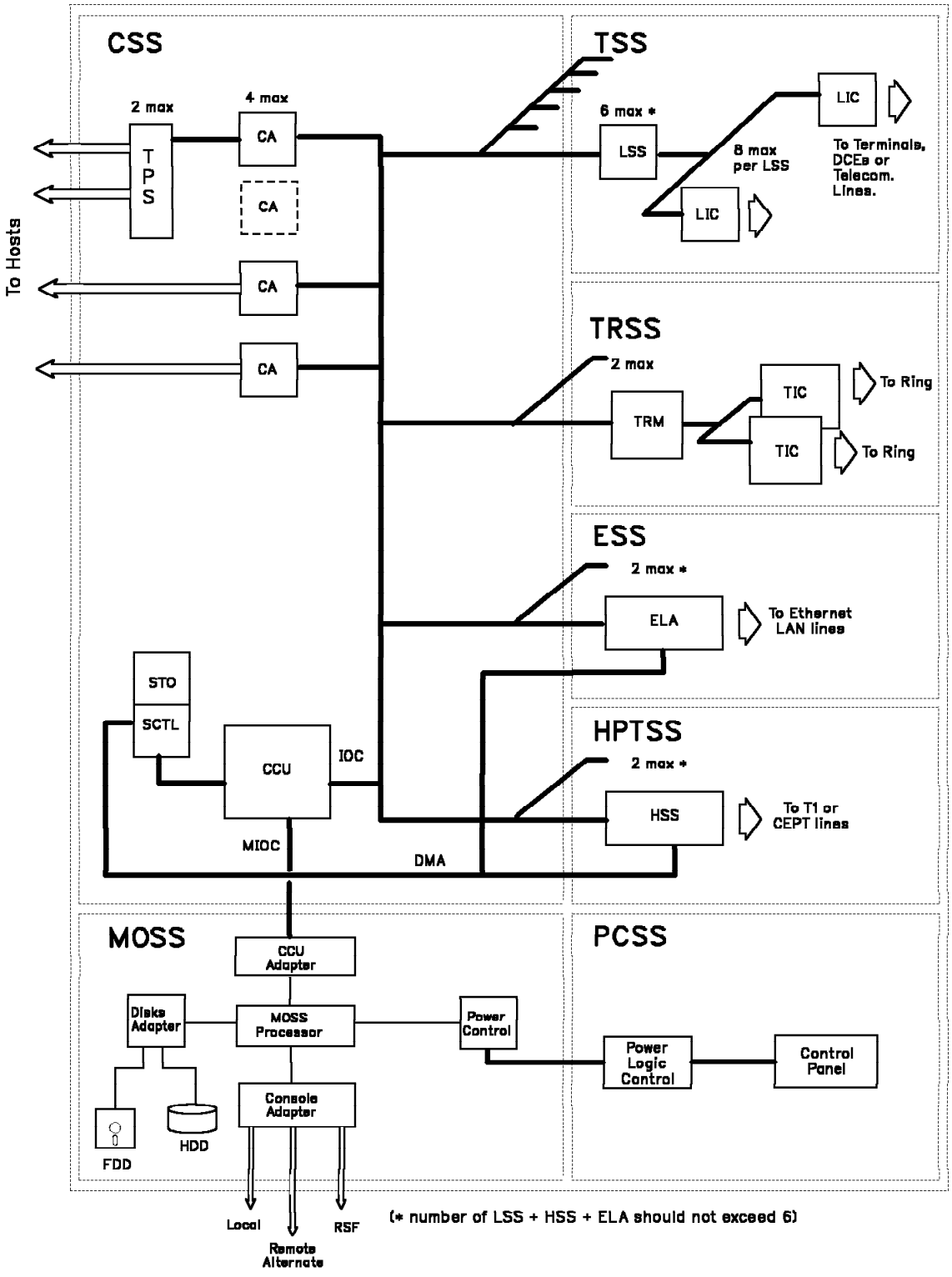
1. Setting the operating characteristics of the local console and, if installed, the other consoles and DCEs.
2. Customizing the 3745 network characteristics and console logon passwords by using the appropriate MOSS menus at the operator console.
3. Configuring the integrated DCE. The parameters for initialization can be set by using:
   - An IBM 5869 Portable Keyboard Display (PKD) to set the line characteristics and speed.

     For a LIC with integrated CSU/DSU (LIC 6), a switch on the LIC allows you to select the interface as V.35 (56 kbps) or V.24. Then, the speed is set to 19.2 or 9.6 kbps via the portable keypad display.
   - A host console to issue the NetView commands to define the mode as point-to-point or multipoint.

| The external cable connections may be perform by the user, if he wants, according
| to the instructions of the *IBM 3745 Communication Controller: Connection and*
| *Integration Guide*.

Also, the user can remove, add, or change a LIC or a TIC at any time. Refer to the IBM 3745 Connection and Integration Guide.

3745-130/150/170 General Data Flow



Appendix A. Data Clocking

This appendix provides clocking considerations for properly operating:

- Low-speed scanners with low/medium-speed lines
- High-speed scanners with high-speed lines.

Data Clocking for Low-Speed Scanners

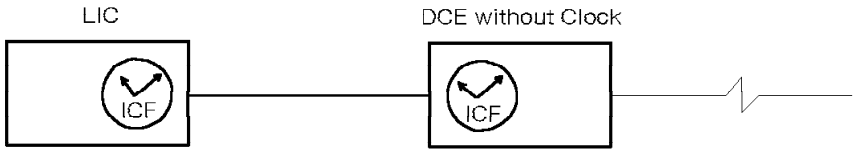
An internal clock function (ICF), associated with each LIC, provides the transmit and receive clocks to:

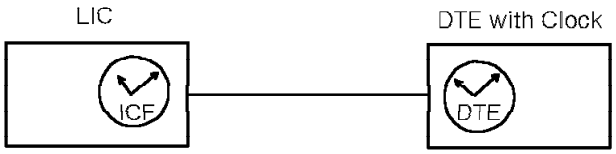
- *The LICs and low-speed nonclocked DCEs*
- *Only the LICs, when their direct-attached DTEs use their own clock*
- *The LICs and their direct-attached nonclocked DTEs.*

Note: A 3725, 3720, or 3745 model 210, 310, 410, or 610 may be locally attached to a 3745-130/150/170 low-speed scanner as for any other DTE at speeds up to 245 760 kbps, via LIC type 3 or 4B.

The ICF is not used when a LIC is attached to a clocked DCE. Depending on the above configurations, the ICF mode can be **Internal**, **3745**, *or* **External**, *and the clockings are provided as follows:*

INTERNAL Mode





Speed Selection : By SSP at generation time

NCP Parameters : CLOCKING=INT, SPEED=xxx

Speeds:

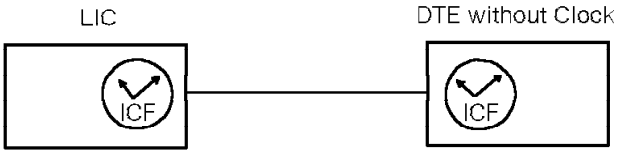
1. Asynchronous lines (Start-Stop)

   50, 75, 100, 110, 134.5, 200, 300, 600, 1200, 2400, 4800, 9600, and 19 200 bps.

2. Synchronous lines (BSC, SDLC)

   50, 100, 134.5, 200, 300, 600, 1200, 2400, and 4800 bps.

3745 Mode



Speed Selection : By SSP at generation time

NCP Parameters : CLOCKING=DIRECT, SPEED=xxx

Speeds:

1. Asynchronous lines (Start-Stop)

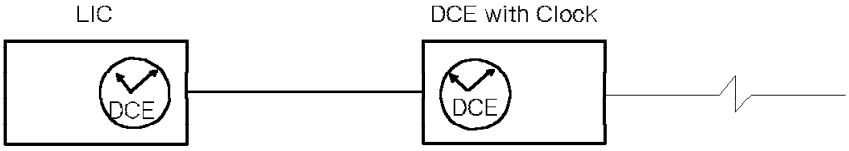
   50, 75, 100, 110, 134.5, 200, 300, 600, 1200, 2400, 4800, 9600, and 19 200 bps.

2. Synchronous lines (BSC, SDLC)

   50, 75, 100, 110, 134.5, 200, 300, 600, 1200, 2400, 4800, 9600, 19 200, 38 400, and 55 855 bps. With SDLC only, 245 760 bps is also allowed.

EXTERNAL Mode

The EXTERNAL clocking mode does not activate the ICF since the DCE provides the transmit and receive clocks to both the LIC and itself (LIC5s and LIC6s provide the clocking to their own LIC and are seen as "External" by NCP).



Speed Selection : By SSP at generation time

NCP Parameters : CLOCKING=EXT, SPEED=xxx

Speeds:

1. Asynchronous lines (Start-Stop):

   Up to 19 200 bps.

2. Synchronous lines (BSC, SDLC):

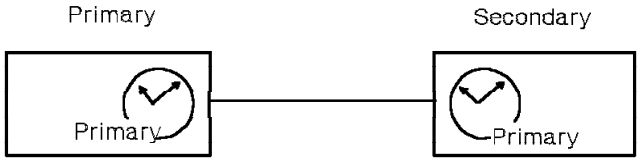
   Up to 256 000 bps.

Data Clocking for High-Speed Scanners

In case of attachment between two compatible high-speed scanners (3745-130/150/170 or 3745-210/410), the clocking is provided by:

- *The primary high-speed scanner in direct-attachment mode*
- *The DCE (network adapter) in remote attachment mode.*

Direct-Attachment

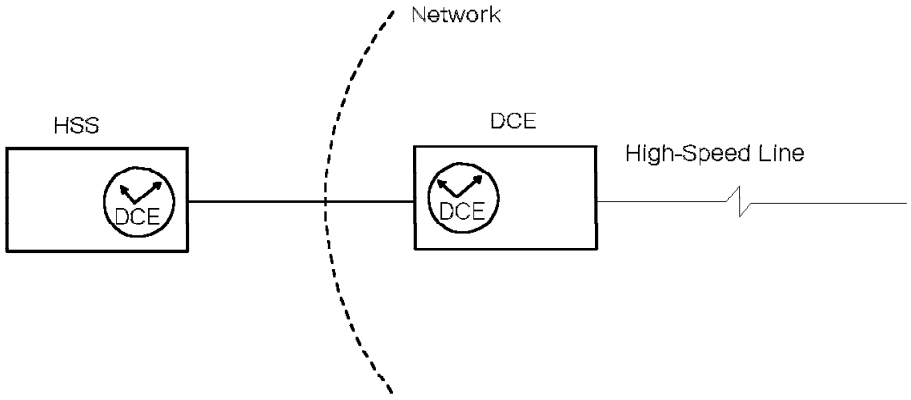


Speed Selection : By SSP at generation time

NCP Parameters : CLOCKING=DIRECT, SPEED=xxx

Speeds : Synchronous (SDLC or HDLC)
0.24576 Mbps
1.47456 Mbps
1.8432 Mbps.

Remote Attachment



Speed Selection : By SSP at generation time

NCP Parameters : CLOCKING=DIRECT, SPEED=xxx

Speeds: Synchronous (SDLC or HDLC)
T1 lines: 0.24576, 0.512, or 1.47456 Mbps
CEPT lines: 2.048 Mbps.

List of Abbreviations

abend	abnormal end of task
AC	alternating current
ACF	Advanced Communications Function
ASCII	American National Standard Code for Information Interchange
AUI	attachment unit interface
autoBER	automatic BER analysis program
BCD	binary-coded decimal notation
BER	box event record
BNN	boundary network node
bps	bits per second
BSC	binary synchronous communication
BTAM	basic telecommunications access method
BTAM-ES	BTAM extended storage
CA	channel adapter
CCITT	Comité Consultatif International Télégraphique et Télép honique (International Telegraph and Telephone Consultative Committee)
CCU	central control unit
CDF	configuration data file
CEPT	Comité Européen des Postes et Télécommunications (European Conference of Postal and Telecommunications Administrations). European service for high-speed transmissions at 2.048 Mbps.
CLIST	command list
CNM	communication network management
CRI	call request identification
CRN	call request number
CSP	communication scanner processor
CSS	control subsystem
CSU	channel service unit
DC	direct current
DCE	data circuit-terminating equipment
DCI	direct current interlock
DDS	digital data service
DII	disk IPL information
DMA	direct memory access
DSU	data service unit
DTE	data terminal equipment
EAC	Ethernet adapter card
EBCD	extended binary-coded decimal
EBCDIC	extended binary-coded decimal interchange code
ECC	error checking and correction
ECMA	European Computer Manufacturer's Association
EIA	Electronic Industries Association
EID	Ethernet interface display
ELA	Ethernet LAN adapter
ELD	event log display
EP	Emulation Program
ESA*	Enterprise Systems Architecture
ESS	Ethernet-type LAN subsystem
FCC	Federal Communications Commission
FESL	front-end scanner low-speed
FESH	front-end scanner high-speed
ft	foot
HCS	Hardware Central Service (WT)
HDLC	high-level data link control
HPO	high performance option
HPTSS	high-performance transmission subsystem
HSB	high-speed buffer
HSC	Hardware Support Center (US)
HSS	high-speed scanner
ICF	internal clock function
IEEE	Institute of Electrical and Electronic Engineers
IML	initial microcode load
INN	intermediate network node (deprecated term for IRN)
INOP	inoperative (line, DCE, or terminal)
I/O	input/output
IOC	input/output control
IPL	initial program load
IRN	intermediate routing node
k	kilo, 1 000

KB	kilobyte; 1024 bytes
kbps	kilobits per second
LA	line adapter
LAN	local area network
LIB	LIC base
LIC	line interface coupler
LIC1	line interface coupler type 1
LIC3	line interface coupler type 3
LIC4A	line interface coupler type 4A
LIC4B	line interface coupler type 4B
LIC5	line interface coupler type 5
LIC6	line interface coupler type 6
LID	line interface display
LIU	LIC unit (equivalent to LIB)
LKP	link IPL port
Logrec	logging record
LPDA	Link Problem Determination Aid
LSI	large scale integration
LSS	low-speed scanner
m	meter
MB	megabyte, 1 048 576 bytes
Mbps	megabits per second
MCF	microcode fix
MIOC	MOSS input/output control
MLT	machine level table
MOSS	maintenance and operator subsystem
MSA	machine status area
MUX	multiplexer function
MVS	Multiple Virtual Storage
MVS/ESA	Multiple Virtual Storage/Enterprise Systems Architecture
MVS/XA	Multiple Virtual Storage/Extended Architecture
N/A	not applicable
NCP	(Advanced Communications Function for the) Network Control Program
NCTE	network channel terminal equipment
NDF	NCP/EP definition facility
NEF	Network Extension Facility
NMVT	network management vector transport
NPM	NetView Performance Monitor
NPSI	X.25 NCP Packet Switching Interface
NRF	Network Routing Facility
ns	nanosecond
NSI	Non-SNA Interconnection
NTO	Network Terminal Option
NTRI	NCP/Token-Ring Interconnection
OLT	online test
OS	operating system
PC	personal computer
PCSS	power control subsystem
PEP	partitioned emulation programming
PKD	portable keypad display
POS	power services
PS	1) power supply 2) personal system
PSF	port swap function
PSW	password management
PSN	public switched network
PTF	program temporary fix
PTT	Post, Telephone, and Telegraph Administration
RAM	random access memory
RECFMS	record formatted maintenance statistics
RECMS	record maintenance statistics
refcode	reference code
RETAIN	Remote Technical Assistance Information Network
RPQ	request for price quotation
RS	register to storage
RS 366	EIA standard
RTAM	Remote Terminal Access Method
RSF	remote support facility
s	second
SDLC	synchronous data link control
SH/MPS	Short Hold Mode/Multiple Port Sharing
SIT	scanner interface trace
SL	serial link
SNA	Systems Network Architecture
SSP	(Advanced Communication Function for the) System Support Programs
TDM	time-division multiplexing

TIC	token-ring interface coupler
TIM	time services
TPS	two-processor switch
TRA	token-ring adapter
TRSS	token-ring subsystem
TSS	transmission subsystem
T1	U.S. service for high-speed transmissions at 1.536 Mbps
VM	Virtual Machine
VM/SP	Virtual Machine/System Product
VM/SP HPO	Virtual Machine/System Product High Performance Option
VM/XA	Virtual Machine/Extended Architecture
VSE	Virtual Storage Extended
VSE/AF	Virtual Storage Extended/Advanced Functions
VSE/SP	Virtual Storage Extended/System Product
VTAM	(Advanced Communications Function for the) Virtual Telecommunications Access Method
V.22	CCITT V.22 recommendation
V.22 bis	CCITT V.22 bis recommendation
V.24	CCITT V.24 recommendation
V.25	CCITT V.25 recommendation
V.25 bis	CCITT V.25 bis recommendation
V.35	CCITT V.35 recommendation
WTT	wrap test
XI	X.25 SNA Interconnection
X.20 bis	CCITT X.20 bis recommendation
X.21	CCITT X.21 recommendation
X.21 bis	CCITT X.21 bis recommendation
X.25	CCITT X.25 recommendation
232D	EIA standard
336	EIA standard
547	EIA standard

Glossary

This glossary defines all new terms used in this manual. It also includes terms and definitions from the *IBM Dictionary of Computing,* SC20-1699. If you do not find the term you are looking for, refer to the index or to the *IBM Dictionary of Computing*.

alarm. A message sent to the MOSS operator 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.

asynchronous transmission. Transmission in which each character is individually synchronized, usually by the use of start and stop elements. The start-stop link protocol, for example, uses asynchronous transmission. Contrast with *synchronous transmission*.

auto-answer. A machine feature that allows a DCE to respond automatically to a call that it receives over a switched line.

autoBER. A program that automatically analyzes a BER file.

auto-call. A machine feature that allows a DCE to initiate a call automatically over a switched line.

availability. The degree to which a system or resource is ready when needed to process data.

Bell 212A. Bell recommendations on transmission interface

binary synchronous communication (BSC). A uniform procedure, using a standardized set of control characters and character sequences, for synchronous transmission of binary-coded data between stations.

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.

Note: The word *box* is used instead of *controller* to contrast with the *network* in which the controller is only a component.

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*.

cache. A high-speed buffer storage that contains frequently accessed instructions and data and currently processed; it is used to reduce access and processing times.

callout. A serial auto-call command that allows a DCE to initiate a call automatically over a switched line.

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.

channel interface. The interface between the controller and the host processors.

clear channel. Mode of data transmission where the data passes through the DCE and network, and arrives at the receiving communication controller (for example, the IBM 3745) 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.

command list. In the NetView program, a sequential list of commands and control statements that is assigned a name. When the name is invoked (as a command), the commands in the list are executed.

communication common carrier. In the U.S.A. and Canada, a public data transmission service that provides the public with transmission service facilities. For example, a telephone or telegraph company (see also *Post, Telephone and Telegraph* for countries outside the U.S.A. and Canada).

communication controller. A communication control unit that is controlled by a program stored and executed in the unit. Examples are the IBM 3705, IBM 3725/3726, IBM 3720, and IBM 3745 models 210/310/410/610.

communication scanner. See *scanner*.

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 switches and indicators for 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. The part of the controller that stores and executes the control program, and monitors the data transfers over the channel and transmission interfaces.

customer engineer. See IBM service representative

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 between the data terminal equipment (DTE) and the line. For example, a modem is a DCE.

Note: The DCE may be a stand-alone equipment or integrated in the 3745.

data host. A host running application programs only.

direct attachment. The attachment of a DTE to another DTE without a DCE.

direct-current interlock (DCI). A mode of data transmission over an I/O interface to enable communication between data processing systems through a channel.

direct memory access (DMA). Mechanism permitting an adapter to access the storage without any control program interaction.

diskette. A thin, flexible magnetic disk, and its protective jacket, that records diagnostics, microcode, and 3745 files.

DTE (data terminal equipment). 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.

duplex transmission. Data transmission in both directions at the same time. Contrast with *half-duplex*.

EIA 232D, 336, 547. EIA recommendations on transmission interface

Emulation Program (EP). An IBM licensed program that allows a channel-attached communication controller to emulate the functions of an IBM 2701 Data Adapter Unit, an IBM 2702 Transmission Control, an IBM 2703 Transmission Control, or an IBM 3705 Communication Controller.

error recovery. The process of correcting or bypassing the effects of a fault to restore a computer system to a prescribed condition.

Ethernet LAN adapter (ELA). Line adapter for Ethernet-type network, composed of one communication scanner processor card (CSP), and one Ethernet adapter card (EAC).

Ethernet-type subsystem (ESS). The part of the controller that controls the data transfers over an Ethernet V2 or IEEE 802.3 local area network.

half-duplex. Data transmission in either direction, one direction at a time. Contrast with *duplex*.

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 Mbps).

high-speed scanner. Line adapter for lines up to two million bps. It is composed of a communication scanner processor (CSP) and a front-end high-speed scanner (FESH).

high-speed transfer. A mode of high-speed data transmission over an I/O interface to enable communication between data processing systems through a channel.

host processor. (1) A processor that controls all or part of a user application network. (2) In a network, the processing unit in which the access method for the network resides. (3) In an SNA network, the processing unit that contains a system services control point (SSCP). (4) A processing unit that executes the access method for attached communication controllers. Also called *host*.

IBM service representative. An individual in IBM who performs maintenance services for IBM products or systems.

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 the 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 (ICF). A LIC function that provides a transmit clock for sending data, and retrieves a receive clock from received data, when DCEs or

direct-attached terminal do not provide those timing signals.

line. See *transmission line*.

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 base (LIB). A board which houses:

- One multiplexer
- Up to eight LICs

line interface coupler (LIC). A circuit that attaches up to four transmission cables to the controller (from DTEs, DCEs or telecommunication lines).

line weight. A value (0.4 through 100) that represents the percentage of scanner occupation. The total weight of the lines connected to a scanner must be equal to or less than 100.

Link Problem Determination Aid (LPDA). A series of test commands executed by an IBM DCE to determine which of various network components may be causing an error in the network.

link protocol. The set of rules by which a logical data link is established, maintained, and terminated, and by which data is transferred across the link.

Logrec. Error logging file managed via the operating system.

low-speed scanner. Line adapter for lines up to 256 kbps. It is composed of a communication scanner processor (CSP) and a front-end low-speed scanner (FESL).

maintenance and operator subsystem (MOSS). The part of the controller that provides operating and servicing facilities to the user's operator and the IBM service representative.

microcode. A program that is loaded in a processor (for example, the MOSS processor) to replace a hardware function. The microcode is not accessible to the customer.

modem (modulator-demodulator). See DCE.

multiplexer channel. A channel designed to operate with a number of I/O devices simultaneously. Several I/O devices can transfer records at the same time by interleaving items of data. See also *byte multiplexer, block multiplexer*.

multiplexing. The division of a transmission facility into two or more channels by allocating the common channel to several different channels, one at a time.

multipoint connection. A connection established among more than two data stations for data transmission. The connection may include switching facilities.

NetView. An IBM licensed program used to monitor a network, manage it, and diagnose its problems.

NetView Performance Monitor (NPM). An IBM licensed program that uses VTAM to record performance data collected for various devices in a network.

Network Control Program (NCP). An IBM licensed program that provides communication controllers supports for single-domain, multiple domain, and interconnected network capability.

nonswitched line. A connection between systems or devices that does not have to be made by dialing. The connection can be point-to-point or multipoint. The line can be leased or private. Contrast with *switched line.*

online tests. Testing of a remote data station concurrently with the execution of the user's programs (that is, with only minimal effect on the user's normal operation).

operator console. The IBM Operator Console that is used to operate and service the 3745 through the MOSS. A local console must be located within 7 m of the 3745. Optionally an alternate console may be installed up to 120 m from the 3745, or a remote console may be connected to the 3745 through the switched network.

owning host. A host which can IPL an 3745 and also run application programs.

pacing. A technique by which a receiving station controls the rate of transmission of a sending station to prevent overrun.

partitioned emulation programming (PEP) extension. A function of a network control program that enables a communication controller to operate some telecommunication lines in network control mode while simultaneously operating others in emulation mode.

point-to-point connection. A connection established between two data stations for data transmission. The connection may include switching facilities.

program temporary fix. A temporary solution or by-pass of a problem diagnosed by IBM as resulting from a defect in a current unaltered release of the program.

PTT (Post Telephone and Telegraph). A generic term for the government-operated common carriers in countries other than the U.S.A. and Canada. Examples of the PTT are British Telecom in the United Kingdom, the Deutsche Bundespost in Germany, and the Nippon Telephone and Telegraph Public Corporation in Japan.

reliability. The ability of a functional unit to perform a required function under stated conditions, for a stated period of time.

remote loading and activation. The remote loading and activation capability allows the host (through VTAM commands) to load and activate a remote NCP when a remote 3745 is connected to a channel-attached 3745 via a switched subarea link (NTRI, X.21 switched or X.25 leased and switched).

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* and *multiplexer channel*.

service representative. See IBM service representative

services. A set of functions designed to facilitate the maintenance of a device or system.

serviceability. The capability to perform effective problem determination, diagnosis, and repair on a data processing system.

start-stop (SS) transmission. Asynchronous transmission in which a group of bits is (a) preceded by a start bit that prepares the receiving mechanism for the reception and registration of a character, and (b) followed by at least one stop bit that enables the receiving mechanism to come to an idle condition pending reception of the next character.

switched line. A transmission line with which the connections are established by dialing, only when data transmission is needed. The connection is point-to-point and uses a different transmission line each time it is established. Contrast with *nonswitched line*.

Synchronous Data Link Control (SDLC). A discipline for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop. SDLC conforms to subsets of the Advanced Data Communication Control Procedures of the American National Standards Institute and High-Level Data Link Control (HDLC) of the International Standards Organization.

synchronous transmission. Data transmission in which the sending and receiving instruments are operating continuously at substantially the same frequency and are maintained, by means of correction, in a desired phase relationship. Contrast with *asynchronous transmission*.

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.

T1. U.S. service for high-speed transmissions at 1.536 Mbps.

token-ring adapter (TRA). Line adapter for IBM Token-Ring Network, composed of one token-ring multiplexor card (TRM), and two token-ring interface couplers (TICs).

token-ring subsystem (TRSS). The part of the controller that controls the data transfers over an IBM Token-Ring Network.

transmission interface. The interface between the controller and the user application network.

transmission line. The physical means for connecting two or more DTEs (via DCEs). It can be nonswitched or switched. Also called a *line*.

transmission subsystem (TSS). The part of the controller that controls the data transfers over low- and medium-speed, switched and nonswitched transmission interfaces.

The TSS consists of:

- Low-speed scanners (LSSs) associated with
- LIBs, through
- Serial links (SLs).

two-processor switch (TPS). A feature of the channel adapter that connects a second channel to the same adapter.

user access area. A specific area in the controller where the customer can install, remove, change, or swap LICs and TICs by himself.

V.22, 22 bis, 23, 24, 25, 25 bis, 35. CCITT recommendations on transmission interfaces.

X.20 bis, 21, 21 bis, 21 native, 24, 25. CCITT recommendations on transmission interfaces.

Bibliography

User Task	Models 130, 150, and 170	Models 210, 310, 410, and 610
Evaluating and configuring		
To evaluate and learn about the 3745 capabilities	*Introduction,* GA33-0138	*Introduction,* GA33-0092
To configure a 3745	*Configuration Program,* GA33-0093	
Preparing your site		
To plan the physical site	*S/370 I/O Installation Manual Physical Planning,* GC22-7064	
To prepare cable installation and LIC5 or LIC6 configuration	*Preparing for Connection,* GA33-0140	*Preparing for Connection,* GA33-0127
Operating and testing		
To carry out routine daily operations	*Basic Operations Guide,* SA33-0146*	*Basic Operations Guide,* SA33-0098*
To carry out advanced operations and testing from the 3745 operator console	*Advanced Operations Guide,* SA33-0097* *Remote Loading/Activation Guide,* SA33-0161	
Managing problems		
To perform problem determination	*Problem Determination Guide,* SA33-0096*	
Finding information		
To find information in the customer library	*Master Index,* SA33-0142*	*Master Index,* SA33-0172*
Customizing your control program		
To understand the 3745 instruction set in order to write or modify a control program	*Principles of Operation,* SA33-0102	
Preparing for operation		
To recall safety principles	*Telecommunication Products Safety Handbook,* GA33-0126*	
To install and test LICs and customize your 3745 after installation	*Connection and Integration Guide,* SA33-0141*	*Connection and Integration Guide,* SA33-0129*
To install local, alternate, or remote consoles.	*Console Setup Guide,* SA33-0158*	

Note: * Shipped with the 3745

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Models 130, 150, and 170
Introduction

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