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AMDAHL 4705
Communications Processor
Machine Reference Manual

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REVISION NOTICE

The 02A version of this manual incorporates changes to the frontispiece, table of contents, page 2 – 6, table 3 – 1, table 3 – 2, appendices A1. A2, A3, and glossary. Technical changes and additions made to text are indicated by a vertical bar in the left margin.

ABSTRACT

This manual describes the functional characteristics and model-dependent features of the Amdahl 4705 Communications Processor. It is intended for managers, system analysts, and programmers.

The topics covered include machine organization and configuration, operational characteristics, and machine serviceability.

READER COMMENT FORM

A reader comment form is provided at the end of this manual. If this form is not available, comments and suggestions may be sent to Amdahl Corporation, Technical Publications Department, Mail Stop 323, P.O. Box 470, Sunnyvale, CA 94086. All comments and suggestions become the property of Amdahl Corporation.
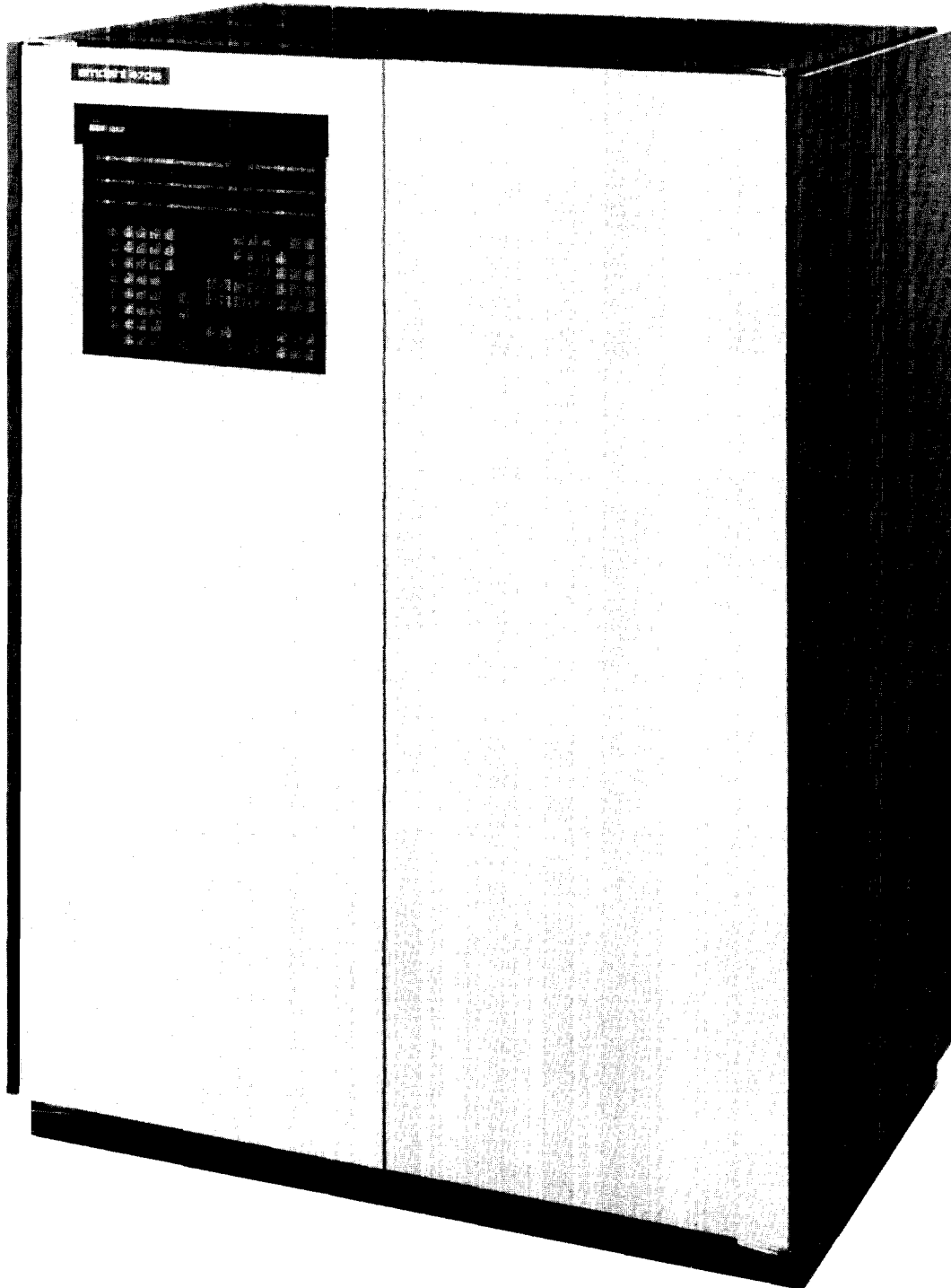
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AMDAHL 4705 Communications Processor

The Amdahl 4705 Communications Processor (CP) is a programmable transmission control unit designed to support host systems operating with IBM 360/370 software. The hardware architecture is compatible with that of the Release 4, (fifth edition), of the *IBM 3705 Principles of Operation* (See Appendix A1 for a full statement of compatibility). This compatibility allows IBM 3705-II software to operate in the Amdahl 4705 CP without modification.

The Amdahl 4705 is also a high performance communication processor. The internal performance of the Amdahl 4705 has been measured under controlled conditions at up to 1.8 times the performance of the IBM 3705-II (for details, refer to the section on Performance in this chapter). The improved performance of the Amdahl 4705 can provide a user with the ability to support a larger number of communication terminals on a single Amdahl 4705 system.

The Amdahl 4705's compatibility with IBM architecture, performance improvements, and its improved reliability and serviceability are discussed in this manual.

SYSTEM SUPPORT PROGRAMS

The Amdahl 4705 is priority-interrupt driven. This allows the control program to handle service requests at five different priority levels. Control and system support programs are compatible with programs used on the IBM 3705-II. IBM software compatibility allows the following operating programs to be run on the Amdahl 4705:

1. Emulation Program (EP)

2. Network Control Program (NCP)

3. Partitioned Emulation Program (PEP)

4. Advanced Communications Function for the Network Control Program (ACF/NCP)

The instruction set is composed of the same 51 instructions used on the IBM 3705-II (see Appendix A4). This IBM instruction set compatibility makes it possible to readily receive the benefit of IBM software enhancements.

4705 HARDWARE FEATURES

The Amdahl 4705 is available in four models, each of which includes the central control unit, main storage, host processor interface(s), and communication line attachments. The individual components are highlighted below (see Chapter 2 for a more detailed description).

- The central control unit (CCU) contains circuits and data flow paths to execute the instruction set, and to control storage, communication scanners and the channel adapters. The CCU operates under control of the programs residing in storage.

- The main storage (MS) contains the control programs and messages. The Amdahl 4705 accommodates up to 512 kilobytes of main storage memory.

- The channel adapter (CA) type 2, 3, or 4 provides the data path between the Amdahl 4705 and the host computer.

- A two-channel switch (TCS) provides a means of manually switching the path between the Amdahl 4705 and the host processors for CA2 or CA4.

- The attachment base (AB) provides the physical and logical interface between the central control unit and the communication scanners.

- The communication scanners (CS type 2 and 3) connect the line interface bases (and associated line sets) with the CCU.

- Line interface bases (LIB) provide certain control functions for particular types of lines and transmission techniques.

- The line sets (LS) provide the interfaces directly with modems and communication lines.

- The internal loader is used to load various maintenance programs into the Amdahl 4705 when the 4705 is in the disabled state or off-line state. It consists of a diskette controller, a diskette drive and diskettes. Maintenance diagnostic programs and internal Initial Program Load (IPL) are resident on the floppy diskettes.

General Characteristics

Table 1-1 lists the general characteristics of the Amdahl 4705. Additional characteristics to those listed in Table 1-1 are as follows:

- Semiconductor memory storage with capacity from 64 kilobytes to 512 kilobytes in 64 kilobyte or 128 kilobyte increments.

- Capability to attach up to four CPU channels simultaneously.

- Easy-to-read and efficiently designed control panel as shown in Appendix A2.

- Maintenance performed by the use of diagnostic and IPL internally resident on floppy disks.

- The Amdahl 4705 is available in four models, with a capacity of 64, 160, 256, and 352 lines, respectively. Each model may be enhanced, or field upgraded to a larger model, by simply adding the necessary elements at the customer site. Refer to the System Configuration section in Chapter 2 for more detailed information.

RELIABILITY AND SERVICEABILITY

The Amdahl 4705 control panel provides the operator with controls to perform off-line maintenance. The loader with resident diagnostics and IPL capabilities provides this stand-alone maintenance capability. The reliability and serviceability (RAS) functions cover, for the most part, the RAS functions of the IBM 3705-II. Highlights of RAS functions of the Amdahl 4705 are provided below (refer to Chapter 3 for more detailed RAS information).

- Detecting multiple bit errors and correcting a single bit error in memory.

- Retry function of instructions (register-to-register and register-to-storage type).

- CS wrap diagnostic function.

- Line Unit (LUT) loop diagnostic function.

- Tag/bus diagnostic wrap of CA4.

Table 1-1.   AMDAHL 4705 General Characteristics

FEATURES	DESCRIPTION
Host Computer	Amdahl CPU product line or equivalent
Host Channels	Multiplexer, block multiplexer or selector channels
Host Access Methods	BTAM, QTAM, TCAM, VTAM; including ACF and MSNF
Communications Processor Software	EP, NCP, PEP; including ACF/NCP
Network Architecture	Systems Network Architecture
Communications Protocols	SDLC, BSC, Start/Stop
Communication Facilities	Half or full duplex; private, leased or switched, EIA RS232C, CCITT V.24 and V.35 interfaces
Transmission Speeds	Up to 56,000 bits per second
Special Highlights	• Potential performance throughput up to 1.8 times the IBM 3705-II. • Stand-alone maintenance • Semiconductor memory using NMOS FET technology • Instruction retry

PERFORMANCE

Measurements of the Amdahl 4705 show the following capabilities:

- The Amdahl 4705 has up to 1.8 times the internal processing power of the IBM 3705-II model F8.

- Throughput capacity (aggregated data rate) of the Amdahl 4705 is up to 1.8

times the throughput capacity of a similarly configured IBM 3705-II model F8.

The performance measurements were conducted at the Amdahl Benchmark Center, Sunnyvale, California. Up to 144 users were simulated using TPNS Release 5 in duplex mode. IBM 3270 type terminals were simulated using BSC protocol and

9600 bps lines. MVS/SE Release 3.8 was used as the host operating system and ACF/NCP was used to define the network control program in native mode. ACF/VTAM was used as the host tele-processing access method. Both communication processors measured were equipped with type 2 communication scanners and type 4 channel adapters.

As throughput measurements are highly dependent upon configuration, application, and operating characteristics, individual user environments should be carefully evaluated before making a specific estimate of throughput.

This chapter is intended to familiarize the reader with the functional characteristics of the units that make up the Amdahl 4705 Communications Processor (CP) system structure.

SOFTWARE/HARDWARE RELATIONSHIPS

The central control unit (CCU), directed by the control program, interacts with communication scanners and the channel adapters to control the flow of data through the CP.

Interaction between the Amdahl 4705 channel adapters and the communication scanners is through interrupts and input/output instructions. Figure 2-1 illustrates the data flow to and from the terminal and the host processor through the various parts of the Amdahl 4705.

Data entered at a terminal is received by the line set (LS) and line interface base (LIB). The communication scanner (CS) recognizes that service is required and receives data from the LIB. The program places the data in storage, making it available to the channel adapter (CA) to be sent to the host processor channel.
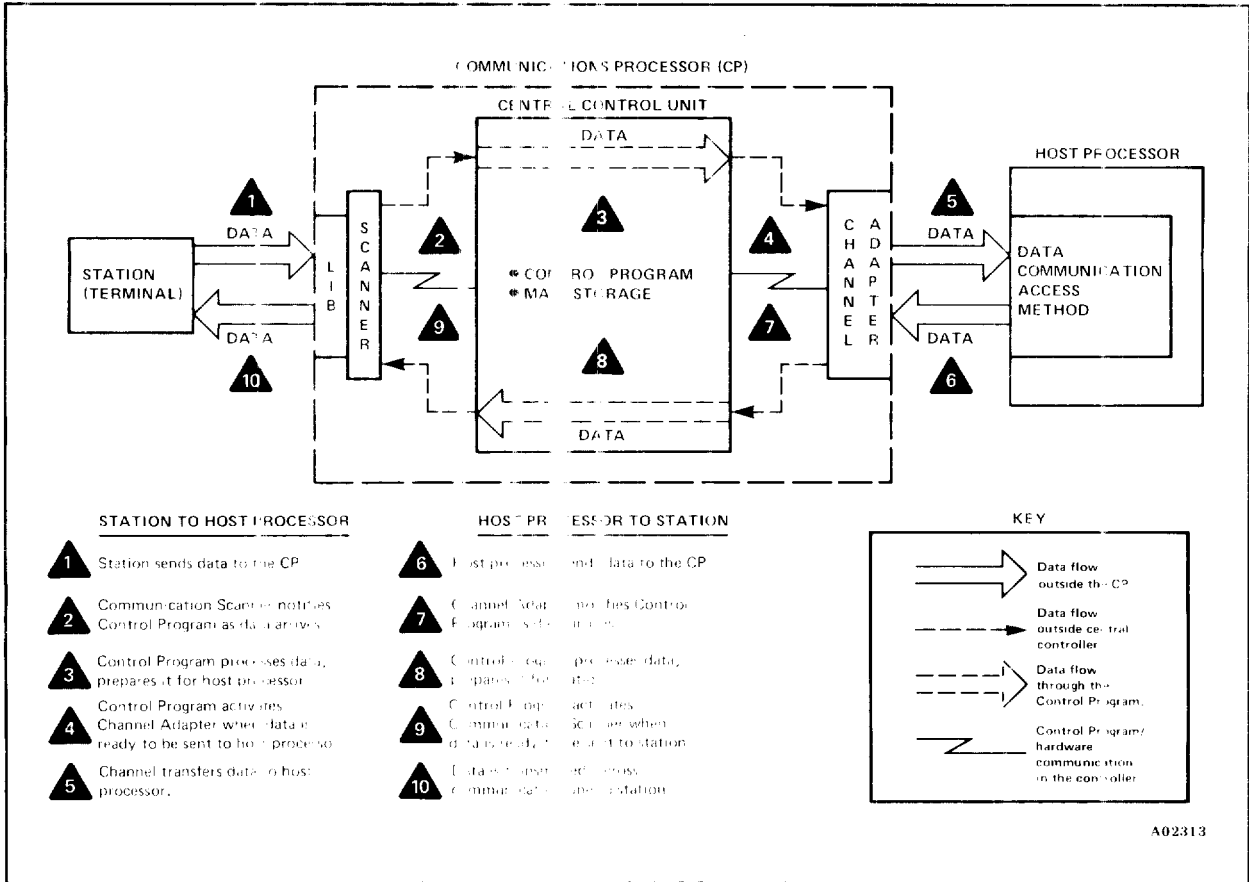

Figure 2- System Data Flow

When data is to be transmitted from the host processor to a terminal, the process is reversed. The host channel sends the data to the Amdahl 4705's channel adapter, which places the data in storage. An interrupt request to send the data to the LIB and finally to the terminal is then signaled to the control program.

PROGRAM SUPPORT

Licensed and nonlicensed control programs are available from IBM for scheduling and controlling the Amdahl 4705. The control program that resides in the Amdahl 4705 storage controls the transfer of data as it passes through the 4705 between the stations in the teleprocessing network and the host processor.

The primary functions of the control program are related to transmitting and receiving data.

Network Control Program

The Network Control Program (NCP), which is loaded into the Amdahl 4705 (via the host processor), provides the 4705 with the flexibility to meet the demands of an expanding data communications network. The Amdahl 4705 executes the NCP, under control of an access method stored in the host processor, and relieves the host processor of much of the responsibility for network management.

The network control program performs a wide range of functions for the data communications subsystem. Certain functions are standard for any network control program; others are optional, selected as part of the program generation procedure.

Advanced Communication Function for the Network Control Program

The Advanced Communication Function for the Network Control Program (ACF/NCP) is a licensed IBM version of the NCP that can be run on the Amdahl 4705. This IBM product works with an access method in the host processor to provide advanced communication function networking, in accordance with the concepts of systems network architecture (SNA). The use of ACF/NCP depends upon (1) the Amdahl 4705 hardware configuration, and (2) the access method in the host processor (for example, ACF/TCAM, ACF/VTAM, or MSNF).

The networking capabilities of ACF/NCP are particularly appropriate for users who wish to interconnect several locations to share resources and reduce communication costs. Formerly, a network included only a single host computer and a variety of communications processor, cluster, and terminal nodes. Combining the ACF/NCP program product with the Amdahl 4705 and access methods such as the ACF/TCAM or ACF/VTAM provides a flexible approach to design of single-system and multi-system data communications networks.

Emulation Program

The Emulation Program (EP) allows an Amdahl 4705 to emulate an IBM 270X transmission control unit. The EP allows many programs written for support of the IBM 270X to operate with the Amdahl 4705 with no modification.

Partitioned Emulation Program

The Partitioned Emulation Program (PEP) extension of the Network Control Program (either NCP or ACF/NCP) allows the Amdahl 4705 to emulate an IBM 270X transmission control unit for certain lines, while performing network control functions for others.

The principal advantage of the PEP extension is that it allows concurrent operation of existing application or access method programs designed to communicate with an IBM 270X transmission control unit and new (or converted) application programs designed to communicate with NCP or ACF/NCP. Concurrent operation can be valuable during the transition from EP to NCP.

HARDWARE FUNCTIONS

The Amdahl 4705 is composed of modular hardware units. Information on the functions of the various hardware units contained in the Amdahl 4705 is provided below.

Central Control Unit

The central control unit (CCU) contains the circuits and data flow paths needed (1) to execute the instruction set, (2) to address storage, (3) to perform arithmetic and logical processing of data, and (4) to control the attached adapters. Operation of the CCU is under control of the programs in storage.

Clock Control

The clock control circuit provides clock pulses and timing signals for all CCU circuits. It also performs clock stop/start control as instructed from the operator control panel or channel adapters and communication scanners. The clock control circuit contains two oscillators (14.28571 MHz and 15 MHz) and waveform shaping logic to ensure proper timing distribution.

Initial Program Load

The initial program load (IPL) control provides various controls for IPL. Its function is to load the bootstrap program (BSP) stored in read-only storage (ROS) into main storage and transfer control to the loaded BSP. IPL occurs when any of the following listed conditions occur.

1. Power is switched ON.

2. Reset switch on the panel is ON.

3. WRITE IPL command is received by a channel adapter.

4. Machine check source is detected, except during IPL phase.

Three phases of the IPL program control the loading operation. IPL is accomplished by successful completion of all three phases.

Phase 1 of the IPL operation is a general reset to the Amdahl 4705. During phase 2, a small bootstrap program is automatically loaded into storage from the 4705's ROS array, and control passes to this program. The bootstrap program (phase 3) then controls channel operations until the first load module from the host is successfully transferred into storage under a WRITE IPL channel command.

After successful transfer of the first program segment into storage, the initial program loading operation performed by the bootstrap program is complete. The Amdahl 4705 is initialized, and the bootstrap program passes control to the loaded program segment. This program segment then controls the loading of whatever additional modules are required to complete the program load operation.

Two lights on the control panel, labeled IPL PHASE, indicate the three phases of IPL. These lights are a binary representa-

tion of the phase number. That is, 01 is phase 1, 10 is phase 2, and 11 is phase 3.

Panel Control Circuit

The panel control circuit provides control required for the following functions of the operator control panel:

1. CP and CCU status display.

2. Host processor connection switching.

3. Main storage and diagnostic program tests.

4. Operator/control program conversation.

Adapter Connection Circuit

The adapter connection circuit connects the CCU and adapters (channel adapters or communication scanners) and controls the connection.

Instruction Look-Ahead Circuit

The CCU has an instruction look-ahead function to decrease instruction execution time and increase control program throughput. It consists of an instruction look-ahead circuit and buffer registers to store up to 3 advance-fetched instructions.

The execution of an instruction consists of an instruction read cycle and an instruction execution cycle, with the former occupying a considerable portion of the total time used for the instruction. Since instruction execution normally proceeds in ascending order, it is possible to eliminate the instruction read cycle by reading the contents of the applicable storage area beforehand. The instruction look-ahead circuit obtains instruction time saving by setting the contents of a number of bytes located

after the current instruction address into various buffer circuits while storage is not used by the CCU, thereby preparing the execution of the next instruction.

General Register Control Circuit

The CCU has 32 general registers (GR), each having 20 bits. These registers are available in the CCU for program use and are located in a local storage array so as not to occupy usable storage locations. The GR control circuit controls pulse signals and address information required to operate the general registers.

CCU Control Circuit

The CCU control circuit provides all the controls for instruction execution. These controls are used for:

1. Execution of instructions.

2. Execution of cycle steal technique.

3. Execution of the control panel instructions.

4. Execution of IPL phases 1 and 2.

Registers and Arithmetic Logic Unit

This circuit component consists of a work register and an arithmetic logic unit (R-ALU) to provide various operations for execution of CCU instructions. The R-ALU processes the data input from main storage and various work registers, and stores the results back into main storage.

Interrupt Control

The Amdahl 4705 has four interrupt levels with the interrupt control governing the programs at five levels (four program levels

associated with the above four interrupt levels and a normal program level). The differences in the five program levels are listed below.

1. Interrupt program level 1: Hardware and software error handling and initial program loading (IPL).

2. Interrupt program level 2: Communication scanner processing.

3. Interrupt program level 3: Channel adapter and time supervisory processing.

4. Interrupt program level 4: Buffer control management; tasking and queue management.

5. Normal program level: Data and message processing and command management.

Except for levels 1 and 2, which share registers, each interrupt level has its own set of registers to speed processing.

Storage Interface Control

The storage control receives storage access requests from various CCU component circuits and controls the storage so that the various components can access the storage.

Main Storage

The Amdahl 4705 main storage (MS) uses NMOS FET technology and can accommodate up to 512 kilobytes of memory with incremental capabilities.

Channel Adapters

The Amdahl 4705 may be attached, via the proper channel adapter, to all Amdahl or equivalent processors, such as IBM System/360, System/370, 303X, or 4300 processors.

The Amdahl 4705 channel adapters (CA) are divided into two categories: CA type 4, designed for both the Emulation Mode (EP) and Network Control Mode (NCP) operations, and CA type 2 and 3, designed for the NCP mode only.

An Amdahl 4705 may be connected to a byte multiplexer, block multiplexer, or selector channel. (Operation of a type 4 channel adapter in emulation mode requires that the CA be on a byte multiplexer channel).

The type 3 channel adapter enables the Amdahl 4705 to be attached to tightly coupled multiprocessor systems as a shared symmetrical I/O unit with an alternate path capability.

Type 2, 3, and 4 channel adapters (CA2, CA3, and CA4) are functionally equivalent to the CA2, CA3, and CA4 of the IBM 3705-II. Channel adapter type 1 (CA1) is not available with the Amdahl 4705 (CA4, with its higher throughput performance, replaces CA1).

Two-Channel Switch Feature

The two-channel switch (TCS) provides a means of manually switching the path between the 4705 and host processor. It is connected to a CA2 or CA4. The use of this facility permits a CA2 or CA4 to be connected to two channels. Only one of the channels can be enabled for operation at a time. The enabled channel is selected by means of a manual switch on the control panel. (CA3 has the ability to replace CA2 and its TCS. It performs cross-call control in multiprocessing systems as well as all CA2 functions).

Remote Program Loader

The remote program loader (RPL) provides the means of remotely loading the NCP with or without a channel adapter on the 4705. The use of the RPL limits the maximum 4705 configuration to three CA4s or two of any other CA combinations.

Communication Scanners

The communication scanners (CS) provide the connection between the CCU and the communication line attachment hardware (line interface bases and line sets). The primary function of the CS is to periodically scan the hardware associated with each communication line for service requests. Two types of communication scanners are available for the Amdahl 4705. Note below that a CS1 equivalent is not supplied, as the CS2 replaces it while providing higher throughput performance.

Type 2 Scanner

The type 2 communication scanner (CS2) executes the I/O instructions from the control program, assembles or disassembles characters, performs various line controls, and services interrupts to the CCU on a send or receive character basis. This scanner transfers a full byte to or from the CCU. The CS2 supports up to six line interface bases (LIBs) with a maximum capability of 96 lines. This CS2 is functionally equivalent to the IBM 3705-II CS2.

Type 3 Scanner

The type 3 communication scanner (CS3) in an Amdahl 4705 supports up to four LIBs with a maximum capability of 64 lines and transfers up to 255 bytes of data to and from

the CCU before interrupting the control program for more data. This CS3 is functionally equivalent to the IBM 3705-II CS3.

Line Unit

The line unit (LUT) is made up of line interface bases and line sets. These units are discussed below.

Line Interface Base

The line interface base (LIB), located between a CS2 (or CS3) and line sets, performs the following functions:

1. Relays all signals between the CS and the line set.

2. Supplies a send/receive bit timing signal to the line set for each tranmission speed.

The Amdahl 4705 requires only one type of LIB (LIB1), which allows a maximum of 16 attachable communication lines (via various types of line sets). The LIB1 is capable of handling various communication line types and speed rates. Refer to Table A3 – 2 in Appendix A3 for a list of communication lines applicable to the Amdahl 4705 LIB.

Line Sets

The line set (LS) transmits and receives necessary signals to and from a LIB under LIB control. Its major functions are:

1. Detect receive bits.

2. Transmit send bits.

3. Transmit modem control signals.

Many Amdahl 4705 LSs support four lines, unlike the two-line capacity of the IBM 3705-II. Refer to Table A3 – 2 in Appendix A3 for description and usage of each line set type.

Loader Unit

The loader unit is used to load the maintenance program into the Amdahl 4705 when the 4705 is in the disabled state. The loader provides the Amdahl 4705 with an independent maintenance IPL capability and a source of resident diagnostics. The loader adds to the stand-alone maintenance capability of the Amdahl 4705 by making it possible to run diagnostic tests at any time the 4705 is not being used and does not require any host processor involvement. The following functions and hardware are provided with the loader unit

1. A diskette storage drive and diskette controller that provide a source for the load programs and diagnostic programs.

2. A register for storing the type of program load and stimulus.

3. A read-only storage (ROS) bootstrap.

Lamp Unit

A device called a lamp unit is incorporated in the Amdahl 4705 as an aid for troubleshooting. The lamp unit is a type of logic probe with an attached light indicator which may be used as a maintenance tool for determining the logic states of the various hardware circuits.

Control Panel

The Amdahl 4705 control panel is a simple, efficiently designed array of touch-sensitive switches and light-emitting diode (LED) displays that allow operator/program conversation and various debugging and testing methods. The Amdahl 4705 control panel is shown in Appendix A2. The major hardware improvements are hexadecimal LED read-outs and touch-sensitive switches that take the place of traditional control panel lamps and rotation-type mechanical switches.

SYSTEM CONFIGURATIONS

The Amdahl 4705 is available in four models (models 5, 6, 7, and 8, with maximum line capacity of 64, 160, 256, and 352, respectively) and can consist of up to three joined cabinets, as shown in Figure 2 – 2. The first cabinet of all models contains the central control unit, control panel, main storage, loader, lamp unit, channel adapters, communication scanners, and provisions for mounting line interface bases and line sets.

Each expansion cabinet has provision for mounting additional line interface bases and line sets. A maximum of two expansion cabinets may be attached.

Since all main storage, channel adapters and communication scanners are mounted in the first cabinet, the upgrade process is simplified.

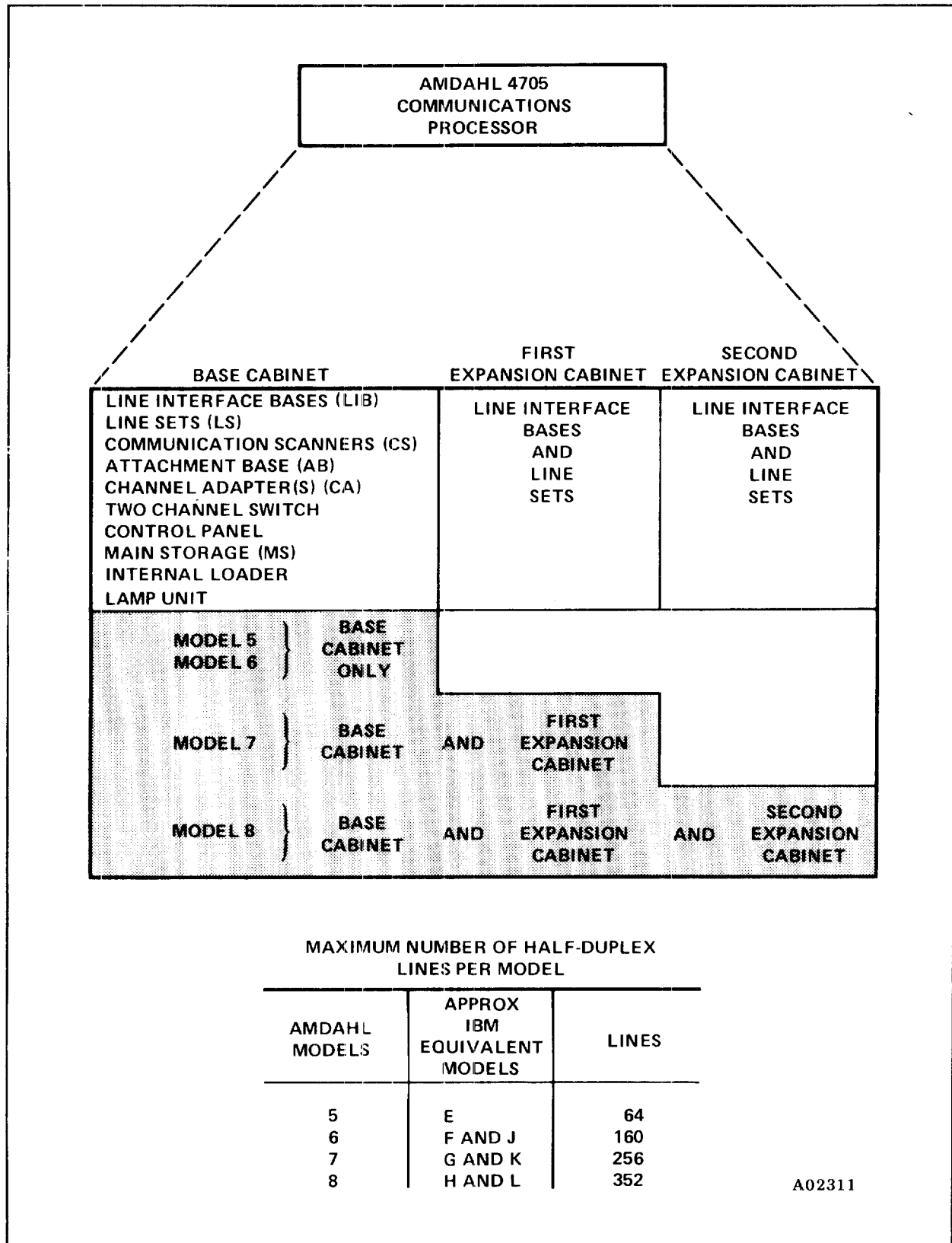Refer to Appendix A3 for a summary table of the hardware features of the Amdahl 4705.

Figure 2 – 2.   AMDAHL 4705 Hardware Configurations and Model Information

This chapter is intended to familiarize the reader with the physical characteristics, maintenance, and reliability and serviceability (RAS) of the Amdahl 4705 Communications Processor (CP).

Much of the improved RAS of the Amdahl 4705 comes from the modular design of the hardware. Such modularity not only allows the Amdahl 4705 to grow easily to meet the needs of an expanding data communications system, but also decreases the mean-time-to-repair (MTTR).

INSTALLATION PLANNING

The module compactness provides an efficient physical component layout which results in a reduction in the required installation and service space.

Table 3 - 1 lists general installation requirements for the Amdahl 4705 CP basic frame and Table 3 - 2 lists the installation requirements for the expansion frame.

Amdahl support personnel will conduct a site survey prior to installation relative to required space, power, cable types, cable lengths, etc. Refer to the *Amdahl 4705 Physical Planning Manual* for detailed installation requirements.

Warning

The Amdahl 4705 generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the *Operations Manual*, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing

device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

MAINTENANCE

Online network systems are composed of a variety of units, including host central processor units and terminals. As a result, failures in such systems may include a wide range of possible causes. In order to trace the source of a failure, it is first necessary to grasp the nature of the failure and programs to determine the cause of the error as quickly as possible.

The Amdahl 4705 uses maintenance programs and various maintenance test devices to help determine the location of failures, diagnose signs of trouble, and finally test and confirm the repairs performed. It should be noted, however, that in troubleshooting a system failure during online processing, it is important to minimize the repair time without affecting the network system as it operates.

The Amdahl 4705 hardware is designed with loopback functions for various sections. These functions can verify hardware integrity by having comparisons made between data leaving a certain unit and the data received. These loopback functions may be utilized by maintenance programs and maintenance analysis procedures

Table 3 - 1.   AMDAHL 4705 Basic Frame Installation Requirements

ITEM	REQUIREMENTS
Dimensions	47 in. (1195 mm) in width 29.5 in. (750 mm) in depth 61.6 in. (1590 mm) in height
Floor Space	9.6 sq. ft. (0.9 sq. m)
Service Clearance	31.5 in. (800 mm) front and back (increases total floor space to 19.2 sq. ft. or 2.8 sq. m)
Weight	1323 pounds (600 kg)
Input Voltage	208 VAC ($\pm$ 10% tolerance)
Phase	3 Phase
Frequency	60 Hertz (50 Hertz optional) +2%, - 4% tolerance
Required Power	4.95 kva
Current	30 amp circuit breaker (draws 15.3 amps maximum)
Plug, Receptacle	Russell-Stoll FS–3760, 3754
Ambient Temperature	59 degrees to 90 degrees Farenheit (15° – 32° centigrade)
Ambient Humidity	20% to 80%
Cooling	Forced-air cooling
Air Conditioning	Under-the-floor ventilation

Table 3-2. AMDAHL 4705 Expansion Frame Installation Requirements

ITEM	REQUIREMENTS
Dimensions	23.5 in. (600 mm) in width 29.5 in. (750 mm) in depth 61.6 in. (1590 mm) in height
Floor Space	4.8 sq. ft. (0.45 sq. m)
Service Clearance	31.5 in. (800 mm) front and back (increases total floor space to 9.6 sq. ft. or 1.4 sq. m)
Weight	662 pounds (300 kg)
Input Voltage	208 VAC (±10% tolerance)
Phase	3 Phase
Frequency	60 Hertz (50 Hertz optional) +2%, -4% tolerance
Required Power	1.15 kva
Current	20 amp circuit breaker (Draws 3.4 amps maximum — see note)
Plug, Receptacle	Russell-Stoll FS–3760, 3754
Ambient Temperature	59 degrees to 90 degrees Farenheit (15° – 32° centigrade)
Ambient Humidity	20% to 80%
Cooling	Forced-air cooling
Air Conditioning	Under-the-floor ventilation

Note: The Expansion Frame(s) may be powered through the Basic Frame circuit breaker.

(MAPs) to isolate errors (refer to the *Amdahl 4705 Maintenance Manual* for detailed information on the use of these loopback functions for MAPs). The diagnostics make use of the Amdahl 4705's unique ability to loop the channel interface (problems here are infrequent, but are difficult to diagnose in traditional communications processors).

Internal Functional Test

The internal functional test (IFT) is a program with which the Amdahl 4705 tests itself internally without dependence on the CPU and outside connections. The IFT can be loaded into the Amdahl 4705 by an internal diskette and has the capability to test the 4705 independently. The host processor is not required to execute the test. It is possible to execute the IFT at any time the 4705 is not being used. The IFT:

1. Tests the CP while not in use.

2. Interacts with the operator through the control panel.

3. Tests each unit individually (for example, the CC unit, the CS unit, etc.).

4. Is stored in the main storage of the 4705 by IPL from an internal diskette (internal loader unit) or from the host processor channel.

Additional maintenance programs are available for the Amdahl 4705 to help (1) determine the location of failures, (2) diagnose devices which are showing signs of trouble, and (3) test and confirm the repairs performed.

Ease of maintenance and efficient installation packaging results in an improved reliability and serviceability of the Amdahl 4705.

APPENDIX A1
AMDAHL 4705 COMPATIBILITY

HARDWARE

The Amdahl 4705, as initially released, conforms functionally to the specifications contained in Release 4 (fifth edition) of the *IBM 3705 Principles of Operation* (GC30-3004-4) for the following features:

> CA2, CA3, CA4, up to 256K memory (in 64K increments), Type 1 and dual ROS, CS2, LIB1, line sets 1A, 1B, 1D, 1E 1H, 1S and 1U, business machine clock, two channel switch, and up to two simultaneous channel adapters.

Please check with your Amdahl sales representative for the scheduled availibility of Release 4 features CS3, remote IPL, four host interfaces using CA4, line sets 1G, 1C, and 1F, and for dates of compatibility with Releases 5 and 6 of the *3705 Principles of Operation*. (The major enhancements provided by Release 5 are the ability to attach greater than 256K of memory (up to 512K) and the Cycle Utilization Counter. The major enhancement of Release 6 is the support of 230.4K bps transmission.)

SOFTWARE

The Amdahl 4705 operates with FEP software ACF/NCP 2.1, NCP 5, EP3 and host MVS, SVS, and VS1 operating systems with the following exceptions:

- Software that requires hardware features not supported.

- Some host software for testing the IBM 3705 FEP may be incompatible with the Amdahl 4705. These are replaced by the 4705 Internal Functional Tests (IFTs) that operate without host involvement.

- An FEP sysgen may be required

MISCELLANEOUS

- Channel connections are functionally compatible with the IBM 3705. Amdahl supplies cables.

- EIA connectors are functionally compatible with the 3705. Amdahl supplies the cables.

- Power cables use the same Russell-Stoll 3760 connector as the 3705, but require one connector per frame (up to 3) rather than a single connector per system (as used for the 3705).

APPENDIX A2
AMDAHL 4705 CONTROL PANEL
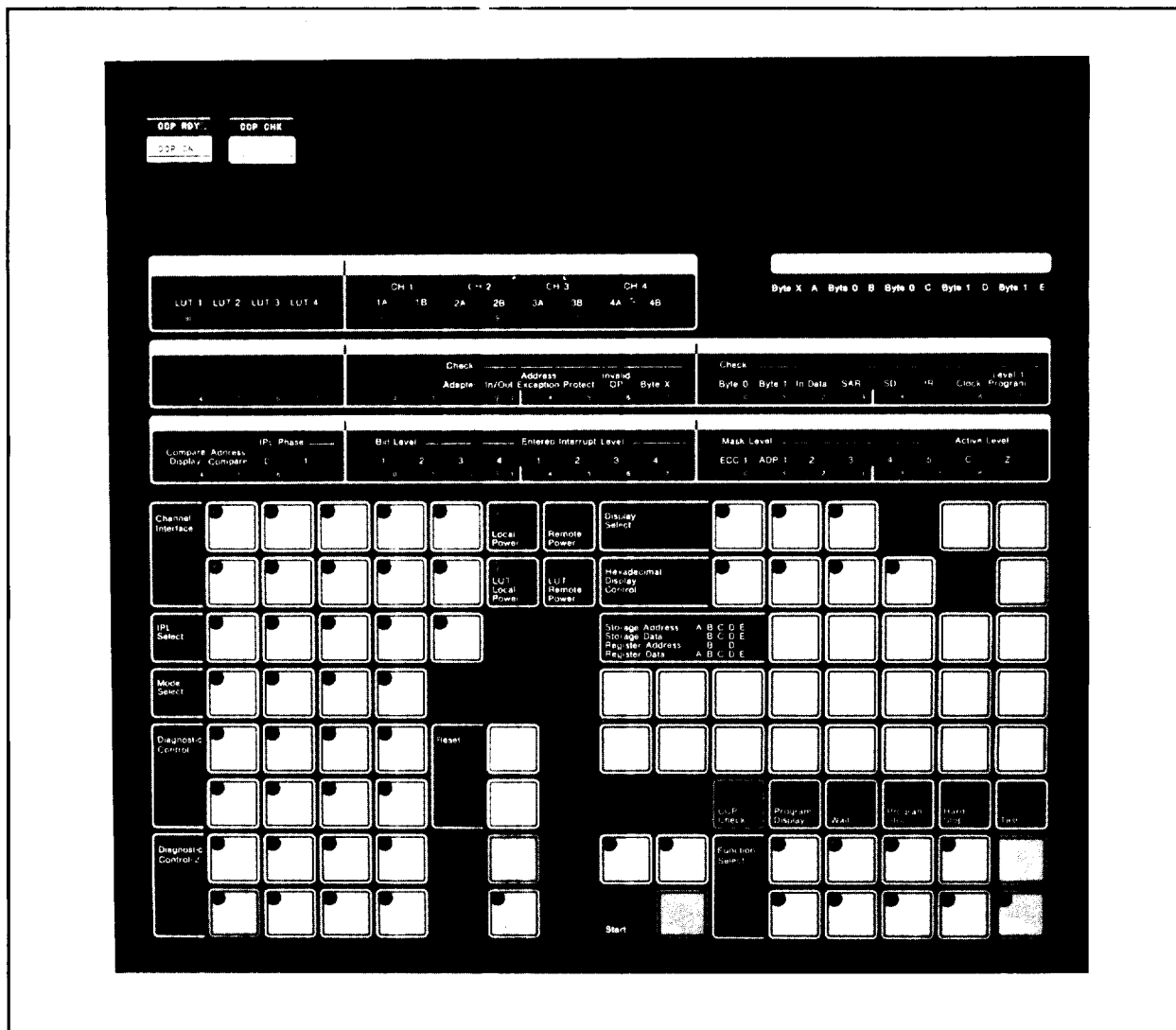
APPENDIX A3
AMDAHL 4705 HARDWARE FEATURES

Table A3 - 1.   Hardware Feature Summary

COMPONENT COMMON NAME	ABBREVIATION	REMARK
CP Base	Base 1	• Basic frame • Includes a CCU with main storage (64 kilobytes expandable to 512 kilobytes), operator panel, CAs (four maximum), LIBs (ten maximum) and CSs (four maximum — one CS required for Model 5, two CSs for Model 6, three and four CSs for Models 7 and 8, respectively) • Attaches to a maximum of 64 lines (Model 5) or 160 lines (Model 6)
Expansion Frame	EX1	• Expansion frame for LIBs and LSs • Need 1 or 2 EX1s when 3 or 4 CSs are installed (Models 7 and 8 respectively) • Attachable to 96 lines (maximum)
Main Storage	MS1 MS2	MS1: 64 kilobyte (KB) unit MS2: 128 kilobyte (KB) unit Combination of MS1 and MS2 64 KB 1 0 128 KB 0 1 192 KB 1 1 256 KB 0 2 320 KB 1 2 384 KB 0 3 448 KB 1 3 512 KB 0 4
Type 2 Channel Adapter	CA2	• Connected to MUX or BMX • Used for NCP • Functionally equivalent to IBM type 2 channel adapter

Table A3 – 1   Hardware Feature Summary (Continued)

COMPONENT COMMON NAME	ABBREVIATION	REMARK
Type 3 Channel Adapter	CA3	• Connected to MUX or BMX • Contains cross call feature • Used for NCP • Functionally equivalent to IBM type 3 channel adapter
Type 4 Channel Adapter	CA4	• Connected to MUX, or BMX, or SLC • Used for EP, PEP, or NCP • Functionally equivalent to IBM type 4 channel adapter • Four CA4s attachable to CP
Two Channel Switch	TCS	• May be installed for CA2 or CA4 • CP can be attached to two host processor channels with this feature, one at a time
Remote Program Loader	RPL	• One maximum per 4705 • Functionally equivalent to IBM remote program loader

Type 2 Communication Scanner	CS2	• Four CS2s attachable to CP (maximum)
		  CS2 #1: 64 lines
		  CS2 #2-4: 96 lines each
		• Functionally equivalent to IBM type 2 communication scanner

Type 3 Communication Scanner	CS3	• Four CS3s attachable to CP (maximum)
		  CS3 #1: 48 lines
		  CS3 #2-4: 64 lines each
		• Functionally equivalent to IBM type 3 communication scanner

Line Interface Base 1	LIB1	• Six LIB1s per CS2; four per CS3 (maximum) • Sixteen lines per LIB1 (maximum)
Line Sets	LS	Refer to Table A3 – 2, on the following page, for line set types and details

Table A3 – 2. AMDAHL 4705 Communication Line Capabilities

TYPE OF LINE INTERFACE	TRANSMISSION					LINE SETS		LINES PER LINE SET	
	AMDAHL MAX SPEED (BPS)	IBM MAX SPEED (BPS)	TIMING	MODE	LINE	AMDAHL	APPROXIMATE IBM EQUIVALENT	AMDAHL	IBM
External RS232C Modem	2400	1200	Asynchronous	Half Duplex	Leased or switched	HD1A	1A	4	2
	2400	1200	Asynchronous	Full Duplex	Leased or Switched	FD1B	1B	2	1
	2400	1200	Asynchronous	Half Duplex	Leased or Switched	HD1	1D	4	2
	19,200	9600	Synchronous	Half Duplex	Leased or switched				
	19,200	9600	Synchronous	Full Duplex	Leased or Switched	FD1	1H	2	1
	2400	1200	Asynchronous	Full Duplex	Leased or Switched				
Wideband (Bell 303)	50,000	50,000	Synchronous	Half Duplex	Leased	HD1G	1G	2	1
External CCITT V35	56,000	56,000	Synchronous	Half Duplex	Leased	HD2	1S	2	1
	56,000	56,000	Synchronous	Full Duplex	Leased	FD2	1U	1	1
Local Attachment	1200	1200	Asynchronous	Half Duplex	Cables	LA1C	1C	4	2
	2400	2400	Synchronous	Half Duplex	Cables	LA1F	1F	4	2
Automatic Dialing (RS366)					RS366	NC1	1E	2	2
	2400	1200	Asynchronous	Half Duplex	Switched			2	0
	19,200	9600	Synchronous	Half Duplex	Switched			2	0

APPENDIX A4
AMDAHL 4705 INSTRUCTION SET

ABBREVIATION	INSTRUCTION	FORMAT CODE
B	BRANCH	
BCL	BRANCH ON C LATCH	
BZL	BRANCH ON Z LATCH	RT
BCT	BRANCH ON COUNT	
BB	BRANCH ON BIT	
LRI	LOAD REGISTER IMMEDIATE	
ARI	ADD REGISTER IMMEDIATE	
SRI	SUBTRACT REGISTER IMMEDIATE	
CRI	COMPARE REGISTER IMMEDIATE	RI
XRI	EOR REGISTER IMMEDIATE	
ORI	OR REGISTER IMMEDIATE	
NRI	AND REGISTER IMMEDIATE	
TRM	TEST REGISTER UNDER MASK	
LCR	LOAD CHARACTER REGISTER	
ACR	ADD CHARACTER REGISTER	
SCR	SUBTRACT CHARACTER REGISTER	
CCR	COMPARE CHARACTER REGISTER	RR
XCR	EOR CHARACTER REGISTER	
OCR	OR CHARACTER REGISTER	
NCR	AND CHARACTER REGISTER	
LCOR	LOAD CHARACTER WITH OFFSET REGISTER	

ABBREVIATION	INSTRUCTION	FORMAT CODE
ICT	INSERT CHARACTER AND COUNT	RSA
STCT	STORE CHARACTER AND COUNT	
IC	INSERT CHARACTER	RS
STC	STORE CHARACTER	
LH	LOAD HALFWORD	
STH	STORE HALFWORD	
L	LOAD HALFWORD	
ST	STORE HALFWORD	
LHR	LOAD HALFWORD REGISTER	RR
AHR	ADD HALFWORD REGISTER	
SHR	SUBTRACT HALFWORD REGISTER	
CHR	COMPARE HALFWORD REGISTER	
XHR	EOR HALFWORD REGISTER	
OHR	OR HALFWORD REGISTER	
NHR	AND HALFWORD REGISTER	
LHOR	LOAD HARDWARE WITH OFFSET REGISTER	
LR	LOAD REGISTER	
AR	ADD REGISTER	
SR	SUBTRACT REGISTER	
CR	COMPARE REGISTER	
XR	EOR REGISTER	

ABBREVIATION	INSTRUCTION	FORMAT CODE
OR	OR REGISTER	RR
NR	AND REGISTER	
LOR	LOAD WITH OFFSET REGISTER	
BALR	BRANCH AND LINK REGISTER	
IN	INPUT	RE
OUT	OUTPUT	
BAL	BRANCH AND LINK	RA
LA	LOAD ADDRESS	
EXIT	EXIT	

GLOSSARY

Advanced Communication Function (ACF). An IBM program product.

Attachment Base (AB). A communications processor hardware feature that provides the controls to the central control unit for the attached adapters.

Basic Telecommunications Access Method (BTAM). A primitive access that permits host application programs to communicate with remote devices via the EP in the 4705.

Binary Synchronous Communication (BSC). IBM's version of character-oriented synchronous transmission in which data is transferred in blocks with synchronization characters on the front end and error control on the rear.

Bits Per Second (bps). In serial transmission, the speed with which a device or channel transmits data.

Byte Multiplexer Channel (BMX). A multiplexer channel that interleaves bytes of data. A BMX can be used to connect the 4705 to a host CPU.

CA2. Channel adapter type 2 (see Appendix A4).

CA3. Channel adapter type 3 (see Appendix A4).

CA4. Channel adapter type 4 (see Appendix A4).
CCITT V.24. International version of EIA RS232C (see EIA RS232C).

CCITT V.35. A standard data transmission interface for sending and receiving stations using digital type communications.

Central Control Unit (CC). A communications processor hardware unit that contains the circuits and data flow paths needed to execute the instruction set and to control controller storage and the attached adapters.

Central Processor Unit (CPU). A unit of a computer that includes circuits controlling the interpretation and execution of instructions. Used in this manual to refer to the host attached to the 4705 communications processor.

Channel Adapter (CA). A communications processor hardware unit that provides attachment of the controller to an Amdahl 460 or 470, or equivalent host processor channel.

Communications Processor (CP). A type of transmission control unit whose operations are controlled by a program stored and executed in the unit. Examples are the Amdahl 4705 and IBM 3705 Communication Processors.

Communication Scanner (CS). A communications processor unit that provides the connection between line interface bases and the central control unit. The communication scanner monitors the communication lines for service requests.

CS2. Communication scanner type 2 (see Appendix A4).

CS3. Communication scanner type 3 (see Appendix A4).

EIA RS232C. The USA standard defining the interface between the modem and the "business machine" (4705 line set or a terminal).

Emulation Program (EP). The program in the 4705 that allows it to operate as if it was a hardwired 270X.

Expansion Frame (EX1). A cabinet housing Line Interface Bases and Line sets for the Amdahl 4705 Communication Processor. One expansion frame cabinet is required for Model 7 and two expansion frame cabinets are required for Model 8 (see Figure 2-2 and Appendix A3).

FD1. Full Duplex type 1 line set (see Appendix A3).

FD1B. Full Duplex type 1B line set (see Appendix A3).

FD2. Full Duplex type 2 line set (see Appendix A3).

HD1. Half Duplex type 1 line set (see Appendix A3).

HD1A. Half Duplex type 1A line set (see Appendix A3).

HD1G. Half Duplex type 1G line set (see Appendix A3).

HD2. Half Duplex type 2 line set (see Appendix A3).

Internal Functional Test (IFT). A program with which the Amdahl 4705 Communications Processor tests itself internally without dependence on outside connections.

Initial Program Load (IPL). The initiation procedure that causes an operating system to commence operation.

Kilobyte (KB). A 1,000 byte unit in decimal notation.

LA1C. Local Attachment type 1C line set (see Appendix A3).

LA1F. Local Attachment type 1F line set (see Appendix A3).

Lamp. A device incorporated in the Amdahl 4705 Communications Processor as an aid for troubleshooting.

Light-Emitting-Diode (LED). An electronic device which transforms electron current into visable or invisable (infrared) light. LED's are commonly used as panel indicators or displays.

Line Interface Base-Type 1 (LIB1). An Amdahl 4705 hardware unit that provides for the attachment of communication lines to the communications scanner unit.

Line Set (LS). An Amdahl 4705 Communications Processor hardware unit through which communication lines are attached to a line interface base.

Line unit (LUT). The line unit is composed of line interface bases and line sets in the Amdahl 4705.

Loader (LD1). A diskette drive unit and diskette controller internally located in the Amdahl 4705 Communications Processor used for maintenance diagnostics.

Maintenance Analysis Procedures (MAP). Directions outlining any activity, such as tests, measurements, replacements, adjustments, and repairs, intended to eliminate faults or to keep a functional unit in a specified state.

Main Storage (MS). The primary semiconductor memory using NMOS technology in the Amdahl 4705 Communications Processor.

Mean-Time-To-Repair (MTTR). The average time to correct a malfunction.

MS1. A 64 kilobyte memory unit used in the Amdahl 4705.

MS2. A 128 kilobyte memory unit used in the Amdahl 4705.

Multiplex (MUX). To interleave or simultaneously transmit two or more messages on a single channel. Also a type of channel used to connect the 4705 to the Host CPU.

Network Control Program (NCP). A program, generated by the user from a library of IBM-supplied modules, that controls the operation of a communication processor used in conjunction with VTAM, or TCAM or the host.

NC1. Automatic Dialing type line set (see Appendix A3).

N-Channel-Metal-Oxide-Semiconductor Field Effect Transistor (NMOS FET). The technology used to manufacture memory for the 4705.

Partitioned Emulation Programming (PEP). A feature of the Network Control Program that allows the Amdahl 4705 to emulate a IBM 270X transmission control unit for certain lines, while performing network control functions for others.

Read-Only-Storage (ROS). The 4705 ROS holds the bootstrap program used during IPL.

Remote Program Loader (RPL). A hardware feature of the Amdahl 4705 Communications Processor that provides the means of remotely loading the NCP with or without a channel adapter on the 4705.

Synchronous Data Link Control (SDLC). IBM's version of a bit-oriented communications protocol used in SNA (see SNA).

System Network Archietecture (SNA). IBM's method for implementing networks.

Telecommunications Access Method (TCAM). Allows host application programs to communicate with remote devices via EP, PEP, or NCP in the 4705.

Two-Channel Switch (TCS). A hardware feature of the Amdahl 4705 Communications Processor that allows the Amdahl 4705 to be attached to two channels through a single type 2 or type 4 channel adapter. Only one path is active at a time.

Virtual Telecommunications Access Method (VTAM). A set of programs that control communication between terminals and application programs running under DOS/VS, OS/VS1, OS/VS2 using PEP or NCP in the 4705.

Queued Telecommunications Access Method (QTAM). Allows host programs to communicate with remote devices via EP in the 4705.

REVISION HISTORY

This revision history lists all versions of this publication along with their effective dates. Also listed is each page and its most recent version number. This version number is either 02A (if the page has never been revised) or the number of the most recent version in which the page was revised.

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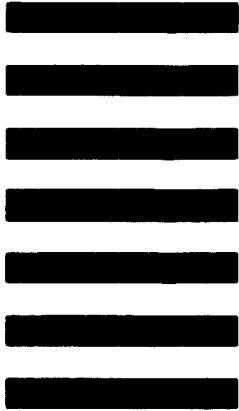**Thank you for your interest. Fold and fasten as shown on back. No postage necessary if mailed in U.S.A.**

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