IBM 3705 Communications Controller

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Product Summary

Editor's Note

The IBM Communications Controller has completed its life cycle and has been replaced by the IBM 372X Series Communications Controllers (see Report C13-491-301). Therefore, this report is now a Reference Edition. Datapro will continue to include this report in *Datapro Reports on Data Communications* because of the historical importance of the product and the number of 3705s still in operation. This version of the report will be the last update.

Description

Announced in the mid-'70s, the 3705 is the best-selling communications processor ever manufactured. The product line features the 3705-80 entry-level and 3705-II large-scale series. The 3705-80 supports 256K bytes of main memory and attachment to two host computers. The 3705-II supports up to 512K bytes of main memory and eight host processors.

The 3705 functions as a front-end or remote full-service communications processor in the IBM mainframe environment. It supports the IBM 360, 370, 303X, 43XX, and 308X mainframes. The 3705 also supports SNA architecture.

Strengths

For almost a decade, the 3705 served users well in IBM mainframe environments. The 3705-80 supported up to 128 communications lines, and the 3705-II supported up to 352 lines. The product did its job so well that it became an industry standard.

Limitations

The 3705 had to defer to the superior power of its successor, the 372X. Its architecture does not meet the needs of the '90s.

Competition

NCR Comten 3600 Series and 5620; Amdahl 4705; CCI CC8, CC80, and CC85; Memorex 1270.

Vendor

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Analysis

The IBM 3705 has the distinction of being the best-selling communications processor ever manufactured and of serving as a standard against which all communications processors are measured. Although the 3705 maintains a large installed base, IBM no longer markets it, having replaced it with the simpler and more powerful 3725 and the 3720.

Product Strategy

The 3705 is an interrupt-driven machine based on an IBM-proprietary 16-bit CPU. It comes in two general series of models, the entry-level 3705-80 and the full-scale 3705-II. The 3705-80 is available in three models, each of which has 256K bytes of memory. The largest 3705-80 supports 16 communications lines. The 3705-II supports 44 configurations of processor and memory, the largest of which accommodates 512K bytes of storage and up to 352 communications lines.

The 3705-II can serve as a front-end processor, a remote concentrator, or a remote switch. Its front-end configuration contains a central processor, main storage, one or more attachment bases for the connection of network-side equipment, up to four channel adapters for connection to the I/O channels of the host processor, and a variety of network-side hardware. For its remote configurations, channels are replaced by a single Remote Program Loader-II (RPL-II) that allows the 3705's operating software to be downloaded from the host through its front end—either another 3705 or a 3725. The 3705-80 has the same basic configuration, but it can contain only two channel adapters and requires no attachment base.

On the network side, the 3705-II uses a three-tiered, pyramidal hierarchy of components. At the top are communications scanners, polling devices that scan their attached communications lines for activity, assemble incoming data into characters, and disassemble outgoing data into serial bit streams. Next are line interface bases (LIBs) that connect the scanners to their attached line sets, which are components that provide the physical connections to specific types of communications facilities. The 3705-II supports three different communications scanners, six types of LIBs, and 19 different types of line sets.

The 3705-80 uses a similar architecture but does not require line interface bases. It contains a single type of scanner as standard equipment and supports a more limited complement of line sets.

In general, the 3705 supports synchronous or start/stop (IBM's term for asynchronous) communications in half- or full-duplex mode at rates from 1200 bps to 230.4K bps and uses ASCII, IBM Correspondence, BSC, or SDLC protocols. The 3705's architecture supports half-duplex communications at rates up to 4800 bps; later additions that support full-duplex transmission and higher speeds require trade-offs in the number of lines the 3705 can support.

The 3705 supports a full, backward-compatible range of software, from total emulation of the old IBM 27XX hard-wired controllers to full-blown SNA networking. In full Emulation mode, it does not support SDLC communications or multisystem networking but does support older IBM communications access methods such as BTAM. In Network Control mode, it supports the full range of SNA features with a given version and release of the Network Control Program (ACF/NCP), including network diagnostics through the host, routing, multisystem networking, and SNA network interconnection. As an intermediate step between Emulation mode and full SNA, IBM provides Partitioned Emulation Programming (PEP), in which one portion of the 3705 runs in Emulation mode and the other runs the Network Control Program. Portions of the network controlled by each partition of the 3705 appear to the user and the host as separate networks.

Table 1. 3705-II Models

Model	Memory (bytes)	Model	Memory (bytes)
E1, F1, G1, H1	32K	E7, F7, G7, H7	224K
E2, F2, G2, H2	64K	E8, F8, G8, H8	256K
E3, F3, G3, H3	96K	J1, K1, L1	320K
E4, F4, G4, H4	128K	J2, K2, L2	384K
E5, F5, G5, H5	160K	J3, K3, L3	448K
E6, F6, G6, H6	192K	J4, K4, L4	512K

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IBM Corporation

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Comm. Sys. Div. Head: Ellen Hancock

Company Background
Year Founded: 1911
No. Employees: 389,000+

International Business Machines (IBM) is synonymous with computers and much more. According to *Business Week*, IBM is among the top five largest industrial corporations by sales volume. It has dominated the mainframe market for over 30 years and has a strong hold on other industry sectors.

IBM designs, manufactures, markets, and services mainframe computer systems and associated peripherals; minicomputer systems and peripherals, microcomputer/personal computer systems; computer system software; data communication controllers and terminals; other communication products such as modems, voice response systems, and voice messaging systems; local area network communications products; and office copiers and typewriters. In addition, IBM provides specialized products and services such as communications carrier and limited timesharing services; the IBM Information Network, a communications facility with remote storage and computing services; OEM manufacturing of terminals, disk drives, and other products; maintenance service and system supplies; and financial services through its IBM Credit Corp. subsidiary.

Management Statement
Like everything else it does, IBM entered the network management field with plans to become the world's premier value-added supplier of network and information services. A major reason for its aggressive entrance into network management is that the company cannot base its continued financial health on the slow-growing mainframe market. Its network management strategy emphasizes four points, which cover centralization, data networks, the logical network, and integration.

In a report prepared by S.G. Hingorani, an analyst with Salomon Brothers, in October 1989, it was estimated that "IBM's revenues will increase by 6.1% in both 1989 and 1990, compared with the 8% growth rate reported in 1988. IBM has stated that it expects the computer industry to grow at a rate of 10% per year over the next couple of years. We do not expect the company to match the growth rate that it has pegged for the industry, because it does not participate significantly in some of the fastest-growing sectors—namely the workstation market and the applications software for desktop computers sector."

Competitive Position
Venerable as it is, the 3705 has never encountered serious competition. Instead, it became a standard upon which several competitors made improvements in order to serve sophisticated users in IBM environments or to serve special applications. Among these vendors were Amdahl Corporation, NCR Comten, Computer Communications, Inc. (CCI), and Memorex. In that sense, the 3705 spawned a small industry, led by NCR Comten, whose 3600 Series processors offered significant performance advantages over the 3705. Amdahl's 4705 was entirely software compatible with the 3705 but outperformed the IBM machine. CCI's processors ran only in Emulation mode but offered important price/performance advantages in specialized applications. The Memorex offering was based on the CCI processor.

The 3705's greatest competitor became its successor, the IBM 3725, which is larger, faster, and offers maintenance features not found on the 3705. IBM has since released the 3745 Communication Controller.

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Table 2. Communications Handled by the 3705-80

Type of Line Interface	Speed (bps)	Transmission Timing	Transmission Mode	Line	Line Set	Number of Lines Supported (M81/M82/ M83)	Comments
External RS-232-C/V.24 modems	Up to 9600	Async/Sync	Half duplex	Leased or switched	Common	4/10/16	Preprogrammed line interface for Start/Stop, BSC, and SDLC protocols.
	Up to 19.2K	Synchronous	Half duplex	Leased or switched	Common	4/8/16	
	Up to 19.2K	Synchronous	Full duplex	Leased or switched	Common	2/5/8	
External CCITT V.35 modem	Up to 56K	Synchronous	Half duplex	Leased	2	2/2/*	
	Up to 56K	Synchronous	Full duplex	Leased	2	1/1/*	
External wideband	Up to 50K	Synchronous	Half duplex	Leased	3	2/2/*	
	Up to 50K	Synchronous	Full duplex	Leased	3	1/1/*	
Automatic dialing; RS-366A/V.25 compatible	—	—	—	Switched	4	4/4/*	For attachment of external dialing units.
Direct attachment	Up to 2400 bps	Async/Sync	Half duplex	IBM cables	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols.
	14.4K or 57.6K	Synchronous	Half duplex		5	2/2/*	Maximum cable length is 200 feet. Interface is CCITT V.35 includes internal clocking.
CCITT X.21 interface	Up to 9600	Synchronous	Half duplex	Leased	8	2/2/*	
	Up to 9600	Synchronous	Full duplex	Leased or switched	8	2/2/*	Switched operation requires: #1409 Business Clock; #1416
	48K	Synchronous	Half duplex	Leased	9	1/1/*	Business Clock (for testing);
	48K	Synchronous	Full duplex	Leased or switched	9	1/1/*	and ACF/NCP R3.

**Not available on M83.*

Decision Points

As an industry standard over 14 years old, the IBM 3705 has performed well in all applications supported by IBM mainframe equipment. However, it suffered somewhat when compared to the products of its competitors. Amdahl's 4705 ran the same software faster and less expensively. NCR Comten's 3600 Series processors supported more communications lines and cost less in similar configurations. IBM's own 3725 costs slightly more but outperformed the 3705 by a factor of nearly two.

Basically, the 3705 is a war-horse ready for pasture. Its architecture was conceived in the mid-'70s for the communications needs of that time. But much has happened to data communications in the last 15 years, and although IBM worked hard to keep the 3705 up to date, it has seriously strained the limits of the processor's original design.

The biggest problem is configurational complexity. Designing a 3705-II to fit a given application, especially one involving line speeds over 4800 bps or full-duplex communications, has become a complex process that can require computer assistance. Most of the problems involve trade-offs in line capacity against line speed. IBM solved these problems in the 3725, which supports a much smaller set of network-side componentry in a much cleaner configuration.

IBM's own mainframes have outgrown the 3705's capability to communicate with them. The 308X mainframes support I/O channel data rates more than twice those supported by the 3705.

The 3705 lacks an operator's console and local facilities for maintenance. It relies on the host processor for diagnostics and control. In the event of total system failure, the user might find it difficult to determine whether the host or the communications processor is at fault. The 3725 contains a maintenance and operator subsystem (MOSS) for diagnostics. All of the 3705's competitors support local diagnostics from an operator's console.

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Table 3. Communications Handled by the IBM 3705-II

Type of Line Interface	Speed (bps)	Transmission Timing	Mode	Line	Line Set	Lines per Line Set	LIB	Max. Line Sets per LIB	Comments
External RS-232-C/ V.24 modem	Up to 9600	Async/sync	Half duplex	Leased or switched	1D	2	Type 1	8	Any combination of speed and timing is possible for each
	Up to 9600	Async/sync	Full duplex	Leased	1D	1	Type 1	8	Line Set 1D.
External wideband modem	19.2K or 50K	Synchronous	Half duplex	Leased or switched	1G	1	Type 1	8	Runs only under NCP.
	50K	Synchronous	Full duplex	Leased	1T	1	Type 1	4	
	Up to 230.4K	Synchronous	Half duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3HS.
	Up to 230.4K	Synchronous	Full duplex	Leased	1TA	1	Type 1	1	Requires Scanner Type 3HS.
External Mil 188C modem	Up to 50K	Async/sync	Half duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half duplex	Leased	1S	1	Type 1	8	Runs only under NCP.
	56K	Synchronous	Full duplex	Leased	1U	1	Type 1	4	
Local attachment	Up to 9600	Synchronous	Half duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
	14.4K or 57.6K	Synchronous	Full duplex	IBM cables	1Z	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
CCITT X.21 Interface	Up to 48K	Synchronous	Half duplex	Leased	1N	2	Type 1	8	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 48K	Synchronous	Full duplex	Leased	1N	1	Type 1	4	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 9600	Synchronous	Full duplex	Switched	1R	1	Type 1	8	Requires Scanner Type 2 and #4650 Business Clock.
	Up to 48K	Synchronous	Full duplex	Switched	1R	1	Type 1	2	Requires Scanner Type 2 and #4650 Business Clock.
Telegraph: 20-, 40-, or 62.5-mA current loop	Up to 200	Asynchronous	Half duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/ 83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full duplex	4-wire private	3B	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	1200 or 600	Async/sync	Half duplex	Leased	8A	2	Type 8	3	
	600	Asynchronous	Half duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half duplex	Switched	9B	1	Type 9	2	Auto dial and auto answer modems.
	Up to 1200	Synchronous	Full duplex	Leased	10A	1	Type 10	6	

Characteristics

Models: 3705-80 entry level, includes Model M81, Model M82, and Model M83; 3705-II large scale, includes 44 different models.

Date Announced: 3705-II, Models E1-H8—November 1975; Model J1-L4—November 1978; 3705-80—March 1981.

Number Delivered to Date: Over 50,000 (estimated for all models).

Configuration

The 3705-80 is a small, entry-level communications processor, capable of supporting 256K bytes of main memory, attachment to two host computers, and up to 128 communications lines.

The 3705-II is a large-scale communications processor, capable of supporting up to 512K bytes of main memory, eight host processors, and 352 communications lines in its largest configurations.

Within the 3705-II Series, IBM offers 44 models, each designated by a letter and a number. The letter describes the type of central processing unit contained in a certain processor and the number of frames in the configuration. The number in the model designation specifies main memory capacity in a standard increment over the next largest model for that unit's processor type: for 3705-II Models En to Hn, the memory increment is 32K bytes; for Models Jn to Ln, the memory increment is 64K bytes.

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Processing Components

All models of the IBM 3705 are based on a *16-bit central processing unit*. The 3705-80 and Models E1 through H8 of the 3705-II use an older processor with a storage cycle time of 1 microsecond; Models J1 through L4 of the 3705-II use a faster processor with a storage access time of 0.9 microsecond (900 nanoseconds). Both processors are interrupt driven; interrupts can come directly from the 3705's operating software or can be generated by incoming data or error conditions from the channel adapters or communications scanners. Some components of the 3705 use a cycle-stealing technique for access to the processor and to memory. Cycle-stealing is a form of interrupt in which the component needing access to memory or to the processor takes control for an entire machine cycle.

All models of the 3705 use *semiconductor main memory*. The 3705-80 comes with 256K bytes of main storage and supports no memory increments. The smaller 3705-II models (E1 through H8) support 32K bytes of memory (Models E1, F1, G1, and H1) and support expansion to 256K bytes (Models E8, F8, G8, and H8) in increments of 32K bytes. The larger 3705-II models (J1 through L4) support 320K bytes of memory (Models J1, K1, and L1) and support expansion to 512K bytes (Models J4, K4, and L4) in increments of 64K bytes. All 3705-II models can be upgraded in stages to the maximum configuration.

Every 3705-II must have at least one *attachment base*: either Type 1, which provides the interface between the CCU and one type of channel adapter (Type 1) and one type of communication scanner (Type 1); or Type 2, which provides the interface between the CCU and the remaining types of communications scanners (Types 2, 3, and 3HS).

Connection to the Host

The IBM 3705 can serve as a front-end processor or as a remote concentrator or switch. In any of these roles, it must receive its initial program load from an IBM mainframe host and must operate under the host's instructions. In front-end configurations, the 3705 communicates with the host through a *channel adapter* connected to one or more of the host's input/output (I/O) channels. In remote configurations, it communicates with the host through a *remote program loader* connected to the host over a high-speed, dedicated data link into that host's front-end processor (IBM 3705 or 3725).

IBM offers four types of channel adapters for the 3705. The 3705-80 can use only Types 1 and 4; the 3705-II can use all four.

Channel Adapter Type 1 (CA1)—The CA1 connects to the byte multiplexer channel of the host and to an Attachment Base Type 1 on the 3705-II. (The 3705-80 does not require an attachment base for the CA1.) It transfers data in units of one, two, three, or four bytes and must interrupt the host for each transfer.

Channel Adapter Type 2 (CA2)—The CA2 interface operates only under the control of the Network Control Program software. It can attach to the host's byte multiplexer, block multiplexer, or selector channel and can transfer data at up to 276K bytes per second in a burst mode. When attached to the byte multiplexer channel, the CA2's bursts of data are limited to two bytes.

Channel Adapter Type 3 (CA3)—The CA3, which offers the same performance characteristics as the CA2, has an additional automatic two-processor switch. When the 3705 functions as a front end to a tightly coupled multiprocessor system, each side of this switch is attached to a different processor. Alternatively, the CA3 can be attached to two I/O channels on the same processor to provide alternate data paths.

Channel Adapter Type 4 (CA4)—The CA4 interface runs under the control of the Network Control Program or the Emulation Program. It attaches to the byte multiplexer, block multiplexer, or selector channel of the host. In Emulation mode, it can attach only to the byte multiplexer channel and must interrupt the control program after transferring a burst of 32 bytes. In NCP mode, it transfers data in bursts of up to 16 bytes, but it can transfer 248 bytes before generating an interrupt. When attached to the block multiplexer or selector channel, it transfers data in bursts of 248 bytes in cycle-steal mode.

Remote Program Loader II (RPL-II)—The RPL-II allows the 3705 to receive its initial program load from a remotely located host without a channel attachment. A 3705 can have only one RPL-II.

Connection to the Network

The 3705-II's network connection hardware forms a three-level hierarchy among communications scanners (CSs), line interface bases (LIBs), and line sets (LSs). The three levels form a pyramid, with the CCU supporting a number of scanners, each scanner in turn supporting a number of LIBs, and each LIB in turn supporting a number of line sets. Depending on its type, each line set supports attachment to one or two communications lines. Depending on its type, and on the data rates, interfaces, and transmission techniques supported by the line sets, an individual LIB can support up to eight communications lines. Depending on its type, its location in the 3705-II configuration (base or expansion frame), and the characteristics of its LIBs, each communications scanner can support the attachment of up to six LIBs.

The communications scanners, through the attachment base, provide the interface between the CCU and the LIBs. The scanners handle data at the character level, assembling characters from incoming bit streams and dissassembling characters for serial transmission on the network. For certain types of communications, the 3705 requires that a Business Machine Clock be attached to the scanners to provide reference timing. IBM currently supports three types of communications scanners. Only one scanner can be installed in any frame of a 3705.

Line interface bases and line sets—The 3705-II supports six types of LIBs and 18 types of line sets.

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Type 1—supports lines with external modems and/or auto call and for directly attached terminals.

Type 2—supports telegraph-grade lines.

Type 3—supports lines with IBM limited-distance line adapters.

Type 8—supports 1200 bps lines with integrated modems.

Type 9—supports 1200 bps lines with integrated modems and auto call.

Type 10—supports 1200 bps lines with integrated modems and full-duplex data transmission.

Transmission Specifications

Both the 3705-II and the 3705-80 support half- or full-duplex transmissions using start/stop (asynchronous), BSC, or SDLC protocols. Start/stop signals can be transmitted at rates up to 56.7K bps; synchronous (BSC or SDLC) signals can be transmitted at rates up to 230.4K bps.

The 3705 was designed in the mid-1970s, and its architecture was originally meant to handle the types of communications that prevailed then—half-duplex transmissions at rates up to 4800 bps. Later enhancements to the hardware, aimed at supporting higher speeds and full-duplex connections, put demands on the 3705 that its architecture was not designed to meet. Attaching any communications line expected to operate in full-duplex mode or at a rate greater than 4800 bps requires some kind of trade-off; such trade-offs reduce the total number of lines attachable to the 3705.

Operator Interface

Once the network has been defined in software, the operator has almost no direct interaction with the 3705. Any interaction between the operator and the network takes place through the host, with such programs as the Network Command and Control Facility (NCCF). The 3705 supports no operator's console. It has a maintenance panel for power-up, reload, and simple diagnostic operations.

Software

In a mainframe network, the communications processor is treated as a peripheral device controller. Like other peripheral controllers, it transfers data from the host to one or more input/output or storage devices under the host's control. In the communications processor's case, the peripheral device is a network, rather than a bank of printers or disk drives. Because a network is more complex than any other "peripheral device," the communications processor must be both more intelligent and more independent of the host than any other controller.

Initially by necessity and later by design, the IBM 3705 depends more on its host processor than most modern communications processors. In part, this results from the 3705's age as a product; it was designed initially to support a network of locally attached terminals. The intentional side of the 3705's dependence on its host springs from the overall design of SNA, IBM's networking architecture.

The 3705 runs in one or both of two distinct modes, *Emulation* and *Network Control*. Emulation mode is a backward-compatibility technique that allows the 3705 to support older IBM start/stop and BSC terminal protocols by emulating the 270X Series of hard-wired communications controllers. Network Control mode is the 3705's native mode of operation; it supports the SDLC link protocol and the SNA architecture. Running in pure Emulation mode, the 3705 uses the Emulation Program as its basic operating software. Running in pure Network Control mode, it uses one of several generations of IBM's Network Control Program. In a third mode, Partitioned Emulation Programming (PEP), separate portions of the 3705 run in Emulation and in Network Control modes; PEP is a feature of later versions of the Network Control Program.

In any of these software configurations, the 3705 runs under the control of its host's telecommunications access method, whether it is attached locally or remotely to the host.

Emulation Program—A 3705 in Emulation mode runs the Emulation Program for the 3705. Processors that run in Emulation mode must be channel attached to a host.

Partitioned Emulation Programming—PEP operations have long been available as an option within ACF/NCP programs. In essence, a 3705 running PEP appears to its host and to its users as two smaller machines.

Network Control Program—The Network Control Program is the native mode 3705 operating system that supports IBM's Synchronous Data Link Control (SDLC) protocol. Later versions of NCP, those designated ACF/NCP, support the full SNA architecture.

X.25 NCP Packet Switching Interface Program—Through this program, users of ACF/NCP can use 3705 Communications Controllers to access public data networks complying with CCITT X.25 standards. This program supports packet sequence numbering up to 128 and packet length up to 4,096 characters. It supports SNA network node interconnection and protocol conversion for non-SNA equipment.

Network Terminal Option—The Network Terminal Option is a separate program product that allows start/stop terminals to participate in an SNA network without Emulation mode.

Non-SNA Interconnection Program—This program allows IBM 3705s and 3725s operating in pure Network Control mode to support BSC terminals. The program envelops BSC data in SDLC framing, allowing lower layers of the architecture to treat the BSC message as an SDLC bit stream.

Network Routing Facility—This facility allows the 3705 to select transmission routes for established SNA sessions. It runs under ACF/VTAM in the host and allows the communications processor to maintain active sessions in the event of a host or access method failure.

System Support Program—Since the 3705 cannot generate its own software, a System Support Program

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(currently ACF/SSP) is required. ACF/SSP is a collection of macroinstructions in IBM Assembler language that allows the user to define the characteristics of both the communications processor and the network it supports.

Associated Host Software—Host-resident programs that communicate directly with the 3705 and control parts of its operation include the communications access methods (currently ACF/TCAM and ACF/VTAM) and certain program products for network management and control.

Equipment Prices

	Purchase Price ($)	Monthly Maint. ($)
3705-80 Communications Controller (No longer being marketed)		
Model M81 (256K bytes, 4 lines)	36,600	259
Model M82 (256K bytes, 10 lines)	46,600	271
Model M83 (256K bytes, 16 lines)	52,600	282
3705-II Communications Controller (No longer being marketed)		
Model E1 (32K bytes, 64 lines)	38,230	173
Model E2 (64K bytes, 64 lines)	39,800	195
Model E3 (96K bytes, 64 lines)	41,370	217
Model E4 (128K bytes, 64 lines)	42,940	238
Model E5 (160K bytes, 64 lines)	44,510	259
Model E6 (192K bytes, 64 lines)	46,080	280
Model E7 (224K bytes, 64 lines)	47,650	301
Model E8 (256K bytes, 64 lines)	49,220	324
Model F1 (32K bytes, 160 lines)	51,530	190
Model F2 (64K bytes, 160 lines)	53,100	209
Model F3 (96K bytes, 160 lines)	54,670	232
Model F4 (128K bytes, 160 lines)	56,240	252
Model F5 (160K bytes, 160 lines)	57,810	274
Model F6 (192K bytes, 160 lines)	59,380	294
Model F7 (224K bytes, 160 lines)	60,950	316
Model F8 (256K bytes, 160 lines)	62,520	338
Model G1 (32K bytes, 256 lines)	64,830	204
Model G2 (64K bytes, 256 lines)	66,400	225
Model G3 (96K bytes, 256 lines)	67,970	245
Model G4 (128K bytes, 256 lines)	69,540	267
Model G5 (160K bytes, 256 lines)	71,110	288
Model G6 (192K bytes, 256 lines)	72,680	311
Model G7 (224K bytes, 256 lines)	74,250	330
Model G8 (256K bytes, 256 lines)	75,820	353
Model H1 (32K bytes, 352 lines)	78,130	218
Model H2 (64K bytes, 352 lines)	79,700	239
Model H3 (96K bytes, 352 lines)	81,270	261
Model H4 (128K bytes, 352 lines)	82,840	281
Model H5 (160K bytes, 352 lines)	84,410	303
Model H6 (192K bytes, 352 lines)	85,980	325
Model H7 (224K bytes, 256 lines)	87,550	346
Model H8 (256K bytes, 352 lines)	89,120	368
Model J1 (320K bytes)	71,020	373
Model J2 (384K bytes)	74,160	415
Model J3 (448K bytes)	77,300	457
Model J4 (512K bytes)	80,440	501
Model K1 (320K bytes)	84,320	386
Model K2 (384K bytes)	87,460	429
Model K3 (448K bytes)	90,600	471
Model K4 (512K bytes)	93,740	515
Model L1 (320K bytes)	97,620	401
Model L2 (384K bytes)	100,760	444
Model L3 (448K bytes)	103,900	488
Model L4 (512K bytes)	107,040	530

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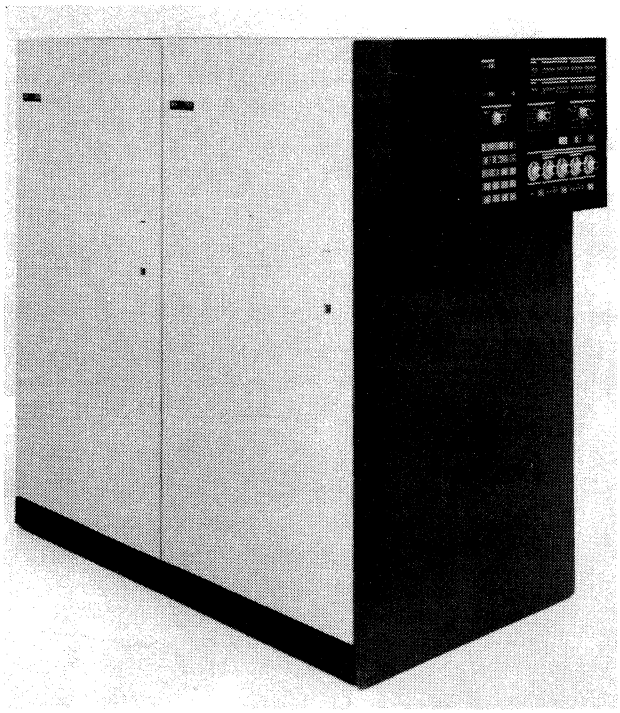
IBM 3705 Communications Controller

MANAGEMENT SUMMARY

The IBM 3705 Communications Controller is nearing the end of its product life. IBM has made few changes to the 3705 in recent years; it is being replaced by the 372X Series Communications Controllers. Despite this, Datapro will continue to include the 3705 report in DATAPRO REPORTS ON DATA COMMUNICATIONS for the foreseeable future, due to the historical importance of the product and the number of 3705s still in operation. This version of the report reflects some pricing changes that have been made for components of the 3705, and will be the last update of this report.

The IBM 3705 is the grandparent of communications processors, the largest selling communications processor in history, and a standard by which all other communications processors are measured. Now, it is also obsolescent. Announced originally in the mid 1970s, the 3705 has gone through its infancy, its maturity, and currently, its dotage. IBM's announcement of the 3725 Communication Controller in April 1983, signalled the beginning of the end for the 3705. While the vendor has not yet removed the 3705 from marketing, its successor is selling extremely well, and the mid 1980s should see the last 3705 sales.



Introduced in the mid 1970s, the IBM 3705 is the largest selling communications processor in the market's history.

The IBM 3705 was the largest selling communications processor ever manufactured, and a standard against which all communications processors are measured. While the 3705 maintains a large installed base, IBM no longer markets it, and its successors, the simpler and more powerful 3725 and the 3720, have replaced it in the marketplace.

FUNCTION: Front-end or remote full-service communications processor for the IBM mainframe environment.
HOST COMPUTERS SUPPORTED: IBM 360, 370, 303X, 43XX, and 308X mainframe computers.
ARCHITECTURE SUPPORTED: SNA; pre-SNA IBM communications.
OPERATING SOFTWARE: ACF/NCP in SNA and partitioned emulation configurations; Emulation Program for the 3705 is pre-SNA configurations. In either case, the 3705 operates under close control of its host's access method, either TCAM or VTAM.
COMPETITION: NCR Comten 3600 Series and 5620; Amdahl 4705; CCI CC8, CC80, and CC85; Memorex 1270.

CHARACTERISTICS

VENDOR: International Business Machines Corporation (IBM), Old Orchard Road, Armonk, NY 10504. Contact your local IBM representative.

DATE OF ANNOUNCEMENT: 3705-II, Models E1-H8—November 1975; Model J1-L4—November 1978; 3705-80—March 1981.

DATE OF FIRST DELIVERY: 3705-II, Models E1-H8—August 1976; Models J1-L4—June 1979; 3705-80—August 1981.

NUMBER DELIVERED TO DATE: Over 50,000 (estimated for all models).

SERVICED BY: IBM.

MODELS

The IBM 3705 Communications Controller comes in two overall series of models. The 3705-80 is a small, entry-level communications processor, able to support 256K bytes of main memory, attachment to two host computers, and up to 128 communications lines. The 3705-II is a large-scale communications processor, able to support up to 512K bytes of main memory, eight host processors, and 352 communications lines in its largest configurations.

REFERENCE EDITION: This is a mature product. No significant further developments are anticipated, but because of its importance in the history of the industry, coverage is being continued. No future updates are planned.

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IBM 3705 Communications Controller

TABLE 1. 3705-II MODELS

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	E7, F7, G7, H7	224K
E2, F2, G2, H2	64K	E8, F8, G8, H8	256K
E3, F3, G3, H3	96K	J1, K1, L1	320K
E4, F4, G4, H4	128K	J2, K2, L2	384K
E5, F5, G5, H5	160K	J3, K3, L3	448K
E6, F6, G6, H6	192K	J4, K4, L4	512K

The 3705 is an interrupt-driven machine based on an IBM-proprietary 16-bit CPU. It comes in two general series of models, the entry-level 3705-80 and the full-scale 3705-II. The 3705-80 is available in three models, each of which has 256K bytes of memory. The largest 3705-80 supports 16 communications lines. The 3705-II is available in 44 different configurations of processor and memory, the largest of which supports 512K bytes of storage and up to 352 communications lines.

The 3705-II can serve as a front-end processor, a remote concentrator, or a remote switch. In its front-end configuration, it contains a central processor, main storage, one or more attachment bases for the connection of network-side equipment, up to four channel adapters for connection to the I/O channels of the host processor, and a variety of network-side hardware. For its remote configurations, channels are replaced by a single Remote Program Loader-II (RPL-II) that allows the 3705's operating software to be downloaded from the host through its front end—either another 3705 or a 3725. The 3705-80 has the same basic configuration, but can contain only two channel adapters and requires no attachment base.

On the network side, the 3705-II uses a three-tiered, pyramidal hierarchy of components. At the top are communications scanners, polling devices that scan their attached communications lines for activity, assemble incoming data into characters, and disassemble outgoing data into serial bit streams. Next are line interface bases (LIBs) that connect the scanners to their attached line sets. Line sets are components that provide the physical connections to specific types of communications facilities. The 3705-II supports three different communications scanners, six types of LIBs, and 19 different types of line sets. The 3705-80 uses a similar architecture, but does not require line interface bases, contains a single type of scanner as standard equipment, and supports a more limited complement of line sets.

In general, the 3705 supports synchronous or start/stop (IBM's term for asynchronous) communications in half- or full-duplex mode at rates from 1200 bps to 230.4K bps, and uses ASCII, IBM Correspondence, BSC, or SDLC protocols. The 3705's architecture was designed to support half-duplex communications at rates up to 4800 bps; later additions that support full-duplex transmission and higher speeds require tradeoffs in the number of lines the 3705 can support.

The 3705-80 is available in three models: Model M81 supports up to 4 communications lines; Model M82 supports up to 10 communications lines; and Model M83 supports up to 16 communications lines.

Within the 3705-II Series, IBM currently offers 44 different models, each designated by a letter and a number. The letter describes both the type of central processing unit a given processor contains and the number of frames (including the 3705 base frame and up to three 3706 expansion frames) in the configuration. Models En to Hn use IBM's older CPU; it has a storage cycle time of 1 microsecond. Models Jn to Ln use IBM's enhanced CPU, which has a storage cycle time of 0.9 microseconds (900 nanoseconds). The number in the model designation specifies main-memory capacity in a standard increment over the next-largest model for that unit's processor type: for 3705-II Models En to Hn, the memory increment is 32K bytes; for Models Jn to Ln, the memory increment is 64K bytes. Thus, a 3705-II Model E1 uses the older processor, has a single frame, and supports 32K bytes of main storage; a 3705-II Model F3 uses the older processor, has two frames, and supports 96K bytes of main storage. A 3705-II Model J1 uses the newer processor, has one frame, and supports 320K bytes of main storage. See Table 1 for a complete list of 3705-II models.

CONFIGURATION

In its basic configuration, the 3705 contains a central control unit (CCU) with a minimum of 32K bytes of main storage; an operator's control panel; one or more Channel Adapters for local connection to a host computer, or a Remote Program Loader (RPL) for remote connection to a host computer; one or two Attachment Bases for connection between the CCU and the network-side equipment; one or more Communications Scanners that control connections between the CCU and the communications lines at the character level; one or more Line Interface Bases that attach the communications lines to the scanners; and one or more Line Sets, which control connection between the Line Interface Bases and communicatons lines at the physical level. One or more Business Machine Clocks can attach to the communications scanners to provide reference timing when such timing is not provided by external facilities or modems.

A 3705-II can include up to three Model 3706 expansion frames. Depending on the processor's specific configuration, these expansion frames contain additional main memory and additional channel adapters, as well as additional communications scanners, line interface bases, and line sets.

The architectures of the 3705 and of its component parts dictate an extremely complex set of rules for configuration. Possible arrangements of parts, both overall and within a given frame, depend on the types of channel attachments required, the types of scanners in use, and the specific line control hardware necessary. These, in turn, depend on the number and models of host computers served, the specific communications facilities used, the data rates and protocols supported, and the specific communications software installed both in the 3705 and in the host. A detailed enumeration of the 3705's configuration rules lies outside the scope of this report; however, IBM does provide configuration aids to assist the user in designing a 3705 for a particular application.

PROCESSING COMPONENTS

All models of the IBM 3705 use a 16-bit central-processing unit. The 3705-80 and Models E1 through H8 of the 3705-II use an older processor with a storage cycle time of 1 microsecond; Models J1 through L4 of the 3705-II use a faster processor with a storage access time of 0.9 microseconds (900 nanoseconds). Both processors are interrupt-driven:

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IBM 3705 Communications Controller

The 3705 supports a full, backward-compatible range of software, from total emulation of the old IBM 27XX hardwired controllers to full-blown SNA networking. In full Emulation mode, it does not support SDLC communications or multisystem networking, but does support older IBM communications access methods such as BTAM. In Network Control mode, it supports the full range of SNA features available with a given version and release of the Network Control Program (ACF/NCP), including network diagnostics through the host, routing, multisystem networking, and SNA network interconnection. As an intermediate step between Emulation mode and full SNA, IBM provides Partitioned Emulation Programming (PEP), in which one portion of the 3705 runs in Emulation mode and the other runs the Network Control Program. Portions of the network controlled by each partition of the 3705 appear to the user and the host as separate networks.

COMPETITIVE POSITION

Venerable as it is, the 3705 has never been confronted by serious competition. Instead, it has provided a standard on which several competitors have improved in order to serve sophisticated users in IBM environments, or to serve special applications. Among these vendors are Amdahl Corporation, NCR Comten, Computer Communications, Inc. (CCI), and Memorex. Two of these competitors, NCR Comten and CCI, conduct almost all of their trade in IBM-compatible communications processors. In that sense, the 3705 alone has spawned a small industry, currently led by NCR Comten, whose 3600 Series processors offer significant performance advantages over the 3705. Amdahl's major selling point is that its 4705 is entirely software-compatible with the 3705 but outperforms the IBM machine. CCI's processors run only in Emulation mode, but offer important price-performance advantages in specialized applications. The Memorex offering is based on the CCI processor.

Currently, the 3705's biggest competitor is its successor, the IBM 3725, which looks to replace the 3705 entirely by the end of the decade. The 3725 is larger, faster, and offers maintenance features not found on the 3705. With the 3705 and 3725, IBM currently controls approximately 90 percent of the communications processor market.

ADVANTAGES AND RESTRICTIONS

As an industry standard over ten years old, the IBM 3705's principal advantage is its track record. It remains the largest selling communication processor ever produced, and has served well in all applications supported by IBM mainframe equipment. However, as an industry standard, it suffers in one way or another when compared to any of its competitors. Amdahl's 4705 runs the same software faster and costs less. NCR Comten's 3600 Series processors support more communications lines and cost less in similar configurations. CCI's processors show performance advantages in Emulation mode and cost less. IBM's own 3725 costs slightly more, but outperforms the 3705 by a factor of nearly two.

interrupts may come directly from the 3705's operating software, or may be generated by incoming data or error conditions from the channel adapters or communications scanners. Some components of the 3705 use a cycle-stealing technique for access to the processor and to memory. Cycle-stealing is an advanced form of interrupt in which the component needing access to memory or to the processor actually takes control for an entire machine cycle.

All models of the 3705 use semiconductor main memory. The 3705-80 initially comes with 256K bytes of main storage, and supports no memory increments. The smaller 3705-II models (E1 through H8) initially support 32K bytes of memory (Models E1, F1, G1, and H1), and support expansion to 256K bytes (Models E8, F8, G8, and H8) in increments of 32K bytes. The larger 3705-II models (J1 through L4) initially support 320K bytes of memory (Models J1, K1, and L1), and support expansion to 512K bytes (Models J4, K4, and L4) in increments of 64K bytes. All 3705-II models can be upgraded, in stages, to the maximum configuration.

Every 3705-II must have at least one *attachment base*; either Type 1, which provides the interface between the CCU and one type of channel adapter (Type 1) and one type of communications scanners (Type 1); or Type 2, which provides the interface between the CCU and the remaining types of communications scanners (Types 2, 3, and 3HS).

CONNECTION TO THE HOST

The IBM 3705 may serve as a front-end processor or as a remote concentrator or switch; however, in any of these roles, it must receive its initial program load from an IBM mainframe host, and must operate under the host's instructions. In front-end configurations, the 3705 communicates with the host through a *channel adapter* connected to one or more of the host's input/output (I/O) channels. In remote configurations, it communicates with the host through a *remote program loader* connected to the host over a high-speed, dedicated data link into that host's front-end processor (IBM 3705 or 3725).

IBM offers four types of channel adapters for the 3705. The 3705-80 can use only Types 1 and 4; the 3705-II can use all four.

Channel Adapter Type 1 (CA1)—The CA1 connects to the byte multiplexer channel of the host, and to an Attachment Base Type 1 on the 3705-II. (The 3705-80 does not require an attachment base for the CA1.) It transfers data in units of one, two, three, or four bytes, and must interrupt the host for each transfer.

Channel Adapter Type 2 (CA2)—The CA2 is a high-performance interface that can operate only under the control of the Network Control Program software. It can attach to the host's byte multiplexer, block multiplexer, or selector channel (the selector channel is a very high-speed, dedicated I/O port), and can transfer data at up to 276K bytes per second in a burst mode. When attached to the byte multiplexer channel, the CA2's bursts of data are limited to 2 bytes.

Channel Adapter Type 3 (CA3)—The CA3, which offers the same performance characteristics as the CA2, has an additional automatic two-processor switch. When the 3705 functions as a front end to a tightly coupled multiprocessor system, each side of this switch is attached to a different processor. Alternatively, the CA3 can be attached to two I/O channels on the same processor to provide alternate data paths.

Channel Adapter Type 4 (CA4)—The CA4 is a high-performance interface that can run under the control of either the Network Control Program or the Emulation Program. It

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IBM 3705 Communications Controller

Basically, the 3705 is a war-horse ready for pasture. Its architecture was conceived in the mid '70s for the communications needs of that time. But much has happened to data communications in the last ten years, and while IBM has worked mightily to keep the 3705 up to date, it has seriously strained the limits of the processor's original design.

The biggest problem is configurational complexity. Designing a 3705-II to fit a given application, especially one involving line speeds over 4800 bps or full-duplex communications, has become a complex process that can require computer assistance. Most of the problems involve tradeoffs in line capacity against line speed. IBM has solved these problems in the 3725, which supports a much smaller set of network-side componentry in a much cleaner configuration.

IBM's own mainframes have outgrown the 3705's ability to communicate with them. The new 308X mainframes support I/O channel data rates more than twice those supported by the 3705. Again, the 3725 meets the needs of the newer hosts.

The 3705 lacks an operator's console and local facilities for maintenance. It relies on the host processor for diagnostics and control; in the event of total system failure, the user might find it difficult to determine whether the host or the communications processor is at fault. The 3725 contains a maintenance and operator subsystem (MOSS) for diagnostics. All of the 3705's competitors support local diagnostics from an operator's console.

USER REACTION

In Datapro's 1986 Data Communications Users Survey, 79 users of the IBM 3705 responded. These users, representing various models of both the 3705-II and 3705-80, reported on a total of 160 processors. Their ratings of the 3705 are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall Performance	18	53	8	0	3.1
Ease of installation	18	50	11	0	3.1
Ease of operation	19	44	14	2	3.0
Ease of expansion	18	38	21	12	2.5
Hardware reliability	46	30	2	1	3.5
Quality of vendor's software/firmware	23	44	10	2	3.1
Ease of programming	6	32	25	6	2.6
Quality of vendor's maintenance/technical support**	29	41	8	1	3.2

*Weighted Average based on a scale of 4.0 for Excellent.
**Technical support is defined as troubleshooting, documentation, education, and related services. □

TABLE 2. LIB CAPACITY PER SELECTED SCANNER OPTION FOR THE 3705-II

Line Interface Base Type	Scanner Type	Maximum Number of LIBs per 3705-II: Base Module	Maximum Number of LIBs per 3705-II: Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2 or 3	2	4	6
	3	—	—
	3 HS	—	—

attaches to the byte multiplexer, block multiplexer, or selector channel of the host. In Emulation mode, it can attach only to the byte multiplexer channel, and must interrupt the control program after transferring a burst of 32 bytes; in NCP mode, it transfers data in bursts of up to 16 bytes, but can transfer 248 bytes before generating an interrupt. When attached to the block multiplexer or selector channel, it transfers data in bursts of 248 bytes in cycle-steal mode.

Remote Program Loader II (RPL-II)—The RPL-II allows the 3705 to receive its initial program load from a remotely located host without a channel attachment. A 3705 can have only one RPL-II.

CONNECTION TO THE NETWORK

The 3705-II's network connection hardware forms a three-level hierarchy among communications scanners (CSs), line interface bases (LIBs), and line sets (LSs). The three levels form a pyramid, with the CCU supporting a number of scanners, each scanner in turn supporting a number of LIBs, and each LIB in turn supporting a number of line sets. Depending on its type, each line set supports attachment to one or two communications lines. Depending on its type, and on the data rates, interfaces, and transmission techniques supported by the line sets, an individual LIB can support up to eight communications lines. Depending on its type, its location in the 3705-II configuration (base or expansion frame), and the characteristics of its LIBs, each communications scanner can support the attachment of up to six LIBs.

The communications scanners, through the attachment base, provide the interface between the CCU and the LIBs. The scanners handle data at the character level, assembling characters from incoming bit streams, and dissassembling characters for serial transmission on the network. For certain types of communications, the 3705 requires that a Business Machine Clock be attached to the scanners to provide reference timing. IBM currently supports three types of communications scanners. (Communications Scanner Type 1 is obsolete.) Only one scanner can be installed in any frame of a 3705.

Communications Scanner Type2 (CS2)—The CS2 transfers data on an interrupt basis between LIBs of any type and the CCU. When installed in the base frame of a 3705-II, it supports the attachment of up to four LIBs; when installed in an expansion frame, it supports the attachment of up to six LIBs.

Communications Scanner Type 3 (CS3)—The CS3 transfers data between its attached LIBs and the CCU by a cycle-steal method in units up to 254 bytes, thus providing higher performance than the interrupt-generating CS2. It supports only synchronous (BSC or SDLC) communications, and, under the control of NCP, performs code translation between ASCII and IBM's native EBCDIC for BSC transmissions. The CS3 also supports auto-dial operations.

Communications Scanner Type 3 High Speed (CS3HS)—The CS3HS, a modified version of the CS3, can support communications line data rates up to 230.4K bps, the maxi-

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IBM 3705 Communications Controller

TABLE 3. COMMUNICATIONS HANDLED BY THE 3705-80

Type of Line Interface	Transmission Speed (bps)	Transmission Timing	Transmission Mode	Line	Line Set	Number of Lines Supported (M81/M82/M83)	Comments
External RS-232-C/V.24 modems	Up to 9600	Async/Sync	Half-duplex	Leased or switched	Common	4/10/16	Preprogrammed line interface for Start/Stop, BSC, and SDLC protocols.
	Up to 19.2K	Synchronous	Half-duplex	Leased or switched	Common	4/8/16	
	Up to 19.2K	Synchronous	Full-duplex	Leased or switched	Common	2/5/8	
External CCITT V.35 modem	Up to 56K	Synchronous	Half-duplex	Leased	2	2/2/*	
	Up to 56K	Synchronous	Full-duplex	Leased	2	1/1/*	
External wideband	Up to 50K	Synchronous	Half-duplex	Leased	3	2/2/*	
	Up to 50K	Synchronous	Full-duplex	Leased	3	1/1/*	
Automatic dialing; RS-366A/V.25 compatible	—	—	—	Switched	4	4/4/*	For attachment of external dialing units.
Direct attachment	Up to 2400 bps	Async/Sync	Half-duplex	IBM cables	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols.
	14.4K or 57.6K	Synchronous	Half-duplex		5	2/2/*	Maximum cable length is 200 feet. Interface is CCITT V.35 includes internal clocking.
CCITT X.21 interface	Up to 9600	Synchronous	Half-duplex	Leased	8	2/2/*	
	Up to 9600	Synchronous	Full-duplex	Leased or switched	8	2/2/*	Switched operation requires: #1409 Business Clock; #1416
	48K	Synchronous	Half-duplex	Leased	9	1/1/*	Business Clock (for testing);
	48K	Synchronous	Full-duplex	Leased or switched	9	1/1/*	and ACF/NCP R3.

*Not available on M83.

mum supported by the 3705. The CS3HS supports only one full-duplex or two half-duplex communications lines.

Line interface bases and line sets—The 3705-II supports six types of LIBs and 18 types of line sets. Each type of LIB supports certain kinds of transmission, and so supports only certain types of line sets. The types of LIB currently available are:

Type 1: supports lines with external modems and/or auto call, and for directly attached terminals.

Type 2: supports telegraph-grade lines.

Type 3: supports lines with IBM limited-distance line adapters.

Type 8: supports 1200 bps lines with integrated modems.

Type 9: supports 1200 bps lines with integrated modems and auto call.

Type 10: supports 1200 bps lines with integrated modems and full-duplex data transmission.

Table 2 shows the types of LIB supported by each type of scanner, and the number of LIBs installable in 3705 base and expansion frames. Table 3 lists the types of communications supported by the 3705-II, and the necessary components for each.

The 3705-80 uses a slightly simpler architecture on the network side. It supports only one type of communications scanner, the CS2, which is included as standard equipment. The 3705-80 has no component equivalent to the 3705-II's LIBs; it supports six types of line sets (called line attachments on the 3705-80). Table 4 lists the types of communications supported by the 3705-80, and the necessary components for each.

TRANSMISSION SPECIFICATIONS

Both the 3705-II and the 3705-80 support half- or full-duplex transmissions using start/stop (asynchronous), BSC, or SDLC protocols. Start/stop signals can be transmitted at rates up to 56.7K bps; synchronous (BSC or SDLC) signals can be transmitted at rates up to 230.4K bps. Table 3 lists the specific types of transmission supported by the 3705-II; Table 4 lists the specific types of transmission supported by the 3705-80. Both tables show the specific hardware necessary for a given mode of transmission.

The 3705 was designed in the mid 1970s, and its architecture was originally meant to handle the types of communications that prevailed then—half-duplex transmissions at rates up to 4800 bps. Later enhancements to the hardware, aimed at supporting higher speeds and full-duplex connections, put demands on the 3705 that its architecture was not designed to meet. Attaching any communications line expected to operate in full-duplex mode or at a rate greater than 4800 bps requires some kind of tradeoff; such tradeoffs reduce the total number of lines attachable to the 3705.

Two tradeoffs designed to handle high-speed transmissions are reduction of the upper scan limit and Address Substitution. Both involve the Type 2 Communications Scanner. Like all 3705 scanners, the CS2 is a polling device; it scans (polls) its attached communications lines for activity in a preset order. To support high-speed communications adequately, the scanner must poll high-speed lines more often. When all lines attached to a given scanner are high-speed, the user can reduce, in software, the number of lines the scanner can scan, shortening the polling sequence and insuring that all lines receive more of the scanner's attention. By

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IBM 3705 Communications Controller

TABLE 4. COMMUNICATIONS HANDLED BY THE IBM 3705-II

Type of Line Interface	Speed (bps)	Transmission Timing	Mode	Line	Line Set	Lines per Line Set	LIB	Max Line Sets per LIB	Comments
External RS-232-C/ V.24 modem	Up to 9600	Async/sync	Half-duplex	Leased or switched	1D	2	Type 1	8	Any combination of speed and timing is possible for each
	Up to 9600	Async/sync	Full-duplex	Leased	1D	1	Type 1	8	Line Set 1D.
External wideband modem	19.2K or 50K	Sycnhronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Runs only under NCP.
	50K	Sycnhronous	Full-duplex	Leased	1T	1	Type 1	4	
	Up to 230.4K	Sycnhronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3HS.
	Up to 230.4K	Sycnhronous	Full-duplex	Leased	1TA	1	Type 1	1	Requires Scanner Type 3HS.
External Mil 188C modem	Up to 50K	Async/sync	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Runs only under NCP.
	56K	Synchronous	Full-duplex	Leased	1U	1	Type 1	4	
Local attachment	Up to 9600	Synchronous	Half-duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
CCITT X.21 Interface	Up to 48K	Synchronous	Half-duplex	Leased	1N	2	Type 1	8	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 48K	Synchronous	Full-duplex	Leased	1N	1	Type 1	4	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 9600	Synchronous	Full-duplex	Switched	1R	1	Type 1	8	Requires Scanner Type 2 and #4650 Business Clock.
	Up to 48K	Synchronous	Full-duplex	Switched	1R	1	Type 1	2	Requires Scanner Type 2 and #4650 Business Clock.
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/ 83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	1200 or 600	Async/sync	Half-duplex	Leased	8A	2	Type 8	3	
	600	Asynchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto-answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto-answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	9B	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	

reducing the upper scan limit (eliminating the higher addresses from the scanning sequence), the user increases the scanning rate for the lines attached at the lower addresses, and, as a direct result, reduces the number of lines that can be attached to the scanner.

Another way of increasing the scanning rate for high-speed lines, this time in configurations where the scanner supports both high- and low-speed lines, is to cause the scanner to poll the high-speed lines more than once in each scanning sequence. To do this, again in software, the user substitutes the addresses of the high-speed lines in positions that other lines would ordinarily occupy. This Address Substitution technique reduces the line capacity of the scanner by the number of extra scans given to the high-speed lines.

OPERATOR INTERFACE

Once the network has been defined in software, the operator has almost no direct interaction with the 3705. Any interaction between the operator and the network takes place through the host, with such programs as the Newtork Command and Control Facility (NCCF). The 3705 supports no operators' console. It has a maintenance panel for power-up, reload, and simple diagnostic operations.

SOFTWARE

In a mainframe network, the communications processor is treated as a peripheral device controller. Like other peripheral controllers, it transfers data from the host to one or more input/output or storage devices under the host's control. In the communications processor's case, the peripheral device is a network, rather than a bank of printers of disk drives. Because a network is more complex than any other "peripheral device," the communications processor must be both more intelligent and more independent of the host than any other controller.

Initially by necessity and later by design, the IBM 3705 depends more on its host processor than most modern communications processors. In part, this results from the

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IBM 3705 Communications Controller

3705's age as a product; it was designed initially to support a network of locally attached terminals. The intentional side of the 3705's dependence on its host springs from the overall design of SNA, IBM's networking architecture. SNA defines protocols and parameters for communications from end to end, from hooks into the applications program in the host to the definitions of screen and response formats at the terminal. The communications processor is an essential, but intermediate, component in an SNA network. Most mainframe vendors' architectures define communications only from communications processor to communications processor, and as architectural endpoints, those vendors' communications processors function more independently of the host than do IBM's.

The 3705 runs in one or both of two distinct modes, *Emulation* mode and *Network Control* mode. Emulation mode is a backward-compatibility feature that allows the 3705 to support older IBM start/stop and BSC terminal protocols by emulating the 270X Series of hard-wired communications controllers. Network Control mode is the 3705's native mode of operation; it supports the SDLC link protocol and the SNA architecture. Running in pure Emulation mode, the 3705 uses the Emulation Program as its basic operating software. Running in pure Network Control mode, it uses one of several generations of IBM's Network Control Program. In a third mode, Partitioned Emulation Programming (PEP), separate portions of the 3705 run in Emulation and in Network Control modes; PEP is a feature of later versions of the Network Control Program.

In any of these software configurations, the 3705 runs under the control of its host's telecommunications access method, whether it is attached locally or remotely to the host. A 3705 in pure Emulation mode runs under the control of either the Basic Telecommunications Access Method (BTAM) or under one of several generations of the Telecommunications Access Method (TCAM). BTAM is an older, nearly obsolete access method. TCAM's current incarnation is the Advanced Communications Function for TCAM (ACF/TCAM). A 3705 running in PEP mode must run under the control of a TCAM access method. A 3705 running in pure Network Control mode can run under the control of either a TCAM access method or the Virtual Telecommunications Access Method (VTAM), whose latest versions are the Advanced Communications Function for VTAM (ACF/VTAM). Those portions of a 3705 participating in an SNA network must run under the control of an ACF-type access method in the host, either ACF/TCAM or ACF/VTAM.

Emulation Program—A 3705 in Emulation mode runs the Emulation Program for the 3705. Processors that run in Emulation mode must be channel-attached to a host. The chief advantage of Emulation mode is that it allows the 3705 to support start/stop and BSC terminals. A user operating in a pure emulation environment need not convert to SNA communications. However, support for the pure Emulation environment is dwindling, both among IBM users and within IBM. The current version of the Emulation Program runs only in PEP mode alongside ACF/NCP.

Previous versions of the Emulation Program supported only Channel Adapter Type 1 in the 3705. The latest version supports only Channel Adapter Type 4.

Partitioned Emulation Programming—PEP operations have long been available as an option within ACF/NCP programs. In essence, a 3705 running PEP appears to its host and to its users as two smaller machines. The Emulation mode partition and the NCP partition must use separate channel adapters, communications scanners, LIBs, and line sets. To the host's access method, the portions of the network controlled by the Emulation mode partition form a separate network from those controlled by NCP.

The latest versions of ACF/NCP do not automatically include a PEP option. Rather, the Emulation Program is available as a separate product that must run under ACF/NCP to enable Emulation.

Network Control Program—The Network Control Program is the native-mode 3705 operating system, introduced to provide support for IBM's Synchronous Data Link Control (SDLC) protocol. Later versions of NCP, those designated ACF/NCP, support the full SNA architecture. For details of the general advantages of SNA, see Report C11-491-101 in this volume of DATAPRO REPORTS ON DATA COMMUNICATIONS.

In summary, the principal advantages of ACF/NCP operations are the efficiency of the SDLC line discipline and an increased breadth of network control in cooperation with several network management program products running in the host. ACF/NCP also supports larger memory sizes and more efficient use of storage.

In addition, ACF/NCP supports the multisystem networking features of SNA, which allows more than one host to participate in a network, with each host controlling a separate network domain. The latest version of ACF/NCP also supports the interconnection of SNA networks through a gateway node that consists of an IBM communications processor (3705 or 3725) and its attached host.

X.25 NCP Packet Switching Interface Program—The X.25 NCP Interface provides users of ACF/NCP the ability to use 3705 Communications Controllers to access public data networks that comply with CCITT X.25 standards. The package has been certified by GTE Telenet, among other packet switching providers. This program supports packet sequence numbering up to 128, with packet length of up to 4,096 characters. It supports SNA network node interconnection and protocol conversion for non-SNA equipment. Within the program, a subset of X.29 allows communications with asynchronous X.28 devices (TTY). It also supports the X.21 line sets.

Network Terminal Option—The Network Terminal Option is a separate program product that allows start/stop terminals to participate in an SNA network without the need for Emulation mode.

Non-SNA Interconnection Program—The Non-SNA Interconnection Program allows IBM 3705s and 3725s operating in pure Network Control mode to support BSC terminals. The program envelops BSC data in SDLC framing, allowing lower layers of the architecture to treat the BSC message as an SDLC bit stream.

Network Routing Facility—The Network Routing Facility allows the 3705 to select transmission routes for established SNA sessions. The facility runs under the control of ACF/VTAM in the host, and allows the communications processor to maintain active sessions in the event of a host or access method failure.

System Support Program—The 3705, like all IBM communications processors, cannot generate its own software, either its initial program load or the required network configuration definitions. A host-resident system generator, called a System Support Program (currently ACF/SSP) is required. ACF/SSP is a collection of macroinstructions in IBM assembler language that allows the user to define the characteristics of both the communications processor and the network it supports. With ACF/SSP, users can generate code for both Emulation and ACF/NCP modes of operation. Code assembled and linked by ACF/SSP is downloaded from the host to the communications processor, either locally through the I/O channel, or remotely, through a front-end processor and an RPL-II in the remote unit.

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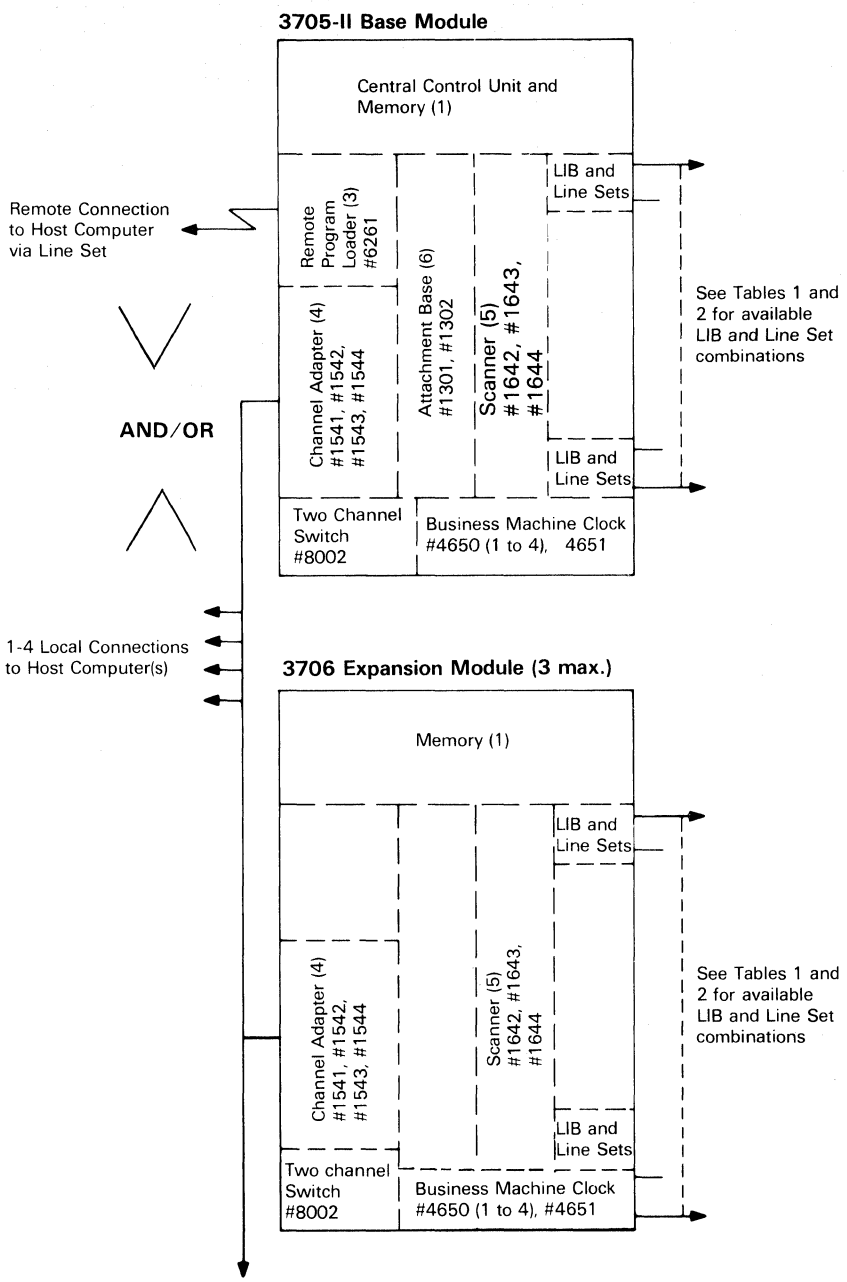
IBM 3705 Communications Controller



(1) In the 3705-II, all memory is located in base module in 32K-byte increments to a maximum of 256K bytes. Models J, K, and L also include a second module with at least one 64K-byte memory increment.
(2) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705-II can be installed with up to three Channel Adapters Type 1, 2, 3, or 4. If more than two adapters are used, all must be Type 4.
(3) Up to 4 Channel Adapters Type 1, 2, 3, or 4 can be installed in the 3705-II: two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 2 or 3 run only under NCP. If more than two CAs are installed, all must be CA Type 4. CA Type 1 may not be used with Models J, K, or L.
(4) One Scanner Type 2 or 3 can be installed in each of the four modules; Scanner Type 33 may be placed in the Base Module.
(5) One or two attachment bases are required as follows:
- *Scanner Type 2 with CA Type 1—Attachment Base Type 1 and 2;*
- *Scanner Type 2, 3, or 3HS with CA Type 2, 3, 4—Attachment Base Type 2.*

(6) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

Figure 1. 3705-II Configuration

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Associated Host Software—Host-resident programs that communicate directly with the 3705 and control parts of its operation include the communications access methods (currently ACF/TCAM and ACF/VTAM) and certain program products for network management and control. Between the access methods, ACF/TCAM supports emulation mode, while ACF/VTAM does not. Users migrating gradually to SNA should install ACF/TCAM, while users running full SNA networks may use either.

Network management and control products include the *Network Communications Control Facility* (NCCF) which allows network configuration control from the operator's console of the host, and supports diagnostics under IBM's network troubleshooting program, the *Network Problem Determination Application* (NPDA). *The Network Logical Data Manager* is a data base driver for the recording of network performance and maintenance information.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705-II and up to 45 percent on the 3705-80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 a.m. and 6 p.m., Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

EQUIPMENT PRICES

	Purchase Price ($)	Monthly Maint. ($)
3705-80 Communications Controller (No longer being marketed)		
Model M81 (256K bytes, 4 lines)	36,600	259
Model M82 (256K bytes, 10 lines)	46,600	271
Model M83 (256K bytes, 16 lines)	52,600	282
3705-II Communications Controller (no longer being marketed)		
Model E1 (32K bytes, 64 lines)	38,230	173
Model E2 (64K bytes, 64 lines)	39,800	195
Model E3 (96K bytes, 64 lines)	41,370	217
Model E4 (128K bytes, 64 lines)	42,940	238
Model E5 (160K bytes, 64 lines)	44,510	259
Model E6 (192K bytes, 64 lines)	46,080	280
Model E7 (224K bytes, 64 lines)	47,650	301
Model E8 (256K bytes, 64 lines)	49,220	324
Model F1 (32K bytes, 160 lines)	51,530	190
Model F2 (64K bytes, 160 lines)	53,100	209
Model F3 (96K bytes, 160 lines)	54,670	232
Model F4 (128K bytes, 160 lines)	56,240	252
Model F5 (160K bytes, 160 lines)	57,810	274
Model F6 (192K bytes, 160 lines)	59,380	294
Model F7 (224K bytes, 160 lines)	60,950	316
Model F8 (256K bytes, 160 lines)	62,520	338
Model G1 (32K bytes, 256 lines)	64,830	204
Model G2 (64K bytes, 256 lines)	66,400	225
Model G3 (96K bytes, 256 lines)	67,970	245
Model G4 (128K bytes, 256 lines)	69,540	267
Model G5 (160K bytes, 256 lines)	71,110	288
Model G6 (192K bytes, 256 lines)	72,680	311
Model G7 (224K bytes, 256 lines)	74,250	330
Model G8 (256K bytes, 256 lines)	75,820	353

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IBM 3705 Communications Controller

3705-II Communications Controller (No longer being marketed) (Continued)	Purchase Price ($)	Monthly Maint. ($)
Model H1 (32K bytes, 352 lines)	78,130	218
Model H2 (64K bytes, 352 lines)	79,700	239
Model H3 (96K bytes, 352 lines)	81,270	261
Model H4 (128K bytes, 352 lines)	82,840	281
Model H5 (160K bytes, 352 lines)	84,410	303
Model H6 (192K bytes, 352 lines)	85,980	325
Model H7 (224K bytes, 256 lines)	87,550	346
Model H8 (256K bytes, 352 lines)	89,120	368
Model J1 (320K bytes)	71,020	373
Model J2 (384K bytes)	74,160	415
Model J3 (448K bytes)	77,300	457
Model J4 (512K bytes)	80,440	501
Model K1 (320K bytes)	84,320	386
Model K2 (384K bytes)	87,460	429
Model K3 (448K bytes)	90,600	471
Model K4 (512K bytes)	93,740	515
Model L1 (320K bytes)	97,620	401
Model L2 (384K bytes)	100,760	444
Model L3 (448K bytes)	103,900	488
Model L4 (512K bytes)	107,040	530

			Monthly Charges*		
		Purchase Price ($)	Monthly Maint. ($)	Two-Yr. Lease ($)	Rental ($)
Communications Line Sets for 3705-80					
6712	Line Set Type 2	5,440	11.00	219	257
6713	Line Set Type 3	4,850	9.00	195	229
6714	Line Set Type 4	2,060	4.00	80	94
5657	Line Set Type 8	2,600	3.50	98	115
5658	Line Set Type 9	1,550	3.00	57	67
14XX	Business Machine Clock	424	1.00	13	15
Attachment Bases (for 3705-II only)					
1301	Type 1	641	0.50	22	26
1302	Type 2	641	0.50	22	26
Channel Adapters					
1541	Type 1	2,700	9.00	142	167
1542	Type 2 (3705-II only)	6,470	9.00	266	312
1543	Type 3 (3705-II only)	12,910	11.00	541	636
1544	Type 4	4,410	8.00	228	268
1551	Type 1; for 3705-80 only	3,340	9.50	165	194
8002	Two-Channel Switch	2,040	3.50	81	95
Communications Scanners for 3705-II					
1642	Type 2	4,750	9.00	255	300
1643	Type 3	17,210	31.00	915	1,075
1644	Type 3 High Speed	25,120	37.00	1,230	1,445
4650	Business Machine Clock for 3705-II	424	1.00	13	15
4651	Business Machine Clock for 3705-II	880	1.50	33	39

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IBM 3705 Communications Controller

		Monthly Charges*			
	Communication Line Attachment Features for 3705-II	**Purchase Price ($)**	**Monthly Maint. ($)**	**Two-Yr. Lease ($)**	**Rental ($)**
4701	Line Interface Base Type 1:	1,105	3.00	56	66
4714	Line Set Type 1D	1,030	3.00	51	60
4715	Line Set Type 1E	1,030	2.50	40	47
4717	Line Set Type 1G	2,050	6.00	108	126
4719	Line Set Type 1J	1,455	2.50	56	66
5655	Line Set Type 1N	2,040	3.00	69	81
5656	Line Set Type 1R	1,700	3.00	57	67
4720	Line Set Type 1S	3,020	6.50	118	139
4722	Line Set Type 1GA	2,695	6.00	108	126
4723	Line Set Type 1TA	4,850	9.00	195	229
4725	Line Set Type 1T	4,850	9.00	195	229
4726	Line Set Type 1U	5,440	10.00	219	257
4727	Line Set Type 1W	4,720	6.00	180	212
4728	Line Set Type 1Z	8,640	10.00	335	394
4702	Line Interface Base Type 2:	1,455	2.50	56	66
4721	Line Set Type 2A	1,030	3.50	40	47
4703	Line Interface Base Type 3:	2,515	2.50	100	117
4731	Line Set Type 3A	850	1.50	32	37
4732	Line Set Type 3B	850	1.50	32	37
4708	Line Interface Base Type 8:	1,455	3.50	56	66
4781	Line Set Type 8A	1,490	4.50	57	67
4782	Line Set Type 8B	1,920	6.00	75	88
4709	Line Interface Base Type 9:	1,455	2.50	56	66
4791	Line Set Type 9A	1,785	10.00	83	98
5000	Line Interface Base Type 10:	1,685	2.50	63	74
4784	Line Set Type 10A	2,685	5.50	108	126
	Remote Concentrator Features				
6250	Remote Power Off	416	0.50	13	15
6261	Remote Program Loader-II	9,335	28.00	391	459

SOFTWARE PRICES*

		Monthly Basic License ($)	Monthly DSLO License ($)	Monthly Licensed Program Support ($)	Monthly Multiple Licensed Program Support ($)
5744-BA2	Network Control Program	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	234	176	35	56
5735-XX3	SSP for ACF/NCP/VS Version 2	72	54	19	30
	Host Access Methods				
5735-RC1	ACF/TCAM Version 1	352	263	12	19
	With Multisystem Networking Facility	1,305	979	31	50
5735-RC3	ACF/TCAM Version 2, Releases 1, 2, 3, & 4	874	655	91	145
	With Multisystem Networking Facility	1,465	1,099	113	181
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	197	177	58	93
	With Multisystem Networking Facility	374	337	174	278
5735-RC2	ACF/VTAM Version 1, Release 1, 2, & 3	457	343	55	88
	With Multisystem Networking Facility	1,100	825	163	260
	Encrypt/Decrypt Feature	269	202	8	13
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	191	172	82	131
	Other Host Networking Software				
5735-XX7	Network Terminal Option Releases 1, 2, & 3	206	155	12	19
5735-XX8	Network Problem Determination Application (NPDA) Releases 1 & 2	72	54	23	37
5735-XX6	Network Communications Control Facility (NCCF)	156	117	48	77
5668-963	Network Routing Facility Version 3.0	1,175	881	248	397
5668-981	X.25 Packet Switching Interface Versions 3 & 4	269	202	40	64

NC—No charge, as basic software load is provided as part of System Control Programming (SCP).
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide on-site service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.* ■

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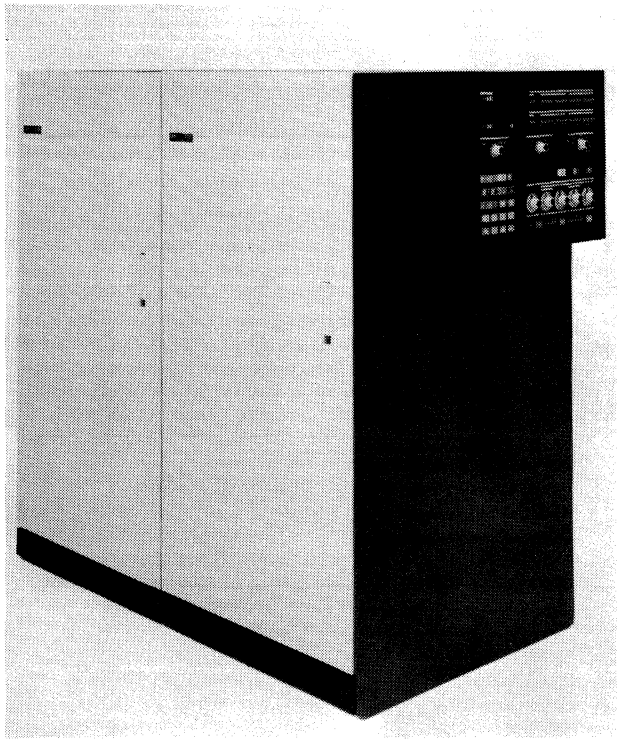
IBM 3705 Communications Controller



Introduced in the mid 1970s, the IBM 3705 is the largest selling communications processor in the market's history.

The IBM 3705 is the largest selling communications processor ever manufactured, and a standard against which all communications processors are measured. While the 3705 remains an active IBM product, its eventual successor, the simpler and more powerful 3725, is gradually replacing it in the marketplace.

FUNCTION: Front-end or remote full-service communications processor for the IBM mainframe environment.
HOST COMPUTERS SUPPORTED: IBM 360, 370, 303X, 43XX, and 308X mainframe computers.
ARCHITECTURE SUPPORTED: SNA; pre-SNA IBM communications.
OPERATING SOFTWARE: ACF/NCP in SNA and partitioned emulation configurations; Emulation Program for the 3705 is pre-SNA configurations. In either case, the 3705 operates under close control of its host's access method, either TCAM or VTAM.
COMPETITION: NCR Comten 3600 Series and 5620; Amdahl 4705; CCI CC8, CC80, and CC85; Memorex 1270.
PRICE: Purchase price for a 3705-II Model G8 with 256K bytes of memory and support for 256 communications lines is $75,820. The maintenance charge is $298 per month. Model G8 is a middle-of-the-line system in the larger 3705-II Series.

MANAGEMENT SUMMARY

UPDATE: *The IBM 3705 Communications Controller is nearing the end of its product life. IBM has made few changes to the 3705 in recent years; it will eventually be replaced by the 3725 Communications Controller. Despite this, Datapro will continue to include the 3705 report in DATAPRO REPORTS ON DATA COMMUNICATIONS for the foreseeable future, due to the historical importance of the product and the number of 3705s still in operation. This version of the report reflects some pricing changes that have been made for components of the 3705.*

The IBM 3705 is the grandparent of communications processors, the largest selling communications processor in history, and a standard by which all other communications processors are measured. Now, it is also obsolescent. Announced originally in the mid 1970s, the 3705 has gone through its infancy, its maturity, and currently, its dotage. IBM's announcement of the 3725 Communication Controller in April 1983, signalled the beginning of the end for the 3705. While the vendor has not yet removed the 3705 from marketing, its successor is selling extremely well, and the mid 1980s should see the last 3705 sales.

The 3705 is an interrupt-driven machine based on an IBM-proprietary 16-bit CPU. It comes in two general series of models, the entry-level 3705-80 and the full-scale 3705-II.

CHARACTERISTICS

VENDOR: International Business Machines Corporation (IBM), Old Orchard Road, Armonk, NY 10504. Contact your local IBM representative.

DATE OF ANNOUNCEMENT: 3705-II, Models E1-H8—November 1975; Model J1-L4—November 1978; 3705-80—March 1981.

DATE OF FIRST DELIVERY: 3705-II, Models E1-H8—August 1976; Models J1-L4—June 1979; 3705-80—August 1981.

NUMBER DELIVERED TO DATE: Over 50,000 (estimated for all models).

SERVICED BY: IBM.

MODELS

The IBM 3705 Communications Controller comes in two overall series of models. The 3705-80 is a small, entry-level communications processor, able to support 256K bytes of main memory, attachment to two host computers, and up to 128 communications lines. The 3705-II is a large-scale communications processor, able to support up to 512K bytes of main memory, eight host processors, and 352 communications lines in its largest configurations.

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IBM 3705 Communications Controller

The 3705-80 is available in three models, each of which has 256K bytes of memory. The largest 3705-80 supports 16 communications lines. The 3705-II is available in 44 different configurations of processor and memory, the largest of which supports 512K bytes of storage and up to 352 communications lines.

The 3705-II can serve as a front-end processor, a remote concentrator, or a remote switch. In its front-end configuration, it contains a central processor, main storage, one or more attachment bases for the connection of network-side equipment, up to four channel adapters for connection to the I/O channels of the host processor, and a variety of network-side hardware. For its remote configurations, channels are replaced by a single Remote Program Loader-II (RPL-II) that allows the 3705's operating software to be downloaded from the host through its front end—either another 3705 or a 3725. The 3705-80 has the same basic configuration, but can contain only two channel adapters and requires no attachment base.

On the network side, the 3705-II uses a three-tiered, pyramidal hierarchy of components. At the top are communications scanners, polling devices that scan their attached communications lines for activity, assemble incoming data into characters, and disassemble outgoing data into serial bit streams. Next are line interface bases (LIBs) that connect the scanners to their attached line sets. Line sets are components that provide the physical connections to specific types of communications facilities. The 3705-II supports three different communications scanners, six types of LIBs, and 19 different types of line sets. The 3705-80 uses a similar architecture, but does not require line interface bases, contains a single type of scanner as standard equipment, and supports a more limited complement of line sets.

In general, the 3705 supports synchronous or start/stop (IBM's term for asynchronous) communications in half- or full-duplex mode at rates from 1200 bps to 230.4K bps, and uses ASCII, IBM Correspondence, BSC, or SDLC protocols. The 3705's architecture was designed to support half-duplex communications at rates up to 4800 bps; later additions that support full-duplex transmission and higher speeds require tradeoffs in the number of lines the 3705 can support.

The 3705 supports a full, backward-compatible range of software, from total emulation of the old IBM 27XX

TABLE 1. 3705-II MODELS

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	E7, F7, G7, H7	224K
E2, F2, G2, H2	64K	E8, F8, G8, H8	256K
E3, F3, G3, H3	96K	J1, K1, L1	320K
E4, F4, G4, H4	128K	J2, K2, L2	384K
E5, F5, G5, H5	160K	J3, K3, L3	448K
E6, F6, G6, H6	192K	J4, K4, L4	512K

The 3705-80 is available in three models: Model M81 supports up to 4 communications lines; Model M82 supports up to 10 communications lines; and Model M83 supports up to 16 communications lines.

Within the 3705-II Series, IBM currently offers 44 different models, each designated by a letter and a number. The letter describes both the type of central processing unit a given processor contains and the number of frames (including the 3705 base frame and up to three 3706 expansion frames) in the configuration. Models En to Hn use IBM's older CPU; it has a storage cycle time of 1 microsecond. Models Jn to Ln use IBM's enhanced CPU, which has a storage cycle time of 0.9 microseconds (900 nanoseconds). The number in the model designation specifies main-memory capacity in a standard increment over the next-largest model for that unit's processor type: for 3705-II Models En to Hn, the memory increment is 32K bytes; for Models Jn to Ln, the memory increment is 64K bytes. Thus, a 3705-II Model E1 uses the older processor, has a single frame, and supports 32K bytes of main storage; a 3705-II Model F3 uses the older processor, has two frames, and supports 96K bytes of main storage. A 3705-II Model J1 uses the newer processor, has one frame, and supports 320K bytes of main storage. See Table 1 for a complete list of 3705-II models.

CONFIGURATION

In its basic configuration, the 3705 contains a central control unit (CCU) with a minimum of 32K bytes of main storage; an operator's control panel; one or more Channel Adapters for local connection to a host computer, or a Remote Program Loader (RPL) for remote connection to a host computer; one or two Attachment Bases for connection between the CCU and the network-side equipment; one or more Communications Scanners that control connections between the CCU and the communications lines at the character level; one or more Line Interface Bases that attach the communications lines to the scanners; and one or more Line Sets, which control connection between the Line Interface Bases and communicatons lines at the physical level. One or more Business Machine Clocks can attach to the communications scanners to provide reference timing when such timing is not provided by external facilities or modems.

A 3705-II can include up to three Model 3706 expansion frames. Depending on the processor's specific configuration, these expansion frames contain additional main memory and additional channel adapters, as well as additional communications scanners, line interface bases, and line sets.

The architectures of the 3705 and of its component parts dictate an extremely complex set of rules for configuration. Possible arrangements of parts, both overall and within a given frame, depend on the types of channel attachments required, the types of scanners in use, and the specific line control hardware necessary. These, in turn, depend on the number and models of host computers served, the specific communications facilities used, the data rates and protocols supported, and the specific communications software installed both in the 3705 and in the host. A detailed enumeration of the 3705's configuration rules lies outside the scope of this report; however, IBM does provide configuration aids to assist the user in designing a 3705 for a particular application.

PROCESSING COMPONENTS

All models of the IBM 3705 use a 16-bit central-processing unit. The 3705-80 and Models E1 through H8 of the 3705-II use an older processor with a storage cycle time of 1 microsecond; Models J1 through L4 of the 3705-II use a faster processor with a storage access time of 0.9 microseconds (900 nanoseconds). Both processors are interrupt-driven: interrupts may come directly from the 3705's operating

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hardwired controllers to full-blown SNA networking. In full Emulation mode, it does not support SDLC communications or multisystem networking, but does support older IBM communications access methods such as BTAM. In Network Control mode, it supports the full range of SNA features available with a given version and release of the Network Control Program (ACF/NCP), including network diagnostics through the host, routing, multisystem networking, and SNA network interconnection. As an intermediate step between Emulation mode and full SNA, IBM provides Partitioned Emulation Programming (PEP), in which one portion of the 3705 runs in Emulation mode and the other runs the Network Control Program. Portions of the network controlled by each partition of the 3705 appear to the user and the host as separate networks.

COMPETITIVE POSITION

Venerable as it is, the 3705 has never been confronted by serious competition. Instead, it has provided a standard on which several competitors have improved in order to serve sophisticated users in IBM environments, or to serve special applications. Among these vendors are Amdahl Corporation, NCR Comten, Computer Communications, Inc. (CCI), and Memorex. Two of these competitors, NCR Comten and CCI, conduct almost all of their trade in IBM-compatible communications processors. In that sense, the 3705 alone has spawned a small industry, currently led by NCR Comten, whose 3600 Series processors offer significant performance advantages over the 3705. Amdahl's major selling point is that its 4705 is entirely software-compatible with the 3705 but outperforms the IBM machine. CCI's processors run only in Emulation mode, but offer important price-performance advantages in specialized applications. The Memorex offering is based on the CCI processor.

Currently, the 3705's biggest competitor is its successor, the IBM 3725, which looks to replace the 3705 entirely by the end of the decade. The 3725 is larger, faster, and offers maintenance features not found on the 3705. With the 3705 and 3725, IBM currently controls approximately 90 percent of the communications processor market.

ADVANTAGES AND RESTRICTIONS

As an industry standard over ten years old, the IBM 3705's principal advantage is its track record. It remains the largest selling communication processor ever produced, and has served well in all applications supported by IBM mainframe equipment. However, as an industry standard, it suffers in one way or another when compared to any of its competitors. Amdahl's 4705 runs the same software faster and costs less. NCR Comten's 3600 Series processors support more communications lines and cost less in similar configurations. CCI's processors show performance advantages in Emulation mode and cost less. IBM's own 3725 costs slightly more, but outperforms the 3705 by a factor of nearly two.

Basically, the 3705 is a war-horse ready for pasture. Its architecture was conceived in the mid '70s for the commu-

software, or may be generated by incoming data or error conditions from the channel adapters or communications scanners. Some components of the 3705 use a cycle-stealing technique for access to the processor and to memory. Cycle-stealing is an advanced form of interrupt in which the component needing access to memory or to the processor actually takes control for an entire machine cycle.

All models of the 3705 use semiconductor main memory. The 3705-80 initially comes with 256K bytes of main storage, and supports no memory increments. The smaller 3705-II models (E1 through H8) initially support 32K bytes of memory (Models E1, F1, G1, and H1), and support expansion to 256K bytes (Models E8, F8, G8, and H8) in increments of 32K bytes. The larger 3705-II models (J1 through L4) initially support 320K bytes of memory (Models J1, K1, and L1), and support expansion to 512K bytes (Models J4, K4, and L4) in increments of 64K bytes. All 3705-II models can be upgraded, in stages, to the maximum configuration.

Every 3705-II must have at least one *attachment base*; either Type 1, which provides the interface between the CCU and one type of channel adapter (Type 1) and one type of communications scanners (Type 1); or Type 2, which provides the interface between the CCU and the remaining types of communications scanners (Types 2, 3, and 3HS).

CONNECTION TO THE HOST

The IBM 3705 may serve as a front-end processor or as a remote concentrator or switch; however, in any of these roles, it must receive its initial program load from an IBM mainframe host, and must operate under the host's instructions. In front-end configurations, the 3705 communicates with the host through a *channel adapter* connected to one or more of the host's input/output (I/O) channels. In remote configurations, it communicates with the host through a *remote program loader* connected to the host over a high-speed, dedicated data link into that host's front-end processor (IBM 3705 or 3725).

IBM offers four types of channel adapters for the 3705. The 3705-80 can use only Types 1 and 4; the 3705-II can use all four.

Channel Adapter Type 1 (CA1)—The CA1 connects to the byte multiplexer channel of the host, and to an Attachment Base Type 1 on the 3705-II. (The 3705-80 does not require an attachment base for the CA1.) It transfers data in units of one, two, three, or four bytes, and must interrupt the host for each transfer.

Channel Adapter Type 2 (CA2)—The CA2 is a high-performance interface that can operate only under the control of the Network Control Program software. It can attach to the host's byte multiplexer, block multiplexer, or selector channel (the selector channel is a very high-speed, dedicated I/O port), and can transfer data at up to 276K bytes per second in a burst mode. When attached to the byte multiplexer channel, the CA2's bursts of data are limited to 2 bytes.

Channel Adapter Type 3 (CA3)—The CA3, which offers the same performance characteristics as the CA2, has an additional automatic two-processor switch. When the 3705 functions as a front end to a tightly coupled multiprocessor system, each side of this switch is attached to a different processor. Alternatively, the CA3 can be attached to two I/O channels on the same processor to provide alternate data paths.

Channel Adapter Type 4 (CA4)—The CA4 is a high-performance interface that can run under the control of either the Network Control Program or the Emulation Program. It attaches to the byte multiplexer, block multiplexer, or selec-

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nications needs of that time. But much has happened to data communications in the last ten years, and while IBM has worked mightily to keep the 3705 up to date, it has seriously strained the limits of the processor's original design.

The biggest problem is configurational complexity. Designing a 3705-II to fit a given application, especially one involving line speeds over 4800 bps or full-duplex communications, has become a complex process that can require computer assistance. Most of the problems involve tradeoffs in line capacity against line speed. IBM has solved these problems in the 3725, which supports a much smaller set of network-side componentry in a much cleaner configuration.

IBM's own mainframes have outgrown the 3705's ability to communicate with them. The new 308X mainframes support I/O channel data rates more than twice those supported by the 3705. Again, the 3725 meets the needs of the newer hosts.

The 3705 lacks an operator's console and local facilities for maintenance. It relies on the host processor for diagnostics and control; in the event of total system failure, the user might find it difficult to determine whether the host or the communications processor is at fault. The 3725 contains a maintenance and operator subsystem (MOSS) for diagnostics. All of the 3705's competitors support local diagnostics from an operator's console.

USER REACTION

In Datapro's 1985 Network Users Survey, 204 users of the IBM 3705 responded. These users, representing various models of both the 3705-II and 3705-80, reported on a total of 615 processors. Their ratings of the 3705 are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	103	92	9	0	3.5
Ease of installation	48	110	42	4	2.9
Ease of operation	57	104	41	3	3.1
Ease of expansion	34	88	63	19	2.7
Hardware reliability	126	73	6	0	3.6
Quality of vendor's software/firmware	60	119	24	1	3.2
Ease of programming	24	73	50	9	2.7
Quality of vendor's maintenance/technical support**	77	103	19	1	3.3

*Weighted Average based on a scale of 4.0 for Excellent.
**Technical support is defined as troubleshooting, documentation, education, and related services. □

tor channel of the host. In Emulation mode, it can attach only to the byte multiplexer channel, and must interrupt the control program after transferring a burst of 32 bytes; in NCP mode, it transfers data in bursts of up to 16 bytes, but can transfer 248 bytes before generating an interrupt. When attached to the block multiplexer or selector channel, it transfers data in bursts of 248 bytes in cycle-steal mode.

Remote Program Loader II (RPL-II)—The RPL-II allows the 3705 to receive its initial program load from a remotely located host without a channel attachment. A 3705 can have only one RPL-II.

TABLE 2. LIB CAPACITY PER SELECTED SCANNER OPTION FOR THE 3705-II

Line Interface Base Type	Scanner Type	Maximum Number of LIBs per 3705-II: Base Module	Maximum Number of LIBs per 3705-II: Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2 or 3	2	4	6
	3	—	—
	3 HS	—	—

CONNECTION TO THE NETWORK

The 3705-II's network connection hardware forms a three-level hierarchy among communications scanners (CSs), line interface bases (LIBs), and line sets (LSs). The three levels form a pyramid, with the CCU supporting a number of scanners, each scanner in turn supporting a number of LIBs, and each LIB in turn supporting a number of line sets. Depending on its type, each line set supports attachment to one or two communications lines. Depending on its type, and on the data rates, interfaces, and transmission techniques supported by the line sets, an individual LIB can support up to eight communications lines. Depending on its type, its location in the 3705-II configuration (base or expansion frame), and the characteristics of its LIBs, each communications scanner can support the attachment of up to six LIBs.

The communications scanners, through the attachment base, provide the interface between the CCU and the LIBs. The scanners handle data at the character level, assembling characters from incoming bit streams, and dissassembling characters for serial transmission on the network. For certain types of communications, the 3705 requires that a Business Machine Clock be attached to the scanners to provide reference timing. IBM currently supports three types of communications scanners. (Communications Scanner Type 1 is obsolete.) Only one scanner can be installed in any frame of a 3705.

Communications Scanner Type2 (CS2)—The CS2 transfers data on an interrupt basis between LIBs of any type and the CCU. When installed in the base frame of a 3705-II, it supports the attachment of up to four LIBs; when installed in an expansion frame, it supports the attachment of up to six LIBs.

Communications Scanner Type 3 (CS3)—The CS3 transfers data between its attached LIBs and the CCU by a cycle-steal method in units up to 254 bytes, thus providing higher performance than the interrupt-generating CS2. It supports only synchronous (BSC or SDLC) communications, and, under the control of NCP, performs code translation between ASCII and IBM's native EBCDIC for BSC transmissions. The CS3 also supports auto-dial operations.

Communications Scanner Type 3 High Speed (CS3HS)—The CS3HS, a modified version of the CS3, can support communications line data rates up to 230.4K bps, the maximum supported by the 3705. The CS3HS supports only one full-duplex or two half-duplex communications lines.

Line interface bases and line sets—The 3705-II supports six types of LIBs and 18 types of line sets. Each type of LIB supports certain kinds of transmission, and so supports only certain types of line sets. The types of LIB currently available are:

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TABLE 3. COMMUNICATIONS HANDLED BY THE 3705-80

Type of Line Interface	Transmission			Line	Line Set	Number of Lines Supported (M81/M82/M83)	Comments
	Speed (bps)	Timing	Mode				
External RS-232-C/V.24 modems	Up to 9600	Async/Sync	Half-duplex	Leased or switched	Common	4/10/16	Preprogrammed line interface for Start/Stop, BSC, and SDLC protocols.
	Up to 19.2K	Synchronous	Half-duplex	Leased or switched	Common	4/8/16	
	Up to 19.2K	Synchronous	Full-duplex	Leased or switched	Common	2/5/8	
External CCITT V.35 modem	Up to 56K	Synchronous	Half-duplex	Leased	2	2/2/*	
	Up to 56K	Synchronous	Full-duplex	Leased	2	1/1/*	
External wideband	Up to 50K	Synchronous	Half-duplex	Leased	3	2/2/*	
	Up to 50K	Synchronous	Full-duplex	Leased	3	1/1/*	
Automatic dialing; RS-366A/V.25 compatible	—	—	—	Switched	4	4/4/*	For attachment of external dialing units.
Direct attachment	Up to 2400 bps	Async/Sync	Half-duplex	IBM cables	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols.
	14.4K or 57.6K	Synchronous	Half-duplex		5	2/2/*	Maximum cable length is 200 feet. Interface is CCITT V.35 includes internal clocking.
CCITT X.21 interface	Up to 9600	Synchronous	Half-duplex	Leased	8	2/2/*	
	Up to 9600	Synchronous	Full-duplex	Leased or switched	8	2/2/*	Switched operation requires: #1409 Business Clock; #1416 Business Clock (for testing); and ACF/NCP R3.
	48K	Synchronous	Half-duplex	Leased	9	1/1/*	
	48K	Synchronous	Full-duplex	Leased or switched	9	1/1/*	

*Not available on M83.

Type 1: supports lines with external modems and/or auto call, and for directly attached terminals.

Type 2: supports telegraph-grade lines.

Type 3: supports lines with IBM limited-distance line adapters.

Type 8: supports 1200 bps lines with integrated modems.

Type 9: supports 1200 bps lines with integrated modems and auto call.

Type 10: supports 1200 bps lines with integrated modems and full-duplex data transmission.

Table 2 shows the types of LIB supported by each type of scanner, and the number of LIBs installable in 3705 base and expansion frames. Table 3 lists the types of communications supported by the 3705-II, and the necessary components for each.

The 3705-80 uses a slightly simpler architecture on the network side. It supports only one type of communications scanner, the CS2, which is included as standard equipment. The 3705-80 has no component equivalent to the 3705-II's LIBs; it supports six types of line sets (called line attachments on the 3705-80). Table 4 lists the types of communications supported by the 3705-80, and the necessary components for each.

TRANSMISSION SPECIFICATIONS

Both the 3705-II and the 3705-80 support half- or full-duplex transmissions using start/stop (asynchronous), BSC, or SDLC protocols. Start/stop signals can be transmitted at rates up to 56.7K bps; synchronous (BSC or SDLC) signals can be transmitted at rates up to 230.4K bps. Table 3 lists the specific types of transmission supported by the 3705-II; Table 4 lists the specific types of transmission supported by the 3705-80. Both tables show the specific hardware necessary for a given mode of transmission.

The 3705 was designed in the mid 1970s, and its architecture was originally meant to handle the types of communications that prevailed then—half-duplex transmissions at rates up to 4800 bps. Later enhancements to the hardware, aimed at supporting higher speeds and full-duplex connections, put demands on the 3705 that its architecture was not designed to meet. Attaching any communications line expected to operate in full-duplex mode or at a rate greater than 4800 bps requires some kind of tradeoff; such tradeoffs reduce the total number of lines attachable to the 3705.

Two tradeoffs designed to handle high-speed transmissions are reduction of the upper scan limit and Address Substitution. Both involve the Type 2 Communications Scanner. Like all 3705 scanners, the CS2 is a polling device; it scans (polls) its attached communications lines for activity in a preset order. To support high-speed communications adequately, the scanner must poll high-speed lines more often. When all lines attached to a given scanner are high-speed, the user can reduce, in software, the number of lines the scanner can scan, shortening the polling sequence and insuring that all lines receive more of the scanner's attention. By reducing the upper scan limit (eliminating the higher addresses from the scanning sequence), the user increases the scanning rate for the lines attached at the lower addresses, and, as a direct result, reduces the number of lines that can be attached to the scanner.

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TABLE 4. COMMUNICATIONS HANDLED BY THE IBM 3705-II

Type of Line Interface	Transmission Speed (bps)	Transmission Timing	Transmission Mode	Line	Line Set	Lines per Line Set	LIB	Max Line Sets per LIB	Comments
External RS-232-C/ V.24 modem	Up to 9600	Async/sync	Half-duplex	Leased or switched	1D	2	Type 1	8	Any combination of speed and timing is possible for each Line Set 1D.
	Up to 9600	Async/sync	Full-duplex	Leased	1D	1	Type 1	8	
External wideband modem	19.2K or 50K	Sycnhronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Runs only under NCP.
	50K	Sycnhronous	Full-duplex	Leased	1T	1	Type 1	4	
	Up to 230.4K	Sycnhronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3HS.
	Up to 230.4K	Sycnhronous	Full-duplex	Leased	1TA	1	Type 1	1	Requires Scanner Type 3HS.
External Mil 188C modem	Up to 50K	Async/sync	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Runs only under NCP.
	56K	Synchronous	Full-duplex	Leased	1U	1	Type 1	4	
Local attachment	Up to 9600	Synchronous	Half-duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35. Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
CCITT X.21 Interface	Up to 48K	Synchronous	Half-duplex	Leased	1N	2	Type 1	8	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 48K	Synchronous	Full-duplex	Leased	1N	1	Type 1	4	Requires Scanner Type 2 or 3 and #4650 Business Clock.
	Up to 9600	Synchronous	Full-duplex	Switched	1R	1	Type 1	8	Requires Scanner Type 2 and #4650 Business Clock.
	Up to 48K	Synchronous	Full-duplex	Switched	1R	1	Type 1	2	Requires Scanner Type 2 and #4650 Business Clock.
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/ 83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	1200 or 600	Async/sync	Half-duplex	Leased	8A	2	Type 8	3	
	600	Asynchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto-answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto-answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	9B	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	

Another way of increasing the scanning rate for high-speed lines, this time in configurations where the scanner supports both high- and low-speed lines, is to cause the scanner to poll the high-speed lines more than once in each scanning sequence. To do this, again in software, the user substitutes the addresses of the high-speed lines in positions that other lines would ordinarily occupy. This Address Substitution technique reduces the line capacity of the scanner by the number of extra scans given to the high-speed lines.

OPERATOR INTERFACE

Once the network has been defined in software, the operator has almost no direct interaction with the 3705. Any interaction between the operator and the network takes place through the host, with such programs as the Newtork Command and Control Facility (NCCF). The 3705 supports no operators' console. It has a maintenance panel for power-up, reload, and simple diagnostic operations.

SOFTWARE

In a mainframe network, the communications processor is treated as a peripheral device controller. Like other peripheral controllers, it transfers data from the host to one or more input/output or storage devices under the host's control. In the communications processor's case, the peripheral device is a network, rather than a bank of printers of disk drives. Because a network is more complex than any other "peripheral device," the communications processor must be both more intelligent and more independent of the host than any other controller.

Initially by necessity and later by design, the IBM 3705 depends more on its host processor than most modern communications processors. In part, this results from the 3705's age as a product; it was designed initially to support a network of locally attached terminals. The intentional side of the 3705's dependence on its host springs from the overall

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design of SNA, IBM's networking architecture. SNA defines protocols and parameters for communications from end to end, from hooks into the applications program in the host to the definitions of screen and response formats at the terminal. The communications processor is an essential, but intermediate, component in an SNA network. Most mainframe vendors' architectures define communications only from communications processor to communications processor, and as architectural endpoints, those vendors' communications processors function more independently of the host than do IBM's.

The 3705 runs in one or both of two distinct modes, *Emulation* mode and *Network Control* mode. Emulation mode is a backward-compatibility feature that allows the 3705 to support older IBM start/stop and BSC terminal protocols by emulating the 270X Series of hard-wired communications controllers. Network Control mode is the 3705's native mode of operation; it supports the SDLC link protocol and the SNA architecture. Running in pure Emulation mode, the 3705 uses the Emulation Program as its basic operating software. Running in pure Network Control mode, it uses one of several generations of IBM's Network Control Program. In a third mode, Partitioned Emulation Programming (PEP), separate portions of the 3705 run in Emulation and in Network Control modes; PEP is a feature of later versions of the Network Control Program.

In any of these software configurations, the 3705 runs under the control of its host's telecommunications access method, whether it is attached locally or remotely to the host. A 3705 in pure Emulation mode runs under the control of either the Basic Telecommunications Access Method (BTAM) or under one of several generations of the Telecommunications Access Method (TCAM). BTAM is an older, nearly obsolete access method. TCAM's current incarnation is the Advanced Communications Function for TCAM (ACF/TCAM). A 3705 running in PEP mode must run under the control of a TCAM access method. A 3705 running in pure Network Control mode can run under the control of either a TCAM access method or the Virtual Telecommunications Access Method (VTAM), whose latest versions are the Advanced Communications Function for VTAM (ACF/VTAM). Those portions of a 3705 participating in an SNA network must run under the control of an ACF-type access method in the host, either ACF/TCAM or ACF/VTAM.

Emulation Program—A 3705 in Emulation mode runs the Emulation Program for the 3705. Processors that run in Emulation mode must be channel-attached to a host. The chief advantage of Emulation mode is that it allows the 3705 to support start/stop and BSC terminals. A user operating in a pure emulation environment need not convert to SNA communications. However, support for the pure Emulation environment is dwindling, both among IBM users and within IBM. The current version of the Emulation Program runs only in PEP mode alongside ACF/NCP.

Previous versions of the Emulation Program supported only Channel Adapter Type 1 in the 3705. The latest version supports only Channel Adapter Type 4.

Partitioned Emulation Programming—PEP operations have long been available as an option within ACF/NCP programs. In essence, a 3705 running PEP appears to its host and to its users as two smaller machines. The Emulation mode partition and the NCP partition must use separate channel adapters, communications scanners, LIBs, and line sets. To the host's access method, the portions of the network controlled by the Emulation mode partition form a separate network from those controlled by NCP.

The latest versions of ACF/NCP do not automatically include a PEP option. Rather, the Emulation Program is available as a separate product that must run under ACF/NCP to enable Emulation.

Network Control Program—The Network Control Program is the native-mode 3705 operating system, introduced to provide support for IBM's Synchronous Data Link Control (SDLC) protocol. Later versions of NCP, those designated ACF/NCP, support the full SNA architecture. For details of the general advantages of SNA, see Report C11-491-101 in this volume of DATAPRO REPORTS ON DATA COMMUNICATIONS.

In summary, the principal advantages of ACF/NCP operations are the efficiency of the SDLC line discipline and an increased breadth of network control in cooperation with several network management program products running in the host. ACF/NCP also supports larger memory sizes and more efficient use of storage.

In addition, ACF/NCP supports the multisystem networking features of SNA, which allows more than one host to participate in a network, with each host controlling a separate network domain. The latest version of ACF/NCP also supports the interconnection of SNA networks through a gateway node that consists of an IBM communications processor (3705 or 3725) and its attached host.

X.25 NCP Packet Switching Interface Program—The X.25 NCP Interface provides users of ACF/NCP the ability to use 3705 Communications Controllers to access public data networks that comply with CCITT X.25 standards. The package has been certified by GTE Telenet, among other packet switching providers. This program supports packet sequence numbering up to 128, with packet length of up to 4,096 characters. It supports SNA network node interconnection and protocol conversion for non-SNA equipment. Within the program, a subset of X.29 allows communications with asynchronous X.28 devices (TTY). It also supports the X.21 line sets.

Network Terminal Option—The Network Terminal Option is a separate program product that allows start/stop terminals to participate in an SNA network without the need for Emulation mode.

Non-SNA Interconnection Program—The Non-SNA Interconnection Program allows IBM 3705s and 3725s operating in pure Network Control mode to support BSC terminals. The program envelops BSC data in SDLC framing, allowing lower layers of the architecture to treat the BSC message as an SDLC bit stream.

Network Routing Facility—The Network Routing Facility allows the 3705 to select transmission routes for established SNA sessions. The facility runs under the control of ACF/VTAM in the host, and allows the communications processor to maintain active sessions in the event of a host or access method failure.

System Support Program—The 3705, like all IBM communications processors, cannot generate its own software, either its initial program load or the required network configuration definitions. A host-resident system generator, called a System Support Program (currently ACF/SSP) is required. ACF/SSP is a collection of macroinstructions in IBM assembler language that allows the user to define the characteristics of both the communications processor and the network it supports. With ACF/SSP, users can generate code for both Emulation and ACF/NCP modes of operation. Code assembled and linked by ACF/SSP is downloaded from the host to the communications processor, either locally through the I/O channel, or remotely, through a front-end processor and an RPL-II in the remote unit.

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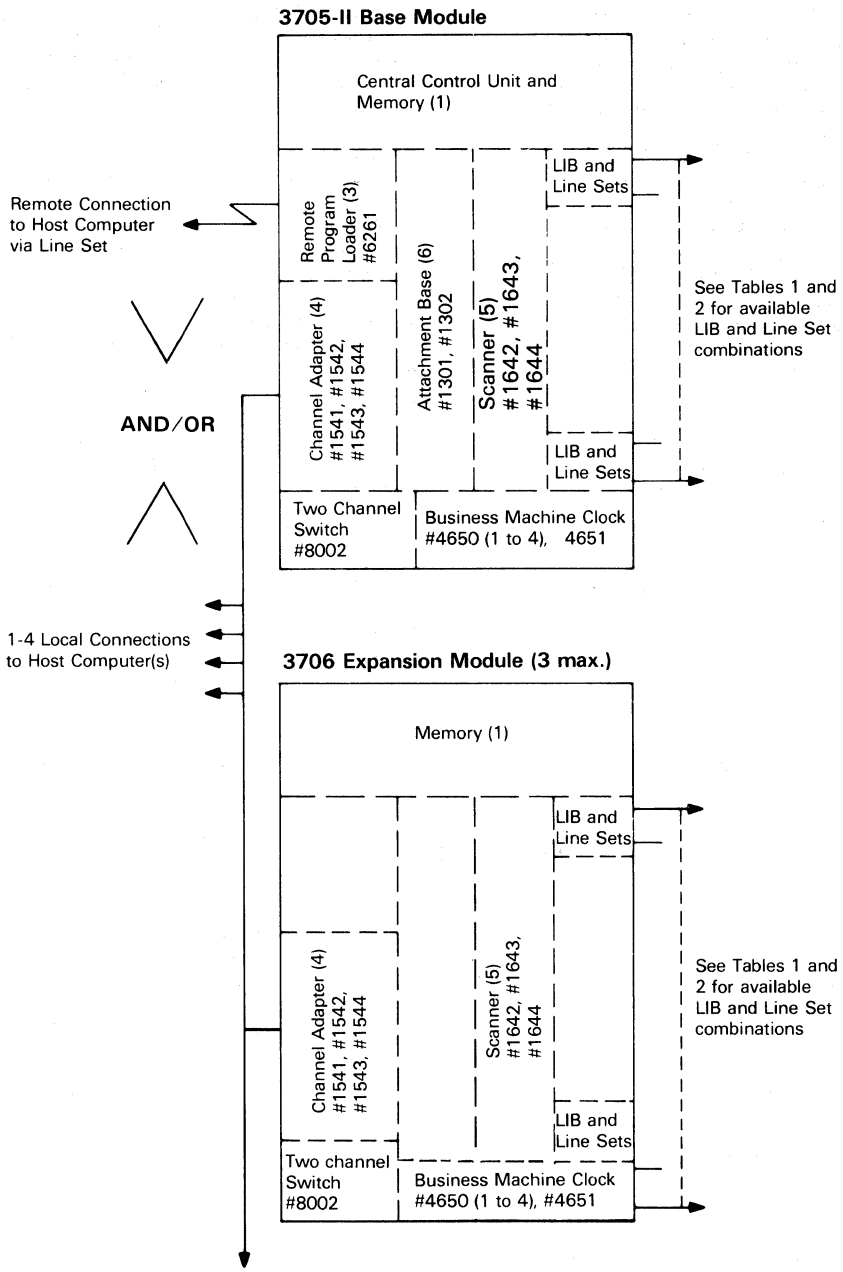
IBM 3705 Communications Controller

3705-II Configuration



(1) In the 3705-II, all memory is located in base module in 32K-byte increments to a maximum of 256K bytes. Models J, K, and L also include a second module with at least one 64K-byte memory increment.

(2) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705-II can be installed with up to three Channel Adapters Type 1, 2, 3, or 4. If more than two adapters are used, all must be Type 4.

(3) Up to 4 Channel Adapters Type 1, 2, 3, or 4 can be installed in the 3705-II: two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 2 or 3 run only under NCP. If more than two CAs are installed, all must be CA Type 4. CA Type 1 may not be used with Models J, K, or L.

(4) One Scanner Type 2 or 3 can be installed in each of the four modules; Scanner Type 33 may be placed in the Base Module.

(5) One or two attachment bases are required as follows:

- *Scanner Type 2 with CA Type 1—Attachment Base Type 1 and 2;*
- *Scanner Type 2, 3, or 3HS with CA Type 2, 3, 4—Attachment Base Type 2.*

(6) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

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IBM 3705 Communications Controller

Associated Host Software—Host-resident programs that communicate directly with the 3705 and control parts of its operation include the communications access methods (currently ACF/TCAM and ACF/VTAM) and certain program products for network management and control. Between the access methods, ACF/TCAM supports emulation mode, while ACF/VTAM does not. Users migrating gradually to SNA should install ACF/TCAM, while users running full SNA networks may use either.

Network management and control products include the *Network Communications Control Facility* (NCCF) which allows network configuration control from the operator's console of the host, and supports diagnostics under IBM's network troubleshooting program, the *Network Problem Determination Application* (NPDA). *The Network Logical Data Manager* is a data base driver for the recording of network performance and maintenance information.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705-II and up to 45 percent on the 3705-80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 a.m. and 6 p.m., Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

EQUIPMENT PRICES

	Purchase Price ($)	Monthly Maint. ($)	Monthly Charges* Two-Yr. Lease ($)	Monthly Charges* Rental ($)
3705-80 Communications Controller				
Model M81 (256K bytes, 4 lines)	1,721	1,465	36,600	219
Model M82 (256K bytes, 10 lines)	2,262	1,925	46,600	229
Model M83 (256K bytes, 16 lines)	2,661	2,265	52,600	239
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	1,874	1,595	38,230	147
Model E2 (64K bytes, 64 lines)	2,050	1,745	39,800	165
Model E3 (96K bytes, 64 lines)	2,227	1,895	41,370	183
Model E4 (128K bytes, 64 lines)	2,403	2,045	42,940	201
Model E5 (160K bytes, 64 lines)	2,579	2,195	44,510	219
Model E6 (192K bytes, 64 lines)	2,755	2,345	46,080	237
Model E7 (224K bytes, 64 lines)	2,932	2,495	47,650	254
Model E8 (256K bytes, 64 lines)	3,108	2,645	49,220	273
Model F1 (32K bytes, 160 lines)	2,510	2,140	51,530	160
Model F2 (64K bytes, 160 lines)	2,690	2,290	53,100	177
Model F3 (96K bytes, 160 lines)	2,867	2,440	54,670	196
Model F4 (128K bytes, 160 lines)	3,040	2,590	56,240	213
Model F5 (160K bytes, 160 lines)	3,215	2,740	57,810	231
Model F6 (192K bytes, 160 lines)	3,395	2,890	59,380	249
Model F7 (224K bytes, 160 lines)	3,570	3,040	60,950	267
Model F8 (256K bytes, 160 lines)	3,745	3,190	62,520	285
Model G1 (32K bytes, 256 lines)	3,150	2,685	64,830	172
Model G2 (64K bytes, 256 lines)	3,330	2,835	66,400	190
Model G3 (96K bytes, 256 lines)	3,505	2,985	67,970	207
Model G4 (128K bytes, 256 lines)	3,680	3,135	69,540	226
Model G5 (160K bytes, 256 lines)	3,855	3,285	71,110	243
Model G6 (192K bytes, 256 lines)	4,035	3,435	72,680	262
Model G7 (224K bytes, 256 lines)	4,210	3,585	74,250	279

*Includes monthly maintainance.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Purchase Price ($)	Monthly Maint. ($)	Two-Yr. Lease ($)	Rental ($)
	Communications Controller (Continued)				
	Model G8 (256K bytes, 256 lines)	4,385	3,735	75,820	298
	Model H1 (32K bytes, 352 lines)	3,795	3,230	78,130	184
	Model H2 (64K bytes, 352 lines)	3,970	3,380	79,700	202
	Model H3 (96K bytes, 352 lines)	4,145	3,530	81,270	220
	Model H4 (128K bytes, 352 lines)	4,320	3,680	82,840	238
	Model H5 (160K bytes, 352 lines)	4,500	3,830	84,410	256
	Model H6 (192K bytes, 352 lines)	4,675	3,980	85,980	274
	Model H7 (224K bytes, 256 lines)	4,850	4,130	87,550	292
	Model H8 (256K bytes, 352 lines)	5,025	4,280	89,120	310
	Model J1 (320K bytes)	5,053	4,300	71,020	314
	Model J2 (384K bytes)	5,045	4,600	74,160	350
	Model J3 (448K bytes)	5,758	4,900	77,300	386
	Model J4 (512K bytes)	6,110	5,200	80,440	422
	Model K1 (320K bytes)	5,690	4,845	84,320	326
	Model K2 (384K bytes)	6,045	5,145	87,460	362
	Model K3 (448K bytes)	6,395	5,445	90,600	398
	Model K4 (512K bytes)	6,750	5,375	93,740	434
	Model L1 (320K bytes)	6,330	5,390	97,620	339
	Model L2 (384K bytes)	6,685	5,690	100,760	375
	Model L3 (448K bytes)	7,035	5,990	103,900	411
	Model L4 (512K bytes)	7,390	6,290	107,040	447
	Communications Line Sets for 3705-80				
#6712	Line Set Type 2	257	219	5,440	10.00
#6713	Line Set Type 3	229	195	4,850	9.00
#6714	Line Set Type 4	94	80	2,060	4.00
#5657	Line Set Type 8	115	98	2,600	3.50
#5658	Line Set Type 9	67	57	1,550	3.00
#14XX	Business Machine Clock	15	13	424	1.00
	Attachment Bases (for 3705-II only)				
#1301	Type 1	26	22	641	0.50
#1302	Type 2	26	22	641	0.50
	Channel Adapters				
#1541	Type 1	167	142	2,700	9.00
#1542	Type 2 (3705-II only)	312	266	6,470	9.00
#1543	Type 3 (3705-II only)	636	541	12,910	11.00
#1544	Type 4	268	228	4,410	8.00
#1551	Type 1; for 3705-80 only	194	165	3,340	9.50
#8002	Two Channel Switch	95	81	2,040	3.50
	Communications Scanners for 3705-II				
#1642	Type 2	300	255	4,750	9.00
#1643	Type 3	1,075	915	17,210	31.00
#1644	Type 3 High Speed	1,445	1,230	25,120	37.00
#4650	Business Machine Clock for 3705-II	15	13	424	1.00
#4651	Business Machine Clock for 3705-II	39	33	880	1.50
	Communication Line Attachment Features for 3705-II				
#4701	Line Interface Base Type 1:	66	56	1,105	3.00
#4714	Line Set Type 1D	60	51	1,030	3.00
#4715	Line Set Type 1E	47	40	1,030	2.50
#4717	Line Set Type 1G	126	108	2,050	6.00
#4719	Line Set Type 1J	66	56	1,455	2.50
#5655	Line Set Type 1N	81	69	2,040	3.00
#5656	Line Set Type 1R	67	57	1,700	3.00
#4720	Line Set Type 1S	139	118	3,020	6.50

**Includes monthly maintainance.*

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IBM 3705 Communications Controller

		Monthly Charges*			
		Purchase Price ($)	Monthly Maint. ($)	Two-Yr. Lease ($)	Rental ($)
	Communication Line Attachment Features for 3705-II (Continued)				
#4722	Line Set Type 1GA	126	108	2,695	6.00
#4723	Line Set Type 1TA	229	195	4,850	9.00
#4725	Line Set Type 1T	229	195	4,850	9.00
#4726	Line Set Type 1U	257	219	5,440	10.00
#4727	Line Set Type 1W	212	180	4,720	6.00
#4728	Line Set Type 1Z	394	335	8,640	10.00
#4702	Line Interface Base Type 2	66	56	1,455	2.50
#4721	Line Set Type 2A	47	40	1,030	3.50
#4703	Line Interface Base Type 3	117	100	2,515	2.50
#4731	Line Set Type 3A	37	32	850	1.50
#4732	Line Set Type 3B	37	32	850	1.50
#4708	Line Interface Base Type 8	66	56	1,455	3.50
#4781	Line Set Type 8A	67	57	1,490	4.50
#4782	Line Set Type 8B	88	75	1,920	6.00
#4709	Line Interface Base Type 9	66	56	1,455	2.50
#4791	Line Set Type 9A	98	83	1,785	10.00
#5000	Line Interface Base Type 10	74	63	1,685	2.50
#4784	Line Set Type 10A	126	108	2,685	5.50
	Remote Concentrator Features				
#6250	Remote Power Off	15	13	416	0.50
#6261	Remote Program Loader-II	459	391	9,335	24.50

**Includes monthly maintainance.*

SOFTWARE PRICES*

		Monthly Basic License ($)	Monthly DSLO License ($)	Monthly Licensed Program Support ($)	Monthly Multiple Licensed Program Support ($)
5744-BA2	Network Control Program	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	234	176	35	56
5735-XX3	SSP for ACF/NCP/VS Version 2	72	54	19	30
	Host Access Methods				
5735-RC1	ACF/TCAM Version 1	329	246	12	19
	With Multisystem Networking Facility	1,220	915	31	50
5735-RC3	ACF/TCAM Version 2, Releases 1, 2, 3, & 4	847	655	91	145
	With Multisystem Networking Facility	1,465	1,099	113	181
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	185	166	53	85
	With Multisystem Networking Facility	350	315	159	254
5735-RC2	ACF/VTAM Version 1, Release 1, 2, & 3	416	343	55	88
	With Multisystem Networking Facility	1,000	825	163	260
	Encrypt/Decrypt Feature	245	202	8	13
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	179	161	75	120
	Other Host Networking Software				
5735-XX7	Network Terminal Option Releases 1, 2, & 3	206	155	12	19
5735-XX8	Network Problem Determination Application (NPDA) Releases 1 & 2	69	51	23	37
5735-XX6	Network Communications Control Facility (NCCF)	156	117	48	77
5668-963	Network Routing Facility Version 1.5	1,070	803	248	397
5668-963	Network Routing Facility Release 2	1,175	881	248	392
5668-981	X.25 Packet Switching Interface	223	166	40	64
5668-981	X.25 Packet Switching Interface Versions 3 & 4	269	202	40	64

NC—no charge, as basic software load is provided as part of System Control Programming (SCP).
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.* ■

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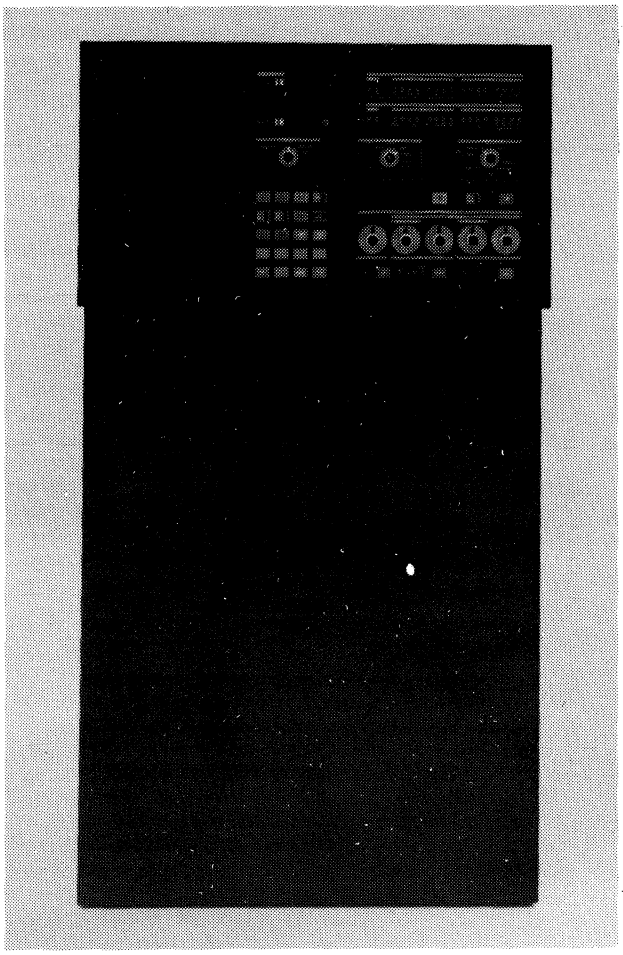
IBM 3705 Communications Controller



The IBM 3705 is the largest selling communications processor ever manufactured, and a standard against which all communications processors are measured. While the 3705 remains an active IBM product, its newer cousin, the simpler and more powerful 3725, is gradually replacing it in the marketplace.

FUNCTION: Front-end or remote full-service communications processor for the IBM mainframe environment.
HOST COMPUTERS SUPPORTED: IBM 360, 370, 303X, 43XX, and 308X mainframe computers
ARCHITECTURE SUPPORTED: SNA; pre-SNA IBM communications.
OPERATING SOFTWARE: ACF/NCP in SNA and partitioned emulation configurations; Emulation Program for the 3705 is pre-SNA configurations. In either case, the 3705 operates under close control of its host's access method, either TCAM or VTAM.
COMPETITION: NCR Comten 3600 Series; Amdahl 4705; CCI CC8, CC80, and CC85; Memorex 1270.
PRICE: Purchase price for a 3705–II model G8 with 256K bytes of memory and support for 256 communications lines is $75,820. The maintenance charge is $323 per month. Model G–8 is a middle-of-the-line system in the larger 3705–II series.

MANAGEMENT SUMMARY

The IBM 3705 is the grandparent of communications processors, the largest-selling communications processor in history, and a standard by which all other communications processors are measured. Now, it is also obsolescent. Announced originally in the mid-1970s, the 3705 has gone through its infancy, its maturity, and currently, its dotage. IBM's announcement of the 3725 Communication Controller in April 1983, signalled the beginning of the end for the 3705. While the vendor has not yet removed the 3705 from marketing, its successor is selling extremely well, and the mid-1980s should see the last 3705 sales.

The 3705 is an interrupt-driven machine based on an IBM-proprietary 16-bit CPU. It comes in two general series of models, the entry-level 3705–80 and the full-scale 3705–II. The 3705–80 is available in three models, each of which has 256K bytes of memory. The largest 3705–80 supports 16 communications lines. The 3705–II is available in 44 different configurations of processor and memory, the largest of which supports 512K bytes of storage and up to 352 communications lines.

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Old Orchard Road, Armonk, NY 10504. Contact your local IBM representative.

DATE OF ANNOUNCEMENT: 3705–II, Models E1–H8—November 1975; Model J1–L4—November 1978; 3705–80—March 1981.

DATE OF FIRST DELIVERY: 3705–II, Models E1–H8—August 1976; Models J1–L4—June 1979; 3705–80—August 1981.

NUMBER DELIVERED TO DATE: Over 50,000 (estimated for all models).

SERVICED BY: International Business Machines Corporation.

MODELS

The IBM 3705 Communications Controller comes in two overall series of models. The 3705–80 is a small, entry-level communications processor, able to support 256K bytes of main memory, attachment to two host computers, and up to

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IBM 3705 Communications Controller

The 3705–II can serve as a front-end processor, a remote concentrator, or a remote switch. In its front-end configuration, it contains a central processor, main storage, one or more attachment bases for the connection of network-side equipment, up to four channel adapters for connection to the I/O channels of the host processor, and a variety of network-side hardware. For its remote configurations, the 3705–II contains no channel adapters, replacing them with a single Remote Program Loader–II (RPL–II) that allows the 3705's operating software to be downloaded from the host through its front end—either another 3705 or a 3725. The 3705–80 has the same basic configuration, but can contain only two channel adapters and requires no attachment base.

On the network side, the 3705–II uses a three-tiered, pyramidal hierarchy of components. At the top are communications scanners, polling devices that scan their attached communications lines for activity, assemble incoming data into characters, and disassemble outgoing data into serial bit streams. Next are line interface bases (LIBs) that connect the scanners to their attached line sets. Line sets are components that provide the physical connections to specific types of communications facility. The 3705–II supports three different communications scanners, six types of LIB, and 19 different types of line set. The 3705–80 uses a similar architecture, but does not require line interface bases, contains a single type of scanner as standard equipment, and supports a more limited complement of line sets.

In general, the 3705 supports synchronous or start/stop (IBM's term for asynchronous) communications in half- or full-duplex mode at rates from 1200 bps to 230.4K bps, and uses ASCII, IBM Correspondence, BSC or SDLC protocols. The 3705's architecture was designed to support half-duplex communications at rates up to 4800 bps; later additions that support full-duplex transmission and higher speeds require tradeoffs in the number of lines the 3705 can support.

The 3705 supports a full, backward-compatible range of software, from total emulation of the old IBM 27XX hardwired controllers to full-blown SNA networking. In full Emulation mode, it does not support SDLC communications or multisystem networking, but does support older IBM communications access methods such as BTAM. In Network Control mode, it supports the full range of SNA features available with a given version and release of the Network Control Program (ACF/NCP), including network diagnostics through the host, routing, multisystem

TABLE 1. 3705-II Models

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	E7, F7, G7, H7	224K
E2, F2, G2, H2	64K	E8, F8, G8, H8	256K
E3, F3, G3, H3	96K	J1, K1, L1	320K
E4, F4, G4, H4	128K	J2, K2, L2	384K
E5, F5, G5, H5	160K	J3, K3, L3	448K
E6, F6, G6, H6	192K	J4, K4, L4	512K

128 communications lines. The 3705–II is a large-scale communications processor, able to support up to 512K bytes of main memory, eight host processors, and 352 communications lines in its largest configurations.

The 3705–80 is available in three models: Model M81 supports up to 4 communications lines; Model M82 supports up to 10 communications lines; and Model M83 supports up to 16 communications lines.

Within the 3705–II series, IBM currently offers 44 different models, each designated by a letter and a number. The letter describes both the type of central processing unit a given processor contains and the number of frames (including the 3705 base frame and up to three 3706 expansion frames) in the configuration. Models En to Hn use IBM's older CPU; it has a storage cycle time of 1 microsecond. Models Jn to Ln use IBM's enhanced CPU, which has a storage cycle time of 0.9 microseconds (900 nanoseconds). The number in the model designation specifies main-memory capacity in a standard increment over the next-largest model for that unit's processor type: for 3705–II Models En to Hn, the memory increment is 32K bytes; for Models Jn to Ln, the memory increment is 64K bytes. Thus, a 3705–II Model E1 uses the older processor, has a single frame, and supports 32K bytes of main storage; a 3705–II Model F3 uses the older processor, has two frames, and supports 96K bytes of main storage. A 3705–II Model J1 uses the newer processor, has one frame, and supports 320K bytes of main storage. See table 1 for a complete list of 3705–II models.

CONFIGURATION

In its basic configuration, the 3705 contains a central control unit (CCU) with a minimum of 32K bytes of main storage; an operator's control panel; one or more Channel Adapters for local connection to a host computer, or a Remote Program Loader (RPL) for remote connection to a host computer; one or two Attachment Bases for connection between the CCU and the network-side equipment; one or more Communications Scanners that control connections between the CCU and the communications lines at the character level; one or more Line Interface Bases that attach the communications lines to the scanners; and one or more Line Sets, which control connection between the Line Interface Bases and communicatons lines at the physical level. One or more Business Machine Clocks can attach to the communications scanners to provide reference timing when such timing is not provided by external facilities or modems.

A 3705–II can include up to three Model 3706 expansion frames. Depending on the processor's specific configuration, these expansion frames contain additional main memory and additional channel adapters, as well as additional communications scanners, line interface bases, and line sets.

The architectures of the 3705 and of its component parts dictate an extremely complex set of rules for configuration. Possible arrangements of parts, both overall and within a given frame, depend on the types of channel attachments required, the types of scanners in use, and the specific line control hardware necessary. These, in turn, depend on the number and models of host computers served, the specific communications facilities used, the data rates and protocols supported, and the specific communications software installed both in the 3705 and in the host. A detailed enumeration of the 3705's configuration rules lies outside the scope of this report; however, IBM does provide configuration aids to assist the user in designing a 3705 for a particular application.

PROCESSING COMPONENTS

All models of the IBM 3705 use a 16-bit central-processing unit. The 3705–80 and models E1 through H8 of the

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IBM 3705 Communications Controller

networking, and SNA network interconnection. As an intermediate step between Emulation mode and full SNA, IBM provides Partitioned Emulation Programming (PEP), in which one portion of the 3705 runs in Emulation mode and the other runs the Network Control Program. Portions of the network controlled by each partition of the 3705 appear to the user and the host as separate networks.

COMPETITIVE POSITION

Venerable as it is, the 3705 has never sustained serious competition. Instead, it has provided a standard on which several competitors have improved in order to serve sophisticated users in IBM environments, or to serve special applications. Among these vendors are Amdahl Corporation, NCR Comten, Computer Communications, Inc. (CCI), and Memorex. Two of these competitors, NCR Comten and CCI, conduct almost all of their trade in IBM-compatible communications processors. In that sense, the 3705 alone has spawned a small industry, currently led by NCR Comten, whose 3600 Series processors offer significant performance advantages over the 3705 along with a number of value-added features. Amdahl's major selling point is that its 4705 is entirely software-compatible with the 3705 but outperforms the IBM machine. CCI's processors run only in Emulation mode, but offer important price-performance advantages in specialized applications. The Memorex offering is based on the CCI processor.

Currently, the 3705's biggest competitor is its successor, the IBM 3725, which looks to replace the 3705 entirely by the end of the decade. The 3725 is larger, faster, and offers maintenance features not found on the 3705.

ADVANTAGES AND RESTRICTIONS

As an industry standard over ten years old, the IBM 3705's principal advantage is its track record. It remains the largest selling communication processor ever produced, and has served well in all applications supported by IBM mainframe equipment. However, as an industry standard, it suffers in one way or another when compared to any of its competitors. Amdahl's 4705 runs the same software faster and costs less. NCR Comten's 3600 series processors support more communications lines and cost less in similar configurations. CCI's processors show performance advantages in Emulation mode and cost less. IBM's own 3725 costs slightly more, but outperforms the 3705 by nearly a factor of two.

Basically, the 3705 is a war horse ready for pasture. Its architecture was conceived in the mid-70s for the communications needs of that time. But much has happend to data communications in the last ten years, and while IBM has worked mightily to keep the 3705 up to date, it has seriously strained the limits of the processor's original design.

The biggest problem is configurational complexity. Designing a 3705–II to fit a given application, especially one involving line speeds over 4800 bps or full-duplex communications, has become a complex process, which can require computer assistance. Most of the problems involve

3705–II use an older processor with a storage cycle time of 1 microsecond; models J1 through L4 of the 3705–II use a faster processor with a storage access time of 0.9 microseconds (900 nanoseconds). Both processors are interrupt-driven: interrupts may come directly from the 3705's operating software, or may be generated by incoming data or error conditions from the channel adapters or communications scanners. Some components of the 3705 use a cycle-stealing technique for access to the processor and to memory. Cycle-stealing is an advanced form of interrupt in which the component needing access to memory or to the processor actually takes control for an entire machine cycle.

All models of the 3705 use semiconductor main memory. The 3705–80 initially comes with 256K bytes of main storage, and supports no memory increments. The smaller 3705–II models (E1 through H8) initially support 32K bytes of memory (Models E1, F1, G1, and H1), and support expansion to 256K bytes (Models E8, F8, G8, and H8) in increments of 32K bytes. The larger 3705–II models (J1 through L4) initially support 320K bytes of memory (Models J1, K1, and L1), and support expansion to 512K bytes (Models J4, K4, and L4) in increments of 64K bytes. All 3705–II models can be upgraded, in stages, to the maximum configuration.

Every 3705–II must have at least one *attachment base*; either Type 1, which provides the interface between the CCU and one type of channel adapter (Type 1) and one type of communications scanners (Type 1); or Type 2, which provides the interface between the CCU and the remaining types of communications scanners (Types 2, 3, and 3HS).

CONNECTION TO THE HOST

The IBM 3705 may serve as a front-end processor or as a remote concentrator or switch; however, in any of these roles, it must receive its initial program load from an IBM mainframe host, and must operate under host's instructions. In front-end configurations, the 3705 communicates with the host through a *channel adapter* connected to one or more of the host's input/output (I/O) channels. In remote configurations, it communicates with the host through a *remote program loader* connected to the host over a high-speed, dedicated data link into that host's front-end processor (IBM 3705 or 3725).

IBM offers four types of channel adapters for the 3705. The 3705–80 can use only Types 1 and 4; the 3705–II can use all four.

***Channel Adapter Type 1 (CA1)*—The CA1 connects to the byte multiplexer channel of the host, and to an Attachment Base Type 1 on the 3705–II. (The 3705–80 does not require an attachment base for the CA1). It transfers data in units of one, two, three, or four bytes, and must interrupt the host for each transfer.**

***Channel Adapter Type 2 (CA2)*—The CA2 is a high-performance interface that can operate only under the control of the Network Control Program software. It can attach to the host's byte multiplexer, block multiplexer, or selector channel (the selector channel is a very-high-speed, dedicated I/O port), and can transfer data at up to 276K bytes per second in a burst mode. When attached to the byte multiplexer channel, the CA2's bursts of data are limited to 2 bytes.**

***Channel Adapter Type 3 (CA3)*—The CA3, which offers the same performance characteristics as the CA2, has an additional automatic two-processor switch. When the 3705 functions as a front-end to a tightly coupled multiprocessor system, each side of this switch is attached to a different processor. Alternatively, the CA3 can be attached to two I/O channels on the same processor to provide alternate data paths.**

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tradeoffs in line capacity against line speed. IBM has solved these problems in the 3725, which supports a much smaller set of network-side componentry in a much cleaner configuration.

IBM's own mainframes have outgrown the 3705's ability to communicate with them. The new 308X mainframes support I/O channel data rates more than twice those supported by the 3705. Again, the 3725 meets the needs of the newer hosts.

The 3705 lacks an operator's console and local facilities for maintenance. It relies on the host processor for diagnostics and control; in the event of total system failure, the user might find it difficult to determine whether the host or the communications processor is at fault. The 3725 contains a maintenance and operator subsystem (MOSS) for diagnostics. All of the 3705's competitors support local diagnostics from an operator's console.

USER REACTION

In Datapro's 1984 Network Users Survey, 222 users of the IBM 3705 responded. Of these, 8 specified that they used the 3705–II, 9 specified that they used the 3705–80, and 205 did not specify which model they used. The eight 3705–II users reported on a total of 51 machines. The nine 3705–80 users reported on a total of 13 machines. The 205 users who did not specify a model reported on a total of 858 machines. Their ratings of the 3705 are as follows:

3705–II

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	7	1	0	0	3.9
Ease of installation	4	4	0	0	3.5
Ease of operation	3	4	1	0	3.3
Ease of expansion	1	3	2	1	2.6
Hardware reliability	7	1	0	0	3.9
Quality of vendor's software/firmware	7	1	0	0	3.9
Ease of programming	0	6	0	0	3.0
Quality of vendor's maintenance	5	2	1	0	3.5
Quality of vendor's technical support**	4	2	2	0	3.3

3705–80

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	6	3	0	0	3.7
Ease of installation	2	5	2	0	3.0
Ease of operation	1	7	1	0	3.0
Ease of expansion	1	3	2	1	2.6
Hardware reliability	6	2	1	0	3.6
Quality of vendor's software/firmware	6	2	1	0	3.6
Ease of programming	0	7	0	1	2.7
Quality of vendor's maintenance	4	4	1	0	3.3
Quality of vendor's technical support**	3	5	1	0	3.2

TABLE 2.
LIB CAPACITY PER SELECTED SCANNER OPTION FOR THE 3705-II

Line Interface Base Type	Scanner Type	Maximum Number of LIBs per 3705-II	
		Base Module	Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2 or 3	2	4	6
	3	—	—
	3 HS	—	—

***Channel Adapter Type 4 (CA4)*—The CA4 is a high-performance interface that can run under the control of either the Network Control Program or the Emulation Program. It attaches to the byte multiplexer, block multiplexer, or selector channel of the host. In Emulation mode, it can attach only to the byte multiplexer channel, and must interrupt the control program after transferring a burst of 32 bytes; in NCP mode, it transfers data in bursts of up to 16 bytes, but can transfer 248 bytes before generating an interrupt. When attached to the block multiplexer or selector channel, it transfers data in bursts of 248 bytes in cycle-steal mode.**

***Remote Program Loader II (RPL–II)*—The RPL–II allows the 3705 to receive its initial program load from a remotely located host without a channel attachment. A 3705 can have only one RPL–II.**

CONNECTION TO THE NETWORK

The 3705–II's network connection hardware forms a three-level hierarchy among communications scanners (CSs), line interface bases (LIBs), and line sets (LSs). The three levels form a pyramid, with the CCU supporting a number of scanners, each scanner in turn supporting a number of LIBs, and each LIB in turn supporting a number of line sets. Depending on its type, each line set supports attachment to one or two communications lines. Depending on its type, and on the data rates, interfaces, and transmission techniques supported by the line sets, an individual LIB can support up to eight communications lines. Depending on its type, its location in the 3705–II configuration (base or expansion frame), and the characteristics of its LIBs, each communications scanner can support the attachment of up to six LIBs.

The communications scanners, through the attachment base, provide the interface between the CCU and the LIBs. The scanners handle data at the character level, assembling characters from incoming bit streams, and dissasembling characters for serial transmission on the network. For certain types of communications, the 3705 requires that a Business Machine Clock be attached to the scanners to provide reference timing. IBM currently supports three types of communications scanners. (Communications Scanner Type 1 is obsolete.) Only one scanner can be installed in any frame of a 3705.

***Communications Scanner Type2 (CS2)*—The CS2 transfers data on an interrupt basis between LIBs of any type and the**

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TABLE 3. COMMUNICATIONS HANDLED BY THE 3705-80

Type of Line Interface	Transmission			Line	Line Set	Number of Lines Supported (M8I/M82/M83\)	Comments
	Speed (bps)	Timing	Mode				
External RS-232-C/V.24 modems	Up to 9600	Async./Sync.	Half-duplex	Leased or switched	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols
	Up to 19.2K	Synchronous	Half-duplex	Leased or switched	Common	4/8/16	
	Up to 19.2K	Synchronous	Full-duplex	Leased or switched	Common	2/5/8	
External CCITT V.35 modem	Up to 56K	Synchronous	Half-duplex	Leased	2	2/2/*	
	Up to 56K	Synchronous	Full-duplex	Leased	2	1/1/*	
External wideband	Up to 50K	Synchronous	Half-duplex	Leased	3	2/2/*	
	Up to 50K	Synchronous	Full-duplex	Leased	3	1/1/*	
Automatic dialing; RS-366A/V.25 compatible	—	—	—	Switched	4	4/4/*	For attachment of external dialing units
Direct attachment	Up to 2400 bps	Async./Sync.	Half-duplex	IBM cables	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols.
	14.4K or 57.6K	Synchronous	Half-duplex		5	2/2/*	Maximum cable length is 200 feet. Interface is CCITT V.35 Includes internal clocking.
CCITT X.21 interface	Up to 9600	Synchronous	Half-duplex	Leased	8	2/2/*	
	Up to 9600	Synchronous	Full-duplex	Leased or switched	8	2/2/*	Switched operation requires: #1409 Business Clock; #1416 Business Clock (for testing); and ACF/NCP R3.
	48K	Synchronous	Half-duplex	Leased	9	1/1/*	
	48K	Synchronous	Full-duplex	Leased or switched	9	1/1/*	

*Not available on M83.

Unspecified 3705

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	117	81	6	1	3.5
Ease of installation	50	120	30	3	3.7
Ease of operation	57	112	31	4	3.1
Ease of expansion	34	102	52	16	2.8
Hardware reliability	138	61	5	0	3.7
Quality of vendor's software/firmware	70	113	15	1	3.3
Ease of programming	26	87	49	14	2.7
Quality of vendor's maintenance	99	89	14	1	3.4
Quality of vendor's technical support**	84	83	33	2	3.2

*Weighted Average based on a scale of 4.0 for Excellent.
**Technical support is defined as troubleshooting, documentation, education, and related services.

The user's generally high ratings testify to the IBM 3705's overall quality and durability as the mainstay of the mainframe communications industry. Datapro was unable to contact any of the respondents for further information. □

CCU. When installed in the base frame of a 3705-II, it supports the attachment of up to four LIBs; when installed in an expansion frame, it supports the attachment of up to six LIBs.

***Communications Scanner Type 3 (CS3)*—The CS3 transfers data between its attached LIBs and the CCU by a cycle-steal method in units up to 254 bytes, thus providing higher performance than the interrupt-generating CS2. It supports only synchronous (BSC or SDLC) communications, and, under the control of NCP, performs code translation between ASCII and IBM's native EBCDIC for BSC transmissions. The CS3 also supports auto-dial operations.**

***Communications Scanner Type 3 High Speed (CS3HS)*—The CS3HS, a modified version of the CS3, can support communications line data rates up to 230.4K bps, the maximum supported by the 3705. The CS3HS supports only one full-duplex or two half-duplex communications lines.**

***Line interface bases and line sets*—The 3705-II supports six types of LIBs and 18 types of line sets. Each type of LIB supports certain kinds of transmission, and so supports only certain types of line sets. The types of LIB currently available are:**

Type 1: supports lines with external modems and/or auto call, and for directly attached terminals.

Type 2: supports telegraph-grade lines.

Type 3: supports lines with IBM limited distance line adapters.

Type 8: supports 1200 bps lines with integrated modems.

Type 9: supports 1200 bps lines with integrated modems and auto call.

Type 10: supports 1200 bps lines with integrated modems and full-duplex data transmission.

Table 2 shows the types of LIB supported by each type of scanner, and the number of LIBs installable in 3705 base and expansion frames. Table 3 lists the types of communications supported by the 3705-II, and the necessary components for each.

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TABLE 4. COMMUNICATIONS HANDLED BY THE IBM 3705-II

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Max Line Sets Per LIB	Comments
	Speed (bps)	Timing	Mode	Line					
External RS-232-C/V.24 modem	Up to 9600	Async./sync.	Half-duplex	Leased or switched	1D	2	Type 1	8	Any combination of speed and timing is possible for each Line Set 1D.
	Up to 9600	Async./sync.	Full-duplex	Leased	1D	1	Type 1	8	
External wideband modem	19.2K or 50K	Synchronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Runs only under NCP
	50K	Synchronous	Full-duplex	Leased	1T	1	Type 1	4	
	Up to 230.4K	Synchronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3HS
	Up to 230.4K	Synchronous	Full-duplex	Leased	1TA	1	Type 1	1	Requires Scanner Type 3HS
External Mil 188C modem	Up to 50K	Async./sync.	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Runs only under NCP
	56K	Synchronous	Full-duplex	Leased	1U	1	Type 1	4	
Local attachment	Up to 9600	Synchronous	Half-duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35 Requires #4651 Business Clock
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35 Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
CCITT X.21 Interface	Up to 48K	Synchronous	Half-duplex	Leased	1N	2	Type 1	8	Requires Scanner Type 2 or 3 and #4650 Business Clock
	Up to 48K	Synchronous	Full-duplex	Leased	1N	1	Type 1	4	Requires Scanner Type 2 or 3 and #4650 Business Clock
	Up to 9600	Synchronous	Full-duplex	Switched	1R	1	Type 1	8	Requires Scanner Type 2 and #4650 Business Clock
	Up to 48K	Synchronous	Full-duplex	Switched	1R	1	Type 1	2	Requires Scanner Type 2 and #4650 Business Clock
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	1200 or 600	Asynch./sync.	Half-duplex	Leased	8A	2	Type 8	3	
	600	Asynchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	9A	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	

The 3705-80 uses a slightly simpler architecture on the network side. It supports only one type of communications scanner, the CS2, which is included as standard equipment. The 3705-80 has no component equivalent to the 3705-II's LIBs; it supports six types of line sets (called line attachments on the 3705-80). Table 4 lists the types of communications supported by the 3705-80, and the necessary components for each.

TRANSMISSION SPECIFICATIONS

Both the 3705-II and the 3705-80 support half- or full-duplex transmissions using start/stop (asynchronous), BSC, or SDLC protocols. Start/stop signals can be transmitted at rates up to 56.7K bps; synchronous (BSC or SDLC) signals can be transmitted at rates up to 230.4K bps. Table 3 lists the specific types of transmission supported by the 3705-II; Table 4 lists the specific types of transmission supported by the 3705-80. Both tables show the specific hardware necessary for a given mode of transmission.

The 3705 was designed in the mid-1970s, and its architecture was originally meant to handle the types of communications that prevailed then: half-duplex transmissions at rates up to 4800 bps. Later enhancements to the hardware, aimed at supporting higher speeds and full-duplex connections, put demands on the 3705 that its architecture was not designed to meet. Attaching any communications line expected to operate in full-duplex mode or at a rate greater than 4800 bps requires some kind of tradeoff; such tradeoffs reduce the total number of lines attachable to the 3705.

Two tradeoffs designed to handle high-speed transmissions are reduction of the upper scan limit and Address Substitution. Both involve the Type 2 Communications Scanner. Like all 3705 scanners, the CS2 is a polling device; it scans (polls) its attached communications lines for activity in a preset order. To support high-speed communications adequately, the scanner must poll high-speed lines more often. When all lines attached to a given scanner are high-speed, the user can reduce, in software, the number of lines the scanner can scan, shortening the polling sequence and insuring that all lines receive more of the scanner's attention. By reducing the upper scan limit (eliminating the higher addresses from the scanning sequence), the user increases the scanning rate for the lines attached at the lower addresses, and, as a direct result, reduces the number of lines that can be attached to the scanner.

Another way of increasing the scanning rate for high-speed lines, this time in configurations where the scanner supports both high- and low-speed lines, is to cause the scanner to

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poll the high-speed lines more than once in each scanning sequence. To do this, again in software, the user substitutes the addresses of the high-speed lines in positions that other lines would ordinarily occupy. This Address Subsitution technique reduces the line capacity of the scanner by the number of extra scans given to the high-speed lines.

OPERATOR INTERFACE

Once the network has been defined in software, the operator has almost no direct interaction with the 3705. Any interaction between the operator and the network takes place through the host, with such programs as the Newtork Command and Control Facility (NCCF). The 3705 supports no operators' console. It has a maintenance panel for power-up, reload, and simple diagnostic operations.

SOFTWARE

In a mainframe network, the communications processor is treated as a peripheral device controller. Like other peripheral controllers, it transfers data from the host to one or more input/output or storage devices under the host's control. In the communications processor's case, the peripheral device is a network, rather than a bank of printers of disk drives. Because a network is orders of magnitude more complex than any other "peripheral device," the communications processor must be both more intelligent and more independent of the host than any other controller.

Initially by necessity and later by design, the IBM 3705 depends more on its host processor than most modern communications processors. In part, this results from the 3705's age as a product; it was designed initially to support a network of locally attached terminals. The intentional side of the 3705's dependence on its host springs from the overall design of SNA, IBM's networking architecture. SNA defines protocols and parameters for communications from end to end, from hooks into the applications program in the host to the definitions of screen and response formats at the terminal. The communications processor is an essential, but intermediate, component in an SNA network. Most mainframe vendors' architectures define communications only from communications processor to communications processor, and as architectural endpoints, those vendors' communications processors function more independently of the host than do IBM's.

The 3705 runs in one or both of two distinct modes, *Emulation* mode and *Network Control* mode. Emulation mode is a backward-compatibility feature that allows the 3705 to support older IBM start/stop and BSC terminal protocols by emulating the 270X series of hard-wired communications controllers. Network Control mode is the 3705's native mode of operation; it supports the SDLC link protocol and the SNA architecture. Running in pure Emulation mode, the 3705 uses the Emulation Program as its basic operating software. Running in pure Network Control mode, it uses one of several generations of IBM's Network Control Program. In a third mode, Partitioned Emulation Programming (PEP), separate portions of the 3705 run in Emulation and in Network Control modes; PEP is a feature of later versions of the Network Control Program.

In any of these software configurations, the 3705 runs under the control of its host's telecommunications access method, whether it is attached locally or remotely to the host. A 3705 in pure Emulation mode runs under the control of either the Basic Telecommunications Access Method (BTAM) or under one of several generations of the Telecommunications Access Method (TCAM). BTAM is an older, nearly obsolete access method. TCAM's current incarnation is the Advanced Communications Function for TCAM (ACF/TCAM). A 3705 running in PEP mode must run under the control of a TCAM access method. A 3705 running in pure Network Control mode can run under the control of either a TCAM access method or the Virtual Telecommunications Access Method (VTAM), whose latest versions are the Advanced Communications Function for VTAM (ACF/VTAM). Those portions of a 3705 participating in an SNA network must run under the control of an ACF-type access method in the host, either ACF/TCAM or ACF/VTAM.

Emulation Program—A 3705 in Emulation mode runs the Emulation Program for the 3705. Processors that run in Emulation mode must be channel-attached to a host. The chief advantage of Emulation mode is that it allows the 3705 to support start/stop and BSC terminals. A user running in a pure emulation environment need not convert to SNA communications. However, support for the pure Emulation environment is dwindling, both among IBM users and within IBM. The current version of the Emulation Program runs only in PEP mode alongside ACF/NCP.

Previous versions of the Emulation Program supported only Channel Adapter Type 1 in the 3705. The latest version supports only Channel Adapter Type 4.

Partitioned Emulation Programming—PEP operations have long been available as an option within ACF/NCP programs. In essence, a 3705 running PEP appears to its host and to its users as two smaller machines. The Emulation mode partition and the NCP partition must use separate channel adapters, communications scanners, LIBs, and line sets. To the host's access method, the portions of the network controlled by the Emulation mode partition form a separate network from those controlled by NCP.

The latest versions of ACF/NCP do not automatically include a PEP option. Rather, the Emulation Program is available as a separate product that must run under ACF/NCP to enable Emulation.

Network Control Program—The Network Control Program is the native-mode 3705 operating system, introduced to provide support for IBM's Synchronous Data Link Control (SDLC) protocol. Later versions of NCP, those designated ACF/NCP, support the full SNA architecture. For details of the general advantages of SNA, see Report C11-491-101 in this volume of DATAPRO REPORTS ON DATA COMMUNICATIONS.

In summary, the principal advantages of ACF/NCP operations are the efficiency of the SDLC line discipline and an increased breadth of network control in cooperation with several network management program products running in the host. ACF/NCP also supports larger memory sizes and more efficient use of storage.

In addition, ACF/NCP supports the multisystem networking features of SNA, which allows more than one host to participate in a network, with each host controlling a separate network domain. The latest version of ACF/NCP also supports the interconnection of SNA networks through a gateway node that consists of an IBM communications processor (3705 or 3725) and its attached host.

X.25 NCP Packet Switching Interface Program—The X.25 NCP Interface provides users of ACF/NCP the ability to use 3705 Communications Controllers to access public data networks complying with CCITT X.25 standards. The package has been certified by GTE Telenet, among other packet switching providers. This program supports packet sequence numbering up to 128, with packet length of up to 4096 characters. It supports SNA network node interconnection and protocol conversion for non-SNA equipment. Within the program, a subset of X.29 allows communications with asynchronous X.28 devices (TTY). It also supports the X.21 line sets.

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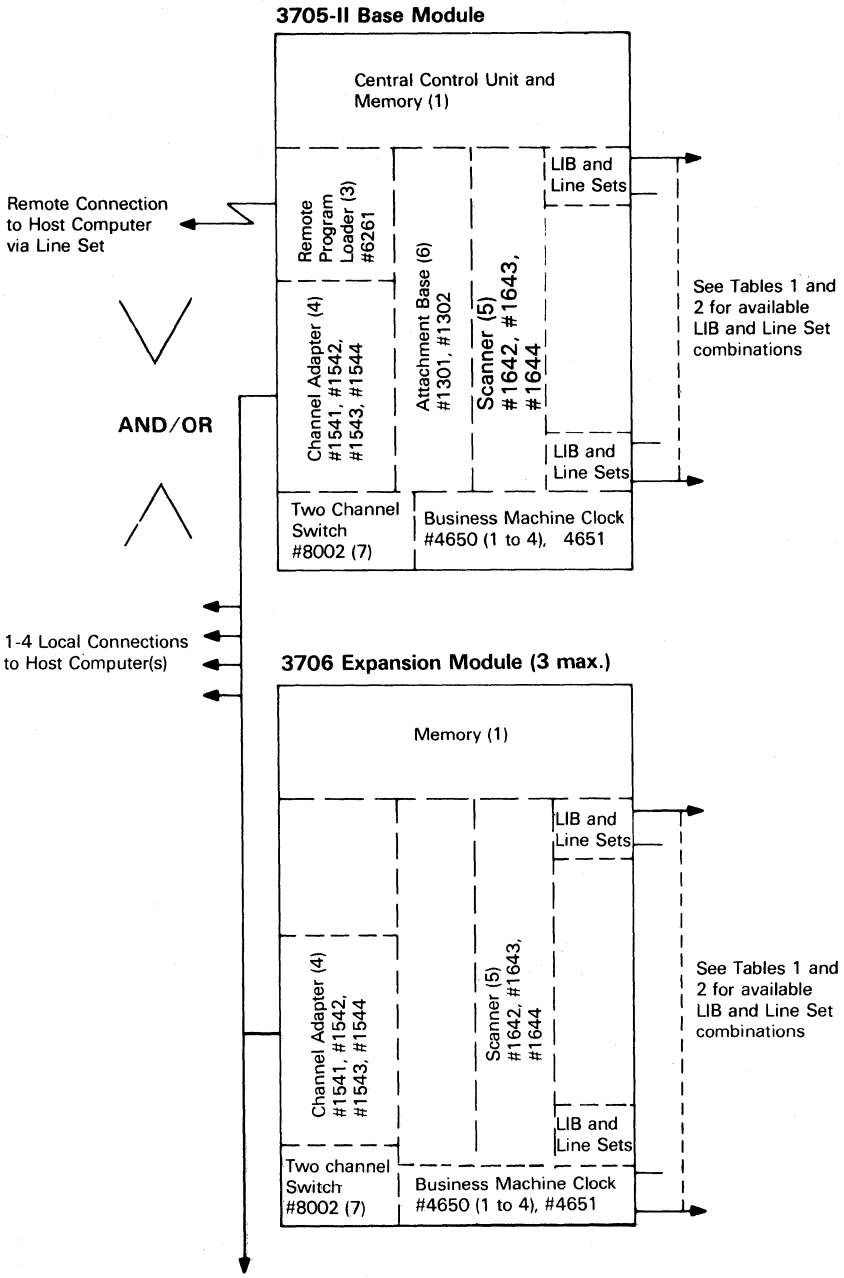
3705-II Configuration



(1) In the 3705–II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes. Models J, K and L also include a second module with at least one 64K-byte memory increment.
(2) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705–II can be installed with up to three Channel Adapters Type 1, 2, 3, or 4. If more than two adapters are used, all must be Type 4.
(3) Up to 4 Channel Adapters Type 1, 2, 3, or 4 can be installed in the 3705–II: two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 2 or 3 run only under NCP. If more than two CAs are installed, all must be CA Type 4. CA Type 1 may not be used with Models J, K or L.
(4) One Scanner Type 2 or 3 can be installed in each of the four modules; Scanner Type 33 may be placed in the Base Module.
(5) One or two attachment bases are required as follows:
- Scanner Type 2 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2, 3, or 3HS with CA Type 2, 3, 4—Attachment Base Type 2.

(6) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

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Network Terminal Option—The Network Terminal Option is a separate program product that allows start/stop terminals to participate in an SNA network without the need for Emulation mode.

Non-SNA Interconnection Program—The Non-SNA Interconnection Program allows IBM 3705s and 3725s operating in pure Network Control mode to support BSC terminals. The program envelops BSC data in SDLC framing, allowing lower layers of the architecture to treat the BSC message as an SDLC bit stream.

Network Routing Facility—The Network Routing Facility allows the 3705 to select transmission routes for established SNA sessions. The facility runs under the control of ACF/VTAM in the host, and allows the communications processor to maintain active sessions in the event of a host or access method failure.

System Support Program—The 3705, like all IBM communications processors, cannot generate its own software, either its initial program load or the required network configuration definitions. A host-resident system generator, called a System Support Program (currently ACF/SSP) is required. ACF/SSP is a collection of macro instructions in IBM assembler language that allows the user to define the characteristics of both the communications processor and the network it supports. With ACF/SSP, users can generate code for both Emulation and ACF/NCP modes of operation. Code assembled and linked by ACF/SSP is downloaded from the host to the communications processor, either locally through the I/O channel, or remotely, through a front-end processor and an RPL–II in the remote unit.

Associated Host Software—Host-resident programs that communicate directly with the 3705 and control parts of its operation include the communications access methods (currently ACF/TCAM and ACF/VTAM) and certain program products for network management and control. Between the access methods, ACF/TCAM supports emulation mode, while ACF/VTAM does not. Users migrating gradually to SNA should install ACF/TCAM, while users running full SNA networks may use either.

Network management and control products include the *Network Communications Control Facility* (NCCF) which allows network configuration control from the operator's console of the host, and supports diagnostics under IBM's network troubleshooting program, the *Network Problem Determination Application* (NPDA). *The Network Logical Data Manager* is a data-base driver for the recording of network performance and maintenance information.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705–II and up to 45 percent on the 3705–80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

EQUIPMENT PRICES

	Monthly Charges*			
	Rental	Two-Yr. Lease	Purchase	Monthly Maint.
3705-80 Communications Controller				
Model M81 (256K bytes, 4 lines)	$1,721	$1,465	$36,600	$219
Model M82 (256K bytes, 10 lines)	2,262	1,925	46,600	229
Model M83 (256K bytes, 16 lines)	2,661	2,265	52,600	239
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	1,874	1,595	38,230	147
Model E2 (64K bytes, 64 lines)	2,050	1,745	39,800	165
Model E3 (96K bytes, 64 lines)	2,227	1,895	41,370	183
Model E4 (128K bytes, 64 lines)	2,403	2,045	42,940	201

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IBM 3705 Communications Controller

EQUIPMENT PRICES (Continued)

		Monthly Charges*			
		Rental	Two-Yr. Lease	Purchase	Monthly Maint.
3705-II Communications Controller (Continued)					
	Model E5 (160K bytes, 64 lines)	2,579	2,195	44,510	219
	Model E6 (192K bytes, 64 lines)	2,755	2,345	46,080	237
	Model E7 (224K bytes, 64 lines)	2,932	2,495	47,650	254
	Model E8 (256K bytes, 64 lines)	3,108	2,645	49,220	273
	Model F1 (32K bytes, 160 lines)	2,510	2,140	51,530	160
	Model F2 (64K bytes, 160 lines)	2,690	2,290	53,100	177
	Model F3 (96K bytes, 160 lines)	2,867	2,440	54,670	196
	Model F4 (128K bytes, 160 lines)	3,040	2,590	56,240	213
	Model F5 (160K bytes, 160 lines)	3,215	2,740	57,810	231
	Model F6 (192K bytes, 160 lines)	3,395	2,890	59,380	249
	Model F7 (224K bytes, 160 lines)	3,570	3,040	60,950	267
	Model F8 (256K bytes, 160 lines)	3,745	3,190	62,520	285
	Model G1 (32K bytes, 256 lines)	3,150	2,685	64,830	172
	Model G2 (64K bytes, 256 lines)	3,330	2,835	66,400	190
	Model G3 (96K bytes, 256 lines)	3,505	2,985	67,970	207
	Model G4 (128K bytes, 256 lines)	3,680	3,135	69,540	226
	Model G5 (160K bytes, 256 lines)	3,855	3,285	71,110	243
	Model G6 (192K bytes, 256 lines)	4,035	3,435	72,680	262
	Model G7 (224K bytes, 256 lines)	4,210	3,585	74,250	279
	Model G8 (256K bytes, 256 lines)	4,385	3,735	75,820	298
	Model H1 (32K bytes, 352 lines)	3,795	3,230	78,130	184
	Model H2 (64K bytes, 352 lines)	3,970	3,380	79,700	202
	Model H3 (96K bytes, 352 lines)	4,145	3,530	81,270	220
	Model H4 (128K bytes, 352 lines)	4,320	3,680	82,840	238
	Model H5 (160K bytes, 352 lines)	4,500	3,830	84,410	256
	Model H6 (192K bytes, 352 lines)	4,675	3,980	85,980	274
	Model H7 (224K bytes, 256 lines)	4,850	4,130	87,550	292
	Model H8 (256K bytes, 352 lines)	5,025	4,280	89,120	310
	Model J1 (320K bytes)	5,053	4,300	71,020	314
	Model J2 (384K bytes)	5,045	4,600	74,160	350
	Model J3 (448K bytes)	5,758	4,900	77,300	386
	Model J4 (512K bytes)	6,110	5,200	80,440	422
	Model K1 (320K bytes)	5,690	4,845	84,320	326
	Model K2 (384K bytes)	6,045	5,145	87,460	362
	Model K3 (448K bytes)	6,395	5,445	90,600	398
	Model K4 (512K bytes)	6,750	5,375	93,740	434
	Model L1 (320K bytes)	6,330	5,390	97,620	339
	Model L2 (384K bytes)	6,685	5,690	100,760	375
	Model L3 (448K bytes)	7,035	5,990	103,900	411
	Model L4 (512K bytes)	7,390	6,290	107,040	447
#8510	Unit Protection	**35	—	**35	NC
	Communications Line Sets for 3705-80				
#6712	Line Set Type 2	241	205	5,440	10.00
#6713	Line Set Type 3	215	183	4,850	9.00
#6714	Line Set Type 4	88	75	2,060	4.00
#6715	Line Set Type 5	436	371	10,320	13.50
#5657	Line Set Type 8	108	92	2,600	3.50
#5658	Line Set Type 9	63	54	1,550	3.00
#14XX	Business Machine Clock	14	12	424	1.00
	Attachment Bases (for 3705-II only)				
#1301	Type 1	26	22	641	0.50
#1302	Type 2	26	22	641	0.50

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►EQUIPMENT PRICES (Continued)

		Monthly Charges*			
		Rental	Two-Yr. Lease	Purchase	Monthly Maint.
	Channel Adapters				
#1541	Type 1	167	142	2,700	9.00
#1542	Type 2 (3705-II only)	312	266	6,470	9.00
#1543	Type 3 (3705-II only)	636	541	12,910	11.00
#1544	Type 4	268	228	4,410	8.00
#1551	Type 1; for 3705-80 only	194	165	3,340	9.50
#8002	Two Channel Switch	87	74	2,090	2.50
	Communications Scanners for 3705-II				
#1642	Type 2	300	255	4,750	9.00
#1643	Type 3	1,075	915	17,210	31.00
#1644	Type 3 High Speed	1,445	1,230	25,120	37.00
#4650	Business Machine Clock for 3705-II	15	13	424	1.00
#4651	Business Machine Clock for 3705-II	39	33	880	1.50
	Communication Line Attachment Features for 3705-II				
#4701	Line Interface Base Type 1:	62	53	1,105	3.00
#4714	Line Set Type 1D	52	44	1,030	3.00
#4715	Line Set Type 1E	45	38	1,030	2.50
#4717	Line Set Type 1G	118	101	2,050	6.00
#4719	Line Set Type 1J	62	53	1,455	2.50
#5655	Line Set Type 1N	76	65	2,040	3.00
#5656	Line Set Type 1R	63	54	1,700	3.00
#4720	Line Set Type 1S	130	111	3,020	6.50
#4722	Line Set Type 1GA	118	101	2,695	6.00
#4723	Line Set Type 1TA	215	183	4,850	9.00
#4725	Line Set Type 1T	215	183	4,850	9.00
#4726	Line Set Type 1U	241	205	5,440	10.00
#4727	Line Set Type 1W	198	169	4,720	6.00
#4728	Line Set Type 1Z	369	314	8,640	10.00
#4702	Line Interface Base Type 2	62	53	1,455	2.50
#4721	Line Set Type 2A	45	38	1,030	3.50
#4703	Line Interface Base Type 3	110	94	2,515	2.50
#4731	Line Set Type 3A	35	30	850	1.50
#4732	Line Set Type 3B	35	30	850	1.50
#4708	Line Interface Base Type 8	62	53	1,455	3.50
#4781	Line Set Type 8A	63	54	1,490	4.50
#4782	Line Set Type 8B	83	71	1,920	6.00
#4709	Line Interface Base Type 9	62	53	1,455	2.50
#4791	Line Set Type 9A	92	78	1,785	10.00
#5000	Line Interface Base Type 10	69	59	1,685	2.50
#4784	Line Set Type 10A	118	101	2,685	5.50
	Remote Concentrator Features				
#6250	Remote Power Off	15	13	416	0.50
#6261	Remote Program Loader-II	430	366	9,335	24.50

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IBM 3705 Communications Controller

	Software*	Monthly Basic License	Monthly DSLO License	Monthly Licensed Program Support	Monthly Multiple Licensed Program Support
5744-BA2	Network Control Program	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	$194	$145	$32	$ 51
5735-XX3	SSP for ACF/NCP/VS Version 2	59	44	17	27
	Host Access Methods				
5735-RC1	ACF/TCAM Version 1	329	246	12	19
	With Multisystem Networking Facility	1,220	915	31	50
5735-RC3	ACF/TCAM Version 2, Release 1, 2, and 3	723	542	83	132
	With Multisystem Networking Facility	1,215	910	103	165
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	157	117	50	80
	With Multisystem Networking Facility	298	223	149	237
5735-RC2	ACF/VTAM Version 1, Release 2, and Release 3	378	282	50	80
	With Multisystem Networking Facility	909	681	149	237
	Encrypt/Decrypt Feature	223	166	7	11
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	153	114	71	113
	Other Host Networking Software				
5735-XX7	Network Terminal Option Release 1 and 2	171	127	11	18
5735-XX8	Network Problem Determination Application (NPDA) Release 1 and 2	69	51	23	37
5735-XX6	Network Communications Control Facility (NCCF)	129	97	44	70
5668-963	Network Routing Facility	972	729	226	362
5668-981	X.25 Packet Switching Interface	223	166	36	58

NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP).
*Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.■

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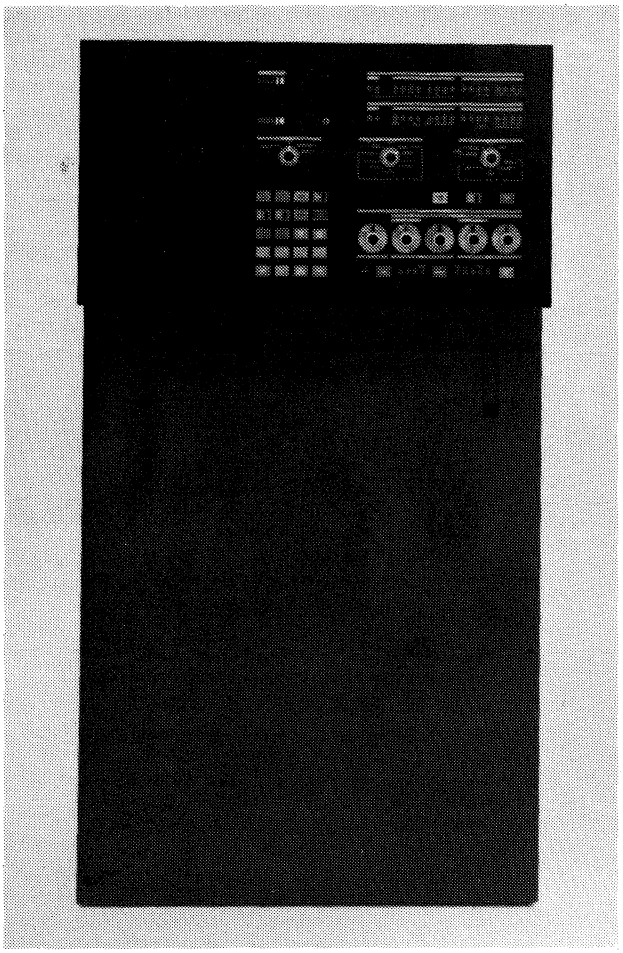
IBM 3705 Communications Controller



A series of programmable communications processors primarily used as front-ends to IBM or compatible mainframes.

The series consists of the entry level 3705–80, which allows for 256K bytes of memory and up to 16 communications lines, and the 3705–II, which supplies up to 512K bytes of memory and supports as many as 352 communications lines. The 3705–II accommodates asynchronous or synchronous, half- or full-duplex transmissions with synchronous speeds of up to 230.4K bps.

Numerous software options permit a user to implement a 3705 into different modes and configurations with varying degrees of network control. Software support may be 270X hard-wired control emulation to gradual migration of complete network control.

A 3705–II model G8 with 256K bytes of memory and the ability to support 256 communications lines may be purchased for $75,820. The maintenance charge on this mid-range system is $323 per month.

MANAGEMENT SUMMARY

Although IBM announced its new 3725 Communication Controller on March 8, 1983, the IBM 3705–II and 3705–80 are still being marketed and are compatible with the new model. The 3705-II and 3705-80 can be intermixed concurrently with the 3725 in the same single-domain or multi-domain network. Software such as ACF/SSP V2 Release 1.1 is supported by both the 3705 and 3725.

The 3705 can serve as a front-end to IBM and compatible mainframes for communications with local or remote I/O devices. The 3705 attaches to all IBM System/370, 30XX, or 43XX and compatible processors. In 270X emulation mode, they attach to the System/360. As front end, a 3705 requires at least one channel attachment, one line scanner, and appropriate line adapters and interfaces. The 3705 can also be used as a remote communications controller, without channel attachment to a host processor.

The 3705 models are packaged in configurations of various sizes. The low-end 3705–80 is designed for smaller networks or for remote facilities of large networks, and comes in three configurations. The 3705–80 configurations sup- ➢

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Information Systems Group, National Accounts Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

DATE OF ANNOUNCEMENT: 3705–II—November 1975, Models E1–H8; November 1978, Models J1–L4; 3705–80—March 1981.

DATE OF FIRST DELIVERY: 3705–II—August 1976, Models E1–H8; June 1979, Models J1–L4; 3705–80—August 1981.

NUMBER DELIVERED TO DATE: Over 50,000 (estimated for all models).

SERVICED BY: International Business Machines Corporation.

CONFIGURATION

Model 3705–80

The 3705–80 Communications Controller is composed of a central control unit, main memory, and space for mounting interfaces between the central control unit and the host computer. The 3705–80 may attach via one Channel Adapter Type 1 or up to two Channel Adapters Type 4. It may only use a single, specially modified version of a Type 2 Scanner which is a standard component. All 3705–80 controllers have 256K bytes of memory. ➢

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port either 4, 10, or 16 lines; each of these configurations has a standard memory capacity of 256K bytes.

The 3705–II comes in 44 configurations. Salient characteristics of the 3705–II include:

- Transmission rates of up to 230.4K bps. Supports, within restrictions, leased, switched, synchronous/asynchronous, and full-/half-duplex lines. The maximum number of lines depends on line mix. A physical maximum of 352 lines can be attained only by half-duplex lines operating at 9600 bps or slower.
- Supports external and internal modems, local attachment of terminals, and automatic dialing.
- Semiconductor memory storage with capacity from 32K to 512K bytes, in 32K- or 64K-byte increments.
- Channel adapters that will allow attachment of up to four CPU channels or attachment of a Remote Program Loader–II along with up to three adapters.

The low end 3705–II E1 offers 32K bytes of memory and supports 64 communications lines. The top of the line 3705–II provides up to 512K bytes of monolithic (high-speed) memory and supports as many as 352 communications lines.

The user has a choice of several software options, each of which provide significantly different capabilities. For migration from the ancient 270X hard-wired controller, a user may load the 3705 with the Emulation Program (EP). The main advantage of EP is that no changes need to be made to the user's existing network (terminals, lines, etc.) as the 3705 merely emulates the operation of the 270X controller. However, with EP there is no real off-loading of communications processing from the host, which is generally the incentive for implementing a programmable front end in the first place.

The migrating user would then logically move to the Partitioned Emulation Programming (PEP), which permits the 3705 to operate *both* in 270X emulation mode, and in its own native network control mode. This permits the user to gradually convert terminals and line control equipment to operate in network control mode. PEP is an extension of the Network Control Program (NCP) which would ultimately be running alone in the 3705. Running NCP, the 3705 makes full use of its inherent capabilities, which includes significant off-loading of communications processing from the host.

A series of software enhancements, grouped under the name Advanced Communications Function (ACF), permits the linking of two or more host computers via their respective front-end (local) 3705 controllers to form a Multi-System Networking Facility. The host computers are interrupted only initially by transmissions flowing through their local 3705s that are destined for another host. The enhancements also permit up to four computers at the same location to share a common 3705. The host comput-

Required features and functions to run half- or full-duplex communications lines to an RS-232–C or CCITT V.24 interface are preprogrammed in a common line set that is included in the basic system. The common line set supports start/stop communications at up to 9600 bps and BSC and SDLC communications at up to 19.2K bps. This eliminates the need to order separate Line Attachment, Line Interface Base, or Line Set features for routine communications interfaces (cables, however, do need to be ordered separately). The number of lines supported depends on the 3705–80 model: Model M81 is preconfigured to support 4 lines; M82, 10 lines; and M83, 16 lines. (Operation at 19.2K bps or full-duplex operation reduces line capacity.) A 134.5 bps Business Machine Clock is also standard. One optional line set may be ordered to support special communications requirements on Models M81 and M82 (Model M83 supports only the common line set.) Users may select from Line Sets 2, 3, 4, 5, 8, or 9. All 3705–80 line sets are summarized in the tables accompanying this report.

Model 3705–II

The 3705–II Communications Controller is composed of:

- **The basic 3705–II model (E1 through L4) which includes the central control unit, main memory, and space for mounting the interfaces between the central control unit and the communications lines and between the central control unit and the host computer.**
- **Channel Adapter (1 to 4) and/or Remote Program Loader, which provides the data path between the 3705 and the host computer. The Type 1 Channel Adapter cannot be used with 3705 Models J1 to L4.**
- **Attachment Bases (1 or 2), which provide the physical and logical interface between the Channel Adapter (Type 1 only) and the Central Control Unit and between the CCU and the Communications Scanners.**
- **Scanners (1 to 4), which connect the Interface Bases (and associated line sets) with the 3705–II central control unit.**
- **Line Interface Bases, which provide certain control functions for paticular types of lines and transmission techniques.**
- **Line Sets, which provide the interfaces with data sets or directly with the communications lines.**

The configuration diagram at the end of this report illustrates the relationships among these computers.

The 3705–II can accommodate up to 352 communications lines. The 3705–II (Models E1-H8) have a cycle time of 1200 nanoseconds and contains 32K to 256K bytes of semiconductor (MOSFET) memory in 32K–byte increments over 32 models. Models J1-L4 have a memory cycle time of 900 nanoseconds and feature memory ranging from 320K bytes to 512K bytes in 64K–byte increments. For Models E1 to H8, the letter (E, F, G, H) refers to the number of physical modules (1 through 4) that compose the 3705 system and determine the number of communications lines that can be accommodated. The J models consist of two modules; the K models three; and the L models four.

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ers in either case can use any mix of VS operting systems and can use either VTAM or TCAM access methods.

The Multisystem Networking Facility is an optional licensed program feature of ACF that permits dynamic allocation of CPU work loads and network routing based on the nature and volume of the transmissions and the hardware resources operative at the time.

The ACF software also supports a hardware enhancement known as the Remote Program Loader–II (RPL–II). In the event of a host computer failure, a local controller can be linked, as a remote controller, to another 3705, provided an RPL–II and an appropriate line are installed. RPL-II can be included with channel adapters in a 3705–II, permitting the controller to be used as a remote or a local controller.

A 3705 or 3725 Communications Controller is a prerequisite to networking under IBM's System Network Architecture (SNA). SNA requires the 3705 to run in its native NCP mode, although there are several different versions of NCP which support varying degrees of network sophistication. A 3705 running PEP may be supporting an SNA network, but only for those lines and devices which are connected under the NCP portion.

SNA also requires certain operating software in the host which works with the front end and NCP in control of the network. Virtually all of the current IBM 370, 303X, 308X, or 4300 operating systems may support SNA networking, but each requires an appropriate version of either the TCAM or VTAM telecommunications access methods. Whether or not the 3705 is controlling an SNA network, the software load for the front end (or remote 3705) is defined and generated on the host with the use of the System Support Programming (SSP), and the 3705 is then loaded over the channel (or downline, if remote).

SNA is seen by IBM watchers to be the reason many users will continue to stay with IBM for communications processors. This tightly meshed networking discipline may cause difficulty for other vendors to integrate their equipment into an SNA environment. If IBM alters its SNA structure, the feeling is that third party vendors may not be able to react quickly enough to these changes. Many third party vendors will present SNA alternatives in order to market their products.

COMPETITIVE POSITION

The IBM 3705 models have been the most popular communications processors for the past decade. The 3705–I, which is no longer available, was introduced in 1972 and was succeeded by the 3705–II in 1975 and the 3705–80 in 1981. The increase, effective May 1, 1983, in lease prices but not purchase prices of the 3705–80 may stimulate purchase of these models.

Competitors include the Amdahl 4705 Communications Processor and the NCR Comten 3600 Communications Processors. Both can be attached to the same mainframes that support the IBM 3705 models. The Amdahl 4705

3705-II Models

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	E7, F7, G7, H7	224K
E2, F2, G2, H2	64K	E8, F8, G8, H8	256K
E3, F3, G3, H3	96K	J1, K1, L1	320K
E4, F4, G4, H4	128K	J2, K2, L2	384K
E5, F5, G5, H5	160K	J3, K3, L3	448K
E6, F6, G6, H6	192K	J4, K4, L4	512K

Physically, the 3705–II is configured in one to four cabinets of modules. The Base Module includes the central control unit and from 32K to 256K bytes of semiconductor memory. The Base Module also accommodates one or two Channel Adapters, one or two Attachment Bases, one Scanner, and its associated Line Interface Bases and Line Sets. Models J1, K1 and L1 include a second module which contains a 64K–byte memory increment.

An Expansion Module (referred to as the 3706) is required to add each additional Scanner and its associated Line Interface Bases and Line Sets. Up to three 3706 Expansion Modules can be included in a 3705–II system. For the 3705–II, the base module can be equipped with two Channel Adapters, or one Remote Program Loader and one Channel Adapter; the first 3706 can be equipped with two additional channel adapters. No Channel Adapters are allowed in the second or third Expansion Module (3706) of either version. All memory over 256K bytes resides in the expansion modules of the 3705–II. When the 3705–II functions as a remote concentrator, the Remote Program Loader is used in place of a Channel Adapter in the base module. Local 3705–IIs can attach a Remote Program Loader–II along with Channel Adapters. With Line Set Type 1D as line linkage, the Controller can operate as a remote to another controller that is locally attached to another host. In effect, a back-up procedure for computer failure in a multi-computer system, the Remote Program Loader–II requires ACF software.

In general, the Base Module can contain up to four Line Interface Bases and each Line Interface Base can accommodate up to eight Line Sets. Each Line Set can accommodate up to two communications lines. For some types of lines, these maximums cannot be attained, as shown in the accompanying tables. Each Expansion Module can contain up to six Line Interface Bases.

Channel Adapters are available in four types, Communication Scanners in three. The restrictions that apply to the Channel Adapters and Scanners affect configuration possibilities and performance in addition to the limitations imposed by the different models. The selection of Channel Adapters and Scanners is determined by the desired level of performance, the number of lines to be implemented, and the mode of operation (i.e., Emulation Mode or Network Control Mode).

The Communications Scanners link the communications lines via their respective Line Interface Bases and Line Sets, with the Central Control Unit (CCU). The Scanner transfers data between the lines and the CCU memory on an interrupt basis and performs character assembly and disassembly functions. The Scanners differ only in performance. Medium and high operating performance is provided by Type 2 and Type 3 Scanners, respectively. The control program is interrupted on a byte-by-byte basis for Type 2, and on a block basis for Type 3. A modified version of Type 2 is used with 3705–80 controllers. Line control, control character recognition, code translation, and user recovery functions are performed by the control program.

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matches the IBM 3705–II in maximum number of hosts channel-attachable and supported concurrently (4 hosts), in maximum number of half duplex lines attachable (352 lines), and in maximum main memory (512K bytes). The Amdahl 4705 claims to have faster throughput, a more compact physical design, and a simpler configuration than the IBM 3705; these differences have been addressed by IBM's new 3725. In addition, the IBM 3705–II provides two 230.4K bps synchronous line sets not available for the Amdahl 4705; on the other hand, the Amdahl 4705 still supports several line set types that have been discontinued by IBM, including 1A, 1B, 1C, 1F, and 1H. Amdahl prices are generally lower than IBM's for comparable configurations with equivalent memory, channel adaptors, communications scanners, and line sets.

The NCR Comten 3650, 3670, and 3670–85 are comparable to the IBM 3705–II in maximum main memory and line speed. The 3650 attaches to a maximum of two hosts and 128 full duplex lines, the 3670 to a maximum of four hosts and 384 full duplex lines. Price comparisons are difficult because each vendor bundles different components in its price lists, but our research indicates that the new NCR Comten low-end 3670–85, which attaches to a maximum of two hosts and 128 full duplex lines, is generally less expensive to purchase or lease than either the IBM 3705–II or the Amdahl 4705, which serve up to four hosts and 176 full duplex lines. The high-end model of the NCR Comten 3600 series, the 3690, should be compared with the high-end IBM 3725, rather than the 3705s.

ADVANTAGES AND RESTRICTIONS

IBM 3705 advantages include its ability to relieve the CPU of such functions as line control, polling, addressing, code translation, and error recovery, and to increase the communications capabilities of its host. The 3705 modularity and programmability allow it to be configured for the individual teleprocessing system.

A 3705 minimizes host interrupts while optimizing I/O channel transfers by employing an 80–byte block level transfer technique. It does not, however, support file level transfers or disk access methods.

An advantage to using IBM hardware is that IBM provides the software, which is written specifically for that company's equipment, although other vendors' communications processors also run on IBM software.

USER REACTION

In response to our Network Survey conducted in January and February of 1983, we received 342 replies from IBM 3705 users, representing their experience with 1,258 installed units.

TABLE 1:
LIB CAPACITY PER SELECTED SCANNER OPTION FOR THE 3705-II

Line Interface Base Type	Scanner Type	Maximum Number of LIBs per 3705-II: Base Module	Maximum Number of LIBs per 3705-II: Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2 or 3	2	4	6
	3	—	—
	3 HS	—	—

The Type 3 Scanner performs data transfer functions on a cycle-steal basis, halting the control program for a complete machine cycle. The control program resumes operation at the conclusion of the data transfer unless another cycle-steal request is pending. An interrupt can occur on buffer boundaries (up to 254 characters), by unique control character, or by specific error conditions. Type 3 supports only LIB Types 1, 8, 9 and 10. Type 3 also provides control character recognition for BSC and SDLC line controls, and performs ASCII to EBCDIC (and the converse) code translation when operating under BSC line control. There is additionally a high-speed version of the Type 3 Communications Scanner which supports line speeds up to 230.4K bps. Only two half-duplex or one full-duplex line operating at this speed can be attached to the scanner, however. Also, only one of these high-speed scanners can be configured per frame (module). The Business Machine Clock #4650 is prerequisite, and no other clock is allowed. Only line sets 1GA or 1TA may be used with the high-speed scanner.

Channel Adapters are divided into two groups: those designed for the Emulation Mode of operation but also usable in the Network Control Model (Types 1 and 4), and those designed for the Network Control Mode of operation only (Types 2 and 3). The Channel Adapter Type 1 is a low-performance adapter and is used in the Base Module of a 3705–80, but could be used in a 3705–II. Type 4 provides higher performance and can be used in a Base and Expansion Module of a 3705–II or 3705–80. Channel Adapters Types 2 and 3 provide a higher level of perfomance and can be used in both a Base and Expansion Module, but Type 3 is designed to support both processors of a "tightly coupled" multiprocessor system.

The various configuration restrictions add up to two basic configuration groups:

- **A 3705–II Base Module with a Channel Adapter Type 1 and a Scanner Type 2. This configuration can be fully expanded with an additional Scanner Type 2 in each Expansion Module containing Line Interface Bases. A Channel Adapter Type 2 or 3 can be added to the first Expansion Module. An Attachment Base Type 2 is required for the first Scanner Type 2, and an Attachment Base Type 1 is required for the Channel Adapter Type 1. Alternatively, the Remote Program Loader can be used in place of a Channel Adapter. This configuration can be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing. When emulating a 270X controller, the number of communications lines is restricted to the number of available multiplexer subchannels (255 maximum). Note that the Chan-**

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TABLE 2. COMMUNICATIONS HANDLED BY THE 3705-80

Type of Line Interface	Transmission			Line	Line Set	Number of Lines Supported (MBI/M82/M83)	Comments
	Speed (bps)	Timing	Mode				
External RS-232-C/V.24 modems	Up to 9600 Up to 19.2K Up to 19.2K	Async./Sync. Synchronous Synchronous	Half-duplex Half-duplex Full-duplex	Leased or switched Leased or switched Leased or switched	Common Common Common	4/10/16 4/8/16 2/5/8	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols
External CCITT V.35 modem	Up to 56K Up to 56K	Synchronous Synchronous	Half-duplex Full-duplex	Leased Leased	2 2	2/2/* 1/1/*	
External wideband	Up to 50K Up to 50K	Synchronous Synchronous	Half-duplex Full-duplex	Leased Leased	3 3	2/2/* 1/1/*	
Automatic dialing; RS-366A/V.25 compatible	—	—	—	Switched	4	4/4/*	For attachment of external dialing units
Direct attachment	Up to 2400 bps	Async./Sync.	Half-duplex	IBM cables	Common	4/10/16	Preprogrammed line interfaces for Start/Stop, BSC, and SDLC protocols.
	14.4K or 57.6K	Synchronous	Half-duplex		5	2/2/*	Maximum cable length is 200 feet. Interface is CCITT V.35 Includes internal clocking.
CCITT X.21 interface	Up to 9600 Up to 9600 48K 48K	Synchronous Synchronous Synchronous Synchronous	Half-duplex Full-duplex Half-duplex Full-duplex	Leased Leased or switched Leased Leased or switched	8 8 9 9	2/2/* 2/2/* 1/1/* 1/1/*	Switched operation requires: #1409 Business Clock; #1416 Business Clock (for testing); and ACF/NCP R3.

*Not available on M83.

	Excellent	Good	Fair	Poor	WA*
Overall performance	149	121	9	1	3.5
Ease of installation	69	153	46	6	3.0
Ease of operation	81	137	48	11	3.0
Ease of expansion	46	120	88	20	2.7
Hardware reliability	181	83	10	1	3.6
Quality of manufacturer's software/ firmware	78	162	31	4	3.1
Ease of programming	28	106	76	23	2.6
Quality of manufacturer's maintenance	112	136	27	3	3.3
Manufacturer's technical support	74	133	56	10	3.0

*Weighted Average based on a scale of 4.0 for Excellent.

The consensus shows that most users were very pleased with the reliability of the hardware. Overall, the survey seems to indicate that the 3705 upholds IBM's standard of excellence since it reflects no major flaws in the 3705.

In March 1983, we randomly contacted three of these users by telephone. A large insurance company, based in the eastern United States, has been leasing an IBM 3705-II E7 for about ten years as a front end to an IBM 3033; running under Information Management System application software. A company spokesperson said, "It's the best piece of hardware on the market to do what it does. It just sits there and runs." He said they never had any problems with it and everyone he talks to says it's a solid piece of equipment.

"Dependability" was noted as a distinctive attribute of the 3705 by a spokesman for a southern company that pro-

nel Adapter Type 1 may not be used with Models J, K or L.

- **A 3705-II Base Module with a Channel Adapter Type 2, 3, or 4 and a Scanner Type 2, 3, or 3HS. This configuration can be expanded fully with Expansion Modules, additional Type 2, 3, or 3HS Scanners, and additional Channel Adapters. An Attachment Base Type 2 is required to interface the first Type 2, 3, or 3HS Scanner. This configuration supports only front-end processing. Any combination of two Channel Adapters Type 2, 3, and 4 can be used, except that a Type 4 must be used in the Base Module when combined with a Type 2 or 3. Channel Adapters Type 2, 3, and 4 include the Attachment Base function, which precludes the use of a separate Attachment Base. The Type 3, or 3HS Scanners can be combined in any arrangement, except that they cannot be used in emulating the 270X controllers or for attachment to an IBM System/360.**

Timing and interpretation of data signals on the communications lines can be provided by the modems or by a series of Business Machine Clocks. Clocks ranging from 45 to 2400 bits per second are available and are required for all asynchronous lines. Up to four can be installed with each Scanner, but at least one is required, per scanner, regardless of line types used. Clocks are program-assigned and can be shared among several lines.

Complete configuration of a 3705-II system revolves around determination of the number of Line Interface Bases required. This sets the minimum model that will suffice. Larger models can be implemented to provide additional memory. The accompanying tables and diagram fully set forth the rules for determining the number and types of Line Interface Bases (LIBs) and Line Sets required for the types of lines that can be accommodated. Many of the Line Set types include internal modems.

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duces textiles. The company's three IBM 3705s with 3706 extension cabinets are front ends to IBM 3083 and 3033 mainframes. These communications controllers were acquired from three to eight years ago. None of the units have been problematic, except that in the past the "power supply was going bad," perhaps from age. The vendor responded satisfactorily in the user's opinion and replaced the power supply. A disadvantage of this equipment is that the software does not provide sufficient ability to make changes or add devices, the user noted.

The 3705–II is "fairly flexible for adding lines to teleprinters," a spokesman for a western bank observed. The bank uses two 3705 E5 models for communications with two IBM System/34s and an IBM 3694. One of the communications controllers is leased from IBM and the other from a third party. The first one was installed several years ago; the second, a few months ago. The spokesman said the 3705s are "pretty stable hardware-wise;" they have been operating without problems. The second one can serve as backup to the first, if necessary, but they've never had to use it as backup. His advice to potential buyers of the 3705 is that, "somebody strong in systems work" should operate it as NCP requires very careful administration. The spokesman recalled that in his previous job, he had used a Memorex front-end processor, which he liked better, because it was faster than the 3705 and had a number of features implemented in hardware, in contrast to the IBM 3705, which requires a lot of software.□

CONNECTION TO HOST COMPUTER: **The Type 1 Channel Adapter provides attachment to the byte multiplexer channel of an IBM System/360 (32K Model 30 and larger), System/370, 30XX, or 43XX and compatible computer. The Type 2 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channel of an IBM System/370, 30XX, or 43XX System. The Type 3 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channels of a pair of System/370 processors (Model 135 and larger), 30XX, or 43XX operating in a virtual mode as a tightly coupled multiprocessor system. A Type 4 Channel Adapter provides attachment to the System/360 byte multiplexer channel in EP mode, or the selector, byte multiplexer, or block multiplexer channel of an IBM System/370, 30XX, or 43XX.**

The Type 1 Channel Adapter transfers data one, two, three, or four bytes at a time over the attached byte multiplexer channel. The transfer rate appears to be in the neighborhood of 16,000 bytes per second. A separate transfer control operation is required of the 3705 control unit for each data burst transferred.

The Type 2 Channel Adapter always operates in the burst mode, with two-byte transfers over an attached byte multiplexer channel and multi-byte transfers over an attached block multiplexer or selector channel. It can sustain a data rate of 276,000 bytes per second. Data is transferred in blocks, and except for initiation and termination of a transfer operation, data transfers interrupt the 3705 central control unit only for the memory cycles required to access and move the data.

The Type 3 Channel Adapter has a performance level equivalent to that of the Type 2, but includes an automatic two-processor switch for symmetric support of tightly coupled System/370 multiprocessor configurations. The Type 3 can also be used to provide alternate-path capability by connecting both sides of the switch to two channels of a single processor. The Type 3 also includes a remote switch attachment capability throught the configuration control panel of a System/370 158 MP or 168 MP or from a 2925 Model 10 Remote Switching Console.

The Type 4 Channel Adapter operates in burst mode and transfers multi-byte bursts over the channel. Under ACF/NCP/VS, it can operate in cycle-steal mode, which improves throughput by reducing the number and complexity of interrupts.

In configurations having four Channel Adapters (Type 1, 2, or 4), connection an be made to four different ports on the same CPU or to four different CPUs (or a mixture). This configuration is useful when operating under 270X emulation mode and full ACF/NCP mode concurrently. When using a Type 3 Channel Adapter (NCP only), there are two connections from each adapter to two tightly coupled CPUs, or, alternatively, to two channels of the same CPU. Only one channel per adapter is active at a time and the channel selection is made by a manual switch located on the control panel of the CPUs or under program control.

A manual Two Channel Switch option can be attached to Channel Adapter Type 1, 2, or 4. This allows the physical connection of up to two (3705–80) or four (3705–II) I/O channels on a CPU. However, only one path, per Channel Adapter, can be active at a time. In the 3705–II, the Two Channel Switch option cannot be implemented in any module containing more than one Channel Adapter.

TRANSMISSION SPECIFICATIONS

The accompanying tables summarize the capabilities and restrictions of the 3705 for accommodating various types of communications lines and techniques.

The type of LIB required for each type of line set for the 3705–II is indicated in Table 3. The number of LIBs of a given type or of a given mix that is allowed in a module is indicated in Table 1. The type of Communications Scanner to use is also indicated in Table 1. The maximum number of LIBs, obtained from Table 1, multiplied by the product of the lines per line set and the line sets per LIB from Table 3 will supply the maximum number of lines that can be connected to a module.

An exception to the rules depicted in the tables occurs when using Communications Scanners 2 and 3 for line speeds over 4800 bps. To assure adequate scanning of high speed lines, the mix and/or number of line sets per LIB must be restricted. This can be done physically or logically via program control.

Providing the high speed line set is wired to the lower address of an LIB (and in some cases the LIB must be the first LIB of the module), the Communication Scanner can be told, by program, to ignore the higher address lines and to use its scanning time to service the high speed line. For line speeds over 10,000 bps, the line sets must be wired to the lowest address of the LIB.

The reason for this requirement is the manner in which the scanner is made to scan a line more frequently via programming initiation. A Type 2 Scanner will normally attempt to scan 96 interfaces (lines). This represents the maximum case of 16 lines for each 6 LIBs in an expansion module. Starting with the first address in its list of interface addresses, the scanner proceeds to scan each interface; it consults an Upper Scan Limit counter to determine when a scanning cycle is completed and it is time to start at the

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TABLE 3: COMMUNICATIONS HANDLED BY THE IBM 3705-II

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Line Sets Line LIB*	Comments
	Speed (bps)	Timing	Mode	Line					
External RS-232-C/V.24 modem	Up to 9600	Async./sync.	Half-duplex	Leased or switched	1D	2	Type 1	8	Any combination of speed and timing
	Up to 9600	Async./sync.	Full-duplex	Leased	1D	1	Type 1	8	is possible for each Line Set 1D.
External wideband modem	19.2K or 50K	Synchronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Runs only under NCP
	50K	Synchronous	Full-duplex	Leased	1T	1	Type 1	4	
	Up to 230.4K	Synchronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3HS
	Up to 230.4K	Synchronous	Full-duplex	Leased	1TA	1	Type 1	1	Requires Scanner Type 3HS
External Mil 188C modem	Up to 50K	Async./sync.	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Runs only under NCP
	56K	Synchronous	Full-duplex	Leased	1U	1	Type 1	4	
Local attachment	Up to 9600	Synchronous	Half-duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35 Requires #4651 Business Clock
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35 Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
CCITT X.21 Interface	Up to 48K	Synchronous	Half-duplex	Leased	1N	2	Type 1	8	Requires Scanner Type 2 or 3 and #4650 Business Clock
	Up to 48K	Synchronous	Full-duplex	Leased	1N	1	Type 1	4	Requires Scanner Type 2 or 3 and #4650 Business Clock
	Up to 9600	Synchronous	Full-duplex	Switched	1R	1	Type 1	8	Requires Scanner Type 2 and #4650 Business Clock
	Up to 48K	Synchronous	Full-duplex	Switched	1R	1	Type 1	2	Requires Scanner Type 2 and #4650 Business Clock
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	1200 or 600	Asynch./sync.	Half-duplex	Leased	8A	2	Type 8	3	
	600	Asynchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	8B	2	Type 8	3	Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched	9A	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	

beginning again. By changing the Upper Scan Limit counter to scan fewer interfaces, the scanning cycle will accordingly take less time. Of course, any line attached to interfaces whose address position in the list is beyond the scan limit will not be scanned. The Upper Scan Limit can be set to scan 96, 48, 16, or 8 interfaces.

Another method of decreasing the elapsed time between scanning a line on a Type 2 Scanner is by Address Substitution. Normally, the address of the high speed line in position 1 of a LIB is substituted in the address list of the addresses of the highest addresses withing the same LIB. This causes the scanner to scan the same line two or more times within the same scan cycle. Features to block installation of line sets for the lines that will not be scanned are available for LIB Types 1, 2, 3, and 10. When Address Substitution is used, all Type 2 Scanners must operate in the same manner. Address Substitution causes the scanner to scan only 8, as opposed to 16, lines per LIB. A total of four no-cost features are available for Address Substitution; they must be implemented in order. The first and second features block installation of a line set in partition 8 and 7, respectively, on all Type 1 or 2 LIBs of all modules. The third and fourth features block installation of a line set in partition 6 and 5, respectively, of all Type 1, 2, 3, and 10 LIBs of all modules. Each LIB is divided into eight Partitions for line addressing purposes. The two lines wired with the lowest addresses in an LIB are in partition 1; the two lines wired with the highest addresses in an LIB are in partition 8.

Upper Scan Limit modification can also be employed with Type 3 scanner. High Speed Select, analogous to Address Substitution is used to modify address. An important difference between Address Substitution and High Speed Select, is that High Speed Select is applicable only to a specific scanner; i.e., configuration restrictions apply to only one module. A total of eight no-cost features are available; they must be implemented in order. Each feature blocks the installation of a line set in one partition of any additional LIBs in that module only.

The purpose for each type of LIB is:

Type 1: Lines with external modems and/or auto call, and for directly attached terminals.

Type 2: Telegraph-grade lines.

Type 3: Lines with IBM limited distance line adapters.

Type 8: 1200 bps lines with integrated modems.

Type 9: 1200 bps lines with integrated modems and auto call.

Type 10: 1200 bps lines with integrated modems and full-duplex data transmission.

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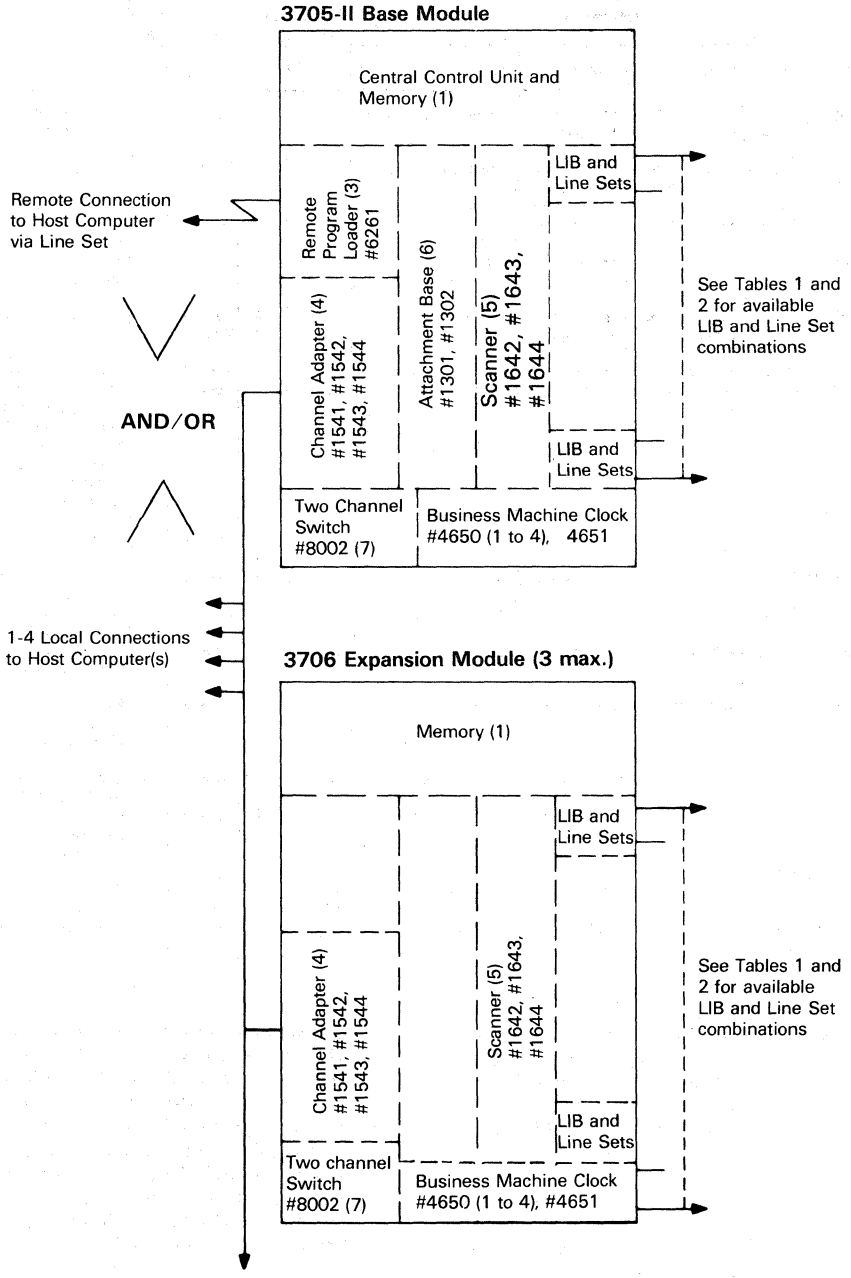
Configuration



(1) In the 3705–II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes. Models J, K and L also include a second module with at least one 64K-byte memory increment.

(2) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705–II can be installed with up to three Channel Adapters Type 1, 2, 3, or 4. If more than two adapters are used, all must be Type 4.

(3) Up to 4 Channel Adapters Type 1, 2, 3, or 4 can be installed in the 3705–II: two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 2 or 3 run only under NCP. If more than two CAs are installed, all must be CA Type 4. CA Type 1 may not be used with Models J, K or L.

(4) One Scanner Type 2 or 3 can be installed in each of the four modules; Scanner Type 33 may be placed in the Base Module.

(5) One or two attachment bases are required as follows:
- Scanner Type 2 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2, 3, or 3HS with CA Type 2, 3, 4—Attachment Base Type 2.

(6) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

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IBM provides a gateway to X.25 packet switching public data networks by offering a combination of hardware and software support. SNA terminal support is provided through the Network Interface Adapter (RPQ 5973-LO2). This adapter is a prerequisite for X.25 access and may be used with all 3705 family Communications Controllers with a Type 2 or 3 Communications Scanner and appropriate line set. An X.21 Line Set allows the physical attachment to the X.25 network. The following software section will provide more details about X.25 support.

SOFTWARE

The program stored in memory controls all functions of the 3705. Many functions such as control character recognition and error procedures are defined and controlled by software. In previous, hard-wired controllers, such as the IBM 2701, 2702, and 2703, these functions were fixed once a particular set of adapters was selected. The 3705 is not totally independent, however. Functions are executed in response to commands issued by the host processor. Indeed, all control ultimately resides with the host processor, including program loading.

The control program residing in the memory of the 3705 is generated on an IBM System/360, System/370 non-virtual or System/370 virtual computer system, some 4300 Series, 308X, and possibly 303X systems, through a macro-assembly/link-edit procedure. Generated control programs are loaded into the 3705 memory over the I/O channel connection or over a communications line if the Remote Program Load feature is implemented. The support package for the 360/370 includes the macro assembler, a load program, and a dump routine.

Two types of control programs can be generated. One, which is called NCP for Network Control Program (NCP/VS in virtual environments), provides front-end processing functions that can relieve the host processor of much of the overhead associated with managing multiple data communications lines. The other, which is called EP for Emulation Program (EP/VS for virtual environments) allows a 3705 to replace multiple 2701, 2702, and 2703 controllers with little or no modification of user application programs; operation of the host processor when EP is active is identical with activity under the previous 270X hard-wired controllers, and none of the potential benefits of front-ending is realized. NCP/VS includes provisions for running NCP and EP simultaneously.

NCP, like most general-purpose operating systems, requires a generation procedure to define the hardware (i.e., communications lines and terminals) configuration available and to specify which of the optional facilities will be included. IBM has implemented a macro language for specification of NCP. The language is divided into three types of macros. Systems macros define the 3705 configuration parameters, such as memory size, buffer sizes, and type of channel adapter installed, and any optional control facilities included, such as checkpoint/restart and on-line terminal testing. Configuration macros define the makeup of the network and supply information pertinent to each individual type of terminal, including composition of multipoint line operations. Block-handling macros specify any processing to be done in the 3705 on the blocks of data exchanged between the 3705 and the host processor. At present, the only processing macros supplied by IBM provide for insertion of date and time for next correction involving backspaces to correct entries, but the assembler can be used to create additional macros. A framework is provided for structuring routines into symbolically named groups and sets and for controlling the point of execution of each component.

Extensive provisions can be included in NCP for accommodating transient or permanent failures of the communications lines and for gathering statistics on detected errors.

Many of the functions can be controlled dynamically through commands issued by the host processor, including specification of the network configuration by activating and deactivating devices, lines, and groups of lines. In addition, terminal ID, polling, and addressing characters can be modified, the frequency and duration of polling and transmission among the terminals or components of a multipoint line or multi-component terminal can be modified, and the block processing routines associated with a particular terminal can be switched.

NCP/VS provides all the capabilities of NCP plus some valuable additions. One of the principal benefits is the capability to operate in the EP mode and NCP mode concurrently; i.e., a portion of the lines can be operated in the 270X mode while the others operate under NCP. This capability is particularly valuable during the cutover of applications from 270X operation to front-end processing with the 3704, and is referred to as Partitioned Emulation Programming Extension or PEP. The other major expansion of NCP capabilities is the operation of the 3705 as a remote concentrator.

PEP can support concurrent operation in a dual-processor environment. One CPU supports communication via VTAM or TCAM through VTAM, and is attached via a Type 2 or 3 Channel Adapter; communications are supported under the NCP mode. The other CPU supports communications via a non-VTAM control program which operates under the Emulation Program, and is attached to the same 3705 via a Channel Adapter Type 1; communications are supported under the EP mode of PEP. Control of the dual-CPU PEP operation is performed using the operator control facility of the host CPU operating with the NCP mode of PEP. Functions include: IPL 3705, Dump 3705, and line switching between the EP and NCP modes of PEP. Lines assigned to the NCP portion of PEP are under control of the VTAM facility; lines assigned to the EP portion of PEP are controlled by the Operator Control facility operating with the EP portion of PEP.

NCP/VS operates through the access method, VTAM, in DOS/VS environments and through either VTAM, TCAM, or a combination of OS/VS environments. The combination mode of operation eases conversion requirements.

VTAM is acknowledged by IBM to be the principal access method for telecommunications support under DOS/VS and OS/VS. BTAM and QTAM will not be extended, and enhancements for TCAM will be in the environment provided by VTAM under OS/VS. The chief feature of VTAM is dynamic sharing of network resources. Application programs working through VTAM have access to any terminal, line, or 3705 controller in the network; for example, different application programs can initiate transmission and reception with terminals located on the same multipoint communications lines. By the same token, multiple application programs can have access to the same data base. One component of VTAM is TOLTEP, an on-line testing program for exercising and testing the complete network.

The EP or Emulation Program makes the 3705 look like one or more 2701, 2702, and/or 2703 controllers to the host processor. It offers no operational benefits over the earlier controllers, except for migration. User programs now written for the 270X series will work with a 3705 under EP with some restrictions. Some of the 270X features not supported include transmission with older, 4-or-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission at 230,400 bps, second channel interface, and programmable two-processor switch.

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However, many of the more common RPQ's are supported. In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) is available. ACF/NCP Version 2 for the 3705 can still be obtained after ACF/NCP Version 2 for the 3725 is available. ACF/NCP Version 1 Release 3 and Release 2.1 can also be ordered for the 3705. The capabilities are significant for multi-system users, Multiple System/370s can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705s. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705s to a down-stream CPU with minimal involvement of the host or intermediate CPUs. ACF allows for logical groupings of transmission links between adjacent network nodes. It provides multiple routes for SNA or non-SNA message transmission between network nodes along with error notification facilities. It allows session selection of three priority levels. To utilize ACF/NCP/VS, Advanced Communication Function for VTAM and TCAM is necessary.

Another ACF feature is the capability for up to four CPUs to share a single 3705–II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must all be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports the Remote Program Loader–II (RPL–II). RPL–II can be attached to a 3705–II along with up to three channel adapters. With this attachment, a controller normally operates as a local controller. This enables the rerouting of a deactivated or a failed host computer's traffic to another CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705–II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPUs for applications processing.

X.25 NCP PACKET SWITCHING INTERFACE PROGRAM: Provides users of ACF/NCP/VS the facility to use 3705–II or 3705–80 Communications Controllers to access public data networks complying with CCITT X.25 standards. The package is Telenet-certified. This program supports packet sequence numbering of up to 128, with packet length section of up to 4096 characters. It supports SNA network node interconnection and protocol conversion for non–SNA equipment. Within the program is a subset of X.29 allowing communications with asynchronous X.28 devices (TTY). It also supports the X.21 line sets.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, NCP/VS can be loaded into the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voice-band line operating synchronously at up to 9600 bps or a half-duplex wide-band facility operating at up to 50,000 bps. All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3705 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Aid Circulation 1 and 2 (for the first and second block and core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications lines; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader–II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not necessary and therefore the options are not provided for the RPL–II.

NETWORK TERMINAL OPTION (NTO): is a software product which is loaded in the 3705 and extends the SNA environment to include support for several common asynchronous terminals. These include the IBM 2740 and 2741 terminals on either switched or leased lines, and Teletype models 33/35 on switched lines only.

TELEPROCESSING NETWORK SIMULATOR (TPNS): is a software package that enables the user to test and evaluate application and communications control programs prior to actual network activation. The latest release (as of this publication) is TPNS Release 5, which supports the testing of all the features detailed in the following newly scheduled releases.

NETWORK COMMUNICATIONS CONTROL FACILITY (NCCF): is a program product which runs under the

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SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

NETWORK PROBLEM DETERMINATION APPLICATION (NPDA): is a program product which supports the collection and on-line retrieval of network error and status information. NPDA assigns probable causes to all specific errors, and runs with NCCF under either VTAM or TCAM.

NETWORK ROUTING FACILITY: is a program product that allows the 3705 to route terminal-to-terminal messages without the use of a host processor. Once sessions are established by the host's ACF/VTAM system, the Network Routing Facility maintains the sessions and continues routing functions, even in the event of the failure of the host's ACF/VTAM. Supported devices include the 3650 Programmable Store System, the Series/1, and the 3780 Data Communications Terminal. The Network Routing Facility operates under hosts running under OS/VS2 (MVS3.8) and ACF/VTAM Version 2; routing to 3780 terminals also requires NTO Release 2 in the 3705.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705–II and up to 45 percent on the 3705–80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-80 Communications Controller				
Model M81 (256K bytes, 4 lines)	$1,610	$1,370	$36,600	$219
Model M82 (256K bytes, 10 lines)	2,115	1,800	46,600	229
Model M83 (256K bytes, 16 lines)	2,491	2,120	52,600	239
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	1,757	1,495	38,230	147
Model E2 (64K bytes, 64 lines)	1,921	1,635	39,800	165
Model E3 (96K bytes, 64 lines)	2,086	1,775	41,370	183
Model E4 (128K bytes, 64 lines)	2,250	1,915	42,940	201
Model E5 (160K bytes, 64 lines)	2,415	2,055	44,510	219
Model E6 (192K bytes, 64 lines)	2,579	2,195	46,080	237
Model E7 (224K bytes, 64 lines)	2,744	2,335	47,650	254
Model E8 (256K bytes, 64 lines)	2,908	2,475	49,220	273
Model F1 (32K bytes, 160 lines)	2,356	2,005	51,530	160
Model F2 (64K bytes, 160 lines)	2,520	2,145	53,100	177
Model F3 (96K bytes, 160 lines)	2,685	2,285	54,670	196
Model F4 (128K bytes, 160 lines)	2,854	2,430	56,240	213
Model F5 (160K bytes, 160 lines)	3,019	2,570	57,810	231
Model F6 (192K bytes, 160 lines)	3,183	2,710	59,380	249
Model F7 (224K bytes, 160 lines)	3,348	2,850	60,950	267
Model F8 (256K bytes, 160 lines)	3,512	2,990	62,520	285
Model G1 (32K bytes, 256 lines)	2,961	2,520	64,830	172

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller				
	Model G2 (64K bytes, 256 lines)	3,126	2,660	66,400	190
	Model G3 (96K bytes, 256 lines)	3,290	2,800	67,970	207
	Model G4 (128K bytes, 256 lines)	3,454	2,440	69,540	226
	Model G5 (160K bytes, 256 lines)	3,619	3,080	71,110	243
	Model G6 (192K bytes, 256 lines)	3,784	3,220	72,680	262
	Model G7 (224K bytes, 256 lines)	3,948	3,360	74,250	279
	Model G8 (256K bytes, 256 lines)	4,113	3,500	75,820	298
	Model H1 (32K bytes, 352 lines)	3,560	3,030	78,130	184
	Model H2 (64K bytes, 352 lines)	3,731	3,175	79,700	202
	Model H3 (96K bytes, 352 lines)	3,895	3,315	81,270	220
	Model H4 (128K bytes, 352 lines)	4,060	3,455	82,840	238
	Model H5 (160K bytes, 352 lines)	4,224	3,595	84,410	256
	Model H6 (192K bytes, 352 lines)	4,389	3,735	85,980	274
	Model H7 (224K bytes, 256 lines)	4,553	3,875	87,550	292
	Model H8 (256K bytes, 352 lines)	4,718	4,015	89,120	310
	Model J1 (320K bytes)	4,724	4,020	71,020	314
	Model J2 (384K bytes)	5,053	4,300	74,160	350
	Model J3 (448K bytes)	5,382	4,580	77,300	386
	Model J4 (512K bytes)	5,716	4,865	80,440	422
	Model K1 (320K bytes)	5,329	4,535	84,320	326
	Model K2 (384K bytes)	5,658	4,815	87,460	362
	Model K3 (448K bytes)	5,987	5,095	90,600	398
	Model K4 (512K bytes)	6,316	5,375	93,740	434
	Model L1 (320K bytes)	5,928	5,045	97,620	339
	Model L2 (384K bytes)	6,257	5,325	100,760	375
	Model L3 (448K bytes)	6,592	5,610	103,900	411
	Model L4 (512K bytes)	6,921	5,890	107,040	447
#8510	Unit Protection	**35	—	**35	NC
	Attachment Bases (for 3705-II only)				
#1301	Type 1	25	21	641	0.50
#1302	Type 2	25	21	641	0.50
	Channel Adapters				
#1541	Type 1	156	133	2,700	9.00
#1542	Type 2 (3705-II only)	292	249	6,470	9.00
#1543	Type 3 (3705-II only)	595	506	12,910	11.00
#1544	Type 4	251	214	4,410	8.00
#1551	Type 1; for 3705-80 only	182	155	3,340	9.50
#8002	Two Channel Switch	92	78	2,090	2.50
	Communications Scanners for 3705-II				
#1642	Type 2	281	239	4,750	9.00
#1643	Type 3	1,006	856	17,210	31.00
#1644	Type 3 High Speed	1,351	1,150	25,120	37.00
#4650	Business Machine Clock for 3705-II	15	13	424	1.00
#4651	Business Machine Clock for 3705-II	36	31	880	1.50
	Communication Line Attachment Features for 3705-II				
#4701	Line Interface Base Type 1:	62	53	1,105	3.00
#4714	Line Set Type 1D	52	44	1,030	3.00
#4715	Line Set Type 1E	45	38	1,030	2.50
#4717	Line Set Type 1G	118	101	2,050	6.00
#4719	Line Set Type 1J	62	53	1,455	2.50
#5655	Line Set Type 1N	76	65	2,040	3.00
#5656	Line Set Type 1R	63	54	1,700	3.00

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SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

NETWORK PROBLEM DETERMINATION APPLICATION (NPDA): is a program product which supports the collection and on-line retrieval of network error and status information. NPDA assigns probable causes to all specific errors, and runs with NCCF under either VTAM or TCAM.

NETWORK ROUTING FACILITY: is a program product that allows the 3705 to route terminal-to-terminal messages without the use of a host processor. Once sessions are established by the host's ACF/VTAM system, the Network Routing Facility maintains the sessions and continues routing functions, even in the event of the failure of the host's ACF/VTAM. Supported devices include the 3650 Programmable Store System, the Series/1, and the 3780 Data Communications Terminal. The Network Routing Facility operates under hosts running under OS/VS2 (MVS3.8) and ACF/VTAM Version 2; routing to 3780 terminals also requires NTO Release 2 in the 3705.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705-II and up to 45 percent on the 3705-80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-80 Communications Controller				
Model M81 (256K bytes, 4 lines)	$1,610	$1,370	$36,600	$203
Model M82 (256K bytes, 10 lines)	2,115	1,800	46,600	212
Model M83 (256K bytes, 16 lines)	2,491	2,120	52,600	221
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	1,627	1,385	38,230	159
Model E2 (64K bytes, 64 lines)	1,779	1,515	39,800	179
Model E3 (96K bytes, 64 lines)	1,931	1,645	41,370	198
Model E4 (128K bytes, 64 lines)	2,083	1,775	42,940	218
Model E5 (160K bytes, 64 lines)	2,235	1,905	44,510	237
Model E6 (192K bytes, 64 lines)	2,387	2,035	46,080	257
Model E7 (224K bytes, 64 lines)	2,539	2,165	47,650	276
Model E8 (256K bytes, 64 lines)	2,691	2,295	49,220	296
Model F1 (32K bytes, 160 lines)	2,185	1,860	51,530	173
Model F2 (64K bytes, 160 lines)	2,337	1,990	53,100	192
Model F3 (96K bytes, 160 lines)	2,489	2,120	54,670	212
Model F4 (128K bytes, 160 lines)	2,641	2,250	56,240	231
Model F5 (160K bytes, 160 lines)	2,793	2,380	57,810	251
Model F6 (192K bytes, 160 lines)	2,945	2,510	59,380	270
Model F7 (224K bytes, 160 lines)	3,097	2,640	60,950	290
Model F8 (256K bytes, 160 lines)	3,249	2,770	62,520	309
Model G1 (32K bytes, 256 lines)	2,743	2,335	64,830	186
Model G2 (64K bytes, 256 lines)	2,895	2,465	66,400	206
Model G3 (96K bytes, 256 lines)	3,047	2,595	67,970	225
Model G4 (128K bytes, 256 lines)	3,187	2,725	69,540	245
Model G5 (160K bytes, 256 lines)	3,351	2,855	71,110	264

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		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller				
	Model G6 (192K bytes, 256 lines)	$3,503	$2,985	$72,680	$284
	Model G7 (224K bytes, 256 lines)	3,655	3,115	74,250	303
	Model G8 (256K bytes, 256 lines)	3,807	3,245	75,820	323
	Model H1 (32K bytes, 352 lines)	3,301	2,810	78,130	200
	Model H2 (64K bytes, 352 lines)	3,453	2,940	79,700	219
	Model H3 (96K bytes, 352 lines)	3,605	3,070	81,270	239
	Model H4 (128K bytes, 352 lines)	3,757	3,200	82,840	258
	Model H5 (160K bytes, 352 lines)	3,909	3,330	84,410	278
	Model H6 (192K bytes, 352 lines)	4,061	3,460	85,980	297
	Model H7 (224K bytes, 256 lines)	4,213	3,590	87,550	317
	Model H8 (256K bytes, 352 lines)	4,365	3,720	89,120	336
	Model J1 (320K bytes)	4,377	3,725	71,020	341
	Model J2 (384K bytes)	4,683	3,985	74,160	380
	Model J3 (448K bytes)	4,989	4,245	77,300	419
	Model J4 (512K bytes)	5,295	4,505	80,440	458
	Model K1 (320K bytes)	4,935	4,200	84,320	354
	Model K2 (384K bytes)	5,241	4,460	87,460	393
	Model K3 (448K bytes)	5,547	4,720	90,600	432
	Model K4 (512K bytes)	5,853	4,980	93,740	471
	Model L1 (320K bytes)	5,493	4,675	97,620	368
	Model L2 (384K bytes)	5,799	4,935	100,760	407
	Model L3 (448K bytes)	6,105	5,195	103,900	446
	Model L4 (512K bytes)	6,411	5,455	107,040	485
#8510	Unit Protection	**35	—	**35	NC
	Attachment Bases (for 3705-II only)				
#1301	Type 1	22	19	641	0.50
#1302	Type 2	22	19	641	0.50
	Channel Adapters				
#1541	Type 1	146	124	2,700	10.00
#1542	Type 2 (3705-II only)	271	231	6,470	10.00
#1543	Type 3 (3705-II only)	551	469	12,910	12.00
#1544	Type 4	234	199	4,410	8.50
#1551	Type 1; for 3705-80 only	169	144	3,340	10.50
#8002	Two Channel Switch	85	72	2,090	2.50
	Communications Scanners for 3705-II				
#1642	Type 2	261	222	4,750	10.00
#1643	Type 3	932	793	17,210	33.50
#1644	Type 3 High Speed	1,251	1,065	25,120	40.00
#4650	Business Machine Clock for 3705-II	14	12	424	1.00
#4651	Business Machine Clock for 3705-II	34	29	880	1.50
	Communication Line Attachment Features for 3705-II				
#4701	Line Interface Base Type 1:	58	49	1,105	3.00
#4714	Line Set Type 1D	52	44	1,030	3.00
#4715	Line Set Type 1E	41	35	1,030	2.50
#4717	Line Set Type 1G	110	94	2,050	6.50
#4719	Line Set Type 1J	58	49	1,455	2.50
#5655	Line Set Type 1N	71	60	2,040	3.00
#5656	Line Set Type 1R	59	50	1,700	3.00
#4720	Line Set Type 1S	121	103	3,020	6.50
#4722	Line Set Type 1GA	110	94	2,695	6.50
#4723	Line Set Type 1TA	200	170	4,850	10.00
#4725	Line Set Type 1T	200	170	4,850	10.00
#4726	Line Set Type 1U	223	190	5,440	11.00
#4727	Line Set Type 1W	184	157	4,720	6.50
#4728	Line Set Type 1Z	342	291	8,640	11.00
#4702	Line Interface Base Type 2	58	49	1,455	2.50
#4721	Line Set Type 2A	41	35	1,030	4.00
#4703	Line Interface Base Type 3	102	87	2,515	2.50
#4731	Line Set Type 3A	33	28	850	1.50
#4732	Line Set Type 3B	33	28	850	1.50
#4708	Line Interface Base Type 8	58	49	1,455	4.00
#4781	Line Set Type 8A	59	50	1,490	5.00
#4782	Line Set Type 8B	78	66	1,920	6.50
#4709	Line Interface Base Type 9	58	49	1,455	2.50

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		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features for 3705-II (Continued)				
#4720	Line Set Type 1S	130	111	3,020	6.50
#4722	Line Set Type 1GA	118	101	2,695	6.00
#4723	Line Set Type 1TA	215	183	4,850	9.00
#4725	Line Set Type 1T	215	183	4,850	9.00
#4726	Line Set Type 1U	241	205	5,440	10.00
#4727	Line Set Type 1W	198	169	4,720	6.00
#4728	Line Set Type 1Z	369	314	8,640	10.00
#4702	Line Interface Base Type 2	62	53	1,455	2.50
#4721	Line Set Type 2A	45	38	1,030	3.50
#4703	Line Interface Base Type 3	110	94	2,515	2.50
#4731	Line Set Type 3A	35	30	850	1.50
#4732	Line Set Type 3B	35	30	850	1.50
#4708	Line Interface Base Type 8	62	53	1,455	3.50
#4781	Line Set Type 8A	63	54	1,490	4.50
#4782	Line Set Type 8B	83	71	1,920	6.00
#4709	Line Interface Base Type 9	62	53	1,455	2.50
#4791	Line Set Type 9A	92	78	1,785	10.00
#5000	Line Interface Base Type 10	69	59	1,685	2.50
#4784	Line Set Type 10A	118	101	2,685	5.50
	Communications Line Sets for 3705-80				
#6712	Line Set Type 2	241	205	5,440	10.00
#6713	Line Set Type 3	215	183	4,850	9.00
#6714	Line Set Type 4	88	75	2,060	4.00
#6715	Line Set Type 5	436	371	10,320	13.50
#5657	Line Set Type 8	108	92	2,600	3.50
#5658	Line Set Type 9	63	54	1,550	3.00
#14XX	Business Machine Clock	14	12	424	1.00
	Remote Concentrator Features				
#6250	Remote Power Off	15	13	416	0.50
#6261	Remote Program Loader-II	430	366	9,335	24.50

*Includes monthly maintenance.
**Single-use charge, one-time

	Software*	Monthly Basic License	Monthly DSLO License	Monthly Licensed Program Support	Monthly Multiple Licensed Program Support
5744-BA2	Network Control Program	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	$194	$145	$32	$ 51
5735-XX3	SSP for ACF/NCP/VS Version 2	59	44	17	27
	Host Access Methods				
5735-RC1	ACF/TCAM Version 1	329	246	12	19
	With Multisystem Networking Facility	1,220	915	31	50
5735-RC3	ACF/TCAM Version 2, Release 1, 2, and 3	723	542	83	132
	With Multisystem Networking Facility	1,215	910	103	165
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	157	117	50	80
	With Multisystem Networking Facility	298	223	149	237
5735-RC2	ACF/VTAM Version 1, Release 2, and Release 3	378	282	50	80
	With Multisystem Networking Facility	909	681	149	237
	Encrypt/Decrypt Feature	223	166	7	11
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	153	114	71	113

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	Software* (Continued)	Monthly Basic License	Monthly DSLO License	Monthly Licensed Program Support	Monthly Multiple Licensed Program Support
	Other Host Networking Software				
5735-XX7	Network Terminal Option Release 1 and 2	171	127	11	18
5735-XX8	Network Problem Determination Application (NPDA) Release 1 and 2	69	51	23	37
5735-XX6	Network Communications Control Facility (NCCF)	129	97	44	70
5740-XT4	Teleprocessing Network Simulator (TPNS) Release 5	1,675	NA	NA	NA
5668-963	Network Routing Facility	972	729	226	362
5668-981	X.25 Packet Switching Interface	223	166	36	58

NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP).
NA—not applicable.
*Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.■

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features for 3705-II				
#4791	Line Set Type 9A	85	72	1,785	10.00
#5000	Line Interface Base Type 10	65	55	1,685	2.50
#4784	Line Set Type 10A	110	94	2,685	6.00
	Communications Line Sets for 3705-80				
#6712	Line Set Type 2	223	190	5,440	11.00
#6713	Line Set Type 3	200	170	4,850	10.00
#6714	Line Set Type 4	81	69	2,060	4.50
#6715	Line Set Type 5	404	344	10,320	14.50
#5657	Line Set Type 8	100	85	2,600	4.00
#5658	Line Set Type 9	59	50	1,550	3.00
#14XX	Business Machine Clock	14	12	424	1.00
	Remote Concentrator Features				
#6250	Remote Power Off	14	12	416	0.50
#6261	Remote Program Loader-II	398	339	9,335	26.50

*Includes monthly maintenance.
**Single-use Charge, one-time.

Software

			Monthly Charge (New Plan)**			
		Monthly Charge (Old Plan)*	Basic License	DSLO License	Licensed Program Support	Multiple Licensed Program Support
5744-BA2	Network Control Program	NC	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	NA	$200	$150	$ 55	$ 33
5735-XX3	SSP for ACF/NCP/VS Version 2	NA	70	53	20	12
	Host Access Methods					
5735-RC1	ACF/TCAM Version 1	NA	329	246	12	19
	With Multisystem Networking Facility	NA	1,220	915	31	50
5735-RC3	ACF/TCAM Version 2, Release 1, 2, and 3		670	502	77	123
	With Multisystem Networking Facility		1,123	843	96	153
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	NA	146	109	46	74
	With Multisystem Networking Facility	NA	276	207	138	220
5735-RC2	ACF/VTAM Version 1, Release 2, and Release 3	NA	350	262	46	74
	With Multisystem Networking Facility	NA	842	631	138	220
	Encrypt/Decrypt Feature	NA	207	154	6	10
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	NA	142	106	66	105
	Other Host Networking Software					
5735-XX7	Network Terminal Option Release 1 and 2	NA	159	118	10	16
5735-XX8	Network Problem Determination Application (NPDA) Release 1 and 2	NA	64	48	21	34
5735-XX6	Network Communications Control Facility (NCCF)	NA	120	90	41	66
5740-XT4	Teleprocessing Network Simulator (TPNS) Release 5	$1,555	NA	NA	NA	NA
5668-963	Network Routing Facility	NA	900	675	210	336
5668-981	X.25 Packet Switching Interface	NA	207	154	33	53

NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP).
NA—not applicable.
*Includes onsite field engineering support.
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.■

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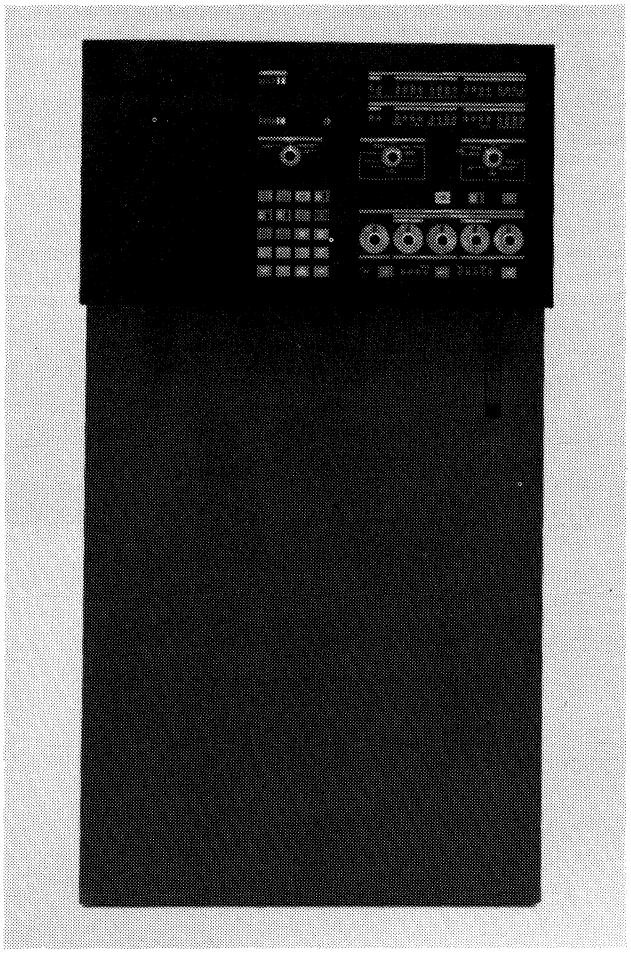
IBM 3705 Communications Controller



A series of programmable communications processors primarily used as front-ends to IBM or compatible mainframes. The 3705 minimizes host interrupts while optimizing I/O channel transfers by employing an 80 byte block level transfer technique. It does not, however, support file level transfers or disk access methods.

The series consists of the entry level 3705-80, which allows for 256K bytes of memory and up to 16 communications lines, and the 3705-II, which supplies up to 512K bytes of memory and support for as many as 352 communications lines. In addition to its extended memory and line support capabilities, the 3705-II can accommodate asynchronous or synchronous, half- or full-duplex transmissions with synchronous speeds of up to 230.4K bps.

Numerous software options permit a user to implement a 3705 into different modes and configurations with varying degrees of network control. Software support may be 270X hard-wired control emulation to gradual migration of complete network control.

A 3705-II model G8 with 256K bytes of memory and the ability to support 256 communications lines may be purchased for $75,820. The maintenance charge on this mid-range system is $323 per month.

MANAGEMENT SUMMARY

The 3705 communications controller family has been an IBM staple for the past decade. Originally introduced in 1972, approximately one of every two front-end processors installed in North America is a 3705 family processor. Whether IBM can maintain this lofty position is subject to conjecture. In the last five years, substantial gains have been made by some of IBM's competitors, such as Amdahl and Comten. IBM is taking strides to be more responsive to meeting customer requirements, while simultaneously staving off competitors.

In March of 1981, IBM announced a new line of processors called the 3705-80. The 80 series is intended to be a low cost introduction to communications processing. Supporting a maximum of 16 communications lines, the 80 series is designed for smaller networks or remote facilites of large networks.

Domestic customer clamoring forced the introduction of the X.25 NCP Packet Switching Interface in July of 1981. Although an RPQ (request for price quote) product, it nonetheless provides a Level Three CCITT X.25 gateway

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Information Systems Group, National Accounts Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

DATE OF ANNOUNCEMENT: 3705-II—November 1975, Models E1-H8; November 1978, Models J1-L4; 3705-80—March 1981.

DATE OF FIRST DELIVERY: 3705-II—August 1976, Models E1-H8; June 1979, Models J1-L4; 3705-80—August 1981.

NUMBER DELIVERED TO DATE: Over 50,000 (estimated for all models).

SERVICED BY: International Business Machines Corporation.

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IBM 3705 Communications Controller

for 3705 users. In March of 1982, GTE Telenet became the first U.S. carrier to certify its use.

Aside from the unveiling of the aforementioned, the 3705 remains practically unaltered since the debut of the 3705-II in late 1975. The 3705-II is packaged in various configurations for user selection. The low end 3705-II E1 offers 32K bytes of memory and supports 64 communications lines. The top of the line 3705-II provides up to 512K bytes of monolithic (high-speed) memory and supports as many as 352 communications lines.

Basically, the 3705 acts as a front end to IBM family host processors. It requires at least one channel attachment, one line scanner, and appropriate line adapters and interfaces.

The user has a choice of several software options, each of which provide significantly different capabilities. For migration from the ancient 270X hard-wired controller, a user may load the 3705 with the Emulation Program (EP). The main advantage to EP is that no changes need to be made to the user's existing network (terminals, lines, etc.) as the 3705 merely emulates the operation of the 270X controller. However, with EP there is no real off-loading of communications processing from the host, which is generally the incentive for implementing a programmable front end in the first place.

The migrating user would then logically move to the Partitioned Emulation Programming (PEP), which permits the 3705 to operate *both* in 270X emulation mode, and in its own native network control mode. This permits the user to gradually convert his terminals and line control equipment to operate in network control mode. PEP is an extension of the Network Control Program (NCP) which would ultimately be running alone in the 3705. Running NCP, the 3705 makes full use of its inherent capabilities, which includes significant off-loading of communications processing from the host.

A series of software enhancements, grouped under the name Advanced Communications Function (ACF), permits the linking of two or more host computers via their respective front-end (local) 3705 controllers to form a Multi-System Networking Facility. The host computers are interrupted only initially by transmissions flowing through their local 3705s that are destined for another host. The enhancements also permit up to four computers at the same location to share a common 3705. The host computers in either case can use any mix of VS operating systems and can use either VTAM or TCAM access methods.

The Multisystem Networking Facility is an optional licensed program feature of ACF that permits dynamic allocation of CPU work loads and network routing based on the nature and volume of the transmissions and the hardware resources operative at the time.

CONFIGURATION

The 3705-80 can accommodate up to 16 communications lines: the 3705-M81 can support 4 lines; the M82 can support ten lines; and the M83 can support up to 16 lines. All 3705-80 controllers have 256K bytes of memory.

The 3705-II can accommodate up to 352 communications lines. The 3705-II (Models E1-H8) have a cycle time of 1,000 nanoseconds and contains 32K to 256K bytes of semiconductor (MOSFET) memory in 32K-byte increments over 32 models. Models J1-L4 have a memory cycle time of 900 nanoseconds and feature memory ranging from 320K bytes to 512K bytes in 64K-byte increments. For models E1 to H8, the letter (E, F, G, H) refers to the number of physical modules (1 through 4) that compose the 3705 system and determine the number of communications lines that can be accommodated. The J models consist of two modules: the K models three; and the L models four.

3705-II

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	J1, K1, L1	320K
E2, F2, G2, H2	64K	J2, K2, L2	384K
E3, F3, G3, H3	96K	J3, K3, L3	448K
E4, F4, G4, H4	128K	J4, K4, L4	512K
E5, F5, G5, H5	160K		
E6, F6, G6, H6	192K		
E7, F7, G7, H7	224K		
E8, F8, G8, H8	256K		

The 3705-80 Communications Controller is composed of a central control unit, main memory, and space for mounting interfaces between the central control unit and the host computer. The 3705-80 may attach via Channel Adapter Type 1 or up to two Channel Adapters Type 4. It may only use a specially modified version of a Type 2 Scanner.

The 3705-II Communications Controller is composed of:

- **The basic 3705-II model (E1 through L4) which includes the central control unit, main memory, and space for mounting the interfaces between the central control unit and the communications lines and between the central control unit and the host computer.**
- **Channel Adapter (1 to 4) and/or Remote Program Loader, which provides the data path betwene the 3705 and the host computer. The Type 1 Channel Adapter cannot be used with the newer models J1 to L4.**
- **Attachment Bases (1 or 2), which provide the physical and logical interface between the Channel Adapter (Type 1 only) and the Central Control Unit and between the CCU and the Communications Scanners.**
- **Scanners (1 to 4), which connect the Interface Bases (and associated line sets) with the 3705-II central control unit.**
- **Line Interface Bases, which provide certain control functions for particular types of lines and transmission techniques.**
- **Line Sets, which provide the interfaces with data sets or directly with the communications lines.**

The configuration diagram at the end of this report illustrates the relationships among these components.

Physically, the 3705-II is configured in one to four cabinets of modules. The Base Module includes the central control

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IBM 3705 Communications Controller

The ACF software also supports a hardware enhancement known as the Remote Program Loader-II (RPL-II). In the event of a host computer failure, a local controller can be linked, as a remote controller, to another 3705, provided an RPL-II and an appropriate line are installed. RPL-II can be included with channel adapters in a 3705-II, permitting the controller to be used as a remote or a local controller.

Salient characteristics of the 3705-II are:

- Transmission rates of up to 230.4K bps. Supports, within restrictions, leased, switched, synchronous/asynchronous, and full-/half-duplex lines. The maximum number of lines depends on line mix. A physical maximum of 352 lines can be attained only by half-duplex lines operating at 9600 bps or slower.
- Supports external and internal modems, local attachment of terminals, and automatic dialing.
- Semiconductor memory storage with capacity from 32K to 512K byte; in 32K- or 64K-byte increments.
- Channel adapters that will allow attachment of up to four CPU channels or attachment of a Remote Program Loader-II along with up to three adapters.

The 3705 Communications Controller is a prerequisite to networking under IBM's Systems Network Architecture (SNA). SNA requires the 3705 to run in its native NCP mode, although there are several different versions of NCP which support varying degrees of network sophistication. A 3705 running PEP may be supporting an SNA network, but only for those lines and devices which are connected under the NCP portion.

SNA also requires certain operating software in the host which works with the front end and NCP in control of the network. Virtually all of the current IBM 370, 303X, 308X, or 4300 operating systems may support SNA networking, but each requires an appropriate version of either the TCAM or VTAM telecommunications access methods. Whether or not the 3705 is controlling an SNA network, the software load for the front end (or remote 3705) is defined and generated on the host with the use of the System Support Programming (SSP), and the 3705 is then loaded over the channel (or downline, if remote).

For more information on SNA, see Report C11-491-101 behind the Networks and Architectures tab of this volume.

SNA is seen by IBM watchers to be the reason many users will continue to stay with IBM for communications processors. This tightly meshed networking discipline may cause difficulty for other vendors to integrate their equipment into an SNA environment. If IBM alters its SNA structure, the feeling is that third party vendors may not be able to react quickly enough to these changes. Many third party vendors will present SNA alternatives in order to market their products.

unit and from 32K to 256K bytes of semiconductor memory. The Base Module also accommodates one or two Channel Adapters, one or two Attachment Bases, one Scanner, and its associated Line Interface Bases and Line Sets. Models J1, K1 and L1 include a second module which contains a 64K-byte memory increment.

An Expansion Module (referred to as the 3706) is required to add each additional Scanner and its associated Line Interface Bases and Line Sets. Up to three 3706 Expansion Modules can be included in a 3705-II system. For the 3705-II, the base module can be equipped with two Channel Adapters, or one Remote Program Loader and one Channel Adapter; the first 3706 can be equipped with two additional channel adapters. No Channel Adapters are allowed in the second or third Expansion Module (3706) of either version. All memory over 256K bytes resides in the expansion modules of the 3705-II. When the 3705-II functions as a remote concentrator, the Remote Program Loader is used in place of a Channel Adapter in the base module. Local 3705-II's can attach a Remote Program Loader-II along with Channel Adapters. With line Set 4714 as line linkage, the Controller can operate as a remote to another controller that is locally attached to another host. In effect, a back-up procedure for computer failure in a multi-computer system, the Remote Program Loader-II requires ACF software.

In general, the Base Module can contain up to four Line Interface Bases and each Line Interface Base can accommodate up to eight line Sets. Each Line Set can accommodate up to two communications lines. For some types of lines, these maximums cannot be attained, as shown in the accompanying tables. Each Expansion Module can contain up to six Line Interface Bases.

Channel Adapters are available in four types, Communication Scanners in three. The restrictions that apply to the Channel Adapters and Scanners affect configuration possibilities and performance in addition to the limitations imposed by the different models. The selection of Channel Adapters and Scanners is determined by the desired level of performance, the number of lines to be implemented, and the mode of operation (i.e., Emulation Mode or Network Control Mode).

The Communications Scanners link the communications lines via their respective Line Interface Bases and Line Sets, with the Central Control Unit (CCU). The Scanner transfers data between the lines and the CCU memory on an interrupt basis and performs character assembly and disassembly functions. The Scanners differ only in performance. Medium and high operating performance is provided by Type 2 and Type 3 Scanners, respectively. The control program is interrupted on a byte-by-byte basis for Type 2, and on a block basis for Type 3. A modified version of Type 2 is used with 3705-80 controllers. Line control, control character recognition, code translation, and user recovery functions are performed by the control program.

The Type 3 Scanner performs data transfer functions on a cycle-steal basis, halting the control program for a complete machine cycle. The control program resumes operation at the conclusion of the data transfer unless another cycle-steal request is pending. An interrupt can occur on buffer boundaries (up to 254 characters), by unique control character, or by specific error conditions. Type 3 supports only LIB Types 1, 8, 9 and 10. Type 3 also provides control character recognition for BSC and SDLC line controls, and performs ASCII to EBCDIC (and the converse) code translation when operating under BSC line control. There is additionally a new, high-speed version of the Type 3 Communications Scanner which, when delivered, will support line speeds up to 230.4K bps. Only two half-duplex or one full-duplex line operating at this speed can be attached to this scanner, however, Also, only one of these

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These same analysts also predict that IBM, undaunted by success, will introduce a new communications controller by the end of the 1982. It should provide more main memory and perhaps greater networking attributes as IBM strives to hold their industry domination in the 1980s.

USER REACTION

In response to our Network Survey conducted in November and December of 1981, we received 199 replies from IBM 3705 users, representing their experience with 577 installed units.

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	93	99	6	1	3.4
Ease of installation	39	118	31	3	3.0
Throughput	43	132	22	2	3.1
Hardware reliability	122	70	7	0	3.6
Promptness of manufacturer's maintenance	92	95	12	0	3.4
Quality of manufacturer's maintenance	84	99	15	0	3.4
Manufacturer's software	36	119	37	6	2.9
Manufacturer's technical support	45	108	41	4	3.0

*Weighted Average based on a scale of 4.0 for Excellent.

The consensus shows that most users were very pleased with the reliability of the hardware. Overall, the survey seems to uphold IBM's standard of excellence as it reflected no major flaws in the 3705.

In April of 1982, we randomly contacted three of these users by telephone. One user cited it as a "good, solid box" and mentioned he has had two 3705-II units and could recall only "one failure in four years." This same users, however, warned potential buyers of the importance of maintaining adequate in-house software support and was critical of the "large, cumbersome cables" presented by his 3705s.

The second user represented a state agency. He had his 3705-II installed for almost seven years. He conceded it performed as advertised, but now feels the unit may be "running out of gas" and "has difficulty beyond 4800 bps." he ended the discussion by stating, "It's a good box if you're using under 200 lines."

The third user interviewed had his 3705-M82 for six months. He called it the "right box for the right price" and chose IBM because it fit his company's future SNA plans. He had not experienced any problems whatsoever and stated he would purchase his 3705-M82 again if faced with that buying decision.□

Channel Adapters are divided into two groups: those designed for the Emulation Mode of operation but also usable in the Network Control Model (Types 1 and 4), and those designed for the Network Control Mode of operation only (Types 2 and 3). The Channel Adapter Type 1 is a low-performance adapter and is used in the Base Module of a 3705-80, but could be used in a 3705-II. Type 4 provides higher performance and can be used in a Base and Expansion Module of a 3705-II or 3705-80. Channel Adapter Types 2 and 3 provide a higher level of performance and can be used in both a Base and Expansion Module, but Type 3 is designed to support both processors of a "tightly coupled" multiprocessor system.

The various configuration restrictions add up to four basic configuration groups:

- **A 3705-80 Base Module with a Channel Adapter Type 1 or 4 and a Scanner Type 2.**
- **A 3705-II Base Module with a Channel Adapter Type 1 and a Scanner Type 2 or 3. This configuration can be fully expanded with an additional Scanner Type 2 in each Expansion Module containing Line Interface Bases. A Channel Adapter Type 2 or 3 can be added to the first Expansion Module. An Attachment Base Type 2 is required for the first Scanner Type 2 or 3, and an Attachment Base Type 1 is required for the Channel Adapter Type 1. Alternatively, the Remote Program Loader can be used in place of a Channel Adapter. This configuration can also be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing. When emulating a 270X controller, the number of communications lines is restricted to the number of available multiplexer subchannels (255 maximum). Note that the Channel Adapter Type 1 may not be used with Models J, K or L.**
- **A 3705-II Base Module with a Channel Adapter Type 2, 3, or 4 and a Scanner Type 2 or 3. This configuration can also be expanded fully with Expansion Modules, additional Type 2 or 3 Scanners, and additional Channel Adapters. An Attachment Base Type 2 is required to interface the first Type 2 or 3 Scanner. This configuration supports only front-end processing. Any combination of two Channel Adapters Type 2, 3, and 4 can be used, except that a Type 4 must be used in the Base Module when combined with a Type 2 or 3. Channel Adapters Type 2, 3, and 4 include the Attachment Base function, which precludes the use of a separate Attachment Base. The Type 2 and 3 Scanners can be combined in any arrangement, except that they cannot be used in emulating the 270X controllers or for attachment to an IBM System/360.**

Timing and interpretation of data signals on the communications lines can be provided by the modems or by a series of Business Machine Clocks. Clocks ranging from 45 to 2400 bits per second are available and are required for all asynchronous lines. Up to four can be installed with each Scanner, but at least one is required, per scanner, regardless of line types used. Clocks are program-assigned and can be shared among several lines.

The 3705-80, as previously mentioned, employs only one scanner, a modified Type 2. It may be used with Line Interface Base Type 2, 3, 4, 5, or 8. See Table 1 for a description of 3705-II scanner options.

Complete configuration of a 3705-II system revolves around determination of the number of Line Interface Bases required. This sets the minimum model that will suffice. Larger models can be implemented to provide additional memory. The accompanying tables and diagram fully set forth the rules for determining the number and types of Line

high-speed scanners can be configured per frame (module). The Business Machine Clock #4650 is prerequisite, and no other clock is allowed. Only line sets 1GA or 1TA may be used with the high-speed scanner.

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**TABLE 1:
LIB CAPACITY PER SELECTED
SCANNER OPTION FOR THE 3705-II**

Line Interface Base Type	Scanner Type	Maximum Number of LIB's per 3705-II	
		Base Module	Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2, 3, 6, 7, or 12	2	4	6
	3	—	—
	3 HS	—	—
5 or 11	2	4	—
	3	—	—
	3 HS	—	—

Interface Bases (LIBs) and Line Sets required for the types of lines that can be accommodated. Many of the Line Set types include internal modems.

CONNECTION TO HOST COMPUTER: The Type 1 Channel Adapter provides attachment to the byte multiplexer channel of an IBM System/360 (32K Model 30 and larger) or System/370 computer. The Type 2 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channel of an IBM System/370. The Type 3 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channels of a pair of System/370 processors (Model 135 and larger) operating in a virtual mode as a tightly coupled multiprocessor system.

The Type 1 Channel Adapter transfers data one, two, three, or four bytes at a time over the attached byte multiplexer channel. The transfer rate appears to be in the neighborhood of 16,000 bytes per second. A separate transfer control operation is required of the 3705 control unit for each data burst transferred.

The Type 2 Channel Adapter always operates in the burst mode, with two-byte transfers over an attached byte multiplexer channel and multi-byte transfers over an attached block multiplexer or selector channel. It can sustain a data rate of 276,000 bytes per second. Data is transferred in blocks,and except for initiation and termination of a transfer operation, data transfers interrupt the 3705 central control unit only for the memory cycles required to access and move the data.

The Type 3 Channel Adapter has a performance level equivalent to that of the Type 2, but includes an automatic two-processor switch for symmetric support of tightly coupled System/370 multiprocessor configurations. The Type 3 can also be used to provide alternate-path capability by connecting both sides of the switch to two channels of a single processor. The Type 3 also includes a remote switch attachment capability through the configuration control panel of a System/370 158 MP or 168 MP or from a 2925 Model 10 Remote Switching Console.

The Type 4 Channel Adapter transfers data in a burst mode of up to 32 bytes at a time over the attached byte multiplexer channel. This adapter can be used only with Type 2 or 3 Scanners and is required when using the Type 3 Scanner in Emulation Mode.

In configurations having four Channel Adapters (Type 1, 2, or 4) connection can be made to four different ports on the same CPU or to four different CPU's (or a mixture). This configuraiton is useful when operating under 270X emulation mode and full ACF/NCP mode concurrently. When using a Type 3 Channel Adapter (NCP only), there are two connections from each adapter to two tightly coupled CPUs, or, alternately, to two channels of the same CPU. Only one channel per adapter is active at a time and the channel selection is made by a manual switch located on the control panel of the CPUs or under program control.

A manual Two Channel Switch option can be attached to Channel Adapter Type 1, 2, or 4 in the 3705-II. This allows the physical connection of up to four I/O channels on a CPU. However, only one path, per Channel Adapter, can be active at a time. In the 3705-II, the Two Channel Switch option cannot be implemented in any module containing more than one Channel Adapter.

TRANSMISSION SPECIFICATIONS

The accompanying tables summarize the capabilities of the 3705 for accommodating various types of communications lines and techniques.

A wide range of Line Sets is available, but configurations are not as complex to resolve as Table 2 would tend to indicate at first glance. A couple of examples will illustrate this point.

Suppose you wished to interface a communications line coming from an IBM terminal employing SDLC line protocol. All told, there are 3 different Line Sets that could be used, depending on other parameters. But if you also wished to implement internal data sets, and planned to transmit at 2400 bps in a half-duplex, point-to-point arrangement over a leased voice-grade line, the choice would reduce to Line Set 5A. A Bisync terminal with the same operating parameters could also be interfaced with Line Set 5A. Line protocol considerations are handled by the program.

If you wished to accommodate a line to a Bisync terminal operating at 4800 bps using an external modem, the choice Line Set ID. In fact, Line Set ID accommodates 9600 bps speeds for asynchronous, bisynchronous and SDLC transmissions.

Operation over the switched telephone network or over a multipoint or point-to-point leased facility will govern the selection of modems. The number of lines to be implemented will also have an effect on selection between internal and external modem arrangements. More lines can be accommodated by using external modems, but the maximum number permitted using internal modems is not all that restrictive, except in a few cases such as Line Sets 5A, 5B, 11A, and 11B.

Restrictions on the usage of the various Line Sets are clearly indicated in Table 2.

The type of LIB required for each type of line set is also indicated in Table 2. The number of LIBs of a given type or of a given mix that is allowed in a module is indicated in Table 1. The type of Communications Scanner to use is also indicated in Table 1. The maximum number of LIBs, obtained from Table 1, multiplied by the product of the lines per line set and the line sets per LIB from Table 2 will supply the maximum number of lines that can be connected to a module.

An exception to the rules depicted in the tables occurs when using Communications Scanners 2 and 3 for line speeds over 4800 bps. To assure adequate scanning of high speed lines,

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the mix and/or number of line sets per LIB must be restricted. This can be done physically or logically via program control.

Providing the high speed line set is wired to the lower address of an LIB (and in some cases the LIB must be the first LIB of the module), the Communication Scanner can be told, by program, to ignore the higher address lines and to us its scanning time to service the high speed line. For line speeds over 10,000 bps, the line sets msut be wired to the lowest address of the LIB.

The reason for this requirement is the manner in which the scanner is made to scan a line more frequently via programming initiation. A Type 2 Scanner will normally attempt to scan 96 interfaces (lines). This represents the maximum case of 16 lines for each of 6 LIB's in an expansion module. Starting with the first address in its list of interface addresses, the scanner proceeds to scan each interface; it consults an Upper Scan Limit counter to determine when a scanning cycle is completed and it is time to start at the beginning again. By changing the Upper Scan Limit counter to scan fewer interfaces, the scanning cycle will accordingly take less time. Of course, any line attached to interfaces whose address position in the list is beyond the scan limit will not be scanned. The Upper Scan Limit can be set to scan 96, 48, 16, or 8 interfaces.

Another method of decreasing the elapsed time between scanning a line on a Type 2 Scanner is by Address Substitution. Normally, the address of the high speed line in position 1 of a LIB is substituted in the address list of the addresses of the highest addresses within the same LIB. This causes the scanner to scan the same line two or more times within the same scan cycle. Features to block installation of line sets for the lines that will not be scanned are available for LIB Types 1, 2, 3, and 10. When Address Substitution is used, all Type 2 Scanners must operate in the same manner. Address Substitution causes the scanner to scan only 8, as opposed to 16, lines per LIB. A total of four no-cost features are available for Address Substitution; they must be implemented in order. The first and second features block installation of a line set in partition 8 and 7, respectively, on all Type 1 or 2 LIB's, of all modules. The third and fourth features block installation of a line set in partition 6 and 5, respectively, of all Type 1, 2, 3, and 10 LIB's of all modules. Each LIB is divided into eight Partitions for line addressing purposes. The two lines wired with the lowest addresses in an LIB are in partition 1; the two lines wired with the highest addresses in an LIB are in partition 8.

Upper Scan Limit modification can also be employed with Type 3 scanner. High Speed Select, analogous to Address Substitution is used to modify addresses. An important difference between Address Substitution and High Speed Select, is that High Speed Select is applicable only to a specific scanner; i.e., configuration restrictions apply to only one module. A total of eight no-cost features are available; they must be implemented in order. Each feature blocks the installation of a line set in one partition of any additional LIB's in that module only.

The purpose for each type of LIB is:

Type 1: Lines with external modems and/or auto call, and for directly attached terminals.

Type 2: Telegraph-grade lines.

Type 3: Lines with IBM limited distance line adapters.

Type 5: 2400 bps leased lines with integrated modems.

Type 6: 2400 bps switched network trunks with integrated modems.

Type 7: 2400 bps switched network trunks with integrated modems and auto call.

Type 8: 1200 bps lines with integrated modems.

Type 9: 1200 bps lines with integrated modems and auto call.

Type 10: 1200 bps lines with integrated modems and full-duplex data transmission.

Type 11: 2400 bps lines with integrated modems and full-duplex data transmission.

Type 12: 1200 bps liens with integrated modems and bi-directional interrupt signal.

IBM provides a gateway to X.25 packet switching public data networks by offering a combination of hardware and software support. SNA terminal support is provided through the Network Interface Adapter (RPQ 5973-LO2). This adapter is a prerequisite for X.25 access and may be used with all 3705 family Communications Controllers with a Type 2 or 3 Communications Scanner and appropriate line set. An X.21 Non-switched Adapter allows the physical attachment to the X.25 network. The following software section will provide more details about X.25 support.

SOFTWARE

The program stored in memory controls all functions of the 3705. Many functions such as control character recognition and error procedures are defined and controlled by software. In previous, hard-wired controllers, such as the IBM 2701, 2702, and 2703, these functions were fixed once a particular set of adapters was selected. The 3705 is not totally independent, however. Functions are executed in response to commands issued by the host processor. Indeed, all control ultimately resides with the host processor, including program loading.

The control program residing in the memory of the 3705 is generated on a IBM System/360, System/370 non-virtual, or System/370 virtual computer system through a macro-assembly/link-edit procedure. Generated control programs are loaded into the 3705 memory over the I/O channel connection or over a communications line if the Remote Program Load feature is implemented). The support package for the 360/370 includes the macro assembler, a load program, and a dump routine.

Two types of control programs can be generated. One, which is called NCP for Network Control Program (NCP/VS in virtual environments), provides front-end processing functions that can relieve the host processor of much of the overhead associated with managing multiple data communications lines. The other, which is called EP for Emulation Program (EP/VS for virtual environments) allows a 3705 to replace multiple 2701, 2702, and 2703 controllers with little or no modification of user application programs; operation of the host processor when EP is active is identical with activity under the previous 270X hard-wired controllers, and none of the potential benefits of front-ending is realized. NCP/VS includes provisions for running NCP and EP simultaneously.

NCP, like most general-purpose operating systems, requires a generation procedure to define the hardware (i.e., communications lines and terminals) configuration available and to specify which of the optional facilities will be included. IBM has implemented a macro language for specification of NCP. The language is divided into three types of macros. Systems macros define the 3705 configuration parameters, such as memory size, buffer sizes, and type of channel adapter installed, and any optional

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TABLE 2: COMMUNICATIONS HANDLED BY THE IBM 3705

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Line Sets per LIB*	Comments
	Speed bps	Timing	Mode	Line					
External RS-232C modem	Up to 1200	Asynchronous	Half-duplex	Leased or switched	1D	2	Type 1	8	Cannot use Scanner Type 3.
	Up to 1200	Asynchronous	Full-duplex	Leased	1D	1			Cannot use Scanner Type 3.
	Up to 1200	Asynchronous	Half-duplex	Leased	1D	2			Any combination of speed and timing is possible for each Line Set 1D.
	Up to 600	Asynchronous	Half-duplex	Switched					
	Up to 9600	Synchronous	Half-duplex	Leased or Switched					
	Up to 9600	Synchronous	Full-duplex	Leased	1D	1			
External wideband modem	19.2K or 50K	Synchronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Requires Scanner Type 2 or 3
	50K	Synchronous	Full-duplex	Leased	1T	1		4	
External Mil 188C modem	Up to 50K	Async./sync.	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Requires Scanner Type 2 or 3.
	56K	Synchronous	Full-duplex	Leased	1U	1		4	
	Up to 230.4K	Synchronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3
	Up to 230.4K	Synchronous	Full-duplex	Leased	1TA	1		1	
Local attachment	Up to 1200	Asynchronous	Half-duplex	IBM cables	1D	2	Type 1	8	Maximum cable length is 200 ft. Cannot use Scanner Type 3.
	Up to 9600	Synchronous	Half-duplex	IBM cables	1D	2			Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1		4	Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	7	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2			IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 600	Asynchronous	Half-duplex	2-wire private	4A	2	Type 4	2	IBM Limited Distance Type 2 Line Adapters; 8.25 wire miles maximum.
	Up to 600	Asynchronous	Half-duplex	Leased	4B	2			IBM Leased Line, Line Adapters, 2-wire.
Up to 600	Asynchronous	Full-duplex	Leased	4C	2				IBM Leased Line, Line Adapters, 4-wire.
	2400 or 1200	Synchronous	Half-duplex	Leased	5A	1	Type 5	2	Point-to-point modems.
	2400 or 1200	Synchronous	Half-duplex	Leased	5B	1			Multipoint modems.
	2400 or 1200	Synchronous	Half-duplex	Switched	6A	1	Type 6	2	Auto-answer modems.
	2400	Synchronous	Half-duplex	Switched	—	1	Type 7	1	Auto-dial and auto-answer modems.
	1200 or 600	Async./sync.	Half-duplex	Leased	8A	2	Type 8	3	
	600 or	Asynchronous	Half-duplex	Switched	8B	2			Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched					
	1200 or 600	Synchronous	Half-duplex	Switched	9A	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	
	2400 or 1200	Synchronous	Full-duplex	Leased	11A	1	Type 11	2	Point-to-point modems.
	2400 or 1200	Synchronous	Full-duplex	Leased	11B	1			Multipoint modems.
	300	Asynchronous	Half-duplex	Leased	12A	2	Type 12	2	12B includes auto-answer modems; both include modems with bidirectional interrupt signal capability, intended for IBM 3767 terminals operating as 2741's.
	300	Asynchronous	Half-duplex	Switched	12B	2			

*For speeds over 4800 bps, mix quantity of line sets per LIB can be restricted; see text.

control facilities to be included, such as checkpoint/restart and on-line terminal testing. Configuration macros define the makeup of the network and supply information pertinent to each individual type of terminal, including composition of multipoint line operations. Block-handling macros specify any processing to be done in the 3705 on the blocks of data exchanged between the 3705 and the host processor. At present, the only processing macros supplied by IBM provide for insertion of date and time for next correction involving backspaces to correct entries, but the assembler can be used to create additional macros. A framework is provided for structuring routines into symbolically named groups and sets and for controlling the point of execution of each component.

Extensive provisions can be included in NCP for accommodating transient or permanent failures of the communications lines and for gathering statistics on detected errors.

Many of the functions can be controlled dynamically through commands issued by the host processor, including specification of the network configuration by activating and deactivating devices, lines,and groups of lines. In addition, terminal ID, polling, and addressing characters can be modified, the frequency and duration of polling and transmission among the terminals or components of a multipoint line or multi-component terminal can be

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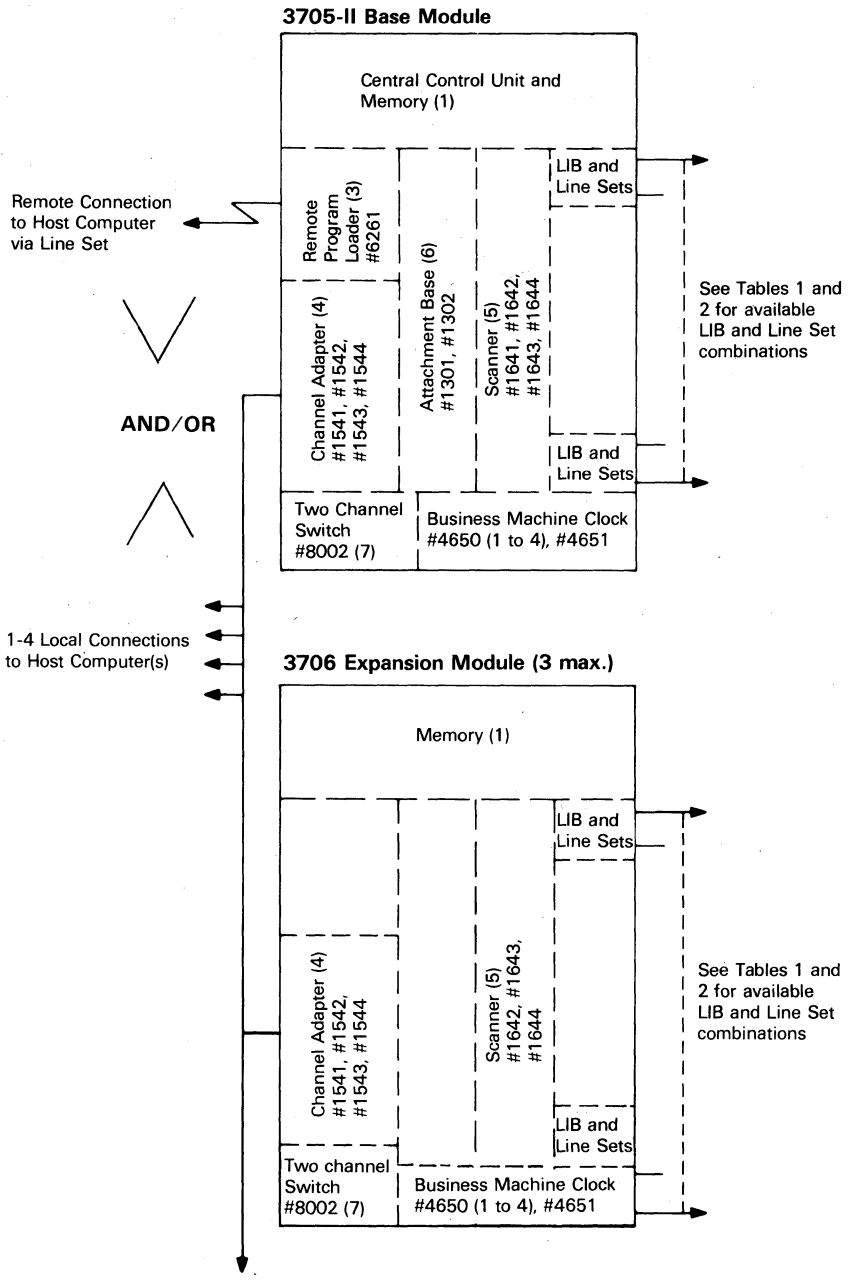
Configuration



(1) In the 3705-II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes. Models J, K and L also include a second module with at least one 64K-byte memory increment.

(2) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705-II can be installed with up to three channel adapters type 1, 2, 3, or 4. If more than two adapters are used, all must be type 4.

(3) Up to 4 channel adapters type 1, 2, 3, or 4 can be installed in the 3705-II. Two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 1 may not be used with Models J, K or L.

(4) One Scanner Type 2 or 3 can be installed in each of the four modules.

(5) One or two attachment bases are required as follows:

- Scanner Type 2 or 3 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2 or 3 with CA Type 2, 3, 4—Attachment Base Type 2;
- Attachment Base Type 1 can be used only with a CA Type 1 in the 3705-II.

(6) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

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modified, and the block processing routines associated with a particular terminal can be switched.

NCP/VS provides all the capabilities of NCP plus some valuable additions. One of the principal benefits is the capability to operate in the EP mode and NCP mode concurrently; i.e., a portion of the lines can be operated in the 270X mode while the others operate under NCP. This capability is particularly valuable during the cutover of applications from 270X operation to front-end processing with the 3704, and is referred to as Partitioned Emulation Programming Extension or PEP. The other major expansion of NCP capabilities is the operation of the 3705 as a remote concentrator.

PEP can now support concurrent operation in a dual-processor environment. One CPU supports communication via VTAM or TCAM through VTAM, and is attached via a Type 2 or 3 Channel Adapter; communications are supported under the NCP mode. The other CPU supports communications via a non-VTAM control program which operates under the Emulation Program, and is attached to the same 3705 via a Channel Adapter Type 1; communications are supported under the EP mode of PEP. Control of the dual-CPU PEP operation is performed using the operator control facility of the host CPU operating with the NCP mode of PEP. Functions include: IPL 3705, Dump 3705, and line switching between the EP and NCP modes of PEP. Lines assigned to the NCP portion of PEP are under control of the VTAM facility; lines assigned to the EP portion of PEP are controlled by the Operator Control facility operating with the EP portion of PEP.

NCP/VS operates through the access method, VTAM, in DOS/VS environments and through either VTAM, TCAM, or a combination of OS/VS environments. The combination mode of operation eases conversion requirements.

VTAM is acknowledged by IBM to be the principal access method for telecommunicaitons support under DOS/VS and OS/VS. BTAM and QTAM will not be extended, and enhancements for TCAM will be in the environment provided by VTAM under OS/VS. The chief feature of VTAM is dynamic sharing of network resources. Application programs working through VTAM have access to any terminal, line, or 3705 controller in the network; for example, different application programs can initiate transmission and reception with terminals located on the same multipoint communications lines. By the same token, multiple application programs can have access to the same data bas. One component of VTAM is TOLTEP, an on-line testing program for exercising and testing the complete network.

The EP or Emulation Program makes the 3705 look like one or more 2701, 2702, and/or 2703 controllers to the host processor. it offers no operational benefits over the earlier controllers, except for migration. User programs now written for the 270X series will work with a 3705 under EP with some restrictions. Some of the 270X features not supported include transmission with older, 4-of-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission with older, 4-of-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission at 230,400 bps, second channel interface, and programmable two-processor switch. However, many of the more common RPQ's are supported. In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) is available. The latest version of ACF is Release 3 which was issued in May of 1981. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU with minimal involvement of the host or intermediate CPU's. ACF allows for logical groupings of transmission links between adjacent network nodes. It provides multiple routes for SNA or non-SNA message transmission between network nodes along with error notification facilities. It allows session selection of three priority levels. To utilize ACF/NCP/VS, Advanced Communication Function for VTAM and TCAM is necessary.

ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS and user programs.

Another ACF features is the capability for up to four CPU's to share a single 3705-II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must all be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports the Remote Program Loader-II (RPL-II). RPL-II can be attached to a 3705-II along with up to three channel adapters. With this attachment, a controller that normally operates as a local controller. This enables the rerouting of a deactivated or a failed host computer's traffic to other CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705-II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPU's for applications processing.

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X.25 NCP PACKET SWITCHING INTERFACE PROGRAM: Provides users of ACF/NCP/VS the facility to use 3705-II or 3705-80 Communications Controllers to access public data networks complying with CCITT X.25 standards. This program supports packet sequence numbering of up to 128, with packet length section of up to 4096 characters. It supports SNA network node interconnection and protocol conversion for non-SNA equipment. Within the program is a subset of X.29 allowing communications with asynchronous X.28 devices (TTY). It also supports the non-switched X.21 adapter.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, NCP/VS can be loaded into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voice-band line operating synchronously at up to 9600 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3705 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Aid Circulation 1 and 2 (for the first and second block and core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications lines; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability forthe 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader-II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not necessary and therefore the options are not provided for the RPL-II.

NETWORK TERMINAL OPTION (NTO): is a software product which is loaded in the 3705 and extends the SNA environment to include support for several common asynchronous terminals. These include the IBM 2740 and 2741 terminals on either switched or leased lines, and Teletype models 33/35 on switched lines only.

TELEPROCESSING NETWORK SIMULATOR (TPNS): is a software package that enables the user to test and evaluate application and communications control programs prior to actual network activation. The latest release (as of this publication) is TPNS Release 5, which supports the testing of all the features detailed in the following newly scheduled releases.

NETWORK COMMUNICATIONS CONTROL FACILITY (NCCF): is a program product which runs under the SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

NETWORK PROBLEM DETERMINATION APPLICATION (NPDA): is a program product which supports the collection and on-line retrieval of network error and status information. NPDA assigns probable causes to all specific errors, and runs with NCCF under either VTAM or TCAM.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place. Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per our over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

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		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-80 Communications Controller				
	Model M81 (256K bytes, 4 lines)	$1,492	$1,270	$36,600	$203
	Model M82 (256K bytes, 10 lines)	1,956	1,665	46,600	212
	Model M83 (256K bytes, 16 lines)	2,309	1,965	52,600	221
	3705-II Communications Controller				
	Model E1 (32K bytes, 64 lines)	1,627	1,385	38,230	159
	Model E2 (64K bytes, 64 lines)	1,779	1,515	39,800	179
	Model E3 (96K bytes, 64 lines)	1,931	1,645	41,370	198
	Model E4 (128K bytes, 64 lines)	2,083	1,775	42,940	218
	Model E5 (160K bytes, 64 lines)	2,235	1,905	44,510	237
	Model E6 (192K bytes, 64 lines)	2,387	2,035	46,080	257
	Model E7 (224K bytes, 64 lines)	2,539	2,165	47,650	276
	Model E8 (256K bytes, 64 lines)	2,691	2,295	49,220	296
	Model F1 (32K bytes, 160 lines)	2,185	1,860	51,530	173
	Model F2 (64K bytes, 160 lines)	2,337	1,990	53,100	192
	Model F3 (96K bytes, 160 lines)	2,489	2,120	54,670	212
	Model F4 (128K bytes, 160 lines)	2,641	2,250	56,240	231
	Model F5 (160K bytes, 160 lines)	2,793	2,380	57,810	251
	Model F6 (192K bytes, 160 lines)	2,945	2,510	59,380	270
	Model F7 (224K bytes, 160 lines)	3,097	2,640	60,950	290
	Model F8 (256K bytes, 160 lines)	3,249	2,770	62,520	309
	Model G1 (32K bytes, 256 lines)	2,743	2,335	64,830	186
	Model G2 (64K bytes, 256 lines)	2,895	2,465	66,400	206
	Model G3 (96K bytes, 256 lines)	3,047	2,595	67,970	225
	Model G4 (128K bytes, 256 lines)	3,187	2,725	69,540	245
	Model G5 (160K bytes, 256 lines)	3,351	2,855	71,110	264
	Model G6 (192K bytes, 256 lines)	3,503	2,985	72,680	284
	Model G7 (224K bytes, 256 lines)	3,655	3,115	74,250	303
	Model G8 (256K bytes, 256 lines)	3,807	3,245	75,820	323
	Model H1 (32K bytes, 352 lines)	3,301	2,810	78,130	200
	Model H2 (64K bytes, 352 lines)	3,453	2,940	79,700	219
	Model H3 (96K bytes, 352 lines)	3,605	3,070	81,270	239
	Model H4 (128K bytes, 352 lines)	3,757	3,200	82,840	258
	Model H5 (160K bytes, 352 lines)	3,909	3,330	84,410	278
	Model H6 (192K bytes, 352 lines)	4,061	3,460	85,980	297
	Model H7 (224K bytes, 256 lines)	4,213	3,590	87,550	317
	Model H8 (256K bytes, 352 lines)	4,365	3,720	89,120	336
	Model J1 (320K bytes)	4,377	3,725	71,020	341
	Model J2 (384K bytes)	4,683	3,985	74,160	380
	Model J3 (448K bytes)	4,989	4,245	77,300	419
	Model J4 (512K bytes)	5,295	4,505	80,440	458
	Model K1 (320K bytes)	4,935	4,200	84,320	354
	Model K2 (384K bytes)	5,241	4,460	87,460	393
	Model K3 (448K bytes)	5,547	4,720	90,600	432
	Model K4 (512K bytes)	5,853	4,980	93,740	471
	Model L1 (320K bytes)	5,493	4,675	97,620	368
	Model L2 (384K bytes)	5,799	4,935	100,760	407
	Model L3 (448K bytes)	6,105	5,195	103,900	446
	Model L4 (512K bytes)	6,411	5,455	107,040	485
#8510	Unit Protection	35**	—	35**	NC
	Attachment Bases				
#1301	Type 1	22	19	641	0.50
#1302	Type 2	22	19	641	0.50
	Channel Adapters				
#1541	Type 1	146	124	2,700	10.00
#1542	Type 2	271	231	6,470	10.00
#1543	Type 3	551	469	12,910	12.00
#1544	Type 4	234	199	4,410	8.50
#8002	Two Channel Switch	85	72	2,090	2.50

*Includes monthly maintenance.
**Single-Use Charge, one-time.

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		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communications Scanners				
#1641	Type 1	$ 76	$ 65	$ 1,880	$ 6.50
#1642	Type 2	261	222	4,750	10.00
#1643	Type 3	932	793	17,210	33.50
#1644	Type 3 High Speed	1,251	1,065	25,120	40.00
#4650	Business Machine Clock	14	12	424	1.00
#4651	Business Machine Clock	34	29	880	1.50
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	58	49	1,105	3.00
#4714	Line Set Type 1D	52	44	1,030	3.00
#4715	Line Set Type 1E	41	35	1,030	2.50
#4717	Line Set Type 1G	110	94	2,050	6.50
#4719	Line Set Type 1J	58	49	1,455	2.50
#4720	Line Set Type 1S	121	103	3,020	6.50
#4722	Line Set Type 1GA	110	94	2,695	6.50
#4723	Line Set Type 1TA	200	170	4,850	10.00
#4725	Line Set Type 1T	200	170	4,850	10.00
#4726	Line Set Type 1U	223	190	5,440	11.00
#4727	Line Set Type 1W	184	157	4,720	6.50
#4728	Line Set Type 1Z	342	291	8,640	11.00
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	58	49	1,455	3.00
#4721	Line Set Type 2A	41	35	1,030	4.00
#4703	Line Interface Base Type 3	102	87	2,515	2.50
#4731	Line Set Type 3A	33	28	850	1.50
#4732	Line Set Type 3B	33	28	850	1.50
#4704	Line Interface Base Type 4	65	55	1,665	3.00
#4741	Line Set Type 4A	58	49	1,455	3.50
#4742	Line Set Type 4B	58	49	1,455	5.00
#4743	Line Set Type 4C	58	49	1,455	5.00
#4705	Line Interface Base Type 5	146	124	3,555	5.50
#4751	Line Set Type 5A	85	72	2,075	7.50
#4752	Line Set Type 5B	76	65	1,860	7.00
#4706	Line Interface Base Type 6	146	124	3,555	5.50
#4761	Line Set Type 6A	95	81	2,295	10.00
#4707	Line Interface Base Type 7	281	239	6,675	18.50
#4708	Line Interface Base Type 8	58	49	1,455	4.00
#4781	Line Set Type 8A	59	50	1,490	5.00
#4782	Line Set Type 8B	78	66	1,920	6.50
#4709	Line Interface Base Type 9	58	49	1,455	2.50
#4791	Line Set Type 9A	85	72	1,785	10.00
#5000	Line Interface Base Type 10	65	55	1,685	2.50
#4784	Line Set Type 10A	110	94	2,685	6.00
#5001	Line Interface Base Type 11	130	111	3,120	3.00
#4754	Line Set Type 11A	130	111	3,120	11.00
#4755	Line Set Type 11B	120	102	2,900	9.00
#5002	Line Interface Base Type 12	54	46	1,190	3.00
#4785	Line Set Type 12A	154	131	3,265	15.50
#4786	Line Set Type 12B	172	146	3,605	17.50
	Remote Concentrator Features				
#6250	Remote Power Off	14	12	416	0.50
#6261	Remote Program Loader-II	398	339	9,335	26.50

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COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 512K bytes. For every two 32K-byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

Each additional 32K-byte memory increment above E1, F1, G1 or H1 costs $1,570.

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

3705-II to 3705-II upgrade
Models E, F, G to Models F, G, H—$13,300 for each additional 3706 Module.
$1,570 for each additional 32K-byte memory increment.
Models F, G, H to Models J, K, L—$23,500 for upgrade from F8 to J1, G8 to K1, or H8 to L1, plus 3,140 for each additional 64K-byte memory increment.

			Monthly Charge (New Plan)**			
		Monthly Charge (Old Plan)*	Basic License	DSLO License	Licensed Program Support	Additional Licensed Program Support
5744-BA2	Network Control Program	NC	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Release 2 and 2.1; Release 3	NA	$135	$101	$ 24	$ 14
5735-XX3	SSP for ACF/NCP/VS Release 2 and 2.1; Release 3	NA	48	36	16	9
	Host Access Methods					
5735-RC1	ACF/TCAM Version 1	NA	263	197	11	7
	With Multisystem Networking Facility	NA	976	732	28	17
5735-RC3	ACF/TCAM Version 2, Release 1, 2, and 3		535	401	71	43
	With Multisystem Networking Facility		900	675	88	53
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	NA	117	87	42	25
	With Multisystem Networking Facility	NA	193	145	181	108
5735-RC2	ACF/VTAM Version 1, Release 2, and Release 3	NA	280	210	42	25
	With Multisystem Networking Facility	NA	673	504	127	76
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	NA	114	86	61	37
	Other Host Networking Software					
5735-XX7	Network Terminal Option Release 1 and 2	NA	121	95	9	5
5735-XX8	Network Problem Determination Application (NPDA) Release 1 and 2	NA	51	38	19	12
5735-XX6	Network Communications Control Facility (NCCF)	NA	97	72	38	23
5740-XT4	Teleprocessing Network Simulator (TPNS) Release 5	$1,245		NA	NA	NA

NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP.)
NA—not applicable.
*Includes onsite field engineering support.
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Additional Licensed Program Support are available for customers with multiple CPU's that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.■

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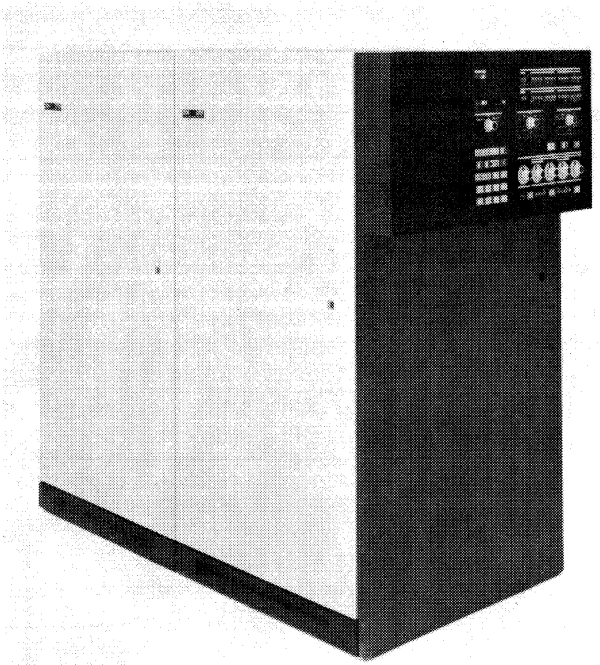
IBM 3705 Communications Controller



A family of programmable communications processors for use in front-end or remote applications with IBM System 360/370, 303X or 4300 host processors.

The 3705 can support up to 352 communications lines, and up to 512K bytes of main memory. A wide variety of facilities can be accommodated, including asynchronous or synchronous transmission, half- or full-duplex modes, switched or leased facilities, and voice grade or wideband lines to 230.4K bps. Peripheral devices such as mass storage, however, are not supported.

Numerous software options permit the 3705 to be implemented in many different modes and configurations, and in varying degrees of network control. Software supports implementation of the 3705 in emulation of 270X hard-wired controllers, and also supports gradual migration to full network control mode.

A minimal 3705 configuration can be leased for about $1,400 per month, including maintenance, or purchased for about $50,000. A practical, mid-range configuration would be about double these prices.

MANAGEMENT SUMMARY

First introduced in 1972, the 3705 family of communications controllers has undergone continual upgrading by IBM. The 3705-I, which contains core memory, has been rapidly losing ground to the 3705-II employing semiconductor memory which was introduced in 1976. In October of this year, IBM announced that the 3705-I was finally being withdrawn from marketing, effective December 1979.

In November 1978, IBM announced twelve new high-end models of the 3705-II (J1 through L4) which featured faster memory and extended the controller's main memory capacity to 512K bytes. (Previous models had been limited to 256K bytes.)

The 3705-II is a high-end alternative to the 3704 Communications Controller, which IBM withdrew from production in August 1978. The 3704 contains a maximum of 64K bytes of memory and can handle no more than 32 half-duplex communications lines while the 3705 will support up to 352 lines.

In its basic implementation, the 3705 front ends an IBM 360/370 host processor and requires as a minimum one host channel attachment, one line scanner, and line adapters and interfaces as appropriate.

The user has several software options for implementing the 3705 front end, and each provides significantly different functions. For migration from a 270X hard-wired controller, a user may load a 3705 with the ▷

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Data Processing Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

DATE OF ANNOUNCEMENT: 3705-I—April 1972; 3705-II—November 1975, Models E1-H8; November 1978, Models J1-L4.

DATE OF FIRST DELIVERY: 3705-I—July 1972; 3705-II—August 1976, Models E1-H8; June 1979, Models J1-L4.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: International Business Machines Corporation.

CONFIGURATION

The 3705-II can accommodate up to 352 communications lines. The 3705-II (Models E1-H8) have a cycle time of 1.0 microseconds and contains 32K to 256K bytes of semiconductor (MOSFET) memory in 32K-byte increments over 32 models. Models J1-L4 have a memory cycle time of 0.9 microseconds and feature memory ranging from 320K bytes to 512K bytes in 64K-byte increments. For models E1 to H8, the letter (E, F, G, H) refers to the number of physical modules (1 through 4) that compose the 3705 system and determine the number of communications lines that can be accommodated. The J models consist of two modules: the K models three; and the L models four. ►

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Emulation Program (EP/VS). The main advantage to EP/VS is that no changes need to be made to the user's existing network (terminals, lines, etc.) as the 3705 merely emulates the operation of the 270X controller. However, with EP/VS there is no real off-loading of communications processing from the host, which is generally the incentive for implementing a programmable front end in the first place.

The migrating user would then logically move to the Partitioned Emulation Programming (PEP), which permits the 3705 to operate *both* in 270X emulation mode, and in its own native network control mode. This permits the user to gradually convert his terminals and line control equipment to operate in network control mode. PEP is an extension of the Network Control Program (NCP) which would ultimately be running alone in the 3705. Running NCP, the 3705 makes full use of its inherent capabilities, which includes significant off-loading of communications processing from the host.

The 3705 (or 3704) Communications Controller is prerequisite to networking under IBM's Systems Network Architecture (SNA). SNA requires the 3705 to run in its native NCP mode, although there are several different versions of NCP which support varying degrees of network sophistication. A 3705 running PEP may be supporting an SNA network, but only for those lines and devices which are connected under the NCP portion.

SNA also requires certain operating software in the host which works with the front end and NCP in control of the network. Virtually all of the current IBM 360/370 operating systems may support SNA networking, but each requires an appropriate version of either the TCAM or VTAM telecommunications access methods. Whether or not the 3705 is controlling an SNA network, the software load for the front end (or remote 3705) is defined and generated on the host with the use of the System Support Programming (SSP), and the 3705 is then loaded over the channel (or downline, if remote).

For more information on SNA, see Report C11-491-101 behind the Networks and Architectures tab of this volume.

A series of software enhancements, grouped under the name Advanced Communications Function (ACF), permits the linking of two or more host computers via their respective front-end (local) 3705 controllers to form a Multisystem Networking Facility. The host computers will be interrupted only initially by transmissions flowing through their local 3705's that are destined for another host. The enhancements also permit up to four computers at the same location to share a common 3705. The host computers in either case can use any mix of VS operating system and can use either VTAM or TCAM access methods.

The Multisystem Networking Facility is an optional licensed program feature of ACF that permits dynamic allocation of CPU work loads and network routing based

3705-II

Model	Memory, bytes	Model	Memory, bytes
E1, F1, G1, H1	32K	J1, K1, L1	320K
E2, F2, G2, H2	64K	J2, K2, L2	384K
E3, F3, G3, H3	96K	J3, K3, L3	448K
E4, F4, G4, H4	128K	J4, K4, L4	512K
E5, F5, G5, H5	160K		
E6, F6, G6, H6	192K		
E7, F7, G7, H7	224K		
E8, F8, G8, H8	256K		

The 3705 Communications Controller is composed of:

- **The basic 3705 model (E 1 through L4) which includes the central control unit, main memory, and space for mounting the interfaces between the central control unit and the communications lines and between the central control unit and the host computer.**
- **Channel Adapter (1 to 4) and/or Remote Program Loader, which provides the data path between the 3705 and the host comptuer. The Type 1 Channel Adapter cannot be used with the newer models J1 to L4.**
- **Attachment Bases (1 or 2), which provide the physical and logical interface between the Channel Adapter (Type 1 only) and the Central Control Unit and between the CCU and the Communications Scanners.**
- **Scanners (1 to 4), which connect the Interface Bases (and associated line sets) with the 3705 central control unit.**
- **Line Interface Bases, which provide certain control functions for particular types of lines and transmission techniques.**
- **Line Sets, which provide the interfaces with data sets or directly with the communications lines.**

The configuration diagram at the end of this report illustrates the relationships among these components.

Physically, the 3705 is configured in one to four cabinets of modules. The Base Module includes the central control unit and from 32K to 256K bytes of semiconductor memory. The Base Module also accommodates one or two Channel Adapters, one or two Attachment Bases, one Scanner, and its associated Line Interface Bases and Line Sets. Models J1, K1 and L1 include a second module which contains a 64K-byte memory increment.

An Expansion Module (referred to as the 3706) is required to add each additional Scanner and its associated Line Interface Bases and Line Sets. Up to three 3706 Expansion Modules can be included in a 3705 system. For the 3705-II, the base module can be equipped with two Channel Adapters, or one Remote Program Loader and one Channel Adapter; the first 3706 can be equipped with two additional channel adapters. No Channel Adapters are allowed in the second or third Expansion Module (3706) of either version. All memory over 256K bytes resides in the expansion modules of the 3705-II. When the 3705 functions as a remote concentrator, the Remote Program Loader is used in place of a Channel Adapter in the base module. Local 3705-II's can now attach a Remote Program Loader-II along with Channel Adapters. With appropriate line linkages, the Controller can operate as a remote to another controller that is locally attached to another host. In effect, a back-up procedure for computer failure in a multi-computer system, the Remote Program Loader-II requires ACF software.

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on the nature and volume of the transmissions and the hardware resources operative at the time.

The ACF software also supports a hardware enhancement known as the Remote Program Loader-II (RPL-II). In the event of a host computer failure, a local controller can be linked, as a remote controller, to another 3705, provided an RPL-II and an appropriate line are installed. RPL-II can be included with channel adapters in a 3705-II, permitting the controller to be used as a remote or a local controller.

Salient characteristics of the 3705-II are:

- Transmission rates of up to 230.4K bps. Supports, within restrictions, leased, switched, synchronous/asynchronous, and full-/half-duplex lines. The maximum number of lines depends on line mix. A physical maximum of 352 lines can be attained only by half-duplex lines operating at 9600 bps or slower.
- Supports external and internal modems, local attachment of terminals, and automatic dialing.
- Semiconductor memory storage with capacity from 32K to 512K bytes; in 32K- or 64K-byte increments.
- Channel adapters that will allow attachment of up to four CPU channels or attachment of a Remote Program Loader-II along with up to three adapters.

These characteristics reflect several significant enhancements to the 3705 which IBM only recently announced. For example, in the spring of 1979, concurrent with the announcement of the new high-end 3705 models, IBM introduced new, high-speed local line sets which support data transfer between communications controllers and/or certain terminals at up to 56K bps without external modems. The maximum link distance, however, is limited to 200 feet.

In June 1979, IBM announced a new library of communications software releases which will be delivered over the next two years and which promise significant new SNA networking capabilities. New hardware which will be supported includes a new line set and scanner which will handle full-duplex synchronous transmission at up to 230.4K bps, and a new family of microprocessor-based diagnostic modems. There is speculation that the new 230.4K bps capability is being provided to permit IBM customers to eventually interconnect with Satellite Business Systems (SBS).

The most current releases and scheduled new software releases are discussed in this report, and include new versions of ACF/NCP/VS, ACF/VTAM, and ACF/TCAM, as well as a number of diagnostic and network management packages which all run on the host processor. The new releases will reportedly add capabilities including the logical grouping and prioritization of communications lines, multiple parallel sessions between controllers, and automatic rerouting.

In general, the Base Module can contain up to four Line Interface Bases and each Line Interface Base can accommodate up to eight Line Sets. Each Line Set can accommodate up to two communications lines. For some types of lines, these maximums cannot be attained, as shown in the accompanying tables. Each Expansion Module can contain up to six Line Interface Bases.

Channel Adapters are available in four types, Communication Scanners in three. The restrictions that apply to the Channel Adapters and Scanners affect configuration possibilities and performance in addition to the limitations imposed by the different models. The selection of Channel Adapters and Scanners is determined by the desired level of performance, the number of lines to be implemented, and the mode of operation (i.e., Emulation Mode or Network Control Mode).

The Communications Scanners link the communications lines via their respective Line Interface Bases and Line Sets, with the Central Control Unit (CCU). The Scanner transfers data between the lines and the CCU memory on an interrupt basis and performs character assembly and disassembly functions. The Scanners differ only in performance. Low, medium, and high operating performance is provided by Type 2, and Type 3 Scanners, respectively. The control program is interrupted on a byte-by-byte basis for Type 2, and on a block basis for Type 3. Line control, control character recognition, code translation, and user recovery functions are performed by the control program.

The Type 3 Scanner performs data transfer functions on a cycle-steal basis, halting the control program for a complete machine cycle. The control program resumes operation at the conclusion of the data transfer unless another cycle-steal request is pending. An interrupt can occur on buffer boundaries (up to 254 characters), by unique control character, or by specific error conditions. Type 3 supports only LIB Types 1, 8, 9 and 10. Type 3 also provides control character recognition for BSC and SDLC line controls, and performs ASCII to EBCDIC (and the converse) code translation when operating under BSC line control. There is additionally a new, high-speed version of the Type 3 Communications Scanner which, when delivered, will support line speeds up to 230.4K bps. Only two half-duplex or one full-duplex line operating at this speed can be attached to this scanner, however. Also, only one of these high-speed scanners can be configured per frame (module). The Business Machine Clock #4650 is prerequisite, and no other clock is allowed. Only line sets 1GA or 1TA may be used with the high-speed scanner.

Channel Adapters are divided into two groups: those designed for the Emulaton Mode of operation but also usable in the Network Control Mode (Types 1 and 4), and those designed for the Network Control Mode of operation only (Types 2 and 3). The Channel Adapter Type 1 is a low-performance adapter and is generally used in the Base Module of a 3705-I, but could be used in a 3705-II. Type 4 provides higher performance and can be used in a Base and Expansion Module of a 3705-II. Channel Adapter Types 2 and 3 provide a higher level of performance and can be used in both a Base and Expansion Module, but Type 3 is designed to support both processors of a "tightly coupled" multiprocessor system.

The various configuration restrictions add up to three basic configuration groups:

- **A 3705-II Base Module with a Channel Adapter Type 1 and a Scanner Type 2 or 3. This configuration can be fully expanded with an additional Scanner Type 2 in each Expansion Module containing Line Interface Bases. A Channel Adapter Type 2 or 3 can be added to**

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TABLE 1: COMMUNICATIONS HANDLED BY THE IBM 3705

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Line Sets per LIB*	Comments
	Speed (bps)	Timing	Mode	Line					
External RS-232C modem	Up to 1200	Asynchronous	Half-duplex	Leased or switched	1A	2	Type 1	8	Cannot use Scanner Type 3.
	Up to 1200	Asynchronous	Full-duplex	Leased	1B	1			Cannot use Scanner Type 3.
	Up to 1200	Asynchronous	Half-duplex	Leased	1D	2			Any combination of speed and timing is possible for each Line Set 1D.
	Up to 600	Asynchronous	Half-duplex	Switched					
	Up to 9600	Synchronous	Half-duplex	Leased or Switched					
	Up to 9600	Synchronous	Full-duplex	Leased	1H	1			
External wideband modem	19.2K or 50K	Synchronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Requires Scanner Type 2 or 3
	50K	Synchronous	Full-duplex	Leased	1T	1		4	
External Mil 188C modem	Up to 50K	Async./sync.	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps.
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Requires Scanner Type 2 or 3.
	56K	Synchronous	Full-duplex	Leased	1U	1		4	
	Up to 230.4K	Synchronous	Half-duplex	Leased	1GA	1	Type 1	2	Requires Scanner Type 3
	Up to 230.4K	Synchronous	Full-duplex	Leased	1TA	1		1	
Local attachment	Up to 1200	Asynchronous	Half-duplex	IBM cables	1C	2	Type 1	8	Maximum cable length is 200 ft. Cannot use Scanner Type 3.
	Up to 2400	Synchronous	Half-duplex	IBM cables	1F	2			Maximum cable length is 100 ft.
	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W	1	Type 1	8	Maximum cable length is 200 ft. Interface is CCITT V.35.
	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z	1		4	Requires #4651 Business Clock.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units.
Telegraph: 20, 40, or 62.5 ma current loop	Up to 200	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature.
Internal modems or adapters (requires no external modems)	Up to 134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	7	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 134.5	Asynchronous	Full-duplex	4-wire private	3B	2			IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum.
	Up to 600	Asynchronous	Half-duplex	2-wire private	4A	2	Type 4	2	IBM Limited Distance Type 2 Line Adapters; 8.25 wire miles maximum.
	Up to 600	Asynchronous	Half-duplex	Leased	4B	2			IBM Leased Line, Line Adapters, 2-wire.
	Up to 600	Asynchronous	Full-duplex	Leased	4C	2			IBM Leased Line, Line Adapters, 4-wire.
	2400 or 1200	Synchronous	Half-duplex	Leased	5A	1	Type 5	2	Point-to-point modems.
	2400 or 1200	Synchronous	Half-duplex	Leased	5B	1			Multipoint modems.
	2400 or 1200	Synchronous	Half-duplex	Switched	6A	1	Type 6	2	Auto-answer modems.
	2400	Synchronous	Half-duplex	Switched	—	1	Type 7	1	Auto-dial and auto-answer modems.
	1200 or 600	Async./sync.	Half-duplex	Leased	8A	2	Type 8	3	
	600 or	Asynchronous	Half-duplex	Switched	8B	2			Auto answer modems.
	1200 or 600	Synchronous	Half-duplex	Switched					
	1200 or 600	Synchronous	Half-duplex	Switched	9A	1	Type 9	2	Auto-dial and auto-answer modems.
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	
	2400 or 1200	Synchronous	Full-duplex	Leased	11A	1	Type 11	2	Point-to-point modems.
	2400 or 1200	Synchronous	Full-duplex	Leased	11B	1			Multipoint modems.
	300	Asynchronous	Half-duplex	Leased	12A	2	Type 12	2	12B includes auto-answer modems; both include modems with bidirectional interrupt signal capability, intended for IBM 3767 terminals operating as 2741's.
	300	Asynchronous	Half-duplex	Switched	12B	2			

*For speeds over 4800 bps, mix and quantity of line sets per LIB can be restricted; see text.

USER REACTION

From the Datapro Survey of Communications Processors conducted in the fall of 1978, 87 users of the 3705 (about a third of the total respondents) were identified. The 87 responses represented 118 units in operation. About a third of the units had been in operation less than 24 months, about a third between 24 and 60 months, and the rest over 60 months. Each 3705 was handling an average of 34.7 communications lines with an average of 6 terminals/devices per line. The ratings were as follows:

the first Expansion Module. An Attachment Base Type 2 is required for the first Scanner Type 2 or 3, and an Attachment Base Type 1 is required for the Channel Adapter Type 1. Alternatively, the Remote Program Loader can be used in place of a Channel Adapter. This configuration can also be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing. When emulating a 270X controller, the number of communications lines is restricted to the number of available multiplexer subchannels (255 maximum). Note that the Channel Adapter Type 1 may not be used with Models J, K or L.

- **A 3705-II Base Module with a Channel Adapter Type 2, 3, or 4 and a Scanner Type 2 or 3. This**

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	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	41	37	5	0	3.4
Ease of installation	23	46	10	5	3.0
Throughput	31	48	6	0	3.3
Hardware reliability	58	25	2	0	3.7
Promptness of maintenance	40	38	5	0	3.4
Quality of maintenance	36	39	8	1	3.3
Software	15	48	19	3	2.9
Technical support	15	50	18	0	3.0

*Weighted Average on a scale of 4.0 for excellent.

The users were obviously most pleased with the hardware reliability of their 3705's. Overall satisfaction and promptness of maintenance also fared well, while the users were apparently less pleased with their software.

Some interesting facts emerged when the 3705 figures were compared with those of the smaller 3704, especially concerning usage. Two distinct patterns of usage were indicated. Some 88 percent of the 3704 users indicated that usage was exclusively 270X emulation, and only 10 percent said that their 3704's were operating in a partitioned mode; performing both network control and 270X emulation functions. One response indicated that a 3704 was operating exclusively as a network-controlling front end, but the operating software indicated that it was, in fact, performing only 270X emulation.

In comparison, users of 3705's indicated a much higher usage as front ends; a dramatic increase over the 1977 survey. Some 40 percent of the 3705 respondees indicated that their units were performing either as network-controlling front ends, or both as front ends and 270X emulators. This represents an 800 percent increase over the 1977 survey in which only four percent indicated that their 3705's were performing as front ends. Of the balance of 3705 responses, 56 percent indicated that usage was only in 270X emulation; two percent were being used as remote concentrators; and the remaining two percent gave an unclear indication of whether usage was as a front end, 270X emulator, or both.

While it is apparent that many users are still not making use of the full power of front-end processors, obviously the percentage of such users is dwindling.□

**TABLE 2:
LIB CAPACITY PER SELECTED
SCANNER OPTION**

Line Interface Base Type	Scanner Type	Maximum Number of LIB's per 3705-II	
		Base Module	Expansion Module
1, 8, 9, or 10	2	4	6
	3	3	4
	3 HS	1	1
2, 3, 6, 7, or 12	2	4	6
	3	—	—
	3 HS	—	—
5 or 11	2	4	—
	3	—	—
	3 HS	—	—

configuration can also be expanded fully with Expansion Modules, additional Type 2 or 3 Scanners, and additional Channel Adapters. An Attachment Base Type 2 is required to interface the first Type 2 or 3 Scanner. This configuration supports only front-end processing. Any combination of two Channel Adapters Type 2, 3, and 4 can be used, except that a Type 4 must be used in the Base Module when combined with a Type 2 or 3. Channel Adapters Type 2, 3, and 4 include the Attachment Base function, which precludes the use of a separate Attachment Base. The Type 2 and 3 Scanners can be combined in any arrangement, except that they cannot be used in emulating the 270X controllers or for attachment to an IBM System/360.

Timing and interpretation of data signals on the communications lines can be provided by the modems or by a series of Business Machine Clocks. Clocks ranging from 45 to 2400 bits per second are available and are required for all asynchronous lines. Up to four can be installed with each Scanner, but at least one is required, per scanner, regardless of line types used. Clocks are program-assigned and can be shared among several lines.

Complete configuration of a 3705 system revolves around determination of the number of Line Interface Bases required. This sets the minimum model that will suffice. Larger models can be implemented to provide additional memory. The accompanying tables and diagram fully set forth the rules for determining the number and types of Line Interface Bases (LIB's) and Line Sets required for the types of lines that can be accommodated. Many of the Line Set types include internal modems.

CONNECTION TO HOST COMPUTER: The Type 1 Channel Adapter provides attachment to the byte multiplexer channel of an IBM System/360 (32K Model 30 and larger) or System/370 computer. The Type 2 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channel of an IBM System/370. The Type 3 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channels of a pair of System/370 processors (Model 135 and larger) operating in a virtual mode as a tightly coupled multiprocessor system.

The Type 1 Channel Adapter transfers data one, two, three, or four bytes at a time over the attached byte multiplexer channel. The transfer rate appears to be in the neighborhood of 16,000 bytes per second. A separate transfer control operation is required of the 3705 control unit for each data burst transferred.

The Type 2 Channel Adapter always operates in the burst mode, with two-byte transfers over an attached byte multiplexer channel and multi-byte transfers over an attached block multiplexer or selector channel. It can sustain a data rate of 276,000 bytes per second. Data is transferred in blocks, and except for initiation and termination of a transfer operation, data transfers interrupt the 3705 central control unit only for the memory cycles required to access and move the data.

The Type 3 Channel Adapter has a performance level equivalent to that of the Type 2, but includes an automatic two-processor switch for symmetric support of tightly coupled System/370 multiprocessor configurations. The Type 3 can also be used to provide alternate-path capability by connecting both sides of the switch to two channels of a single processor. The Type 3 also includes a remote switch attachment capability through the configuration control panel of a System/370 158 MP or 168 MP or from a 2925 Model 10 Remote Switching Console.

The Type 4 Channel Adapter transfers data in a burst mode of up to 32 bytes at a time over the attached byte multiplexer

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channel. This adapter can be used only with Type 2 or 3 Scanners and is required when using the Type 3 Scanner in Emulation Mode.

In configurations having four Channel Adapters (Type 1, 2, or 4) connection can be made to four different ports on the same CPU or to four different CPU's (or a mixture). This configuration is useful when operating under 270X emulation mode and full ACF/NCP mode concurrently. When using a Type 3 Channel Adapter (NCP only), there are two connections from each adapter to two tightly coupled CPU's, or, alternately, to two channels of the same CPU. Only one channel per adapter is active at a time and the channel selection is made by a manual switch located on the control panel of the CPU's or under program control.

A manual Two Channel Switch option can be attached to Channel Adapter Type 1, 2, or 4 in the 3705-II. This allows the physical connection of up to four I/O channels on a CPU. However, only one path, per Channel Adapter, can be active at a time. In the 3705-II, the Two Channel Switch option cannot be implemented in any module containing more than one Channel Adapter.

TRANSMISSION SPECIFICATIONS

The accompanying tables summarize the capabilities of the 3705 for accommodating various types of communications lines and techniques.

A wide range of Line Sets is available, but configurations are not as complex to resolve as Table 1 would tend to indicate at first glance. A couple of examples will illustrate this point.

Suppose you wished to interface a communications line coming from an IBM terminal employing SDLC line protocol. All told, there are 8 different Line Sets that could be used, depending on other parameters. But if you also wished to implement internal data sets, and planned to transmit at 2400 bps in a half-duplex, point-to-point arrangement over a leased voice-grade line, the choice would reduce to Line Set 5A. A Bisync terminal with the same operating parameters could also be interfaced with Line Set 5A. Line protocol considerations are handled by the program.

If you wished to accommodate a line to a Bisync terminal operating at 4800 bps using an external modem, the choice would be Line Set 1D.

Operation over the switched telephone network or over a multipoint or point-to-point leased facility will govern the selection of modems. The number of lines to be implemented will also have an effect on selection between internal and external modem arrangements. More lines can be accommodated by using external modems, but the maximum number permitted using internal modems is not all that restrictive, except in a few cases such as Line Sets 5A, 5B, 11A, and 11B.

Restrictions on the usage of the various Line Sets are clearly indicated in Table 1.

The type of LIB required for each type of line set is also indicated in Table 1. The number of LIB's of a given type or of a given mix that is allowed in a module is indicated in Table 2. The type of Communications Scanner to use is also indicated in Table 2. The maximum number of LIB's, obtained from Table 2, multiplied by the product of the lines per line set and the line sets per LIB from Table 1 will supply the maximum number of lines that can be connected to a module.

An exception to the rules depicted in the tables occurs when using Communications Scanners 2 and 3 for line speeds over 4800 bps. To assure adequate scanning of high speed lines, the mix and/or number of line sets per LIB must be restricted. This can be done physically or logically via program control.

Providing the high speed line set is wired to the lower addresses of an LIB (and in some cases the LIB must be the first LIB of the module), the Communication Scanner can be told, by program, to ignore the higher address lines and to use its scanning time to service the high speed line. For line speeds over 10,000 bps, the line sets must be wired to the lowest address of the LIB.

The reason for this requirement is the manner in which the scanner is made to scan a line more frequently via programming initiation. A Type 2 Scanner will normally attempt to scan 96 interfaces (lines). This represents the maximum case of 16 lines for each of 6 LIB's in an expansion module. Starting with the first address in its list of interface addresses, the scanner proceeds to scan each interface; it consults an Upper Scan Limit counter to determine when a scanning cycle is completed and it is time to start at the beginning again. By changing the Upper Scan Limit counter to scan fewer interfaces, the scanning cycle will accordingly take less time. Of course, any line attached to interfaces whose address position in the list is beyond the scan limit will not be scanned. The Upper Scan Limit can be set to scan 96, 48, 16, or 8 interfaces.

Another method of decreasing the elapsed time between scanning a line on a Type 2 Scanner is by Address Substitution. Normally, the address of the high speed line in position 1 of a LIB is substituted in the address list of the addresses of the highest addresses within the same LIB. This causes the scanner to scan the same line two or more times within the same scan cycle. Features to block installation of line sets for the lines that will not be scanned are available for LIB Types 1, 2, 3, and 10. When Address Substitution is used, all Type 2 Scanners must operate in the same manner. Address Substitution causes the scanner to scan only 8, as opposed to 16, lines per LIB. A total of four no-cost features are available for Address Substitution; they must be implemented in order. The first and second features block installation of a line set in partition 8 and 7, respectively, on all Type 1 or 2 LIB's, of all modules. The third and fourth features block installation of a line set in partition 6 and 5, respectively, of all Type 1, 2, 3, and 10 LIB's of all modules. Each LIB is divided into eight Partitions for line addressing purposes. The two lines wired with the lowest addresses in an LIB are in partition 1; the two lines wired with the highest addresses in an LIB are in partition 8.

Upper Scan Limit modification can also be employed with Type 3 scanner. High Speed Select, analogous to Address Substitution is used to modify addresses. An important difference between Address Substitution and High Speed Select, is that High Speed Select is applicable only to a specific scanner; i.e., configuration restrictions apply to only one module. A total of eight no-cost features are available; they must be implemented in order. Each feature blocks the installation of a line set in one partition of any additional LIB's in that module only.

The purpose for each type of LIB is:

Type 1: Lines with external modems and/or auto call, and for directly attached terminals.

Type 2: Telegraph-grade lines.

Type 3: Lines with IBM limited distance line adapters.

Type 5: 2400 bps leased lines with integrated modems.

Type 6: 2400 bps switched network trunks with integrated modems.

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Type 7: 2400 bps switched network trunks with integrated modems and auto call.

Type 8: 1200 bps lines with integrated modems.

Type 9: 1200 bps lines with integrated modems and auto call.

Type 10: 1200 bps lines with integrated modems and full-duplex data transmission.

Type 11: 2400 bps lines with integrated modems and full-duplex data transmission.

Type 12: 1200 bps lines with integrated modems and bi-directional interrupt signal.

SOFTWARE

The program stored in memory controls all functions of the 3705. Many functions such as control character recognition and error procedures are defined and controlled by software. In previous, hard-wired controllers, such as the IBM 2701, 2702, and 2703, these functions were fixed once a particular set of adapters was selected. The 3705 is not totally independent, however. Functions are executed in response to commands issued by the host processor. Indeed, all control ultimately resides with the host processor, including program loading.

The control program residing in the memory of the 3705 is generated on an IBM System/360, System/370 non-virtual, or System/370 virtual computer system through a macro-assembly/link-edit procedure. Generated control programs are loaded into the 3705 memory over the I/O channel connection or over a communications line if the Remote Program Load feature is implemented). The support package for the 360/370 includes the macro assembler, a load program, and a dump routine.

Two types of control programs can be generated. One, which is called NCP for Network Control Program (NCP/VS in virtual environments), provides front-end processing functions that can relieve the host processor of much of the overhead associated with managing multiple data communications lines. The other, which is called EP for Emulation Program (EP/VS for virtual environments) allows a 3705 to replace multiple 2701, 2702, and 2703 controllers with little or no modification of user application programs; operation of the host processor when EP is active is identical with activity under the previous 270X hard-wired controllers, and none of the potential benefits of front-ending is realized. NCP/VS includes provisions for running NCP and EP simultaneously.

NCP, like most general-purpose operating systems, requires a generation procedure to define the hardware (i.e., communications lines and terminals) configuration available and to specify which of the optional facilities will be included. IBM has implemented a macro language for specification of NCP. The language is divided into three types of macros. Systems macros define the 3705 configuration parameters, such as memory size, buffer sizes, and type of channel adapter installed, and any optional control facilities to be included, such as checkpoint/restart and on-line terminal testing. Configuration macros define the makeup of the network and supply information pertinent to each individual type of terminal, including composition of multipoint line operations. Block-handling macros specify any processing to be done in the 3705 on the blocks of data exchanged between the 3705 and the host processor. At present, the only processing macros supplied by IBM provide for insertion of date and time for next correction involving backspaces to correct entries, but the assembler can be used to create additional macros. A framework is provided for structuring routines into symbolically named groups and sets and for controlling the point of execution of each component.

Extensive provisions can be included in NCP for accommodating transient or permanent failures of the communications lines and for gathering statistics on detected errors.

Many of the functions can be controlled dynamically through commands issued by the host processor, including specification of the network configuration by activating and deactivating devices, lines, and groups of lines. In addition, terminal ID, polling, and addressing characters can be modified, the frequency and duration of polling and transmission among the terminals or components of a multipoint line or multi-component terminal can be modified, and the block processing routines associated with a particular terminal can be switched.

NCP/VS provides all the capabilities of NCP plus some valuable additions. One of the principal benefits is the capability to operate in the EP mode and NCP mode concurrently; i.e., a portion of the lines can be operated in the 270X mode while the others operate under NCP. This capability is particularly valuable during the cutover of applications from 270X operation to front-end processing with the 3704, and is referred to as Partitioned Emulation Programming Extension or PEP. The other major expansion of NCP capabilities is the operation of the 3705 as a remote concentrator.

PEP can now support concurrent operation in a dual-processor environment. One CPU supports communication via VTAM or TCAM through VTAM, and is attached via a Type 2 or 3 Channel Adapter; communications are supported under the NCP mode. The other CPU supports communications via a non-VTAM control program which operates under the Emulation Program, and is attached to the same 3705 via a Channel Adapter Type 1; communications are supported under the EP mode of PEP. Control of the dual-CPU PEP operation is performed using the operator control facility of the host CPU operating with the NCP mode of PEP. Functions include: IPL 3705, Dump 3705, and line switching between the EP and NCP modes of PEP. Lines assigned to the NCP portion of PEP are under control of the VTAM facility; lines assigned to the EP portion of PEP are controlled by the Operator Control facility operating with the EP portion of PEP.

NCP/VS operates through the access method, VTAM, in DOS/VS environments and through either VTAM, TCAM, or a combination in OS/VS environments. The combination mode of operation eases conversion requirements.

VTAM is acknowledged by IBM to be the principal access method for telecommunications support under DOS/VS and OS/VS. BTAM and QTAM will not be extended, and enhancements for TCAM will be in the environment provided by VTAM under OS/VS. The chief feature of VTAM is dynamic sharing of network resources. Application programs working through VTAM have access to any terminal, line, or 3704/3705 controller in the network; for example, different application programs can initiate transmission and reception with terminals located on the same multipoint communications lines. By the same token, multiple application programs can have access to the same data base. One component of VTAM is TOLTEP, an on-line testing program for exercising and testing the complete network.

The EP or Emulation Program makes the 3705 look like one or more 2701, 2702, and/or 2703 controllers to the host processor. It offers no operational benefits over the earlier controllers, except for migration. User programs now written for the 270X series will work with a 3705 under EP with some restrictions. Some of the 270X features not supported include transmission with older, 4-of-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission at 230,400 bps, second channel interface, and programmable two-processor switch. However, many of the more common RPQ's are supported.

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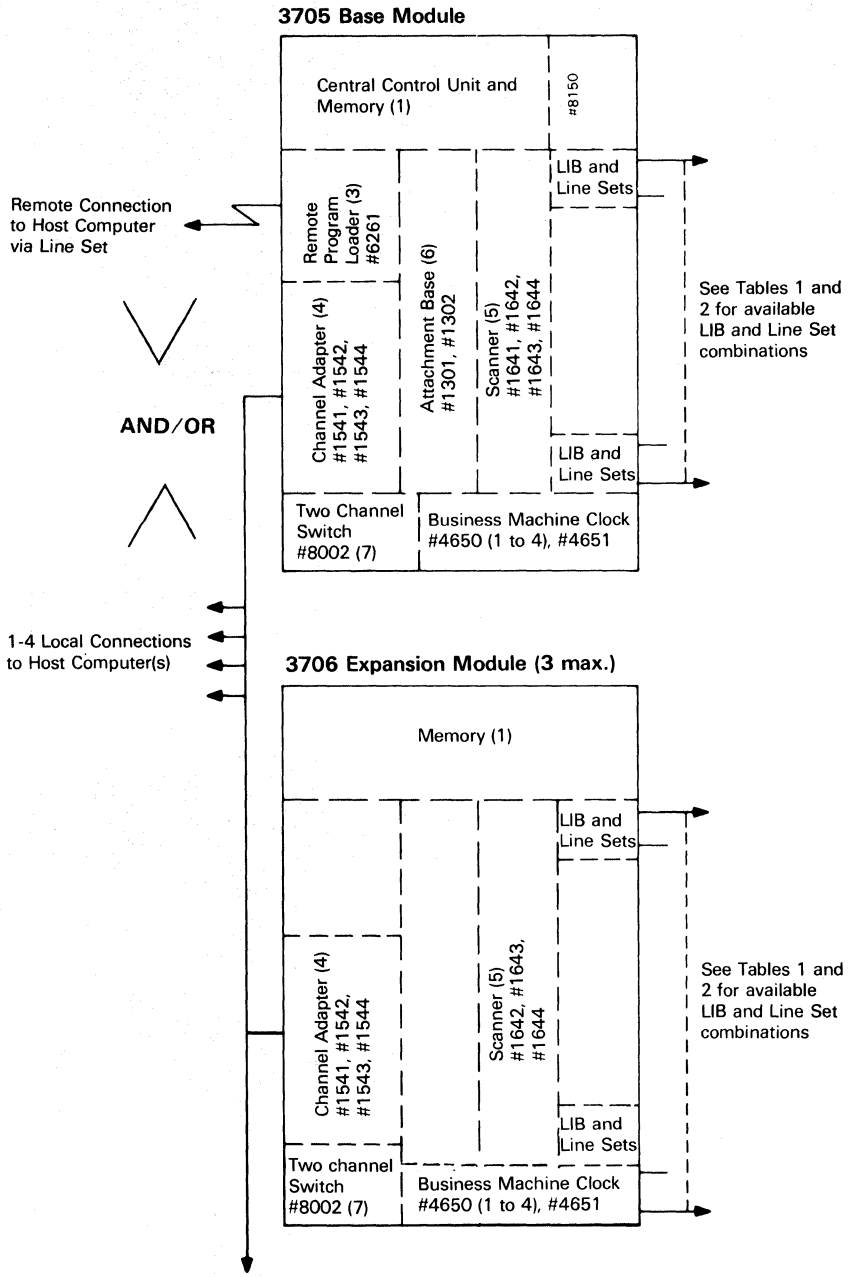
Configuration



(1) In the 3705-II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes. Models J, K and L also include a second module with at least one 64K-byte memory increment.

(2) Extended environment available for all models. Applies to last expansion module.

(3) Maximum of 1 Remote Program Loader per system. Remote Program Loader II for the 3705-II can be installed with up to three channel adapters type 1, 2, 3, or 4. If more than two adapters are used, all must be type 4.

(4) Up to 4 channel adapters type 1, 2, 3, or 4 can be installed in the 3705-II. Two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4. CA Type 1 may not be used with Models J, K or L.

(5) One Scanner Type 2 or 3 can be installed in each of the four modules.

(6) One or two attachment bases are required as follows:

- Scanner Type 2 or 3 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2 or 3 with CA Type 2, 3, 4—Attachment Base Type 2;
- Attachment Base Type 1 can be used only with a CA Type 1 in the 3705-II.

(7) If two Channel Adapters are located in the same frame, no Two Channel Switch is allowed. Can be used with Channel Adapter Type 1, 2, or 4.

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In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) are available. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU with minimal involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, and Advanced Communication Function for VTAM and TCAM is necessary.

ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS and user programs.

Another ACF features is the capability for up to four CPU's to share a single 3705-II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must all be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports the Remote Program Loader-II (RPL-II). RPL-II can be attached to a 3705-II along with up to three channel adapters. With this attachment, a controller that normally operates as a local controller can also function as a remote to another controller. This enables the rerouting of a deactivated or a failed host computer's traffic to other CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705-II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPU's for applications processing.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, NCP/VS can be loaded into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voiceband line operating synchronously at up to 9600 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3705 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Aid Circulation 1 and 2 (for the first and second block of core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications lines; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader-II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not necessary and therefore the options are not provided for the RPL-II.

NEW IBM COMMUNICATIONS SOFTWARE

In the past two years, IBM has taken an increasingly agressive position in the development of communications software, primarily in response to the threatening enhancements made by the competition (other major vendors with architectures, public packet data networks, ATT's proposed ACS, etc.)

As previously mentioned, NCP/VS has become the general system programming for the 3705, which taken together comprise the basic building block of SNA networking. In addition, IBM has made significant progress in recent years through the introduction of additional communications software and modules. This section details some of the new programs and releases, along with their added capabilities. The price list at the end of this report includes the currently available communications software products, and the scheduled forthcoming releases. For an additional discussion on many of these software modules, see the IBM SNA report in tab C11 of this volume.

NETWORK TERMINAL OPTION (NTO): is a software product which is loaded in the 3705 and extends the SNA environment to include support for several common asynchronous terminals. These include the IBM 2740 and 2741 terminals on either switched or leased lines, and Teletype models 33/35 on switched lines only.

TELEPROCESSING NETWORK SIMULATOR (TPNS): is a software package that enables the user to test and evaluate application and communications control programs prior to actual network activation. The latest release

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(as of this publication) is TPNS Release 5, which supports the testing of all of the features detailed in the following newly scheduled releases.

ACF/VTAM ENTRY (ACF/VTAME): is a new telecommunications access method designed for the new 4300 Series processor running DOS/VSE. ACF/VTAME permits the 4331 to handle SNA networking (i.e. SDLC links) with an inexpensive hard-wired communications adapter, instead of a 3705 front end.

NETWORK COMMUNICATIONS CONTROL FACILITY (NCCF): is a program product which runs under the SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

NETWORK PROBLEM DETERMINATION APPLICATION (NPDA): is a program product which supports the collection and on-line retrieval of network error and status information. NPDA assigns probable causes to all specific errors, and runs with NCCF under either VTAM or TCAM. NPDA is required for future implementation of the IBM diagnostic modems scheduled for delivery beginning in 1980.

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In addition, IBM has scheduled new releases of ACF/TCAM (Version 2, Release 3) and ACF/VTAM (Release 3) which will support all of the previously described software modules and projected capabilities. Releases will be made over the next 18 months, depending on the specific operating system.

PRICING

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The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage for any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

3705-II Communications Controller	Monthly Charges* Rental	2-Yr. Lease	Purchase	Monthly Maint.
Model E1 (32K bytes, 64 lines)	$1,263	$1,075	$38,230	$250
Model E2 (64K bytes, 64 lines)	1,392	1,185	39,800	276
Model E3 (96K bytes, 64 lines)	1,521	1,295	41,370	302
Model E4 (128K bytes, 64 lines)	1,650	1,405	42,940	328
Model E5 (160K bytes, 64 lines)	1,779	1,515	44,510	354
Model E6 (192K bytes, 64 lines)	1,908	1,625	46,080	380
Model E7 (224K bytes, 64 lines)	2,037	1,735	47,650	406
Model E8 (256K bytes, 64 lines)	2,166	1,845	49,220	432
Model F1 (32K bytes, 160 lines)	1,692	1,440	51,530	271
Model F2 (64K bytes, 160 lines)	1,821	1,550	53,100	297
Model F3 (96K bytes, 160 lines)	1,950	1,660	54,670	323
Model F4 (128K bytes, 160 lines)	2,079	1,770	56,240	349
Model F5 (160K bytes, 160 lines)	2,208	1,885	57,870	375
Model F6 (192K bytes, 160 lines)	2,337	1,990	59,380	401
Model F7 (224K bytes, 160 lines)	2,466	2,100	60,950	427
Model F8 (256K bytes, 160 lines)	2,595	2,210	62,520	453
Model G1 (32 bytes, 256 lines)	2,120	1,805	64,830	292
Model G2 (64K bytes, 256 lines)	2,249	1,915	66,400	318
Model G3 (96K bytes, 256 lines)	2,378	2,040	67,970	344

*Includes monthly maintenance.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller (Continued)				
	Model G4 (128K bytes, 256 lines)	2,507	2,135	69,540	370
	Model G5 (160K bytes, 256 lines)	2,636	2,245	71,110	396
	Model G6 (192K bytes, 256 lines)	2,765	2,355	72,680	422
	Model G7 (224K bytes, 256 lines)	2,894	2,465	74,250	448
	Model G8 (256K bytes, 256 lines)	3,023	2,575	75,820	474
	Model H1 (32K bytes, 352 lines)	2,548	2,170	78,130	313
	Model H2 (64K bytes, 352 lines)	2,677	2,280	79,700	339
	Model H3 (96K bytes, 352 lines)	2,806	2,390	81,270	365
	Model H4 (128K bytes, 352 lines)	2,935	2,500	82,840	391
	Model H5 (160K bytes, 352 lines)	3,064	2,610	84,410	417
	Model H6 (192K bytes, 352 lines)	3,193	2,720	85,980	443
	Model H7 (224K bytes, 256 lines)	3,322	2,830	87,550	469
	Model H8 (256K bytes, 352 lines)	3,451	2,940	89,120	495
	Model J1 (320K bytes)	3,382	2,880	86,020	535
	Model J2 (384K bytes)	3,640	3,100	89,160	587
	Model J3 (448K bytes)	3,898	3,320	92,300	639
	Model J4 (512K bytes)	4,156	3,540	95,440	691
	Model K1 (320K bytes)	3,810	3,245	99,320	556
	Model K2 (384K bytes)	4,068	3,465	102,460	608
	Model K3 (448K bytes)	4,326	3,685	105,600	660
	Model K4 (512K bytes)	4,586	3,905	108,740	712
	Model L1 (320K bytes)	4,238	3,610	112,620	577
	Model L2 (384K bytes)	4,486	3,830	115,760	629
	Model L3 (448K bytes)	4,754	4,050	118,900	681
	Model L4 (512K bytes)	5,012	4,270	122,040	733
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	19	16	641	0.50
#1302	Type 2	19	16	641	0.50
	Channel Adapters				
#1541	Type 1	115	98	2,700	15.50
#1542	Type 2	212	180	6,470	15.50
#1543	Type 3	427	363	12,910	18.50
#1544	Type 4	184	157	4,410	13.50
#8002	Two Channel Switch	67	57	2,090	4.00
	Communications Scanners				
#1641	Type 1	60	51	1,880	10.00
#1642	Type 2	204	174	4,750	15.50
#1643	Type 3	721	614	17,210	52.00
#1644	Type 3 High Speed	922	785	25,120	62.00
#4650	Business Machine Clock	12	10	424	1.00
#4651	Business Machine Clock	27	23	880	2.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	45	38	1,105	4.50
#4711	Line Set Type 1A	19	16	487	2.00
#4712	Line Set Type 1B	20	17	676	2.00
#4713	Line Set Type 1C	19	16	641	2.00
#4714	Line Set Type 1D	42	36	1,030	4.50
#4715	Line Set Type 1E	33	28	1,030	3.00
#4716	Line Set Type 1F	66	57	2,090	8.50
#4717	Line Set Type 1G	87	74	2,050	9.50
#4718	Line Set Type 1H	74	63	1,745	15.50
#4719	Line Set Type 1J	45	38	1,455	3.50
#4720	Line Set Type 1S	95	81	3,020	9.50
#4722	Line Set Type 1GA	83	71	2,695	9.50
#4723	Line Set Type 1TA	149	127	4,850	15.00
#4725	Line Set Type 1T	156	133	4,850	15.00
#4726	Line Set Type 1U	174	148	5,440	17.00
#4727	Line Set Type 1W	145	123	4,720	10.00
#4728	Line Set Type 1Z	266	226	8,640	17.00
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	45	38	1,455	4.00
#4721	Line Set Type 2A	33	28	1,030	5.50
#4703	Line Interface Base Type 3	82	70	2,515	3.50
#4731	Line Set Type 3A	26	22	850	2.00
#4732	Line Set Type 3B	26	22	850	2.00

*Includes monthly maintenance.
**Single-use Charge, one-time.
NC—No charge.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features (Continued)				
#4704	Line Interface Base Type 4	51	43	1,665	4.50
#4741	Line Set Type 4A	45	38	1,455	5.00
#4742	Line Set Type 4B	45	38	1,455	7.50
#4743	Line Set Type 4C	45	38	1,455	7.50
#4705	Line Interface Base Type 5	115	98	3,555	8.50
#4751	Line Set Type 5A	67	57	2,075	12.00
#4752	Line Set Type 5B	60	51	1,860	11.00
#4706	Line Interface Base Type 6	115	98	3,555	8.50
#4761	Line Set Type 6A	74	63	2,295	15.50
#4707	Line Interface Base Type 7	219	186	6,675	28.50
#4708	Line Interface Base Type 8	45	38	1,455	5.50
#4781	Line Set Type 8A	47	40	1,490	7.50
#4782	Line Set Type 8B	61	52	1,920	9.50
#4709	Line interface Base Type 9	45	38	1,455	4.00
#4791	Line Set Type 9A	67	57	1,785	15.50
#5000	Line Interface Base Type 10	51	43	1,685	3.50
#4784	Line Set Type 10A	87	74	2,685	9.00
#5001	Line Interface Base Type 11	102	87	3,120	4.50
#4754	Line Set Type 11A	102	87	3,120	16.50
#4755	Line Set Type 11B	94	80	2,900	14.00
#5002	Line Interface Base Type 12	43	37	1,190	4.50
#4785	Line Set Type 12A	121	103	3,265	24.00
#4786	Line Set Type 12B	135	115	3,605	27.00
	Remote Concentrator Features				
#6250	Remote Power Off	12	10	416	0.50
#6261	Remote Program Loader-II	308	262	9,335	41.00

*Includes monthly maintenance.

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K-byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

Each additional 32K-byte memory increment above E1, F1, G1 or H1 costs $2,350.

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

3705-II to 3705-II upgrade
Models E, F, G to Models F, G, H — $13,300 for each additional 3706 Module.
$17,750 for each additional 32K-byte memory increment.
Models F, G, H to Models J, K, L — $25,060 for upgrade from F8 to J1, G8 to K1, or H8 to L1, plus $4,700 for each additional 64K-byte memory increment.

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IBM 3705 Communications Controller

SOFTWARE

		Monthly* Charge
5744-BA2	Network Control Program	NC
5747-CH1	System Support Program; for NCP generation and loading	NC
5735-XX1	ACF for NCP/VS; Release 2	$100
5735-XX3	SSP for ACF/NCP/VS; Release 2	50
	Host Access Methods	
5735-RC1	ACF/TCAM; Version 1	200
	With Multisystem Networking Facility	800
5735-RC3	ACF/TCAM; Version 2, Release 1 or Release 2	450
	With Multisystem Networking Facility	800
5746-RC3	ACF/VTAM; Version 1, Release 2; for DOS/VS, DOS/VSE	140
	With Multisystem Networking Facility	325
5735-RC2	ACF/VTAM; Version 1, Release 2; for OS/VS	240
	With Multisystem Networking Facility	600
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	95
	Other Host Networking Software	
5735-XX7	Network Terminal Option; Release 1	100
5735-XX8	Network Problem Determination Application; NPDA	50
5735-XX6	Network Communications Control Facility; NCCF	100
5740-XT4	Teleprocessing Network Simulator; TPNS Release 5	900

SCHEDULED NEW PROGRAM PRODUCT RELEASES

		Monthly Charge	Scheduled Availability
5735-XX1	ACF/NCP/VS; Release 2.1	$120	5/80
5735-XX3	SSP for ACF/NCP/VS; Release 2.1	50	5/80
5735-XX1	ACF/NCP/VS; Release 3	120	5/81
5735-XX3	SSP for ACF/NCP/VS; Release 3	50	5/81
5735-RC3	ACF/TCAM; Version 2, Release 3	450	11/80—MVS
	With Multisystem Networking Facility	800	2/81—OS/VS1
5735-RC2	ACF/VTAM; Release 3; for OS/VS1, MVS	240	11/80—MVS
	With Multisystem Networking Facility	600	5/81—OS/VS1
5746-RC3	ACF/VTAM; Release 3; for DOS/VSE	85	2/81
	With Multisystem Networking Facility	160	
5735-XX8	NPDA; Release 2	50	9/80—MVS 11/80—DOS/VSE 1/81—OS/VS1
5735-XX7	Network Terminal Option; Release 2	100	2/81

*NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP.)■

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Update

IBM 3705 Communications Controller

In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) are available. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU with minimal involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, and Advanced Communication Function for VTAM and TCAM is necessary.

ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS and user programs.

Another ACF features is the capability for up to four CPU's to share a single 3705-II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must all be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports the Remote Program Loader-II (RPL-II). RPL-II can be attached to a 3705-II along with up to three channel adapters. With this attachment, a controller that normally operates as a local controller can also function as a remote to another controller. This enables the rerouting of a deactivated or a failed host computer's traffic to other CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705-II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPU's for applications processing.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, NCP/VS can be loaded into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voiceband line operating synchronously at up to 9600 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3705 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Aid Circulation 1 and 2 (for the first and second block of core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications lines; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader-II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not necessary and therefore the options are not provided for the RPL-II.

NEW IBM COMMUNICATIONS SOFTWARE

In the past two years, IBM has taken an increasingly agressive position in the development of communications software, primarily in response to the threatening enhancements made by the competition (other major vendors with architectures, public packet data networks, ATT's proposed ACS, etc.)

As previously mentioned, NCP/VS has become the general system programming for the 3705, which taken together comprise the basic building block of SNA networking. In addition, IBM has made significant progress in recent years through the introduction of additional communications software and modules. This section details some of the new programs and releases, along with their added capabilities. The price list at the end of this report includes the currently available communications software products, and the scheduled forthcoming releases. For an additional discussion on many of these software modules, see the IBM SNA report in tab C11 of this volume.

NETWORK TERMINAL OPTION (NTO): is a software product which is loaded in the 3705 and extends the SNA environment to include support for several common asynchronous terminals. These include the IBM 2740 and 2741 terminals on either switched or leased lines, and Teletype models 33/35 on switched lines only.

TELEPROCESSING NETWORK SIMULATOR (TPNS): is a software package that enables the user to test and evaluate application and communications control programs prior to actual network activation. The latest release

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IBM 3705 Communications Controller

(as of this publication) is TPNS Release 5, which supports the testing of all of the features detailed in the following newly scheduled releases.

ACF/VTAM ENTRY (ACF/VTAME): is a new telecommunications access method designed for the new 4300 Series processor running DOS/VSE. ACF/VTAME permits the 4331 to handle SNA networking (i.e. SDLC links) with an inexpensive hard-wired communications adapter, instead of a 3705 front end.

NETWORK COMMUNICATIONS CONTROL FACILITY (NCCF): is a program product which runs under the SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

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In addition, IBM has scheduled new releases of ACF/TCAM (Version 2, Release 3) and ACF/VTAM (Release 3) which will support all of the previously described software modules and projected capabilities. Releases will be made over the next 18 months, depending on the specific operating system.

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*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	$1,509	$1,285	$38,230	$213
Model E2 (64K bytes, 64 lines)	1,650	1,405	39,800	239
Model E3 (96K bytes, 64 lines)	1,791	1,525	41,370	265
Model E4 (128K bytes, 64 lines)	1,932	1,645	42,940	291
Model E5 (160K bytes, 64 lines)	2,073	1,765	44,510	317
Model E6 (192K bytes, 64 lines)	2,214	1,885	46,080	343
Model E7 (224K bytes, 64 lines)	2,355	2,005	47,650	369
Model E8 (256K bytes, 64 lines)	2,496	2,125	49,220	395
Model F1 (32K bytes, 160 lines)	2,026	1,725	51,530	231
Model F2 (64K bytes, 160 lines)	2,167	1,845	53,100	257
Model F3 (96K bytes, 160 lines)	2,308	1,965	54,670	283
Model F4 (128K bytes, 160 lines)	2,449	2,085	56,240	309
Model F5 (160K bytes, 160 lines)	2,590	2,205	57,810	335
Model F6 (192K bytes, 160 lines)	2,731	2,325	59,380	361
Model F7 (224K bytes, 160 lines)	2,872	2,445	60,950	387
Model F8 (256K bytes, 160 lines)	3,013	2,565	62,520	413
Model G1 (32K bytes, 256 lines)	2,543	2,165	64,830	249
Model G2 (64K bytes, 256 lines)	2,684	2,285	66,400	275
Model G3 (96K bytes, 256 lines)	2,825	2,405	67,970	301

*Includes monthly maintenance.

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IBM 3705 Communications Controller

Associated Host Software—Host-resident programs that communicate directly with the 3705 and control parts of its operation include the communications access methods (currently ACF/TCAM and ACF/VTAM) and certain program products for network management and control. Between the access methods, ACF/TCAM supports emulation mode, while ACF/VTAM does not. Users migrating gradually to SNA should install ACF/TCAM, while users running full SNA networks may use either.

Network management and control products include the *Network Communications Control Facility* (NCCF) which allows network configuration control from the operator's console of the host, and supports diagnostics under IBM's network troubleshooting program, the *Network Problem Determination Application* (NPDA). *The Network Logical Data Manager* is a data base driver for the recording of network performance and maintenance information.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit for equipment in place). Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price, on the 3705-II and up to 45 percent on the 3705-80.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage of any consecutive nine-hour period between 7 a.m. and 6 p.m., Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

EQUIPMENT PRICES

	Purchase Price ($)	Monthly Maint. ($)	Monthly Charges* Two-Yr. Lease ($)	Monthly Charges* Rental ($)
3705-80 Communications Controller				
Model M81 (256K bytes, 4 lines)	36,600	219	1,465	1,721
Model M82 (256K bytes, 10 lines)	46,600	229	1,925	2,262
Model M83 (256K bytes, 16 lines)	52,600	239	2,265	2,661
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	38,230	147	1,595	1,874
Model E2 (64K bytes, 64 lines)	39,800	165	1,745	2,050
Model E3 (96K bytes, 64 lines)	41,370	183	1,895	2,227
Model E4 (128K bytes, 64 lines)	42,940	201	2,045	2,403
Model E5 (160K bytes, 64 lines)	44,510	219	2,195	2,579
Model E6 (192K bytes, 64 lines)	46,080	237	2,345	2,755
Model E7 (224K bytes, 64 lines)	47,650	254	2,495	2,932
Model E8 (256K bytes, 64 lines)	49,220	273	2,645	3,108
Model F1 (32K bytes, 160 lines)	51,530	160	2,140	2,510
Model F2 (64K bytes, 160 lines)	53,100	177	2,290	2,690
Model F3 (96K bytes, 160 lines)	54,670	196	2,440	2,867
Model F4 (128K bytes, 160 lines)	56,240	213	2,590	3,040
Model F5 (160K bytes, 160 lines)	57,810	231	2,740	3,215
Model F6 (192K bytes, 160 lines)	59,380	249	2,890	3,395
Model F7 (224K bytes, 160 lines)	60,950	267	3,040	3,570
Model F8 (256K bytes, 160 lines)	62,520	285	3,190	3,745
Model G1 (32K bytes, 256 lines)	64,830	172	2,685	3,150
Model G2 (64K bytes, 256 lines)	66,400	190	2,835	3,330

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IBM 3705 Communications Controller

		Purchase Price ($)	Monthly Maint. ($)	Monthly Charges* Two-Yr. Lease ($)	Monthly Charges* Rental ($)
3705-80 Communications Controller (Continued)					
	Model G3 (96K bytes, 256 lines)	67,970	207	2,985	3,505
	Model G4 (128K bytes, 256 lines)	69,540	226	3,135	3,680
	Model G5 (160K bytes, 256 lines)	71,110	243	3,285	3,855
	Model G6 (192K bytes, 256 lines)	72,680	262	3,435	4,035
	Model G7 (224K bytes, 256 lines)	74,250	279	3,585	4,210
	Model G8 (256K bytes, 256 lines)	75,820	298	3,735	4,385
	Model H1 (32K bytes, 352 lines)	78,130	184	3,230	3,795
	Model H2 (64K bytes, 352 lines)	79,700	202	3,380	3,970
	Model H3 (96K bytes, 352 lines)	81,270	220	3,530	4,145
	Model H4 (128K bytes, 352 lines)	82,840	238	3,680	4,320
	Model H5 (160K bytes, 352 lines)	84,410	256	3,830	4,500
	Model H6 (192K bytes, 352 lines)	85,980	274	3,980	4,675
	Model H7 (224K bytes, 256 lines)	87,550	292	4,130	4,850
	Model H8 (256K bytes, 352 lines)	89,120	310	4,280	5,025
	Model J1 (320K bytes)	71,020	314	4,300	5,053
	Model J2 (384K bytes)	74,160	350	4,600	5,045
	Model J3 (448K bytes)	77,300	386	4,900	5,758
	Model J4 (512K bytes)	80,440	422	5,200	6,110
	Model K1 (320K bytes)	84,320	326	4,845	5,690
	Model K2 (384K bytes)	87,460	362	5,145	6,045
	Model K3 (448K bytes)	90,600	398	5,445	6,395
	Model K4 (512K bytes)	93,740	434	5,375	6,750
	Model L1 (320K bytes)	97,620	339	5,390	6,330
	Model L2 (384K bytes)	100,760	375	5,690	6,685
	Model L3 (448K bytes)	103,900	411	5,990	7,035
	Model L4 (512K bytes)	107,040	447	6,290	7,390
Communications Line Sets for 3705-80					
6712	Line Set Type 2	5,440	10.00	219	257
6713	Line Set Type 3	4,850	9.00	195	229
6714	Line Set Type 4	2,060	4.00	80	94
5657	Line Set Type 8	2,600	3.50	98	115
5658	Line Set Type 9	1,550	3.00	57	67
14XX	Business Machine Clock	424	1.00	13	15
Attachment Bases (for 3705-II only)					
1301	Type 1	641	0.50	22	26
1302	Type 2	641	0.50	22	26
Channel Adapters					
1541	Type 1	2,700	9.00	142	167
1542	Type 2 (3705-II only)	6,470	9.00	266	312
1543	Type 3 (3705-II only)	12,910	11.00	541	636
1544	Type 4	4,410	8.00	228	268
1551	Type 1; for 3705-80 only	3,340	9.50	165	194
8002	Two-Channel Switch	2,040	3.50	81	95
Communications Scanners for 3705-II					
1642	Type 2	4,750	9.00	255	300
1643	Type 3	17,210	31.00	915	1,075
1644	Type 3 High Speed	25,120	37.00	1,230	1,445
4650	Business Machine Clock for 3705-II	424	1.00	13	15
4651	Business Machine Clock for 3705-II	880	1.50	33	39

**Includes monthly maintainance.*

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IBM 3705 Communications Controller

In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) are available. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU with minimal involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, and Advanced Communication Function for VTAM and TCAM is necessary.

ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS and user programs.

Another ACF features is the capability for up to four CPU's to share a single 3705-II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must all be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports the Remote Program Loader-II (RPL-II). RPL-II can be attached to a 3705-II along with up to three channel adapters. With this attachment, a controller that normally operates as a local controller can also function as a remote to another controller. This enables the rerouting of a deactivated or a failed host computer's traffic to other CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705-II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPU's for applications processing.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, NCP/VS can be loaded into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voiceband line operating synchronously at up to 9600 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3705 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Aid Circulation 1 and 2 (for the first and second block of core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications lines; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader-II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not necessary and therefore the options are not provided for the RPL-II.

NEW IBM COMMUNICATIONS SOFTWARE

In the past two years, IBM has taken an increasingly agressive position in the development of communications software, primarily in response to the threatening enhancements made by the competition (other major vendors with architectures, public packet data networks, ATT's proposed ACS, etc.)

As previously mentioned, NCP/VS has become the general system programming for the 3705, which taken together comprise the basic building block of SNA networking. In addition, IBM has made significant progress in recent years through the introduction of additional communications software and modules. This section details some of the new programs and releases, along with their added capabilities. The price list at the end of this report includes the currently available communications software products, and the scheduled forthcoming releases. For an additional discussion on many of these software modules, see the IBM SNA report in tab C11 of this volume.

NETWORK TERMINAL OPTION (NTO): is a software product which is loaded in the 3705 and extends the SNA environment to include support for several common asynchronous terminals. These include the IBM 2740 and 2741 terminals on either switched or leased lines, and Teletype models 33/35 on switched lines only.

TELEPROCESSING NETWORK SIMULATOR (TPNS): is a software package that enables the user to test and evaluate application and communications control programs prior to actual network activation. The latest release

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IBM 3705 Communications Controller

(as of this publication) is TPNS Release 5, which supports the testing of all of the features detailed in the following newly scheduled releases.

ACF/VTAM ENTRY (ACF/VTAME): is a new telecommunications access method designed for the new 4300 Series processor running DOS/VSE. ACF/VTAME permits the 4331 to handle SNA networking (i.e. SDLC links) with an inexpensive hard-wired communications adapter, instead of a 3705 front end.

NETWORK COMMUNICATIONS CONTROL FACILITY (NCCF): is a program product which runs under the SNA-supporting versions of either TCAM or VTAM, and supports the network diagnostic capabilities of the Network Problem Determination Application (see below). In addition, NCCF supports multiple network operators (local and/or remote), and operator access to the network through the use of user-written exit routines and user-defined commands.

NETWORK PROBLEM DETERMINATION APPLICATION (NPDA): is a program product which supports the collection and on-line retrieval of network error and status information. NPDA assigns probable causes to all specific errors, and runs with NCCF under either VTAM or TCAM. NPDA is required for future implementation of the IBM diagnostic modems scheduled for delivery beginning in 1980.

In June 1979, IBM released schedules for extensive new battery of communications software releases, to be delivered through 1981. These included two new releases of ACF/NCP/VS; Release 2.1, which is scheduled for release in May 1980; and Release 3, scheduled for release in May 1981. The former will provide support for the diagnostic modems and the 230.4K bps line capability. The latter will reportedly add support for enhanced network flow control, automatic rerouting between nodes, logical grouping of transmission links between adjacent nodes, extended interconnection of local and remote 3705's, and assignment of priority levels to all session traffic.

In addition, IBM has scheduled new releases of ACF/TCAM (Version 2, Release 3) and ACF/VTAM (Release 3) which will support all of the previously described software modules and projected capabilities. Releases will be made over the next 18 months, depending on the specific operating system.

PRICING

All 3705 components can be acquired by purchase or under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit) for equipment in place. Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage for any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	$1,351	$1,150	$38,230	$250
Model E2 (64K bytes, 64 lines)	1,486	1,265	39,800	276
Model E3 (96K bytes, 64 lines)	1,621	1,380	41,370	302
Model E4 (128K bytes, 64 lines)	1,756	1,495	42,940	328
Model E5 (160K bytes, 64 lines)	1,891	1,610	44,510	354
Model E6 (192K bytes, 64 lines)	2,026	1,725	46,080	380
Model E7 (224K bytes, 64 lines)	2,161	1,840	47,650	406
Model E8 (256K bytes, 64 lines)	2,296	1,955	49,220	432
Model F1 (32K bytes, 160 lines)	1,809	1,540	51,530	271
Model F2 (64K bytes, 160 lines)	1,944	1,655	53,100	297
Model F3 (96K bytes, 160 lines)	2,079	1,770	54,670	323
Model F4 (128K bytes, 160 lines)	2,214	1,885	56,240	349
Model F5 (160K bytes, 160 lines)	2,349	2,000	57,810	375
Model F6 (192K bytes, 160 lines)	2,484	2,115	59,380	401
Model F7 (224K bytes, 160 lines)	2,619	2,230	60,950	427
Model F8 (256K bytes, 160 lines)	2,754	2,345	62,520	453
Model G1 (32 bytes, 256 lines)	2,267	1,903	64,830	292
Model G2 (64K bytes, 256 lines)	2,402	2,045	66,400	318
Model G3 (96K bytes, 256 lines)	2,537	2,160	67,970	344

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Update

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First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponded to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) are available. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU with minimal involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, and Advanced Communication Function for VTAM and TCAM is necessary.

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The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	$1,415	$1,205	$38,230	$250
Model E2 (64K bytes, 64 lines)	1,556	1,325	39,800	276
Model E3 (96K bytes, 64 lines)	1,697	1,445	41,370	302
Model E4 (128K bytes, 64 lines)	1,838	1,565	42,940	328
Model E5 (160K bytes, 64 lines)	1,979	1,685	44,510	354
Model E6 (192K bytes, 64 lines)	2,120	1,805	46,080	380
Model E7 (224K bytes, 64 lines)	2,261	1,925	47,650	406
Model E8 (256K bytes, 64 lines)	2,402	2,045	49,220	432
Model F1 (32K bytes, 160 lines)	1,897	1,615	51,530	271
Model F2 (64K bytes, 160 lines)	2,038	1,735	53,100	297
Model F3 (96K bytes, 160 lines)	2,179	1,855	54,670	323
Model F4 (128K bytes, 160 lines)	2,320	1,975	56,240	349
Model F5 (160K bytes, 160 lines)	2,461	2,095	57,810	375
Model F6 (192K bytes, 160 lines)	2,602	2,215	59,380	401
Model F7 (224K bytes, 160 lines)	2,743	2,335	60,950	427
Model F8 (256K bytes, 160 lines)	2,884	2,455	62,520	453
Model G1 (32K bytes, 256 lines)	2,379	2,025	64,830	292
Model G2 (64K bytes, 256 lines)	2,520	2,145	66,400	318
Model G3 (96K bytes, 256 lines)	2,661	2,265	67,970	344

*Includes monthly maintenance.

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IBM 3705 Communications Controller

Update

PRICING

All 3705 components can be acquired by purchase or are available under the terms of IBM's Lease or Rental Agreement (LRA). LRA provides for month-to-month rentals or two-year leases. A lease can be extended indefinitely in increments of one year, or one time for less than one year. IBM's present pricing policy on the 3705 allows lease extensions at no increase in monthly charges (zero percent upper limit) for equipment in place. Penalty charges for early termination of a lease (including model downgrades and feature removals) are computed as the lower of either 5 months' charges or 25 percent of the remaining value of the lease. The monthly charges for a lease are generally 15 percent less than monthly rental charges.

The 3705 is covered under Plan A of the Lease or Rental Agreement. Under rental Plan A, there is an overtime premium charge of 10 percent per hour over the 176 hours per month allowed; under the lease plan, there are no overtime charges. Purchase credits for basic payments made under LRA can be accrued up to a maximum of 60 percent of the total purchase price.

LRA includes prime-shift maintenance; a separate agreement can be arranged for maintenance on purchased units. The 3705 is covered under Category D maintenance, which provides coverage for any consecutive nine-hour period between 7 AM and 6 PM, Monday through Friday (prime shift maintenance period). Extended period maintenance is available up to 24 hours a day, 7 days per week. The Monthly Maintenance Charge shown in the accompanying price list covers prime-shift maintenance for purchased equipment and serves as a basis for calculating extended charges for rented or leased equipment.

The premiums for extended maintenance are expressed in the following table as percentages of the basic maintenance charge shown in the price list.

Consecutive Hours	9*	12	16	20	24
Monday-Friday	10%	14%	18%	22%	26%
Saturday	4%	5%	7%	8%	9%
Sunday	5%	7%	9%	11%	12%

*Outside prime shift.

	Monthly Charges*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-I Communications Controller				
Model A1 (16K bytes, 64 lines)	$1,345	$1,145	$ 40,800	$197.00
Model A2 (48K bytes, 64 lines)	1,926	1,640	58,550	239.00
Model B1 (16K bytes, 160 lines)	1,773	1,510	54,100	220.00
Model B2 (48K bytes, 160 lines)	2,354	2,005	71,850	261.00
Model B3 (80K bytes, 160 lines)	2,935	2,500	89,600	304.00
Model B4 (112K bytes, 160 lines)	3,516	2,995	107,350	345.00
Model C1 (16K bytes, 256 lines)	2,201	1,875	67,400	241.00
Model C2 (48K bytes, 256 lines)	2,782	2,370	85,150	285.00
Model C3 (80K bytes, 256 lines)	3,363	2,865	102,900	326.00
Model C4 (112K bytes, 256 lines)	3,944	3,360	120,650	369.00
Model C5 (144K bytes, 256 lines)	4,525	3,855	138,400	410.00
Model C6 (176K bytes, 256 lines)	5,106	4,350	156,150	452.00
Model D1 (16K bytes, 352 lines)	2,629	2,240	80,700	264.00
Model D2 (48K bytes, 352 lines)	3,210	2,735	98,450	306.00
Model D3 (80K bytes, 352 lines)	3,791	3,230	116,200	350.00
Model D4 (112K bytes, 352 lines)	4,372	3,725	133,950	391.00
Model D5 (144K bytes, 352 lines)	4,953	4,220	151,700	433.00
Model D6 (176K bytes, 352 lines)	5,534	4,715	169,450	475.00
Model D7 (208K bytes, 352 lines)	6,115	5,210	187,200	517.00
Model D8 (240K bytes, 352 lines)	6,696	5,705	204,950	560.00
#8510 Unit Protection	35**	35**	35	NC
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	$1,263	$1,075	38,230	250.00
Model E2 (64K bytes, 64 lines)	1,392	1,185	40,580	276.00
Model E3 (96K bytes, 64 lines)	1,521	1,295	42,930	302.00
Model E4 (128K bytes, 64 lines)	1,650	1,405	45,280	328.00
Model E5 (160K bytes, 64 lines)	1,779	1,515	47,630	354.00
Model E6 (192K bytes, 64 lines)	1,908	1,625	49,980	380.00
Model E7 (224K bytes, 64 lines)	2,037	1,735	52,330	406.00
Model E8 (256K bytes, 64 lines)	2,166	1,845	54,680	432.00
Model F1 (32K bytes, 160 lines)	1,692	1,440	51,530	271.00
Model F2 (64K bytes, 160 lines)	1,821	1,550	53,880	297.00
Model F3 (96K bytes, 160 lines)	1,950	1,660	56,230	323.00
Model F4 (128K bytes, 160 lines)	2,079	1,770	58,580	349.00
Model F5 (160K bytes, 160 lines)	2,208	1,885	60,930	375.00
Model F6 (192K bytes, 160 lines)	2,337	1,990	63,280	401.00
Model F7 (224K bytes, 160 lines)	2,466	2,100	65,630	427.00
Model F8 (256K bytes, 160 lines)	2,595	2,210	67,980	453.00

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller (Continued)				
	Model G1 (32 bytes, 256 lines)	$2,120	$1,805	64,830	292.00
	Model G2 (64K bytes, 256 lines)	2,249	1,915	67,180	318.00
	Model G3 (96K bytes, 256 lines)	2,378	2,040	69,530	344.00
	Model G4 (128K bytes, 256 lines)	2,507	2,135	71,880	370.00
	Model G5 (160K bytes, 256 lines)	2,636	2,245	74,230	396.00
	Model G6 (192K bytes, 256 lines)	2,765	2,355	76,580	422.00
	Model G7 (224K bytes, 256 lines)	2,894	2,465	78,930	448.00
	Model G8 (256K bytes, 256 lines)	3,023	2,575	81,280	474.00
	Model H1 (32K bytes, 352 lines)	2,548	2,170	78,130	313.00
	Model H2 (64K bytes, 352 lines)	2,677	2,280	80,480	339.00
	Model H3 (96K bytes, 352 lines)	2,806	2,390	82,830	365.00
	Model H4 (128K bytes, 352 lines)	2,935	2,500	85,180	391.00
	Model H5 (160K bytes, 352 lines)	3,064	2,610	87,530	417.00
	Model H6 (192K bytes, 352 lines)	3,193	2,720	89,880	443.00
	Model H7 (224K bytes, 256 lines)	3,322	2,830	92,230	469.00
	Model H8 (256K bytes, 352 lines)	3,451	2,940	94,580	495.00
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	19	16	641	0.50
#1302	Type 2	19	16	641	0.50
	Channel Adapters				
#1541	Type 1	115	98	2,700	15.50
#1542	Type 2	212	180	6,470	15.50
#1543	Type 3	427	363	12,910	18.50
#1544	Type 4	184	157	4,410	13.50
#8002	Two Channel Switch	67	57	2,090	4.00
	Communications Scanners				
#1641	Type 1	60	51	1,880	10.00
#1642	Type 2	204	174	4,750	15.50
#1643	Type 3	721	614	17,210	52.00
#4650	Business Machine Clock	12	10	424	1.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	45	38	1,105	4.50
#4711	Line Set Type 1A	19	16	487	2.00
#4712	Line Set Type 1B	20	17	676	2.00
#4713	Line Set Type 1C	19	16	641	2.00
#4714	Line Set Type 1D	42	36	1,030	4.50
#4715	Line Set Type 1E	33	28	1,030	3.00
#4716	Line Set Type 1F	66	57	2,090	8.50
#4717	Line Set Type 1G	87	74	2,050	9.50
#4718	Line Set Type 1H	74	63	1,745	15.50
#4719	Line Set Type 1J	45	38	1,455	3.50
#4720	Line Set Type 1S	95	81	3,020	9.50
#4725	Line Set Type 1T	156	133	4,850	15.00
#4726	Line Set Type 1U	174	148	5,440	17.00
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	45	38	1,455	4.00
#4721	Line Set Type 2A	33	28	1,030	5.50
#4703	Line Interface Base Type 3	82	70	2,515	3.50
#4731	Line Set Type 3A	26	22	850	2.00
#4732	Line Set Type 3B	26	22	850	2.00

*Includes monthly maintenance.
**Single-Use Charge, one time.

NC—No charge.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Purchase Price ($)	Monthly Maint. ($)	Two-Yr. Lease ($)	Rental ($)
Communication Line Attachment Features for 3705-II					
4701	Line Interface Base Type 1:	1,105	3.00	56	66
4714	Line Set Type 1D	1,030	3.00	51	60
4715	Line Set Type 1E	1,030	2.50	40	47
4717	Line Set Type 1G	2,050	6.00	108	126
4719	Line Set Type 1J	1,455	2.50	56	66
5655	Line Set Type 1N	2,040	3.00	69	81
5656	Line Set Type 1R	1,700	3.00	57	67
4720	Line Set Type 1S	3,020	6.50	118	139
4722	Line Set Type 1GA	2,695	6.00	108	126
4723	Line Set Type 1TA	4,850	9.00	195	229
4725	Line Set Type 1T	4,850	9.00	195	229
4726	Line Set Type 1U	5,440	10.00	219	257
4727	Line Set Type 1W	4,720	6.00	180	212
4728	Line Set Type 1Z	8,640	10.00	335	394
4702	Line Interface Base Type 2	1,455	2.50	56	66
4721	Line Set Type 2A	1,030	3.50	40	47
4703	Line Interface Base Type 3	2,515	2.50	100	117
4731	Line Set Type 3A	850	1.50	32	37
4732	Line Set Type 3B	850	1.50	32	37
4708	Line Interface Base Type 8	1,455	3.50	56	66
4781	Line Set Type 8A	1,490	4.50	57	67
4782	Line Set Type 8B	1,920	6.00	75	88
4709	Line Interface Base Type 9	1,455	2.50	56	66
4791	Line Set Type 9A	1,785	10.00	83	98
5000	Line Interface Base Type 10	1,685	2.50	63	74
4784	Line Set Type 10A	2,685	5.50	108	126
Remote Concentrator Features					
6250	Remote Power Off	416	0.50	13	15
6261	Remote Program Loader-II	9,335	24.50	391	459

**Includes monthly maintenance.*

SOFTWARE PRICES*

		Monthly Basic License ($)	Monthly DSLO License ($)	Monthly Licensed Program Support ($)	Monthly Multiple Licensed Program Support ($)
5744-BA2	Network Control Program	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Version 2	234	176	35	56
5735-XX3	SSP for ACF/NCP/VS Version 2	72	54	19	30
	Host Access Methods				
5735-RC1	ACF/TCAM Version 1	329	246	12	19
	With Multisystem Networking Facility	1,220	915	31	50
5735-RC3	ACF/TCAM Version 2, Releases 1, 2, 3, & 4	847	655	91	145
	With Multisystem Networking Facility	1,465	1,099	113	181
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	185	166	53	85
	With Multisystem Networking Facility	350	315	159	254
5735-RC2	ACF/VTAM Version 1, Release 1, 2, & 3	416	343	55	88
	With Multisystem Networking Facility	1,000	825	163	260
	Encrypt/Decrypt Feature	245	202	8	13

NC—No charge, as basic software load is provided as part of System Control Programming (SCP).
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide on-site service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.*

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IBM 3705 Communications Controller

		Monthly Basic License ($)	Monthly DSLO License ($)	Monthly Licensed Program Support ($)	Monthly Multiple Licensed Program Support ($)
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	179	161	75	120
	Other Host Networking Software				
5735-XX7	Network Terminal Option Releases 1, 2, & 3	206	155	12	19
5735-XX8	Network Problem Determination Application (NPDA) Releases 1 & 2	69	51	23	37
5735-XX6	Network Communications Control Facility (NCCF)	156	117	48	77
5668-963	Network Routing Facility Version 1.5	1,070	803	248	397
5668-963	Network Routing Facility Release 2	1,175	881	248	392
5668-981	X.25 Packet Switching Interface	223	166	40	64
5668-981	X.25 Packet Switching Interface Versions 3 & 4	269	202	40	64

NC—No charge, as basic software load is provided as part of System Control Programming (SCP).
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide on-site service. Distributed Systems License Option (DSLO) and Multiple Licensed Program Support are available for customers with multiple CPUs that utilize replicated software managed from a central site; under these plans, software installation support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.* ■

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features (Continued)				
#4704	Line Interface Base Type 4	51	43	1,665	4.50
#4741	Line Set Type 4A	45	38	1,455	5.00
#4742	Line Set Type 4B	45	38	1,455	7.50
#4743	Line Set Type 4C	45	38	1,455	7.50
#4705	Line Interface Base Type 5	115	98	3,555	8.50
#4751	Line Set Type 5A	67	57	2,075	12.00
#4752	Line Set Type 5B	60	51	1,860	11.00
#4706	Line Interface Base Type 6	115	98	3,555	8.50
#4761	Line Set Type 6A	74	63	2,295	15.50
#4707	Line Interface Base Type 7	219	186	6,675	28.50
#4708	Line Interface Base Type 8	45	38	1,455	5.50
#4781	Line Set Type 8A	47	40	1,490	7.50
#4782	Line Set Type 8B	61	52	1,920	9.50
#4709	Line Interface Base Type 9	45	38	1,455	4.00
#4791	Line Set Type 9A	67	57	1,785	15.50
#5000	Line Interface Base Type 10	51	43	1,685	3.50
#4784	Line Set Type 10A	87	74	2,685	9.00
#5001	Line Interface Base Type 11	102	87	3,120	4.50
#4754	Line Set Type 11A	102	87	3,120	16.50
#4755	Line Set Type 11B	94	80	2,900	14.00
#5002	Line Interface Base Type 12	43	37	1,190	4.50
#4785	Line Set Type 12A	121	103	3,265	24.00
#4786	Line Set Type 12B	135	115	3,605	27.00
	Remote Concentrator Features				
#3620	Extended Environment	25	21	832	NC
#4670	Internal Air Circulation	12	10	416	NC
#4671	Internal Air Circulation 2	6	5	207	NC
#6250	Remote Power Off	12	10	416	0.50
#6260	Remote Program Loader	275	234	8,320	45.00
#6261	Remote Program Loader-II	308	262	9,335	41.00

*Includes monthly maintenance.
**Single-Use Charge, one time.

NC—No charge.

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K bytes increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

Additional memory can be added in 32K byte increments for $2,350 per increment. Total memory capacity of the 3705-II is 256K bytes.■

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IBM 3705 Communications Controller (Versions I and II)

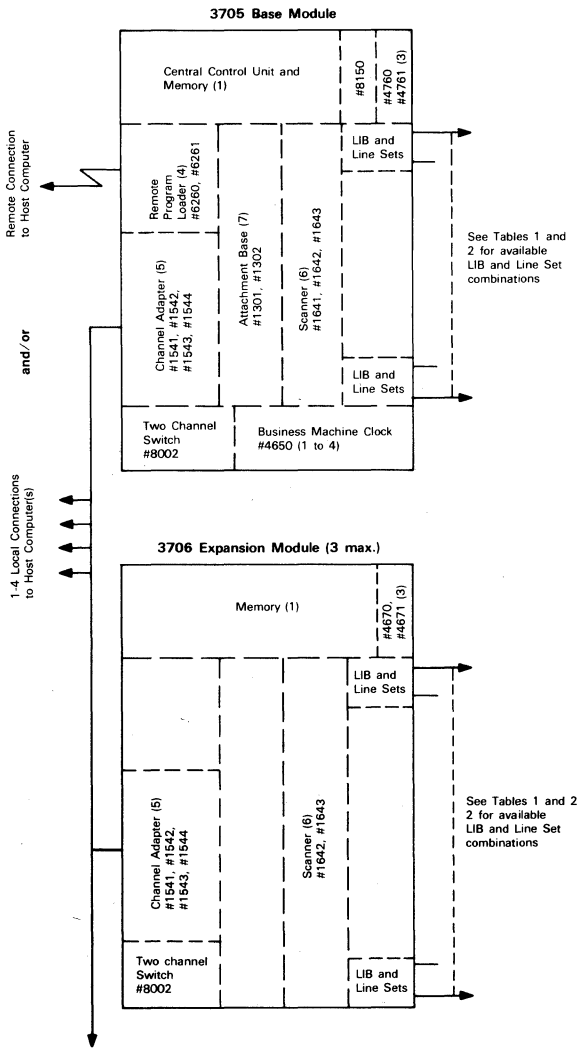
sary and therefore the options are not provided for the RPL-II.

PRICING

The 3705 can be acquired by purchase, short-term rental, or under IBM's Extended Term Lease Plan, which was introduced with the 3705. In the following price list, maintenance charges are included in the figures for both the short-term rental and Extended Term Plan; a separate arrangement is available for purchased units, and the figures are shown.

Under the short-term plan, overtime usage is charged at 10 percent of the regular hourly rates. Under the Extended Term Plan, there are no overtime charges. The initial lease period for the Extended Term Plan is 24 months, and the term is extendable indefinitely in increments of one year or one time for less than a year. However, charges for early termination of the Extended Term Plan range from two to five times the monthly rental, depending on how long the lease has been in effect; equipment can be upgraded without incurring termination charges.

Configuration (Version II)



(1) Memory capacity in the 3705-I is 16K to 48K bytes in base module and 32K to 64K bytes in each expansion module. Maximum 3705-I system capacity is 240K bytes. In the 3705-II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes.

(2) Extended environment available for all models except A1, B1, C1, D1. Applies to base module in A2 module, otherwise to last expansion module.

(3) Air circulation for first and second block of memory for each base or expansion module.

(4) Maximum of 1 Remote Program Loader per system. Cannot be installed with channel adapter type 1, 2, 3, or 4; or Scanner Type 3; or LIB, Type 5 or 11. Remote Program Loader II or the 3705-II can be installed with up to three channel adapters type 1, 2, 3, or 4. If more than two adapters are used, all must be type 4.

(5) In general, 1 channel adapter (CA) Type 1, 2, 3, or 4 can be installed in the first expansion module of the 3705-I; except that types 1 and 4 are mutually exclusive. Up to 4 channel adapters type 1, 2, 3, or 4 can be installed in the 3705-II. Two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4.

(6) One Scanner Type 1, 2 or 3 can be installed in each of the four modules, subject to the following limitations:
- If Type 1 Scanner is installed, no additional Scanners of any Type can be added to the system.
- Scanner Type 1 cannot be used in the 3705-II.
- Scanner Type 3 cannot be installed in a 3705 system with a CA Type 4.
- Scanner Type 3 cannot be installed in base module of 3705-I.

(7) One or two attachment bases are required as follows:
- Scanner Type 1 with CA Type 1—Attachment Base Type 1;
- Scanner Type 2 or 3 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2 or 3 with CA Type 2, 3, 4—Attachment Base Type 2;
- Attachment Base Type 1 can be used only with a CA Type 1 in the 3705-II.

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IBM 3705 Communications Controller
(Versions I and II)

		Monthly Rental*			
		Short Term	Extended Term	Purchase	Monthly Maint.
3705-I Communications Controller					
Model A1 (16K bytes, 64 lines)		$1,287	$1,095	$ 40,800	197
Model A2 (48K bytes, 64 lines)		1,845	1,570	58,550	239.00
Model B1 (16K bytes, 160 lines)		1,698	1,445	54,100	220.00
Model B2 (48K bytes, 160 lines)		2,262	1,925	71,850	261.00
Model B3 (80K bytes, 160 lines)		2,826	2,405	89,600	304.00
Model B4 (112K bytes, 160 lines)		3,384	2,880	107,350	345.00
Model C1 (16K bytes, 256 lines)		2,133	1,815	67,400	241.00
Model C2 (48K bytes, 256 lines)		2,691	2,290	85,150	285.00
Model C3 (80K bytes, 256 lines)		3,249	2,765	102,900	326.00
Model C4 (112K bytes, 256 lines)		3,813	3,245	120,650	369.00
Model C5 (144K bytes, 256 lines)		4,365	3,715	138,400	410.00
Model C6 (176K bytes, 256 lines)		4,923	4,190	156,150	452.00
Model D1 (16K bytes, 352 lines)		2,550	2,170	80,700	264.00
Model D2 (48K bytes, 352 lines)		3,108	2,645	98,450	306.00
Model D3 (80K bytes, 352 lines)		3,672	3,125	116,200	350.00
Model D4 (112K bytes, 352 lines)		4,236	3,605	133,950	391.00
Model D5 (144K bytes, 352 lines)		4,794	4,080	151,700	433.00
Model D6 (176K bytes, 352 lines)		5,352	4,555	169,450	475.00
Model D7 (208K bytes, 352 lines)		5,916	5,035	187,200	517
Model D8 (240K bytes, 352 lines)		6,474	5,510	204,950	560.00
#8510 Unit Protection		35**	35**	35	NC
3705-II Communications Controller					
Model E1 (32K bytes, 64 lines)		1,204	1,025	33,230	250.00
Model E2 (64K bytes, 64 lines)		1,363	1,160	41,730	276.00
Model E3 (96K bytes, 64 lines)		1,522	1,295	45,230	302.00
Model E4 (128K bytes, 64 lines)		1,680	1,430	48,730	328.00
Model E5 (160K bytes, 64 lines)		1,839	1,565	52,230	354.00
Model E6 (192K bytes, 64 lines)		1,998	1,700	55,730	380.00
Model E7 (224K bytes, 64 lines)		2,156	1,835	59,230	406.00
Model E8 (256K bytes, 64 lines)		2,315	1,970	62,730	432.00
Model F1 (32K bytes, 160 lines)		1,616	1,375	51,530	271.00
Model F2 (64K bytes, 160 lines)		1,774	1,510	55,030	297.00
Model F3 (96K bytes, 160 lines)		1,933	1,645	58,530	323.00
Model F4 (128K bytes, 160 lines)		2,092	1,780	62,030	349.00
Model F5 (160K bytes, 160 lines)		2,250	1,915	65,530	375.00
Model F6 (192K bytes, 160 lines)		2,409	2,050	69,030	401.00
Model F7 (224K bytes, 160 lines)		2,567	2,185	72,530	427.00
Model F8 (256K bytes, 160 lines)		2,726	2,320	76,030	453.00
Model G1 (32K bytes, 256 lines)		2,027	1,725	64,830	292.00
Model G2 (64K bytes, 256 lines)		2,186	1,860	68,330	318.00
Model G3 (96K bytes, 256 lines)		2,344	1,995	71,830	344.00
Model G4 (128K bytes, 256 lines)		2,503	2,130	75,330	370.00
Model G5 (160K bytes, 256 lines)		2,661	2,265	78,830	396.00
Model G6 (192K bytes, 256 lines)		2,820	2,400	82,330	422.00
Model G7 (224K bytes, 256 lines)		2,979	2,535	85,830	448.00
Model G8 (256K bytes, 256 lines)		3,137	2,670	89,330	474.00
Model H1 (32K bytes, 352 lines)		2,438	2,075	78,130	313.00
Model H2 (64K bytes, 352 lines)		2,597	2,210	81,630	339.00
Model H3 (96K bytes, 352 lines)		2,755	2,345	85,130	365.00
Model H4 (128K bytes, 352 lines)		2,914	2,480	88,630	391.00
Model H5 (160K bytes, 352 lines)		3,073	2,615	92,130	417.00
Model H6 (192K bytes, 352 lines)		3,231	2,750	95,630	443.00
Model H7 (224K bytes, 256 lines)		3,390	2,885	99,130	469.00
Model H8 (256K bytes, 352 lines)		3,549	3,020	102,630	495.00
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	19	16	641	0.50
#1302	Type 2	19	16	641	0.50
	Channel Adapters				
#1544	Type 1	110	94	3,555	15.50
#1542	Type 2	202	172	6,470	15.50
#1543	Type 3	407	346	12,910	18.50
#1544	Type 4	176	150	5,800	13.50
#8002	Two Channel Switch	65	55	2,090	4.00

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller (Continued)				
	Model G4 (128K bytes, 256 lines)	$2,951	$2,525	$69,540	$327
	Model G5 (160K bytes, 256 lines)	3,107	2,645	71,110	353
	Model G6 (192K bytes, 256 lines)	3,248	2,765	72,680	379
	Model G7 (224K bytes, 256 lines)	3,389	2,885	74,250	405
	Model G8 (256K bytes, 256 lines)	3,530	3,005	75,820	431
	Model H1 (32K bytes, 352 lines)	3,060	2,605	78,130	267
	Model H2 (64K bytes, 352 lines)	3,201	2,725	79,700	293
	Model H3 (96K bytes, 352 lines)	3,342	2,845	81,270	319
	Model H4 (128K bytes, 352 lines)	3,483	2,965	82,840	345
	Model H5 (160K bytes, 352 lines)	3,624	3,085	84,410	371
	Model H6 (192K bytes, 352 lines)	3,765	3,205	85,980	397
	Model H7 (224K bytes, 256 lines)	3,906	3,325	87,550	423
	Model H8 (256K bytes, 352 lines)	4,047	3,445	89,120	449
	Model J1 (320K bytes)	4,059	3,455	86,020	455
	Model J2 (384K bytes)	4,346	3,700	89,160	507
	Model J3 (448K bytes)	4,633	3,945	92,300	559
	Model J4 (512K bytes)	4,920	4,190	95,440	611
	Model K1 (320K bytes)	4,570	3,890	99,320	473
	Model K2 (384K bytes)	4,857	4,135	102,460	525
	Model K3 (448K bytes)	5,144	4,130	105,600	577
	Model K4 (512K bytes)	5,431	4,625	108,740	629
	Model L1 (320K bytes)	5,087	4,330	112,620	491
	Model L2 (384K bytes)	5,374	4,295	115,760	543
	Model L3 (448K bytes)	5,661	4,820	118,900	595
	Model L4 (512K bytes)	5,948	5,065	122,040	647
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	21	18	641	0.50
#1302	Type 2	21	18	641	0.50
	Channel Adapters				
#1541	Type 1	136	116	2,700	13.50
#1542	Type 2	251	214	6,470	13.50
#1543	Type 3	511	435	12,910	16.00
#1544	Type 4	217	185	4,410	11.50
#8002	Two Channel Switch	79	67	2,090	3.50
	Communications Scanners				
#1641	Type 1	71	60	1,880	8.50
#1642	Type 2	242	206	4,750	13.50
#1643	Type 3	864	735	17,210	44.50
#1644	Type 3 High Speed	1,161	988	25,120	53.00
#4650	Business Machine Clock	13	11	424	1.00
#4651	Business Machine Clock	32	27	880	2.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	53	45	1,105	4.00
#4711	Line Set Type 1A	21	18	487	2.00
#4712	Line Set Type 1B	22	19	676	2.00
#4713	Line Set Type 1C	21	18	641	2.00
#4714	Line Set Type 1D	48	41	1,030	4.00
#4715	Line Set Type 1E	38	32	1,030	3.00
#4716	Line Set Type 1F	48	41	1,030	4.00
#4717	Line Set Type 1G	103	88	2,050	8.50
#4718	Line Set Type 1H	48	41	1,030	4.00
#4719	Line Set Type 1J	53	45	1,455	3.00
#4720	Line Set Type 1S	113	96	3,020	8.50
#4722	Line Set Type 1GA	103	88	2,695	8.50
#4723	Line Set Type 1TA	186	158	4,850	13.00
#4725	Line Set Type 1T	186	158	4,850	13.00
#4726	Line Set Type 1U	207	176	5,440	14.50
#4727	Line Set Type 1W	172	146	4,720	9.50
#4728	Line Set Type 1Z	317	270	8,640	14.50
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	53	45	1,455	3.50
#4721	Line Set Type 2A	38	32	1,030	5.00
#4703	Line Interface Base Type 3	95	81	2,515	3.00
#4731	Line Set Type 3A	31	26	850	2.00
#4732	Line Set Type 3B	31	26	850	2.00

*Includes monthly maintenance.
**Single-use Charge, one-time.
NC—No charge.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features (Continued)				
#4704	Line Interface Base Type 4	$60	$51	$1,665	$4.00
#4741	Line Set Type 4A	53	45	1,455	4.50
#4742	Line Set Type 4B	53	45	1,455	6.50
#4743	Line Set Type 4C	53	45	1,455	6.50
#4705	Line Interface Base Type 5	136	116	3,555	7.50
#4751	Line Set Type 5A	79	67	2,075	10.50
#4752	Line Set Type 5B	71	60	1,860	9.50
#4706	Line Interface Base Type 6	136	116	3,555	7.50
#4761	Line Set Type 6A	88	75	2,295	13.50
#4707	Line Interface Base Type 7	261	222	6,675	24.50
#4708	Line Interface Base Type 8	53	45	1,455	5.00
#4781	Line Set Type 8A	54	46	1,490	6.50
#4782	Line Set Type 8B	72	61	1,920	8.50
#4709	Line interface Base Type 9	53	45	1,455	3.50
#4791	Line Set Type 9A	79	67	1,785	13.50
#5000	Line Interface Base Type 10	60	51	1,685	3.00
#4784	Line Set Type 10A	103	88	2,685	8.00
#5001	Line Interface Base Type 11	121	103	3,120	4.00
#4754	Line Set Type 11A	121	103	3,120	14.50
#4755	Line Set Type 11B	112	95	2,900	12.00
#5002	Line Interface Base Type 12	51	43	1,190	4.00
#4785	Line Set Type 12A	143	122	3,265	20.50
#4786	Line Set Type 12B	160	136	3,605	23.00
	Remote Concentrator Features				
#6250	Remote Power Off	13	11	416	0.50
#6261	Remote Program Loader-II	369	314	9,335	35.00

*Includes monthly maintenance.

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K-byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

Each additional 32K-byte memory increment above E1, F1, G1 or H1 costs $2,350.

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

3705-II to 3705-II upgrade
Models E, F, G to Models F, G, H — $13,300 for each additional 3706 Module.
$17,750 for each additional 32K-byte memory increment.
Models F, G, H to Models J, K, L — $25,060 for upgrade from F8 to J1, G8 to K1, or H8 to L1, plus $4,700 for each additional 64K-byte memory increment.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller (Continued)				
	Model G4 (128K bytes, 256 lines)	2,627	2,275	69,540	370
	Model G5 (160K bytes, 256 lines)	2,807	2,390	71,110	396
	Model G6 (192K bytes, 256 lines)	2,942	2,505	72,680	422
	Model G7 (224K bytes, 256 lines)	3,077	2,620	74,250	448
	Model G8 (256K bytes, 256 lines)	3,212	2,375	75,820	474
	Model H1 (32K bytes, 352 lines)	2,726	2,320	78,130	313
	Model H2 (64K bytes, 352 lines)	2,861	2,435	79,700	339
	Model H3 (96K bytes, 352 lines)	2,996	2,550	81,270	365
	Model H4 (128K bytes, 352 lines)	3,131	2,665	82,840	391
	Model H5 (160K bytes, 352 lines)	3,266	2,780	84,410	417
	Model H6 (192K bytes, 352 lines)	3,401	2,895	85,980	443
	Model H7 (224K bytes, 256 lines)	3,536	3,010	87,550	469
	Model H8 (256K bytes, 352 lines)	3,671	3,125	89,120	495
	Model J1 (320K bytes)	3,618	3,080	86,020	535
	Model J2 (384K bytes)	3,894	3,315	89,160	587
	Model J3 (448K bytes)	4,170	3,550	92,300	639
	Model J4 (512K bytes)	4,446	3,785	95,440	691
	Model K1 (320K bytes)	4,076	3,470	99,320	556
	Model K2 (384K bytes)	4,352	3,705	102,460	608
	Model K3 (448K bytes)	4,628	3,940	105,600	660
	Model K4 (512K bytes)	4,904	4,175	108,740	712
	Model L1 (320K bytes)	4,534	3,860	112,620	577
	Model L2 (384K bytes)	4,800	4,095	115,760	629
	Model L3 (448K bytes)	5,086	4,330	118,900	681
	Model L4 (512K bytes)	5,362	4,565	122,040	733
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	20	17	641	0.50
#1302	Type 2	20	17	641	0.50
	Channel Adapters				
#1541	Type 1	122	104	2,700	15.50
#1542	Type 2	226	192	6,470	15.50
#1543	Type 3	456	388	12,910	18.50
#1544	Type 4	196	167	4,410	13.50
#8002	Two Channel Switch	71	60	2,090	4.00
	Communications Scanners				
#1641	Type 1	63	54	1,880	10.00
#1642	Type 2	217	185	4,750	15.50
#1643	Type 3	771	656	17,210	52.00
#1644	Type 3 High Speed	1,035	881	25,120	62.00
#4650	Business Machine Clock	12	10	424	1.00
#4651	Business Machine Clock	28	24	880	2.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	47	40	1,105	4.50
#4711	Line Set Type 1A	20	17	487	2.00
#4712	Line Set Type 1B	21	18	676	2.00
#4713	Line Set Type 1C	20	17	641	2.00
#4714	Line Set Type 1D	43	37	1,030	4.50
#4715	Line Set Type 1E	34	29	1,030	3.00
#4716	Line Set Type 1F	71	60	2,090	8.50
#4717	Line Set Type 1G	93	79	2,050	9.50
#4718	Line Set Type 1H	79	67	1,745	15.50
#4719	Line Set Type 1J	47	40	1,455	3.50
#4720	Line Set Type 1S	101	86	3,020	9.50
#4722	Line Set Type 1GA	93	79	2,695	9.50
#4723	Line Set Type 1TA	166	141	4,850	15.00
#4725	Line Set Type 1T	166	141	4,850	15.00
#4726	Line Set Type 1U	186	158	5,440	17.00
#4727	Line Set Type 1W	154	131	4,720	9.50
#4728	Line Set Type 1Z	283	241	8,640	17.00
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	47	40	1,455	4.00
#4721	Line Set Type 2A	34	29	1,030	5.50
#4703	Line Interface Base Type 3	87	74	2,515	3.50
#4731	Line Set Type 3A	27	23	850	2.00
#4732	Line Set Type 3B	27	23	850	2.00

*Includes monthly maintenance.
**Single-use Charge, one-time.
NC—No charge.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features (Continued)				
#4704	Line Interface Base Type 4	54	46	1,665	4.50
#4741	Line Set Type 4A	47	40	1,455	5.00
#4742	Line Set Type 4B	47	40	1,455	7.50
#4743	Line Set Type 4C	47	40	1,455	7.50
#4705	Line Interface Base Type 5	122	104	3,555	8.50
#4751	Line Set Type 5A	71	60	2,075	12.00
#4752	Line Set Type 5B	63	54	1,860	11.00
#4706	Line Interface Base Type 6	122	104	3,555	8.50
#4761	Line Set Type 6A	79	67	2,295	15.50
#4707	Line Interface Base Type 7	234	199	6,675	28.50
#4708	Line Interface Base Type 8	47	40	1,455	5.50
#4781	Line Set Type 8A	49	42	1,490	7.50
#4782	Line Set Type 8B	65	55	1,920	9.50
#4709	Line interface Base Type 9	47	40	1,455	4.00
#4791	Line Set Type 9A	71	60	1,785	15.50
#5000	Line Interface Base Type 10	54	46	1,685	3.50
#4784	Line Set Type 10A	93	79	2,685	9.00
#5001	Line Interface Base Type 11	109	93	3,120	4.50
#4754	Line Set Type 11A	109	93	3,120	16.50
#4755	Line Set Type 11B	100	85	2,900	14.00
#5002	Line Interface Base Type 12	46	39	1,190	4.50
#4785	Line Set Type 12A	129	110	3,265	24.00
#4786	Line Set Type 12B	143	122	3,605	27.00
	Remote Concentrator Features				
#6250	Remote Power Off	12	10	416	0.50
#6261	Remote Program Loader-II	329	280	9,335	41.00

*Includes monthly maintenance.

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K-byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

Each additional 32K-byte memory increment above E1, F1, G1 or H1 costs $2,350.

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

3705-II to 3705-II upgrade
Models E, F, G to Models F, G, H — $13,300 for each additional 3706 Module.
$17,750 for each additional 32K-byte memory increment.
Models F, G, H to Models J, K, L — $25,060 for upgrade from F8 to J1, G8 to K1, or H8 to L1, plus $4,700 for each additional 64K-byte memory increment.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	3705-II Communications Controller (Continued)				
	Model G4 (128K bytes, 256 lines)	$2,758	$2,385	$69,540	$370
	Model G5 (160K bytes, 256 lines)	2,943	2,505	71,110	396
	Model G6 (192K bytes, 256 lines)	3,084	2,625	72,680	422
	Model G7 (224K bytes, 256 lines)	3,225	2,745	74,250	448
	Model G8 (256K bytes, 256 lines)	3,366	2,865	75,820	474
	Model H1 (32K bytes, 352 lines)	2,861	2,435	78,130	313
	Model H2 (64K bytes, 352 lines)	3,002	2,555	79,700	339
	Model H3 (96K bytes, 352 lines)	3,143	2,675	81,270	365
	Model H4 (128K bytes, 352 lines)	3,284	2,795	82,840	391
	Model H5 (160K bytes, 352 lines)	3,425	2,915	84,410	417
	Model H6 (192K bytes, 352 lines)	3,566	3,035	85,980	443
	Model H7 (224K bytes, 256 lines)	3,707	3,155	87,550	469
	Model H8 (256K bytes, 352 lines)	3,848	3,275	89,120	495
	Model J1 (320K bytes)	3,795	3,230	86,020	535
	Model J2 (384K bytes)	4,082	3,475	89,160	587
	Model J3 (448K bytes)	4,369	3,720	92,300	639
	Model J4 (512K bytes)	4,656	3,965	95,440	691
	Model K1 (320K bytes)	4,277	3,640	99,320	556
	Model K2 (384K bytes)	4,564	3,885	102,460	608
	Model K3 (448K bytes)	4,851	4,130	105,600	660
	Model K4 (512K bytes)	5,138	4,375	108,740	712
	Model L1 (320K bytes)	4,758	4,050	112,620	577
	Model L2 (384K bytes)	5,040	4,295	115,760	629
	Model L3 (448K bytes)	5,332	4,540	118,900	681
	Model L4 (512K bytes)	5,619	4,785	122,040	733
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	20	17	641	0.50
#1302	Type 2	20	17	641	0.50
	Channel Adapters				
#1541	Type 1	128	109	2,700	15.50
#1542	Type 2	236	201	6,470	15.50
#1543	Type 3	478	407	12,910	18.50
#1544	Type 4	204	174	4,410	13.50
#8002	Two Channel Switch	74	63	2,090	4.00
	Communications Scanners				
#1641	Type 1	66	56	1,880	10.00
#1642	Type 2	227	193	4,750	15.50
#1643	Type 3	808	688	17,210	52.00
#1644	Type 3 High Speed	1,086	924	25,120	62.00
#4650	Business Machine Clock	12	10	424	1.00
#4651	Business Machine Clock	29	25	880	2.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	49	42	1,105	4.50
#4711	Line Set Type 1A	20	17	487	2.00
#4712	Line Set Type 1B	21	18	676	2.00
#4713	Line Set Type 1C	20	17	641	2.00
#4714	Line Set Type 1D	45	38	1,030	4.50
#4715	Line Set Type 1E	35	30	1,030	3.00
#4716	Line Set Type 1F	74	63	2,090	8.50
#4717	Line Set Type 1G	96	82	2,050	9.50
#4718	Line Set Type 1H	82	70	1,745	15.50
#4719	Line Set Type 1J	49	42	1,455	3.50
#4720	Line Set Type 1S	106	90	3,020	9.50
#4722	Line Set Type 1GA	96	82	2,695	9.50
#4723	Line Set Type 1TA	174	148	4,850	15.00
#4725	Line Set Type 1T	174	148	4,850	15.00
#4726	Line Set Type 1U	194	165	5,440	17.00
#4727	Line Set Type 1W	161	137	4,720	9.50
#4728	Line Set Type 1Z	297	253	8,640	17.00
	Communication Line Attachment Features				
#4702	Line Interface Base Type 2	49	42	1,455	4.00
#4721	Line Set Type 2A	35	30	1,030	5.50
#4703	Line Interface Base Type 3	90	77	2,515	3.50
#4731	Line Set Type 3A	28	24	850	2.00
#4732	Line Set Type 3B	28	24	850	2.00

*Includes monthly maintenance.
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NC—No charge.

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IBM 3705 Communications Controller

		Monthly Charges*			
		Rental	2-Yr. Lease	Purchase	Monthly Maint.
	Communication Line Attachment Features (Continued)				
#4704	Line Interface Base Type 4	$56	$48	$1,665	$4.50
#4741	Line Set Type 4A	49	42	1,455	5.00
#4742	Line Set Type 4B	49	42	1,455	7.50
#4743	Line Set Type 4C	49	42	1,455	7.50
#4705	Line Interface Base Type 5	128	109	3,555	8.50
#4751	Line Set Type 5A	74	63	2,075	12.00
#4752	Line Set Type 5B	66	56	1,860	11.00
#4706	Line Interface Base Type 6	128	109	3,555	8.50
#4761	Line Set Type 6A	82	70	2,295	15.50
#4707	Line Interface Base Type 7	244	208	6,675	28.50
#4708	Line Interface Base Type 8	49	42	1,455	5.50
#4781	Line Set Type 8A	51	43	1,490	7.50
#4782	Line Set Type 8B	67	57	1,920	9.50
#4709	Line interface Base Type 9	49	42	1,455	4.00
#4791	Line Set Type 9A	74	63	1,785	15.50
#5000	Line Interface Base Type 10	56	48	1,685	3.50
#4784	Line Set Type 10A	96	82	2,685	9.00
#5001	Line Interface Base Type 11	114	97	3,120	4.50
#4754	Line Set Type 11A	114	97	3,120	16.50
#4755	Line Set Type 11B	105	89	2,900	14.00
#5002	Line Interface Base Type 12	47	40	1,190	4.50
#4785	Line Set Type 12A	135	115	3,265	24.00
#4786	Line Set Type 12B	150	128	3,605	27.00
	Remote Concentrator Features				
#6250	Remote Power Off	12	10	416	0.50
#6261	Remote Program Loader-II	345	294	9,335	41.00

*Includes monthly maintenance.

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K-byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

Each additional 32K-byte memory increment above E1, F1, G1 or H1 costs $2,350.

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

3705-II to 3705-II upgrade
Models E, F, G to Models F, G, H — $13,300 for each additional 3706 Module.
$17,750 for each additional 32K-byte memory increment.
Models F, G, H to Models J, K, L — $25,060 for upgrade from F8 to J1, G8 to K1, or H8 to L1, plus $4,700 for each additional 64K-byte memory increment.

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IBM 3705 Communications Controller (Versions I and II)

		Monthly Rental*			
		Short Term	Extended Term	Purchase	Monthly Maint.
	Communications Scanners				
#1641	Type 1	58	49	1,880	10.00
#1642	Type 2	196	167	6,250	15.50
#1643	Type 3	687	585	22,640	52.00
#4650	Business Machine Clock	12	10	424	1.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	43	37	1,455	4.50
#4711	Line Set Type 1A	19	16	641	2.00
#4712	Line Set Type 1B	20	17	676	2.00
#4713	Line Set Type 1C	19	16	641	2.00
#4714	Line Set Type 1D	41	35	1,355	4.50
#4715	Line Set Type 1E	32	27	1,030	3.00
#4716	Line Set Type 1F	65	55	2,090	8.50
#4717	Line Set Type 1G	83	71	2,695	9.50
#4718	Line Set Type 1H	71	60	2,295	15.50
#4719	Line Set Type 1J	43	37	1,455	3.50
#4720	Line Set Type 1S	92	78	3,020	9.50
#4725	Line Set Type 1T	149	127	4,850	15.00
#4726	Line Set Type 1U	166	141	5,440	17.00
#4702	Line Interface Base Type 2	43	37	1,455	4.00
#4721	Line Set Type 2A	32	27	1,030	5.50
#4703	Line Interface Base Type 3	79	67	2,515	3.50
#4731	Line Set Type 3A	25	21	850	2.00
#4732	Line Set Type 3B	25	21	850	2.00
#4704	Line Interface Base Type 4	49	42	1,665	4.50
#4741	Line Set Type 4A	43	37	1,455	5.00
#4742	Line Set Type 4B	43	37	1,455	7.50
#4743	Line Set Type 4C	43	37	1,455	7.50
#4705	Line Interface Base Type 5	110	94	3,555	8.50
#4751	Line Set Type 5A	65	55	2,075	12.00
#4752	Line Set Type 5B	58	49	1,860	11.00
#4706	Line Interface Base Type 6	110	94	3,555	8.50
#4761	Line Set Type 6A	71	60	2,295	15.50
#4707	Line Interface Base Type 7	209	178	6,675	28.50
#4708	Line Interface Base Type 8	43	37	1,455	5.50
#4781	Line Set Type 8A	46	39	1,490	7.50
#4782	Line Set Type 8B	59	50	1,920	9.50
#4709	Line Interface Base Type 9	43	37	1,455	4.00
#4791	Line Set Type 9A	65	55	1,785	15.50
#5000	Line Interface Base Type 10	49	42	1,685	3.50
#4784	Line Set Type 10A	83	71	2,685	9.00
#5001	Line Interface Base Type 11	98	83	3,120	4.50
#4754	Line Set Type 11A	98	83	3,120	16.50
#4755	Line Set Type 11B	90	77	2,900	14.00
#5002	Line Interface Base Type 12	42	36	1,190	4.50
#4785	Line Set Type 12A	116	99	3,265	24.00
#4786	Line Set Type 12B	129	110	3,605	27.00
	Remote Concentrator Features				
#3620	Extended Environment	25	21	832	NC
#4670	Internal Air Circulation	12	10	416	NC
#4671	Inernal Air Circulation 2	6	5	207	NC
#6250	Remote Power Off	12	10	416	0.50
#6260	Remote Program Loader	262	223	8,320	45.00
#6261	Remote Program Loader-II	294	250	9,335	41.00

*Includes monthly maintenance.
**Single-Use Charge, one time.

NC—No charge.

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IBM 3705 Communications Controller (Versions I and II)

COST TO UPGRADE PURCHASED 3705

Memory upgrade on the 3705-I

Additional memory can be added to a purchased 3705-I for $17,750 per 32K bytes. Total memory capacity of the 3705-I is 240K bytes. For every two 32K byte increments added, a 3706 Module to house the memory must be purchased at $13,300 per module.

3705-I upgrade to a 3705-II

From 3705-I Model	To 3705-II Model	Cost
A	E	$16,680
	F	29,980
	G	43,280
	H	56,580
B	E	16,680
	F	16,680
	G	29,980
	H	43,280
C	E	16,680
	F	16,680
	G	16,680
	H	29,980
D	E	16,680
	F	16,680
	G	16,680
	H	16,680

Additional memory can be added in 32K byte increments for $3,500 per increment. Total memory capacity of the 3705-II is 256K bytes.■

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IBM 3705 Communications Controller

		Monthly Charge (Old Plan)*	Monthly Charge (New Plan)** Basic License	DSLO License	Licensed Program Support	Additional Licensed Program Support
5744-BA2	Network Control Program	NC	NC	NC	NC	NC
5747-CH1	System Support Program; for NCP generation and loading	NC	NC	NC	NC	NC
5735-XX1	ACF for NCP/VS Release 2 and 2.1; Release 3 will be available 5/81	145***	118	89	24	14
5735-XX3	SSP for ACF/NCP/VS Release 2 and 2.1; Release 3 will be available 5/81	NA	42	31	16	16
	Host Access Methods					
5735-RC1	ACF/TCAM Version 1	242***	229	171	11	7
	With Multisystem Networking Facility	880***	849	636	28	17
5735-RC3	ACF/TCAM Version 2, Release 1, 2, and 3	544***	466	349	71	43
	With Multisystem Networking Facility	880***	783	587	88	53
5746-RC3	ACF/VTAM Version 1, Release 2 (for the DOS/VS, DOS/VSE) and Release 3 (for DOS/VSE)	NA	102	76	60	36
	With Multisystem Networking Facility	NA	193	145	181	108
5735-RC2	ACF/VTAM Version 1, Release 2 (for OS/VS) and Release 3 (for MVS); Release 3 for OS/VS1 will be available 5/81	290***	244	182	42	25
	With Multisystem Networking Facility	726***	586	438	127	76
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	NA	114	86	61	37
	Other Host Networking Software					
5735-XX7	Network Terminal Option Release 1 and 2	121***	111	83	9	5
5735-XX8	Network Problem Determination Application (NPDA) Release 1 and 2	NA	44	33	19	12
5735-XX6	Network Communications Control Facility (NCCF)	NA	88	66	38	23
5740-XT4	Teleprocessing Network Simulator (TPNS) Release 5	1085	NA	NA	NA	NA

NC indicates no charge, as basic software load is provided as part of System Control Programming (SCP.)
NA—not applicable.
*Includes onsite field engineering support.
**Basic License fee excludes program support. Licensed Program Support provides for customer access to central telephone support center; if problem cannot be resolved at that level, IBM will provide onsite service. Distributed Systems License Option (DSLO) and Additional Licensed Program Support are available for customers with multiple CPU's that utilize replicated software managed from a central site; under these plans, software installation and support is performed at one designated system site, and new programs or necessary changes are transferred through the network to other involved processors.
***Effective until 1/1/82, after which date the new plan becomes effective.■

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IBM 3705 Communications Controller

SOFTWARE

		Monthly* Charge
5744-BA2	Network Control Program	NC
5747-CH1	System Support Program; for NCP generation and loading	NC
5735-XX1	ACF for NCP/VS; Release 2	$132
5735-XX3	SSP for ACF/NCP/VS; Release 2	38
	Host Access Methods	
5735-RC1	ACF/TCAM; Version 1	220
	With Multisystem Networking Facility	880
5735-RC3	ACF/TCAM; Version 2, Release 1 or Release 2	495
	With Multisystem Networking Facility	880
5746-RC3	ACF/VTAM; Version 1, Release 2; for DOS/VS, DOS/VSE	93
	With Multisystem Networking Facility	325
5735-RC2	ACF/VTAM; Version 1, Release 2; for OS/VS	264
	With Multisystem Networking Facility	660
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	104
	Other Host Networking Software	
5735-XX7	Network Terminal Option; Release 1	110
5735-XX8	Network Problem Determination Application; NPDA	50
5735-XX6	Network Communications Control Facility; NCCF	100
5740-XT4	Teleprocessing Network Simulator; TPNS Release 5	990

SCHEDULED NEW PROGRAM PRODUCT RELEASES

		Monthly Charge	Scheduled Availability
5735-XX1	ACF/NCP/VS; Release 2.1	$132	5/80
5735-XX3	SSP for ACF/NCP/VS; Release 2.1	38	5/80
5735-XX1	ACF/NCP/VS; Release 3	132	5/81
5735-XX3	SSP for ACF/NCP/VS; Release 3	38	5/81
5735-RC3	ACF/TCAM; Version 2, Release 3	495	11/80—MVS
	With Multisystem Networking Facility	880	2/81—OS/VS1
5735-RC2	ACF/VTAM; Release 3; for OS/VS1, MVS	264	11/80—MVS
	With Multisystem Networking Facility	660	5/81—OS/VS1
5746-RC3	ACF/VTAM; Release 3; for DOS/VSE	93	2/81
	With Multisystem Networking Facility	176	
5735-XX8	NPDA; Release 2	50	9/80—MVS 11/80—DOS/VSE 1/81—OS/VS1
5735-XX7	Network Terminal Option; Release 2	110	2/81

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	With Multisystem Networking Facility	325
5735-RC2	ACF/VTAM; Version 1, Release 2; for OS/VS	264
	With Multisystem Networking Facility	660
5746-RC7	ACF/VTAM Entry; for 4300 Series hosts and DOS/VSE	104
	Other Host Networking Software	
5735-XX7	Network Terminal Option; Release 1	110
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SCHEDULED NEW PROGRAM PRODUCT RELEASES

		Monthly Charge	Scheduled Availability
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5735-XX3	SSP for ACF/NCP/VS; Release 2.1	38	5/80
5735-XX1	ACF/NCP/VS; Release 3	132	5/81
5735-XX3	SSP for ACF/NCP/VS; Release 3	38	5/81
5735-RC3	ACF/TCAM; Version 2, Release 3	495	11/80—MVS
	With Multisystem Networking Facility	880	2/81—OS/VS1
5735-RC2	ACF/VTAM; Release 3; for OS/VS1, MVS	264	11/80—MVS
	With Multisystem Networking Facility	660	5/81—OS/VS1
5746-RC3	ACF/VTAM; Release 3; for DOS/VSE	93	2/81
	With Multisystem Networking Facility	176	
5735-XX8	NPDA; Release 2	50	9/80—MVS 11/80—DOS/VSE 1/81—OS/VS1
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IBM 3705 Communications Controller

New Product Announcement

On November 14, 1978, IBM's Data Processing Division announced the introduction of 12 new models of the 3705-II Communications Controller; the first shipments are scheduled for June 1979.

The new models (J1-J4, K1-K4, and L1-L4) feature memory beginning at 320K bytes, expandable to 512K bytes in 64K-byte increments; a memory cycle time of 0.9 microsecond (compared with 1.0 microsecond for the previous 3705-II models); and a Cycle Utilization Counter, which accumulates statistical data to assist in measuring machine performance.

At the same time, IBM announced the availability of two new line interfaces, which permit high-speed local data transfer between any 3705 and either another 3705 or a 377X terminal without modems.

NEW 3705-II MODELS: All 12 of the new 3705-II Communications Controllers (Models J, K and L) hold 256K bytes of memory storage in their first frame and at least 64K bytes in the second. Additional storage is added in the second frame in 64K-byte increments, depending on the model, up to the maximum of 512K bytes. The new 3705-II's, like the old, are capable of physically attaching up to 352 communications lines, but are limited in concurrent operation by line speed, Channel Adapter type, memory size, software mode of operation, etc. One significant change in the new models is that the Type 1 Channel Adapter cannot be used, indicating that IBM is gradually moving its users away from the System/360 and 270X emulation mode of operation and toward the high-speed System/370 with SNA compliance.

Also included in the new models is a Cycle Utilization Counter which allows the ACF/NCP/VS (R2) software programming to accumulate statistical data on 3705 cycle utilization for user access. The specific cycles computed are instruction execution and operator panel maintenance cycles, and cycle sharing operations. With this data, ACF/NCP/VS (R2) provides information on the percentage of available cycles used.

The 3705-II Models E, F, G, and H are field-upgradable to 3705-II Models J, K, and L. The model upgrade purchase price for conversion from a Model F8 to J1, for example, is $25,060. The cost is the same for conversion of a G8 to K1 or H8 to L1. The price for additional storage, per 64K-byte increment, is $4,700. Conversion time will vary depending on the configuration.

NEW HIGH-SPEED LOCAL LINE SETS FOR ALL 3705 MODELS: IBM has made available, concurrently with the announcement of the new 3705-II models, two new line sets which allow high-speed local data transfer between communications controllers and terminals without modems. The concurrency indicates IBM's enhancement of the networking capabilities of its systems and a further advance in the implementation of its SNA.

The two line sets, Type 1W and 1Z, are half-duplex and full-duplex, respectively. They are both attachable to all 3705 models, and both permit local data transfer at either 14.4K bps or 57.6K bps between 3705's, or at 14.4K bps between the 3705 and certain 377X terminals. The attachable terminals, which require the 1Z full-duplex line set, are the 3777 (Model 1, 2, or 3) and the 3776 (Model 3 or 4).

Each of the line sets permits attachment of only one device, and the distance is limited to 200 feet (150 feet of 3705 line set cable and 50 feet of attached device cable). Either line set requires one #4651 Business Machine Clock, which provides clocking signals. No clock is required in the attached device, which must be set for external clock control. This attachment requires a CCITT V.35-type interface.

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IBM 3705 Communications Controller

New Product Announcement

CHARACTERISTICS OF LINE SETS

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Comments
	Speed	Timing	Mode	Line				
CCITT V.35	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W (#4727)	1	Type 1	Maximum cable length is 200 ft.
CCITT V.35	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z (#4728)	1	Type 1	Maximum cable length is 200 ft.

	Monthly Charge*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-II Model:				
J1 (320K bytes)	$3,382	$2,880	$ 93,040	$535
J2 (384K bytes)	3,640	3,100	97,740	587
J3 (448K bytes)	3,898	3,320	102,440	639
J4 (512K bytes)	4,156	3,540	107,140	691
K1 (320K bytes)	3,810	3,245	106,340	556
K2 (384K bytes)	4,068	3,465	111,040	608
K3 (448K bytes)	4,326	3,685	115,740	660
K4 (512K bytes)	4,586	3,905	120,440	712
L1 (320K bytes)	4,238	3,610	119,640	577
L2 (384K bytes)	4,486	3,830	124,340	629
L3 (448K bytes)	4,754	4,050	129,040	681
L4 (512K bytes)	5,012	4,270	133,740	733
#4727 Line Set Type IW	145	123	4,720	10
#4728 Line Set Type 1Z	266	226	8,640	17
#4651 Business Machine Clock	27	23	880	2
#4720 V35 Interface	95	81	3,020	10

*Includes maintenance.□

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At the same time, IBM announced the availability of two new line interfaces, which permit high-speed local data transfer between any 3705 and either another 3705 or a 377X terminal without modems.

NEW 3705-II MODELS: All 12 of the new 3705-II Communications Controllers (Models J, K and L) hold 256K bytes of memory storage in their first frame and at least 64K bytes in the second. Additional storage is added in the second frame in 64K-byte increments, depending on the model, up to the maximum of 512K bytes. The new 3705-II's, like the old, are capable of physically attaching up to 352 communications lines, but are limited in concurrent operation by line speed, Channel Adapter type, memory size, software mode of operation, etc. One significant change in the new models is that the Type 1 Channel Adapter cannot be used, indicating that IBM is gradually moving its users away from the System/360 and 270X emulation mode of operation and toward the high-speed System/370 with SNA compliance.

Also included in the new models is a Cycle Utilization Counter which allows the ACF/NCP/VS (R2) software programming to accumulate statistical data on 3705 cycle utilization for user access. The specific cycles computed are instruction execution and operator panel maintenance cycles, and cycle sharing operations. With this data, ACF/NCP/VS (R2) provides information on the percentage of available cycles used.

The 3705-II Models E, F, G, and H are field-upgradable to 3705-II Models J, K, and L. The model upgrade purchase price for conversion from a Model F8 to J1, for example, is $25,060. The cost is the same for conversion of a G8 to K1 or H8 to L1. The price for additional storage, per 64K-byte increment, is $4,700. Conversion time will vary depending on the configuration.

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The two line sets, Type 1W and 1Z, are half-duplex and full-duplex, respectively. They are both attachable to all 3705 models, and both permit local data transfer at either 14.4K bps or 57.6K bps between 3705's, or at 14.4K bps between the 3705 and certain 377X terminals. The attachable terminals, which require the 1Z full-duplex line set, are the 3777 (Model 1, 2, or 3) and the 3776 (Model 3 or 4).

Each of the line sets permits attachment of only one device, and the distance is limited to 200 feet (150 feet of 3705 line set cable and 50 feet of attached device cable). Either line set requires one #4651 Business Machine Clock, which provides clocking signals. No clock is required in the attached device, which must be set for external clock control. This attachment requires a CCITT V.35-type interface.

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IBM 3705 Communications Controller

New Product Announcement

CHARACTERISTICS OF LINE SETS

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Comments
	Speed	Timing	Mode	Line				
CCITT V.35	14.4K or 57.6K	Synchronous	Half-duplex	IBM cables	1W (#4727)	1	Type 1	Maximum cable length is 200 ft.
CCITT V.35	14.4K or 57.6K	Synchronous	Full-duplex	IBM cables	1Z (#4728)	1	Type 1	Maximum cable length is 200 ft.

	Monthly Charge*			
	Rental	2-Yr. Lease	Purchase	Monthly Maint.
3705-II Model:				
J1 (320K bytes)	$3,306	$2,815	$ 93,040	$535
J2 (384K bytes)	3,564	3,035	97,740	587
J3 (448K bytes)	3,822	3,255	102,440	639
J4 (512K bytes)	4,080	3,475	107,140	691
K1 (320K bytes)	3,717	3,165	106,340	556
K2 (384K bytes)	3,975	3,385	111,040	608
K3 (448K bytes)	4,233	3,605	115,740	660
K4 (512K bytes)	4,491	3,825	120,440	712
L1 (320K bytes)	4,128	3,515	119,640	577
L2 (384K bytes)	4,386	3,735	124,340	629
L3 (448K bytes)	4,644	3,955	129,040	681
L4 (512K bytes)	4,902	4,175	133,740	733
#4727 Line Set Type IW	139	118	4,720	10
#4728 Line Set Type 1Z	254	216	8,640	17
#4651 Business Machine Clock	26	22	880	2
#4720 V35 Interface	15	13	510	2

*Includes maintenance.□

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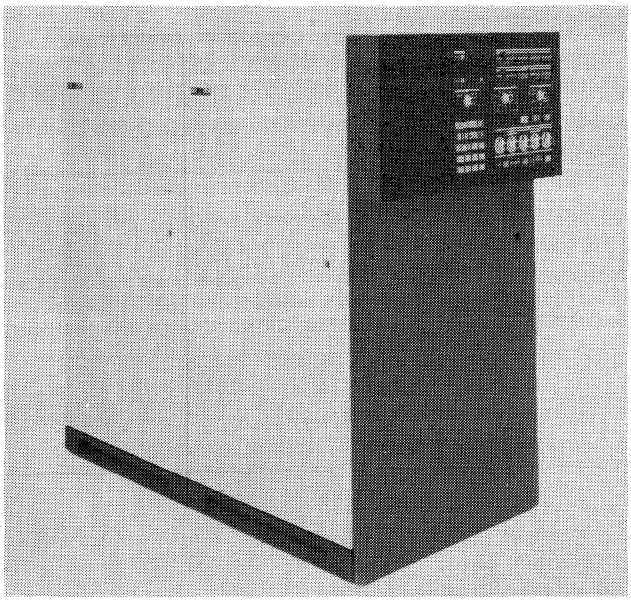
IBM 3705 Communications Controller (Versions I and II)



A programmable front-end processor for IBM System/360 or 370 available with up to 256K bytes of memory supporting a maximum of 352 communications lines.

The 3705-II is an enhanced version of the older 3705-I offering increased memory capacity and reduced cycle time. Both Versions I and II support emulation (270X) and Network Control (front-end) operating modes.

Options include remote or local operation, interconnection of multiple 3705's to form a network, sharing of one 3705 by up to four local computers, and an extensive variety of line interfaces for asynchronous or synchronous, half- or full-duplex transmission from 600 to 56,000 bps.

The short term monthly rental for a 3705-I, Model A1 with 16K byte memory supporting 64 lines is approximately $3,900 per month, includng maintenance.

A 3705-II, Model G8 with 256K byte memory supporting 256 lines is approximately $15,000 per month, including maintenance.

MANAGEMENT SUMMARY

The 3705 Communications Controller can accommodate a variety of dissimilar communication lines while presenting a standardized interface to the host computer, freeing it of much of the communication control function, and permitting modifications to line configurations without affecting the host hardware application programs. At a remote site, the 3705 can be used as a line concentrator.

A series of software enhancements grouped under the name, The Advanced Communications Function (ACF), permits the linking of two or more host computers via their respective front-end (local) 3705 controllers to form a Multi-Systems Network. The host computers will not be interrupted by transmissions flowing through their local 3705's that are destined for another host. The enhancements will also permit up to four computers at the same location to share a common 3705. (Currently only two computer can be attached to one controller, and only one path can be active at a time.)

The host computers in both of the above cases can use any mix of VS operating system and can use either VTAM or TCAM access methods.

For the user of multiple computer systems, the Multi-System Network feature will permit dynamic allocation of CPU work loads and network routing based on the nature and volume of the transmissions and the hardware resources operative at the time.

The ACF software, supports a hardware enhancement, the Remote Program Loader-II (RPL-II). In the event of a host computer failure, a local controller can be ➢

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Data Processing Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

DATE OF ANNOUNCEMENT: 3705-I–April 1972; 3705-II–November 1975.

DATE OF FIRST DELIVERY: 3705-I–July, 1972; 3705-II–August, 1976.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: International Business Machines Corporation.

CONFIGURATION

Either the 3705-I or 3705-II can accommodate up to 352 communications lines. The 3705-I has a cycle time of 1.2 microseconds and contains 16K to 240K bytes of core memory in 32K-byte increments over 20 models. The 3705-II has a cycle time of 1.0 microseconds and contains 32K to 256K bytes of semiconductor (MOSFET) memory in 32K-byte increments over 32 models. Models are designated as A1 through D8 for the 3705-I and E1 through H8 for the 3705-II. The letter (A through D or E through H) refers to the number of physical modules (1 through 4) that compose the 3705 system, which ➢

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IBM 3705 Communications Controller (Versions I and II)

linked, as a remote controller, to another 3705, provided a RPL-II and an appropriate line are installed. Available in December, 1977, RPL-II can be included with channel adapters in a 3705-II, permitting the controller to be used as a remote or a local controller.

Enhancements introduced in November 1975, to the original 3705 (now designated 3705-I) produced the 3705-II. Version II offers significant improvements in cost, performance, and features over the 3705-I, and, thereby, precludes considering Version I for new installation. First customer deliveries of the 3705-II were August 1976. The 3705-I's, first delivered in July 1972, can be field upgraded to a 3707-II.

Salient characteristics of the 3705-II are:

- Transmission rates of up to 56K bps. Supports, within restrictions, leased, switched, synchronous/asynchronous, and full-/half-duplex lines. The maximum number of lines depends on line mix. A physical maximum of 352 lines can be attained only by half-duplex lines operating at 9,600 bps or slower.
- Supports external and internal modems, local attachments, automatic dialing and telegraph.
- Semiconductor memory storage with capacity from 32K to 256K bytes; in eight increments.
- Cycle time of 1.0 microsecond (1.2 microseconds for the 3705-I).
- Communication scanners that can take data from the lines by bit, byte, or block (up to 254 characters) at a time.
- Channel adapters that will allow, until ACF is available, attachment to one or two channels (only one active at a time), attachment to two CPU's, the use of a Remote Program Loader in place of an adapter when the 3705 is remote.
- Channel adapters that will allow, when ACF is employed, attachment of up to four channel adapters and attachment of a Remote Program Loader-II along with up to three adapters.

The Network Control Program, NCP, and the virtual version, NCP/VS, can be viewed as a "software attachment" between the communications scanner and the channel adapter. Program generation is done in the host computer based on the user description of the network configuration selected options.

An extension, Partioned Emulation Program (PEP) can be added to NCP for concurrent operation of NCP and 270x emulation. The Emulation Program alone can operate the 3705 as a 270x, but none of the NCP benefits are accessible.

determines the number of communications lines that can be accommodated. The number (1 through 8) refers to the amount of main memory incorporated. The models for both versions of the 3705 are listed below.

3705-I		3705-II	
Model	Core Memory, bytes	Model	MOSFET Memory, bytes
A1, B1, C1, D1	16K	E1, F1, G1, H1	32K
A2, B2, C2, D2	48K	E2, F2, G2, H2	64K
B3, C3, D3	80K	E3, F3, G3, H3	96K
B4, C4, D4	112K	E4, F4, G4, H4	128K
C5, D5	144K	E5, F5, G5, H5	160K
C6, D6	176K	E6, F6, G6, H6	192K
D7	208K	E7, F7, G7, H7	224K
D8	240K	E8, F8, G8, H8	256K

A 3705 Communications Controller is composed of:

- **The basic 3705 model (A1 through D8 or E1 through H8), which includes the central control unit, main memory, and space for mounting the interfaces between the central control unit and the communications lines and between the central control unit and the host computer.**
- **Channel Adapters (1 to 4) and/or Remote Program Loader, which provides the data path between the 3705 and the System/360 or System/370 host computer.**
- **Attachment Bases (1 or 2), which provide the physical and logical interface between the Channel Adapter (Type 1 only) and the Central Control Unit and between the CCU and the Communications Scanners.**
- **Scanners (1 to 4), which connect the Interface Bases (and associated line sets) with the 3705 central control unit.**
- **Line Interface Bases, which provide certain control functions for particular types of lines and transmission techniques.**
- **Line Sets, which provide the interfaces with data sets or dirctly with the communications lines.**

The configuration diagram at the end of this report illustrates the relationships among these components.

Physically, the 3705 is configured in one to four cabinets or modules (A through D or E through H). The Base Module (A1 or A2 for the 3705-I and E1 through E8 for the 3705-II) includes the central control unit and 16K or 48K bytes of core memory for the 3705-I and 32K to 256K bytes of semiconductor memory for the 3705-II. The Base Module also accommodates one Channel Adapter, one or two Attachment Bases, one Scanner, and its associated Line Interface Bases and Line Sets.

An Expansion Module (referred to as the 3706) is required to add one additional Channel Adapter, each additional Scanner and its associated Line Interface Bases and Line Sets, as well as each additional 32K or 64K increment of core memory for the 3705-I. All memory is contained in the Base Module of the 3705-II. Up to three 3706 Expansion Modules can be included in a 3705 system. When the 3705 functions as a remote concentrator, the Remote Program Loader is used in place of the Channel Adapters. Local 3705-II's can now attach a Remote Program Loader-II along with a Channel Adapter. With appropriate line linkages, the Controller can operate as a remote to another controller that is locally attached to

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The ACF enhancement to NCP/VS, which provides multi-system network and shared controller operation, will be available in December 1977. The equivalent host access method software will be available in various pieces through the first half of 1978.

USER REACTION

In Datapro's December 1975 survey of communications processor users, 50 responses were received from users of the IBM 3705, representing experience with a total of 67 systems. The users' ratings are presented in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	23	26	1	0	3.4
Ease of operation	19	18	9	3	3.1
Throughput	18	27	1	4	3.2
Hardware reliability	37	10	2	0	3.7
Maintenance service:					
Promptness	27	22	1	0	3.5
Quality	28	19	1	1	3.5
Software	8	26	9	5	2.8
Technical support	11	25	11	3	2.9

*Weighted Average on a scale of 4.0 for Excellent.

The composition of the respondents' networks can be summarized as follows:

	Overall	3705's used with 370's	3705's used with 360's
Number of responses	49	40 (82%)	6 (12%)
Number of controllers	67	57 (85%)	6 (9%)
Average number of lines per controller	32	32	28
Average number of terminals per controller	87	91	73
Average number of terminals per line	2.7	2.8	2.6

The largest configuration reported included 200 lines; the smallest, 5 lines. Terminal usage varied widely as well, with configurations ranging from 7 terminals per controller up to 500. The number of terminals per line included both multidrop arrangements and multiple terminals serviced through a single switched telephone network port. All but 7 of these 50 respondents were using the 3705 in the 270X emulation mode.

The users were particularly vocal in their comments. The comments about 3705 advantages were mainly in the areas of reliability (17 mentions), service (9 mentions), easy-to-use software (9 mentions), cost (7 mentions), and flexibility (5 mentions).

On the negative side, the users cited many of the same disadvantages and limitations that were reported in Datapro's 1974 user survey. Software led the list of complaints with 9 mentions, including poor software support and/or limited flexibility (7 mentions) and inadequate technical support (2 mentions). Two users cited problems with the Emulation Mode, and two users commented that the software documentation was hard to interpret. Throughput limitations were cited by three respondents. Only two users reported hardware problems.

another host. In effect, a back-up procedure for computer failure in a multi-computer system, the Remote Program Loader-II requires ACF software.

In general, the Base Module can contain up to four Line Interface Bases and each Line Interface Base can accommodate up to eight Line Sets. Each Line Set can accommodate up to two communications lines. For some types of lines, these maximums cannot be attained, as shown in the accompanying tables. Each Expansion Module can contain up to six Line Interface Bases.

Channel Adapters are available in four types, Communication Scanners in three. The restrictions that apply to the Channel Adapters and Scanners affect configuration possibilities and performance in addition to the limitations imposed by the different models. The selection of Channel Adapters and Scanners is determined by the desired level of performance, the number of lines to be implemented, and the mode of operation (i.e., Emulation Mode or Network Control Mode).

The Communication Scanners link the communications lines, via their respective Line Interface Bases and Line Sets, with the Central Control Unit (CCU). The Scanner transfers data between the lines and the CCU memory on an interrupt basis and performs character assembly and disassembly functions. The Scanners differ only in performance. Low, medium, and high operating performance is provided by Type 1, Type 2, and Type 3 Scanners, respectively. The control program is interrupted on a bit-by-bit basis for the Type 1 Scanner, on a byte-by-byte basis for Type 2, and on a block basis for Type 3. Type 1 is limited to 9600 bps and non-virtual NCP; the others are not speed-limited. Line control, control character recognition, code translation, and user recovery functions are performed by the control program.

The Type 3 Scanner performs data transfer functions on a cycle-steal basis, halting the control program for a complete machine cycle. The control program resumes operation at the conclusion of the data transfer unless another cycle-steal request is pending. An interrupt can occur on buffer boundaries (up to 254 characters), by unique control character, or by specific error conditions. Type 3 supports only LIB Type 1, 8, 9 and 10, provides control character recognition for BSC and SDLC line controls, and performs ASCII to EBCDIC (and the converse) code translation when operating under BSC line control.

Channel Adapters are divided into two groups: those designed for the Emulation Mode of operation but also usable in the Network Control Mode (Types 1 and 4), and those designed for the Network Control Mode of operation only (Types 2 and 3). The Channel Adapter Type 1 is a low-performance adapter and is limited to the Base Module of a 3705-I only, while Type 4 provides higher performance and can be used in a Base and Expansion Module of a 3705-I or 3705-II. Channel Adapter Types 2 and 3 provide a higher level of performance and can be used in both a Base and Expansion Module, but Type 3 is designed to support both processors of a "tightly coupled" multiprocessor system.

The various configuration restrictions add up to three basic configuration groups:

- A 3705-I Base Module with a Channel Adapter Type 1 and a Scanner Type 1. Irrespective of which model (letter series A through D) is chosen, additional Scanners cannot be added, and the maximum number of line Interface Bases accommodated is limited to the

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TABLE 1: COMMUNICATIONS HANDLED BY THE IBM 3705

Type of Line Interface	Transmission				Line Set	Lines per Line Set	LIB	Line Sets per LIB*	Comments
	Speed	Timing	Mode	Line					
External RS-232C modem	Up to 1200	Asynchronous	Half-duplex	Leased or switched	1A	2	Type 1	8	Cannot use Scanner Type 3
	Up to 1200	Asynchronous	Full-duplex	Leased	1B	1			Cannot use Scanner Type 3
	Up to 9600	Asynch./synch.	Half-duplex	Leased or switched	1D	2			
	Up to 9600	Asynch./synch.	Full duplex	Leased	1H	1			
External wide-band modem	19.2K	Synchronous	Half-duplex	Leased or switched	1G	1	Type 1	8	Requires Scanner Type 2 or 3
	40.8K or 50K	Synchronous	Half-duplex	Leased or switched	1G	1		4	Requires Scanner Type 2 or 3
	50K	Synchronous	Full-duplex	Leased	1T	1		4	
External Mil 188C modem	50K	Asynch./synch.	Half-duplex	Leased	1J	1	Type 1	8	Requires Scanner Type 2 or 3 for speeds over 7200 bps
External CCITT V.35 modem	56K	Synchronous	Half-duplex	Leased	1S	1	Type 1	8	Requires Scanner Type
	56K	Synchronous	Full-duplex	Leased	1U	1		4	2 or 3 for speeds over 9600 bps
Local attachment	Up to 1200	Asynchronous	Half-duplex	—	1C	2	Type 1	8	Maximum cable length is 200 ft Cannot use Scanner Type 3
	Up to 2400	Synchronous	Half-duplex	—	1F	2			Maximum cable length is 100 ft.
Automatic dialing; RS-366	—	—	—	Switched	1E	2	Type 1	8	For attachment of external dialing units
Telegraph; 20, 40, or 62.5 ma current loop	Up to 75	Asynchronous	Half-duplex	Leased	2A	2	Type 2	8	For attachment to AT&T 83B2/83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature
Internal modems or adapters (requires no external modems)	134.5	Asynchronous	Half-duplex	2-wire private	3A	2	Type 3	6	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum
	134.5	Asynchronous	Full-duplex	4-wire private	3B	2			IBM Limited Distance Type 1 Line Line Adapters; 4.75 wire miles maximum
	Up to 600	Asynchronous	Half-duplex	2-wire private	4A	2	Type 4	2	IBM Limited Distance Type 2 Line Adapters; 8.25 wire miles maximum
	Up to 600	Asynchronous	Half-duplex	Leased	4B	2			IBM Leased Line, Line Adapters, 2-wire
	Up to 600	Asynchronous	Full-duplex	Leased	4C	2			IBM Leased Line, Line Adapters, 4-wire
	2400 or 1200	Synchronous	Half-duplex	Leased	5A	1	Type 5	2	Point-to-point modems
	2400 or 1200	Synchronous	Half-duplex	Leased	5B	1			Multipoint modems
	2400 or 1200	Synchronous	Half-duplex	Switched	6A	1	Type 6	2	Auto-answer modems
	2400 or 1200	Synchronous	Half-duplex	Switched	—	1	Type 7	1	Auto-dial and auto-answer modems
	1200 or 600	Synchronous	Half-duplex	Leased	8A	2	Type 8	3	
	1200 or 600	Synchronous	Half-duplex	Switched	8B	2			Auto-answer modems
	1200 or 600	Synchronous	Half-duplex	Switched	9A	1	Type 9	2	Auto-dial and auto-answer modems
	Up to 1200	Synchronous	Full-duplex	Leased	10A	1	Type 10	6	
	2400 or 1200	Synchronous	Full-duplex	Leased	11A	1	Type 11	2	Point-to-point modems
	2400 or 1200	Synchronous	Full-duplex	Leased	11B	1			Multipoint modems
	300	Asynchronous	Half-duplex	Leased	12A	2	Type 12	2	12B includes auto-answer modems; both include modems with bidirectional interrupt signal capability, intended for IBM 3767 terminals operating as 2741's
	300	Asynchronous	Half-duplex	Switched	12B	2			

*For speeds over 4800 bps, mix and quantity of line sets per LIB can be restricted; see text.

The specific mentions of good and bad points should be taken with the overall ratings to get the total picture of how these 50 users felt about the 3705, since numerous users left the ratings stand by themselves without additional comment.

An overall assessment of the users' ratings seems to indicate that they are reasonably well satisfied but feel that more could be done with the software. □

four in the Base Module. However, a Channel Adapter Type 2 can be added in the first Expansion Module to provide an alternate data path. This configuration requires an Attachment Base Type I feature to accommodate the Type 1 Channel Adapter and Scanner. Alternatively, the Remote Program Loader features can be used in place of the Channel Adapter. This basic configuration can be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing functions.

- **A 3705-I or -II Base Module with a Channel Adapter Type 1 and a Scanner Type 2 or 3. This configuration can be fully expanded with an additional Scanner Type 2 in each Expansion Module containing Line Interface Bases. A Channel Adapter Type 2 or 3 can be added to the first Expansion Module. An Attachment Base Type 2 is required for the first Scanner Type 2 or 3, and an Attachment Base Type 1 is required for the Channel Adapter Type 1. Alternatively, the Remote Program Loader can be used in place of the Channel Adapters. This configuration can also be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing. When emulating a 270X controller, the number of communications lines is restricted to the number of available multiplexer subchannels (255 maximum).**

- **A 3705-I or -II Base Module with a Channel Adapter Type 2, 3, or 4 and a Scanner Type 2 or 3 (3705-II only). This configuration can also be expanded fully with Expansion Modules, additional Type 2 or 3 Scanners, and a second Type 2, 3, or 4 Channel Adapter. An Attachment Base Type 2 is required to**

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TABLE 2: LIB CAPACITY PER SELECTED SCANNER OPTION

Line Interface Base Type	Scanner Type	Maximum Number of LIB's per			
		3705-I		3705-II	
		Base Module	Expansion Module	Base Module	Expansion Module
1, 8, 9, or 10	1	4	—	—	—
	2	4	6	4	6
	3	—	4	3	4
2, 3, 6, 7, or 12	1	4	—	—	—
	2	4	6	4	6
	3	—	—	—	—
5 or 11	1	4	—	—	—
	2	4	—	—	—
	3	—	—	—	—

interface the first Type 2 or 3 Scanner. This configuration supports only front-end processing. Any combination of two Channel Adapters Type 2, 3, and 4 can be used, except that a Type 4 must be used in the Base Module when combined with a Type 2 or 3. Channel Adapters Type 2, 3, and 4 include the Attachment Base function, which precludes the use of a separate Attachment Base. The Type 2 and 3 Scanners can be combined in any arrangement, except that a Type 3 Scanner cannot be used in the Base Module of a 3705-I. The Type 2 or 3 Channel Adapter cannot be used in emulating the 270X controllers or for attachment to an IBM System/360.

Timing and interpretation of data signals on the communications lines can be provided by the modems or by a series of Business Machine Clocks. Clocks ranging from 45 to 2400 bits per second are available and are required for all asynchronous lines. Up to four can be installed with each Scanner, and at least one is required regardless of line types used. Clocks are program-assigned and can be shared among several lines.

Complete configuration of a 3705 system revolves around determination of the number of Line Interface Bases required. This sets the minimum model that will suffice. Larger models can be implemented to provide additional memory. The accompanying tables and diagram fully set forth the rules for determining the number and types of Line Interface Basis (LIB's) and Line Sets required for the types of lines that can be accommodated. Many of the Line Set types include internal modems.

CONNECTION TO HOST COMPUTER: The Type 1 Channel Adapter provides attachment to the byte multiplexer channel of an IBM System/360 (32K Model 30 and larger) or System/370 computer. The Type 2 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channel of an IBM System/370. The Type 3 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channels of a pair of System/370 processors (Model 135 and larger) operating in a virtual mode as a tightly coupled multiprocessor system.

The Type 1 Channel Adapter transfers data one, two, three, or four bytes at a time over the attached byte multiplexer channel. The transfer rate appears to be in the neighborhood of 16,000 bytes per second. A separate transfer control operation is required of the 3705 control unit for each data burst transferred.

The Type 2 Channel Adapter always operates in the burst mode, with two-byte transfers over an attached byte multiplexer channel and multi-byte transfers over an attached block multiplexer or selector channel. It can sustain a data rate of 276,000 bytes per second. Data is transferred in blocks, and except for initiation and termination of a transfer operation, data transfers interrupt the 3705 central control unit only for the memory cycles required to access and move the data.

The Type 3 Channel Adapter has a performance level equivalent to that of the Type 2, but includes an automatic two-processor switch for symmetric support of tightly coupled System/370 multiprocessor configurations. The Type 3 can also be used to provide alternate-path capability by connecting both sides of the switch to two channels of a single processor. The Type 3 also includes a remote switch attachment capability through the configuration control panel of a System/370 158 MP or 168 MP or from a 2925 Model 10 Remote Switching Console.

The Type 4 Channel Adapter transfers data in a burst mode of up to 32 bytes at a time over the attached byte multiplexer channel. This adapter can be used only with Type 2 or 3 Scanners and is required when using the Type 3 Scanner in Emulation Mode.

In configurations having two Channel Adapters, connection can be made to two channels of the same host processor or to two different host processors. In a mixed configuration (i.e., one Type 1 and one Type 2 Channel Adapter), one must be disabled during operations. This configuration is useful in allowing operation under either the emulation mode (i.e., 2701/2/3) or full 3705 mode; both modes cannot be active simultaneously. In configurations having two Type 2 Channel Adapters, only one can be active at a time, but the active channel can be designated under program control; if connection is made to two host processors, either processor can initiate a switch between Channel Adapters.

A manual two-channel switch can be added to Channel Adapter Type 1, 2, or 4. Thus, the 3705-I (Models B through D) or 3705-II (Models F through H) can be attached to up to four input/output channels in up to four host processors. In all cases, only one input/output path exists at any one time.

The new Advanced Communications Function software permits up to four Channel Adapters to be attached to one

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3705-II for concurrent sharing of the Controller by up to four CPU's.

TRANSMISSION SPECIFICATIONS

The accompanying tables summarize the capabilities of the 3705 for accommodating various types of communications lines and techniques.

A wide range of Line Sets is available, but configurations are not as complex to resolve as Table 1 would tend to indicate at first glance. A couple of examples will illustrate this point.

Suppose you wished to interface a communications line coming from an IBM terminal employing SDLC line protocol. All told, there are 12 different Line Sets that could be used, depending on other parameters. But if you also wished to implement internal data sets, and planned to transmit at 2400 bps in a half-duplex, point-to-point arrangement over a leased voice-grade line, the choices would reduce to Line Set 5A. A Bisync terminal with the same operating parameters could also be interfaced with Line Set 5A. Line protocol considerations are handled by the program.

If you wished to accommodate a line to a Bisync terminal operating at 4800 bps using an external modem, the choice would immediately resolve to Line Set ID. (Bisync terminals cannot operate in a full-duplex mode.)

Operation over the switched telephone network or over a multipoint or point-to-point leased facility will govern the selection of modems. The number of lines to be implemented will also have an effect on selection between internal and external modem arrangements. More lines can be accommodated by using external modems, but the maximum number permitted using internal modems is not all that restrictive, except in a few cases such as Line Sets 5A, 5B, 11A, and 11B.

Restrictions on the usage of the various Line Sets are clearly indicted in Table 1.

The type of LIB required for each type of line set is also indicated in Table 1. The number of LIB's of a given type or of a given mix that is allowed in a module is indicated in Table 2. The type of Communication Scanner to use is also indicated in Table 2. The maximum number of LIB's, obtained from Table 2, multiplied by the product of the lines per line set and the line sets per LIB from Table 1 will supply the maximum number of lines that can be connected to a module.

An exception to the rules depicted in the tables occurs when using Communication Scanners 2 and 3 for line speeds over 4800 bps. To assure adequate scanning of high speed lines, the mix and/or number of line sets per LIB must be restricted. This can be done physically or logically via program control.

Providing the high speed line set is wired to the lower addresses of an LIB (and in some cases the LIB must be the first LIB of the module), the Communication Scanner can be told, by program, to ignore the higher address lines and to use its scanning time to service the high speed line. For line speeds over 10,000 bps, the line sets must be wired to the lowest address of the LIB.

The reason for this requirement is the manner in which the scanner is made to scan a line more frequently via programming initiation. A Type 2 Scanner will normally attempt to scan 96 interfaces (lines). This represents the maximum case of 16 lines for each of 6 LIB's in an expansion module. Starting with the first address in its list of interface addresses, the scanner proceeds to scan each interface; it consults an Upper Scan Limit counter to determine when a scanning cycle is completed and it is time to start at the beginning again. By changing the Upper Scan Limit counter to scan fewer interfaces, the scanning cycle will accordingly take less time. Of course, any line attached to interfaces whose address position in the list is beyond the scan limit will not be scanned. The Upper Scan Limit can be set to scan 96, 48, 16, or 8 interfaces.

Another moethod of decreasing the elapsed time between scanning a line on a Type 2 Scanner is by Address Substitution. Normally, the address of the high speed line in position 1 of a LIB is substituted in the address list of the addresses of the highest addresses within the same LIB. This causes the scanner to scan the same line two or more times wihtin the same scan cycle. Features to block installation of line sets for the lines that will not be scanned are available for LIB Types 1, 2, 3, and 10. When address Substitution is used, all Type 2 Scanners must operate in the same manner. Address substitution causes the scanner to scan only 8, as opposed to 16, lines per LIB. A total of four no-cost features are available for Address Substitution; they must be implemented in order. The first and second features block installation of a line set in partition 8 and 7, respecively, on all Type 1 or 2 LIB's, of all modules. The third and fourth features block installation of a line set in partition 6 and 5, respectively, of all Type 1, 2, 3, and 10 LIB's of all modules. Each LIB is divided into eight Partitions for line addressing purposes. The two lines wired with the lowest addresses in an LIB are in partition 1; the two lines wired with the highest addresses in an LIB are in partition 8.

Upper Scan Limit modification can also be employed with Type 3 scanner. High Speed Select, analogous to Address Substitution is used to modify addresses. An important difference between Address Substitution and High Speed Select, is that High Speed Select is applicable only to a specific scanner; i.e., configuration restrictions apply to only one module. A total of eight no-cost features are available; they must be implemented in order. Each feature blocks the installation of a line set in one partition of any additional LIB's in that module only.

The purpose for each type of LIB is:

Type 1: Lines with external modems and/or auto call, and for directly attached terminals.

Type 2: Telegraph-grade lines.

Type 3: Lines with IBM limited distance line adapters.

Type 5: 2400 bps leased lines with integrated modems.

Type 6: 2400 bps switched network trunks with integrated modems.

Type 7: 2400 bps switched network trunks with integrated modems and auto call.

Type 8: 1200 bps lines with integrated modems.

Type 9: 1200 bps lines with integrated modems and auto call.

Type 10: 1200 bps lines with integrated modems and full-duplex data transmission.

Type 11: 2400 bps lines with integrated modems and full-duplex data transmission.

Type 12: 1200 bps liens with integrated modems and bi-directional interrupt signal.

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SOFTWARE

The program stored in memory controls all functions of the 3705. Many functions such as control character recognition and error procedures are defined and controlled by software. In previous, hard-wired controllers, such as the IBM 2701, 2702, and 2703, these functions were fixed once a particular set of adapters was selected. The 3705 is not totally independent, however. Functions are executed in response to commands issued by the host processor. Indeed, all control ultimately resides with the host processor, including program loading.

The control program residing in the memory of the 3705 is generated on an IBM System/360, System/370 non-virtual, or System/370 virtual computer system through a macro-assembly/link-edit procedure. Generated control programs are loaded into the 3705 memory over the I/O channel connection or over a communications line if the Remote Program Load feature is implemented). The support package for the 360/370 includes the macro assembler, a load program, and a dump routine.

Two types of control programs can be generated. One, which is called NCP for Network Control Program (NCP/VS in virtual environments), provides front-end processing functions that can relieve the host processor of much of the overhead associated with managing multiple data communications lines. The other, which is called EP for Emulation Program (EP/VS for virtual environments) allows a 3705 to replace multiple 2701, 2702, and 2703 controllers with little or no modification of user application programs; operation of the host processor when EP is active is identical with activity under the previous 270X hard-wired controllers, and none of the potential benefits of front-ending is realized. NCP/VS includes provisions for running NCP and EP simultaneously.

NCP, like most general-purpose operating systems, requires a generation procedure to define the hardware (i.e., communications lines and terminals) configuration available and to specify which of the optional facilities will be included. IBM has implemented a macro language for specification of NCP. The language is divided into three types of macros. Systems macros define the 3705 configuration parameters, such as memory size, buffer sizes, and type of channel adapter installed, and any optional control facilities to be included, such as checkpoint/restart and on-line terminal testing. Configuration macros define the makeup of the network and supply information pertinent to each individual type of terminal, including composition of multipoint line operations. Block-handling macros specify any processing to be done in the 3705 on the blocks of data exchanged between the 3705 and the host processor. At present, the only processing macros supplied by IBM provide for insertion of date and time for next correction involving backspaces to correct entries, but the assembler can be used to create additional macros. A framework is provided for structuring routines into symbolically named groups and sets and for controlling the point of execution of each component.

Extensive provisions can be included in NCP for accommodating transient or permanent failures of the communications lines and for gathering statistics on detected errors.

Many of the functions can be controlled dynamically through commands issued by the host processor, including specification of the network configuration by activating and deactivating devices, lines, and groups of lines. In addition, terminal ID, polling, and addressing characters can be modified, the frequency and duration of polling and transmission among the terminals or components of a multipoint line or multi-component terminal can be modified, and the block processing routines associated with a particular terminal can be switched.

NCP/VS provides all the capabilities of NCP plus some valuable additions. One of the principal benefits is the capability to operate in the EP mode and NCP mode concurrently; i.e., a portion of the lines can be operated in the 270X mode while the others operate under NCP. This capability is particularly valuable during the cutover of applications from 270X operation to front-end processing with the 3704, and is referred to as Partitioned Emulation Programming Extension or PEP. The other major expansion of NCP capabilities is the operation of the 3705 as a remote concentrator.

PEP can now support concurrent operation in a dual-processor environment. One CPU supports communication via VTAM or TCAM through VTAM, and is attached via a Type 2 or 3 Channel Adapter; communications are supported under the NCP mode. The other CPU supports communication via a non-VTAM control program which operates under the Emulation Program, and is attached to the same 3705 via a Channel Adapter Type 1; communications are supported under the EP mode of PEP. Control of the dual-CPU PEP operation is performed using the operator control facility of the host CPU operating with the NCP mode of PEP. Functions include: IPL 3705, Dump 3705, and line switching between the EP and NCP modes of PEP. Lines assigned to the NCP portion of PEP are under control of the VTAM facility; lines assigned to the EP portion of PEP are controlled by the Operator Control facility operating with the EP portion of PEP.

NCP/VS operates through the new access method, VTAM, in DOS/VS environments and through either VTAM, TCAM, or a combination in OS/VS environments. The combination mode of operation eases conversion requirements.

VTAM is acknowledged by IBM to be the principal access method for telecommunications support under DOS/VS and OS/VS. BTAM and QTAM will not be extended, and enhancements for TCAM will be in the environment provided by VTAM under OS/VS. The chief feature of VTAM is dynamic sharing of network resources. Application programs working through VTAM have access to any terminal, line, or 3704/3705 controller in the network; for example, different application programs can initiate transmission and reception with terminals located on the same multipoint communications line. By the same token, multiple application programs can have access to the same data base. One component of VTAM is TOLTEP, an on-line testing program for exercising and testing the complete network.

The EP or Emulation Program makes the 3705 look like one or more 2701, 2702, and/or 2703 controllers to the host processor. It offers no operational benefits over the earlier controllers. User programs now written for the 270X series will work with a 3705 under EP with some restrictions. Some of the 270X features not supported include transmission with older, 4-of-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission at 230,400 bps, second channel interface, and programmable two-processor switch. However, many of the more common RPQ's are supported.

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IBM 3705 Communications Controller
(Versions I and II)

In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponds to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems) will be available. The added capabilities are significant for multi-system users. Multiple System/370's can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 3705's to a down-stream CPU without any involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, an Advanced Communication Function for VTAM and TCAM will be necessary.

The availability schedule for ACF/VTAM and ACF/TCAM is:

	Operating System	Availability
ACF/VTAM	DOS/VS	12/77
	OS/VS2MVS	2/78
	OS/VS1	4/78
	OS/VS2SVS	6/78
ACF/TCAM	OS/VS2MVS	2/78
	OS/VS2SVS	4/78
	OS/VS1	6/78

ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS and user programs.

Customized program control of ACF/VTAM operator or user commands will be possible by the Network Operation Support Program (NOP), available as follows:

Operating System	Availability
DOS/VS	12/77
OS/VS2MVS	2/78
OS/VS1	4/78
OS/VS2SVS	6/78

A feature of NOP permits a 3270 Information Display System to be used as a network operator console.

Another ACF capability is the capability for up to four CPU's to share a single 3705-II. Channel Adapter Types 2, 3, or 4 can be used. If more than two are used, they must be Type 4. The computers must be at the same location, but can employ any mix of VS operating systems. The access method can be ACF/VTAM or ACF/TCAM. More than one channel adapter can be connected to one CPU, and each channel can be serviced by a different access method. This arrangement permits different terminals on the same line to communicate with different computers and/or to utilize different access methods.

A third ACF capability supports a new hardware feature, Remote Program Loader-II (RPL-II). RPL-II can be attached to a 3705-II along with up to three channel adapters. With this attachment, a controller that normally operates as a local controller can also function as a remote to another controller. This enables the rerouting of a deactivated or a failed host computer's traffic to other CPU. In the remote state, any communication links to controllers other than the newly assigned local are not supported.

Other ACF capabilities include inbound pacing of traffic from terminals with logical units, such as 3770 programmable terminals; activating and deactivating of channel trace via an operator panel function; and concurrent tracing of up to eight lines attached to a 3705-II.

The multi-System/370 user can create a fully interconnected network with minimal hardware changes and virtually no change to application programs via ACF software. ACF apparently will take users towards relegating one CPU to the job of traffic controller, freeing all other CPU's for applications processing.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, the Remote Program Loader feature replaces the Channel Adapter. This feature permits loading NCP/VS into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voice-hand line operating synchronously at up to 7200 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3704 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Air Circulation 1 and 2 (for the first and second block of core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications line; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

If a Remote Program Loader-II is used, up to three channel adapters can be attached, permitting the controller to function either as a remote or local unit. If more than two channel adapters are attached, they must be Type 4. IBM claims that extended environment features are not neces-

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IBM 3705 Communications Controller (Versions I and II)

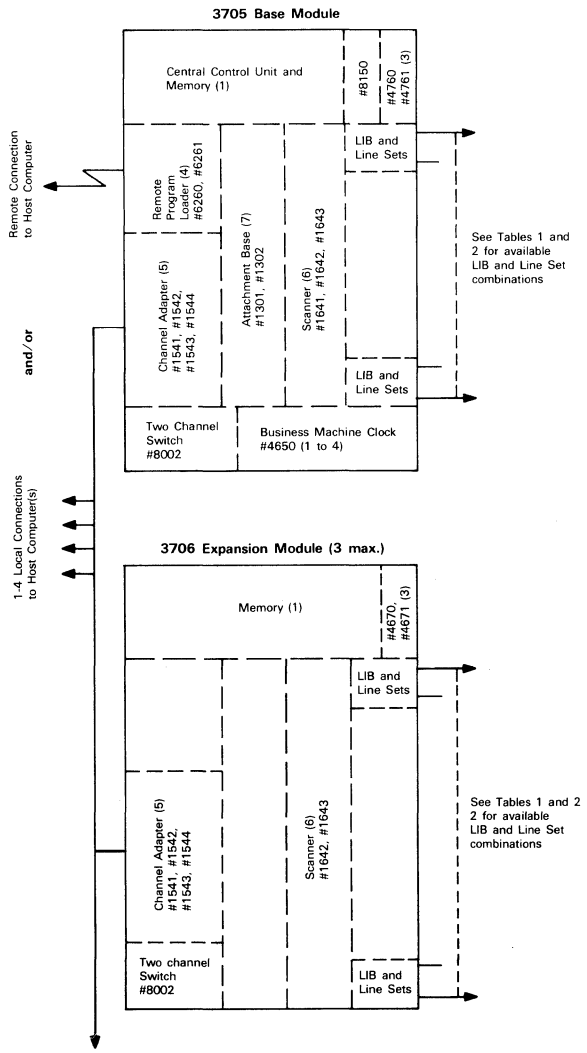
sary and therefore the options are not provided for the RPL-II.

PRICING

The 3705 can be acquired by purchase, short-term rental, or under IBM's Extended Term Lease Plan, which was introduced with the 3705. In the following price list, maintenance charges are included in the figures for both the short-term rental and Extended Term Plan; a separate arrangement is available for purchased units, and the figures are shown.

Under the short-term plan, overtime usage is charged at 10 percent of the regular hourly rates. Under the Extended Term Plan, there are no overtime charges. The initial lease period for the Extended Term Plan is 24 months, and the term is extendable indefinitely in increments of one year or one time for less than a year. However, charges for early termination of the Extended Term Plan range from two to five times the monthly rental, depending on how long the lease has been in effect; equipment can be upgraded without incurring termination charges.

Configuration (Version II)



(1) Memory capacity in the 3705-I is 16K to 48K bytes in base module and 32K to 64K bytes in each expansion module. Maximum 3705-I system capacity is 240K bytes. In the 3705-II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes.

(2) Extended environment available for all models except A1, B1, C1, D1. Applies to base module in A2 module, otherwise to last expansion module.

(3) Air circulation for first and second block of memory for each base or expansion module.

(4) Maximum of 1 Remote Program Loader per system. Cannot be installed with channel adapter type 1, 2, 3, or 4; or Scanner Type 3; or LIB, Type 5 or 11. Remote Program Loader II or the 3705-II can be installed with up to three channel adapters type 1, 2, 3, or 4. If more than two adapters are used, all must be type 4.

(5) In general, 1 channel adapter (CA) Type 1, 2, 3, or 4 can be installed in the first expansion module of the 3705-I; except that types 1 and 4 are mutually exclusive. Up to 4 channel adapters type 1, 2, 3, or 4 can be installed in the 3705-II. Two adapters in the base module and two adapters in the first expansion module. Emulation mode requires CA Type 1 or 4.

(6) One Scanner Type 1, 2 or 3 can be installed in each of the four modules, subject to the following limitations:
- If Type 1 Scanner is installed, no additional Scanners of any Type can be added to the system.
- Scanner Type 1 cannot be used in the 3705-II.
- Scanner Type 3 cannot be installed in a 3705 system with a CA Type 4.
- Scanner Type 3 cannot be installed in base module of 3705-I.

(7) One or two attachment bases are required as follows:
- Scanner Type 1 with CA Type 1—Attachment Base Type 1;
- Scanner Type 2 or 3 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2 or 3 with CA Type 2, 3, 4—Attachment Base Type 2;
- Attachment Base Type 1 can be used only with a CA Type 1 in the 3705-II.

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		Monthly Rental*			
		Short Term	Extended Term	Purchase	Monthly Maint.
3705-I Communications Controller					
Model A1 (16K bytes, 64 lines)		$1,287	$1,095	$ 40,800	197
Model A2 (48K bytes, 64 lines)		1,845	1,570	58,550	239.00
Model B1 (16K bytes, 160 lines)		1,698	1,445	54,100	220.00
Model B2 (48K bytes, 160 lines)		2,262	1,925	71,850	261.00
Model B3 (80K bytes, 160 lines)		2,826	2,405	89,600	304.00
Model B4 (112K bytes, 160 lines)		3,384	2,880	107,350	345.00
Model C1 (16K bytes, 256 lines)		2,133	1,815	67,400	241.00
Model C2 (48K bytes, 256 lines)		2,691	2,290	85,150	285.00
Model C3 (80K bytes, 256 lines)		3,249	2,765	102,900	326.00
Model C4 (112K bytes, 256 lines)		3,813	3,245	120,650	369.00
Model C5 (144K bytes, 256 lines)		4,365	3,715	138,400	410.00
Model C6 (176K bytes, 256 lines)		4,923	4,190	156,150	452.00
Model D1 (16K bytes, 352 lines)		2,550	2,170	80,700	264.00
Model D2 (48K bytes, 352 lines)		3,108	2,645	98,450	306.00
Model D3 (80K bytes, 352 lines)		3,672	3,125	116,200	350.00
Model D4 (112K bytes, 352 lines)		4,236	3,605	133,950	391.00
Model D5 (144K bytes, 352 lines)		4,794	4,080	151,700	433.00
Model D6 (176K bytes, 352 lines)		5,352	4,555	169,450	475.00
Model D7 (208K bytes, 352 lines)		5,916	5,035	187,200	517
Model D8 (240K bytes, 352 lines)		6,474	5,510	204,950	560.00
#8510 Unit Protection		35**	35**	35	NC
3705-II Communications Controller					
Model E1 (32K bytes, 64 lines)		1,204	1,025	38,230	250.00
Model E2 (64K bytes, 64 lines)		1,381	1,175	43,630	276.00
Model E3 (96K bytes, 64 lines)		1,557	1,325	49,030	302.00
Model E4 (128K bytes, 64 lines)		1,733	1,475	54,430	328.00
Model E5 (160K bytes, 64 lines)		1,909	1,625	59,830	354.00
Model E6 (192K bytes, 64 lines)		2,086	1,775	65,230	380.00
Model E7 (224K bytes, 64 lines)		2,262	1,925	70,630	406.00
Model E8 (256K bytes, 64 lines)		2,438	2,075	76,030	432.00
Model F1 (32K bytes, 160 lines)		1,616	1,375	51,530	271.00
Model F2 (64K bytes, 160 lines)		1,792	1,525	56,930	297.00
Model F3 (96K bytes, 160 lines)		1,968	1,675	62,330	323.00
Model F4 (128K bytes, 160 lines)		2,144	1,825	67,730	349.00
Model F5 (160K bytes, 160 lines)		2,321	1,975	73,130	375.00
Model F6 (192K bytes, 160 lines)		2,497	2,125	78,530	401.00
Model F7 (224K bytes, 160 lines)		2,673	2,275	83,930	427.00
Model F8 (256K bytes, 160 lines)		2,849	2,425	89,330	453.00
Model G1 (32K bytes, 256 lines)		2,027	1,725	64,830	292.00
Model G2 (64K bytes, 256 lines)		2,203	1,875	70,230	318.00
Model G3 (96K bytes, 256 lines)		2,379	2,025	75,630	344.00
Model G4 (128K bytes, 256 lines)		2,556	2,175	81,030	370.00
Model G5 (160K bytes, 256 lines)		2,732	2,325	86,430	396.00
Model G6 (192K bytes, 256 lines)		2,908	2,475	91,830	422.00
Model G7 (224K bytes, 256 lines)		3,084	2,625	97,230	448.00
Model G8 (256K bytes, 256 lines)		3,261	2,775	102,630	474.00
Model H1 (32K bytes, 352 lines)		2,438	2,075	78,130	313.00
Model H2 (64K bytes, 352 lines)		2,614	2,225	83,530	339.00
Model H3 (96K bytes, 352 lines)		2,791	2,375	88,930	365.00
Model H4 (128K bytes, 352 lines)		2,967	2,525	94,330	391.00
Model H5 (160K bytes, 352 lines)		3,143	2,675	99,730	417.00
Model H6 (192K bytes, 352 lines)		3,319	2,825	105,130	443.00
Model H7 (224K bytes, 256 lines)		3,496	2,975	110,530	469.00
Model H8 (256K bytes, 352 lines)		3,672	3,125	115,930	495.00
#8510	Unit Protection	35**	35**	35	NC
	Attachment Bases				
#1301	Type 1	19	16	641	0.50
#1302	Type 2	19	16	641	0.50
	Channel Adapters				
#1544	Type 1	110	94	3,555	15.50
#1542	Type 2	202	172	6,470	15.50
#1543	Type 3	407	346	12,910	18.50
#1544	Type 4	176	150	5,800	13.50
#8002	Two Channel Switch	65	55	2,090	4.00

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		Monthly Rental*			
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	Communications Scanners				
#1641	Type 1	58	49	1,880	10.00
#1642	Type 2	196	167	6,250	15.50
#1643	Type 3	687	585	22,640	52.00
#4650	Business Machine Clock	12	10	424	1.00
	Communication Line Attachment Features				
#4701	Line Interface Base Type 1:	43	37	1,455	4.50
#4711	Line Set Type 1A	19	16	641	2.00
#4712	Line Set Type 1B	20	17	676	2.00
#4713	Line Set Type 1C	19	16	641	2.00
#4714	Line Set Type 1D	41	35	1,355	4.50
#4715	Line Set Type 1E	32	27	1,030	3.00
#4716	Line Set Type 1F	65	55	2,090	8.50
#4717	Line Set Type 1G	83	71	2,695	9.50
#4718	Line Set Type 1H	71	60	2,295	15.50
#4719	Line Set Type 1J	43	37	1,455	3.50
#4720	Line Set Type 1S	92	78	3,020	9.50
#4725	Line Set Type 1T	149	127	4,850	15.00
#4726	Line Set Type 1U	166	141	5,440	17.00
#4702	Line Interface Base Type 2	43	37	1,455	4.00
#4721	Line Set Type 2A	32	27	1,030	5.50
#4703	Line Interface Base Type 3	79	67	2,515	3.50
#4731	Line Set Type 3A	25	21	850	2.00
#4732	Line Set Type 3B	25	21	850	2.00
#4704	Line Interface Base Type 4	49	42	1,665	4.50
#4741	Line Set Type 4A	43	37	1,455	5.00
#4742	Line Set Type 4B	43	37	1,455	7.50
#4743	Line Set Type 4C	43	37	1,455	7.50
#4705	Line Interface Base Type 5	110	94	3,555	8.50
#4751	Line Set Type 5A	65	55	2,075	12.00
#4752	Line Set Type 5B	58	49	1,860	11.00
#4706	Line Interface Base Type 6	110	94	3,555	8.50
#4761	Line Set Type 6A	71	60	2,295	15.50
#4707	Line Interface Base Type 7	209	178	6,675	28.50
#4708	Line Interface Base Type 8	43	37	1,455	5.50
#4781	Line Set Type 8A	46	39	1,490	7.50
#4782	Line Set Type 8B	59	50	1,920	9.50
#4709	Line Interface Base Type 9	43	37	1,455	4.00
#4791	Line Set Type 9A	65	55	1,785	15.50
#5000	Line Interface Base Type 10	49	42	1,685	3.50
#4784	Line Set Type 10A	83	71	2,685	9.00
#5001	Line Interface Base Type 11	98	83	3,120	4.50
#4754	Line Set Type 11A	98	83	3,120	16.50
#4755	Line Set Type 11B	90	77	2,900	14.00
#5002	Line Interface Base Type 12	42	36	1,190	4.50
#4785	Line Set Type 12A	116	99	3,265	24.00
#4786	Line Set Type 12B	129	110	3,605	27.00
	Remote Concentrator Features				
#3620	Extended Environment	25	21	832	NC
#4670	Internal Air Circulation	12	10	416	NC
#4671	Inernal Air Circulation 2	6	5	207	NC
#6250	Remote Power Off	12	10	416	0.50
#6260	Remote Program Loader	262	223	8,320	45.00
#6261	Remote Program Loader-II	294	250	9,335	41.00

*Includes monthly maintenance.
**Single-Use Charge, one time.

NC—No charge.■

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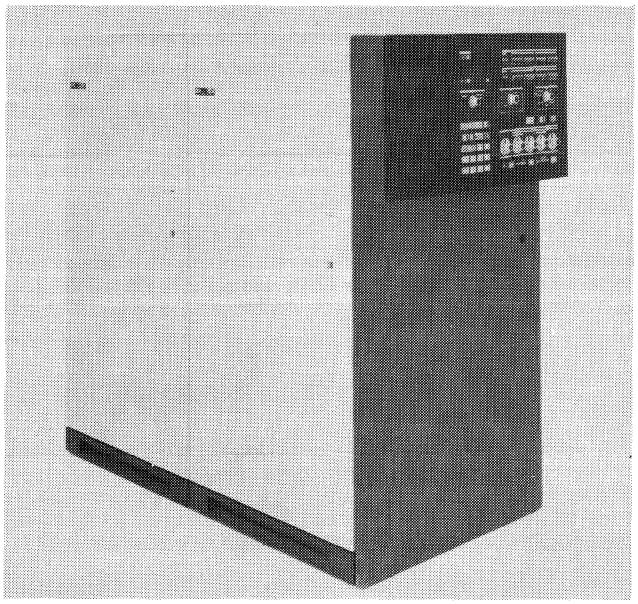

A programmable front-end processor for IBM System/360 or 370 available with up to 256K bytes of memory supporting a maximum of 352 communications lines.

The 3705-II is an enhanced version of the older 3705-I offering increased memory capacity and reduced cycle time. Both Versions I and II support emulation (270X) and Network Control (front-end) operating modes.

Options include remote or local operation, alternate connection to up to four host computers, and an extensive variety of line interfaces for asynchronous or synchronous, half- or full-duplex transmission from 600 to 56,000 bps.

The short term monthly rental for a 3705-I, Model A1 with 16K byte memory supporting 64 lines is approximately $3,900 per month, including maintenance.

A 3705-II, Model G8 with 256K byte memory supporting 256 lines is approximately $15,000 per month, including maintenance.

MANAGEMENT SUMMARY

On November 4, 1975, IBM introduced an enhanced version of its 3705 Communications Controller, the 3705-II, that offers significant improvements in cost and performance over the earlier 3705, now designated the 3705-I. In addition, IBM announced several new features that significantly improved the throughput of both 3705 versions. In May 1976, IBM dropped the purchase prices of its MOSFET memory units, which are used in the 3705-II, but not the 3705-I.

The salient characteristics of the 3705-II are:

- *Semiconductor memory*—storage capacities ranging from 32K to 256K bytes in eight increments. All memory is contained within one cabinet. By contrast, the 3705-I incorporates core memory ranging from 16K to 240K bytes in eight increments. The 3705-I memory is spread across up to four cabinets.
- *Reduced machine cycle time*—the controller cycle time has been reduced from 1.2 microseconds to 1.0 microsecond, yielding a 17 percent speed-up in operations.

New features announced for both the 3705-I and 3705-II include:

- *A high-speed Communications Scanner*—via the new Type 3 Scanner, data is transferred directly between memory and the communications lines (bypassing the control unit) in blocks of up to 254 characters, and the cycle steal feature interrupts the control program for one or more cycles while the data is transferred. The high-speed Scanner supports both BSC and SDLC protocol.

CHARACTERISTICS

VENDOR: International Business Machines Corporation, Data Processing Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

DATE OF ANNOUNCEMENT: 3705-I—April 1972; 3705-II—November 1975.

DATE OF FIRST DELIVERY: 3705-I—July, 1972; 3705-II—August, 1976.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: International Business Machines Corporation.

CONFIGURATION

Either the 3705-I or 3705-II can accommodate up to 352 communications lines. The 3705-I has a cycle time of 1.2 microseconds and contains 16K to 240K bytes of core memory in 32K-byte increments over 20 models. The 3705-II has a cycle time of 1.0 microseconds and contains 32K to 256K bytes of semiconductor (MOSFET) memory in 32K-byte increments over 32 models. Models are designated as A1 through D8 for the 3705-I and E1 through H8 for the 3705-II. The letter (A through D or E through H) refers to the number of physical modules (1 through 4) that compose the 3705 system, which

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(Versions I and II)

TABLE 1: CONFIGURATION LIMITS FOR THE IBM 3705

Line Interface Base (LIB)	LIB's per*		Maximum Half-Duplex Lines per			Maximum Full-Duplex Lines per		
	3705 Base Module	Each Expansion Module	LIB	3705 Module	Expansion Module	LIB	3705 Module	Expansion Module
Type 1:								
Up to 9600 bps**	4	6	16	64	96	8	32	48
19.2K bps**	1***	1***	8	8	8	–	–	–
40.8/50K bps**	1***	1***	4	4	4	–	–	–
Type 2	4	6	16	64	96	–	–	–
Type 3	4	6	12	48	72	12	48	72
Type 4	4	6	4	16	24	4	16	24
Type 5	4	0	2	8	–	–	–	–
Type 6	4	6	2	8	12	–	–	–
Type 7	4	6	1	1	6	–	–	–
Type 8	4	6	6	24	36	–	–	–
Type 9	4	6	2	8	12	–	–	–
Type 10	4	6	–	–	–	6	24	36
Type 11	4	0	–	–	–	2	8	–
Type 12	4	6	2	8	12	–	–	–

* The maximum number of LIB's permitted in combinations is 4 per 3705 Base Module and 6 per each of the up to 3 Expansion Modules; the overall maximum is 22. Installation of Type 5 or Type 11 LIB's in the Base Module does not preclude installation of other LIB's in Expansion Modules.

** Lines operating at above 4800 bps may require installation of the no-charge Address Substitution feature, which is associated with program-initiated change of scanning. In effect, a high-speed line is scanned at a faster rate by eliminating the scanning of another Line Set position on the LIB. Use of this feature will eliminate one Line Set position on each Type 1 and 2 Line Interface Base and perhaps on each Type 3 LIB, depending on the number and position of high-speed lines. Thus, use of lines operating bove 4800 bps up to 9600 bps can eliminate as many as 10 Line Sets, which represent 10 or 20 line appearances.

*** If any one line is operating at 19.2K bps, a maximum of 8 Line Sets, in any combination, can be installed on the 3705 Base Module and each Expansion Module. Operation of one line at 40.8K or 50K bps reduces the maximum to 4 Line Sets in any combination per module, along with appropriate LIB's. Use of Address Substitution (see note above) may further reduce the maximums.

- *An upgraded Channel Adapter*–the new Type 4 Adapter substantially improves throughput in the Emulation Mode when used in conjunction with the new high-speed Scanner. Data is transferred in blocks of up to 32 characters, whereas the earlier Type 1 Adapter transferred data in blocks of up to 4 characters.

- *A high-speed Line Set*–supports transmission rates of up to 56K bps, compared with a maximum rate of 50K bps for earlier Line Sets. The Line Set is compatible with CCITT Standard V.35.

- *Speed upgrade*–synchronous Line Sets have been upgraded from 7200 to 9600 bps.

- *NCP/VS enhancement*–provides concurrent two-CPU capability for PEP (the Partitioned Emulation Program).

- *Emulation Program enhancement*–supports concurrent access to two CPU channels via two Channel Adapter Type 4's.

The Emulation Program and Network Control Program/VS support the 3705-II and the new features on both models. The maximum number of communications lines supported by the 3705-II remains the same as for the **determines the number of communications lines that can be accommodated. The number (1 through 8) refers to the amount of main memory incorporated. The models for both versions of the 3705 are listed below.**

3705-I		3705-II	
Model	Core Memory, bytes	Model	MOSFET Memory, bytes
A1, B1, C1, D1	16K	E1, F1, G1, H1	32K
A2, B2, C2, D2	48K	E2, F2, G2, H2	64K
B3, C3, D3	80K	E3, F3, G3, H3	96K
B4, C4, D4	112K	E4, F4, G4, H4	128K
C5, D5	144K	E5, F5, G5, H5	160K
C6, D6	176K	E6, F6, G6, H6	192K
D7	208K	E7, F7, G7, H7	224K
D8	240K	E8, F8, G8, H8	256K

A 3705 Communications Controller is composed of:

- **The basic 3705 model (A1 through D8 or E1 through H8), which includes the central control unit, main memory, and space for mounting the interfaces between the central control unit and the communications lines and between the central control unit and the host computer.**

- **Channel Adapters (1 or 2) or Remote Program Loader, which provides the data path between the 3705 and the System/360 or System/370 host computer.**

- **Attachment Bases (1 or 2), which provide the physical and logical interface between the Channel Adapter (Type 1 only) and the Central Control Unit and between the CCU and the Communications Scanners.**

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TABLE 2: COMMUNICATIONS LINES HANDLED BY THE IBM 3705

Type of Interface	LIB	Line Sets per LIB	Line Set	Lines per Line Set	Transmission				Comments
					Speed, bps	Timing	Mode	Line	
External RS-232C modem	Type 1	8	1A	2	Up to 1200	Asynchronous	Half-duplex	Leased or switched	
			1B	1	Up to 1200	Asynchronous	Full-duplex	Leased	
			1D	2	Up to 9600	Asynch./synch.	Half-duplex	Leased or switched	
			1H	1	Up to 9600	Asynch./synch.	Full-duplex	Leased	
External wide-band modem	Type 1	8	1G	1	19.2K	Synchronous	Half-duplex	Leased or switched	Requires Scanner Type 2 or 3
		4	1G	1	40.8K or 50K	Synchronous	Half-duplex	Leased or switched	Requires Scanner Type 2 or 3
External Mil 188C modem	Type 1	8	1J	1	50K	Asynch./synch.	Half-duplex	Leased	Requires Scanner Type 2 or 3 for speeds over 7200 bps
External CCITT V.35 modem	Type 1	8	1S	1	56K	Synchronous	Half-duplex	Leased	Requires Scanner Type 2 or 3 for speeds over 9600 bps
Local attachment	Type 1	8	1C	2	Up to 1200	Asynchronous	Half-duplex	–	Maximum cable length is 200 ft.
			1F	2	Up to 2400	Synchronous	Half-duplex	–	Maximum cable length is 100 ft.
Automatic dialing; RS-366	Type 1	8	1E	2	–	–	–	Switched	For attachment of external dialing units
Telegraph; 20, 40, or 62.5 ma current loop	Type 2	8	2A	2	Up to 75	Asynchronous	Half-duplex	Leased	For attachment to AT&T 83B2/ 83B3, Western Union Plan 115A, or IBM terminals with Telegraph feature
Internal modems or adapters (require no external modems)	Type 3	6	3A	2	134.5	Asynchronous	Half-duplex	2-wire private	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum
			3B	2	134.5	Asynchronous	Full-duplex	4-wire private	IBM Limited Distance Type 1 Line Adapters; 4.75 wire miles maximum
	Type 4	2	4A	2	Up to 600	Asynchronous	Half-duplex	2-wire private	IBM Limited Distance Type 2 Line Adapters; 8.25 wire miles maximum
			4B	2	Up to 600	Asynchronous	Half-duplex	Leased	IBM Leased Line, Line Adapters, 2-wire
			4C	2	Up to 600	Asynchronous	Full-duplex	Leased	IBM Leased Line, Line Adapters, 4-wire
	Type 5	2	5A	1	2400 or 1200	Synchronous	Half-duplex	Leased	Point-to-point modems
			5B	1	2400 or 1200	Synchronous	Half-duplex	Leased	Multipoint modems
	Type 6	2	6A	1	2400 or 1200	Synchronous	Half-duplex	Switched	Auto-answer modems
	Type 7	1	—	1	2400 or 1200	Synchronous	Half-duplex	Switched	Auto-dial and auto-answer modems
	Type 8	3	8A	2	1200 or 600	Synchronous	Half-duplex	Leased	
			8B	2	1200 or 600	Synchronous	Half-duplex	Switched	Auto-answer modems
	Type 9	2	9A	1	1200 or 600	Synchronous	Half-duplex	Switched	Auto-dial and auto-answer modems
	Type 10	6	10A	1	Up to 1200	Synchronous	Full-duplex	Leased	
	Type 11	2	11A	1	2400 or 1200	Synchronous	Full-duplex	Leased	Point-to-point modems
			11B	1	2400 or 1200	Synchronous	Full-duplex	Leased	Multipoint modems
	Type 12	2	12A	2	300	Asynchronous	Half-duplex	Leased	12B includes auto-answer
			12B	2	300	Asynchronous	Half-duplex	Switched	modems; both include modems with bidirectional interrupt signal capability, intended for IBM 3767 terminals operating as 2741's

3705-I. First customer deliveries of the 3705-II and the new features for both models are scheduled for August 1976. A 3705-I can be field-upgraded to a 3705-II.

As first delivered in July 1972, the 3705 was equipped to handle only the emulation function. Front-end processing capability was delivered to users in the fall of 1973 but did not keep pace with the push toward virtual systems because of delays in delivery of the Virtual Telecommunications Access Method (VTAM) software. In Datapro's most recent survey of communications processor users in late 1975, all but 7 of the 50 IBM 3705 users who responded were still using their 3705's to emulate the 270X hard-wired controllers.

In a nutshell, the 3705 is a free-standing processing unit that is placed between the host processor and the communications lines. Its programmability is used to expand the capability for interfacing communications lines and terminals with maximum flexibility and minimum specialized hardware components. It can relieve the host processor of much of the housekeeping

- **Scanners (1 to 4), which interface the line attachment hardware with the 3705 central control unit.**
- **Line Interface Bases, which provide certain control functions for particular types of lines and transmission techniques.**
- **Line Sets, which provide the interfaces with data sets or directly with the communications lines.**

Physically, the 3705 is configured in one to four cabinets or modules (A through D or E through H). The Base Module (A1 or A2 for the 3705-I and E1 through E8 for the 3705-II) includes the central control unit and 16K or 48K bytes of core memory for the 3705-I and 32K to 256K bytes of semiconductor memory for the 3705-II. The Base Module also accommodates one Channel Adapter, one or two Attachment Bases, one Scanner, and its associated Line Interface Bases and Line Sets.

An Expansion Module (referred to as the 3706) is required to add one additional Channel Adapter, each additional Scanner and its associated Line Interface Bases and Line Sets, as well as each additional 32K or 64K

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associated with controlling multiple, simultaneous data paths.

The 3705 can be expanded to include up to 240K bytes of core memory (3705-I) or up to 256K bytes of semiconductor memory (3705-II) and adapters for up to 352 communications lines. The maximum limit on lines applies to lines operating at up to 9600 bits per second. Higher-speed lines and lines using IBM internal modems or line adapters in place of external modems reduce the maximum limit, as shown in the accompanying tables.

Alternatively, the 3705 can be used to emulate one or more IBM 2701, 2702, and 2703 Controllers. In this case, the number of lines that can be implemented is also governed by the number of available subchannels on the host processor's byte multiplexer channel in addition to internal 3705 configuration restrictions. A second alternative permits a 3705 to be located remotely, concentrating data from several low-speed lines onto a single higher-speed line between the host computer and the 3705.

The control program that runs on the 3705 is generated in the host computer and transferred to the controller over the I/O channel or communications line connection. The front-end processing support program is called Network Control Program (NCP). The extension for virtual environments is called NCP/VS. Among the important features of this extension are its capabilities for application program, communications line, and terminal sharing; i.e., one terminal can interface more than one applications program. This, together with IBM's concentration on a single communications line discipline, SDLC, should make communications networks and applications easier to construct in the future. The 3705 accommodates SDLC through software routines. The same communications adapters can be used for Bisync, SDLC, or other protocols.

The 3705 received prominent mention in IBM's September 1974 announcement of Advanced Function for Communications and System Network Architecture. This announcement is discussed in Report 70D-491-45 on the IBM 3770 Data Communication System.

USER REACTION

In Datapro's December 1975 survey of communication processor users, 50 responses were received from users of the IBM 3705, representing experience with a total of 67 systems. The users' ratings are presented in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	23	26	1	0	3.4
Ease of operation	19	18	9	3	3.1
Throughput	18	27	1	4	3.2
Hardware reliability	37	10	2	0	3.7
Maintenance service:					
Promptness	27	22	1	0	3.5
Quality	28	19	1	1	3.5
Software	8	26	9	5	2.8
Technical support	11	25	11	3	2.9

*Weighted Average on a scale of 4.0 for Excellent.

increment of core memory for the 3705-I. All memory is contained in the Base Module of the 3705-II. Up to three 3706 Expansion Modules can be included in a 3705 system. When the 3705 functions as a remote concentrator, the Remote Program Loader is used in place of the Channel Adapters.

In general, the Base Module can contain up to four Line Interface Bases and each Line Interface Base can accommodate up to eight Line Sets. Each Line Set can accommodate up to two communications lines. For some types of lines, these maximums cannot be attained, as shown in the accompanying tables. Each Expansion Module can contain up to six Line Interface Bases.

Channel Adapters are available in four types, Communication Scanners in three. The restrictions that apply to the Channel Adapters and Scanners affect configuration possibilities and performance in addition to the limitations imposed by the different models. The selection of Channel Adapters and Scanners is determined by the desired level of performance, the number of lines to be implemented, and the mode of operation (i.e., Emulation Mode or Network Control Mode).

The Communication Scanners link the communications lines, via their respective Line Interface Bases and Line Sets, with the Central Control Unit (CCU). The Scanner transfers data between the lines and the CCU memory on an interrupt basis and performs character assembly and disassembly functions. The Scanners differ only in performance. Low, medium, and high operating performance is provided by Type 1, Type 2, and Type 3 Scanners, respectively. The control program is interrupted on a bit-by-bit basis for the Type 1 Scanner, on a byte-by-byte basis for Type 2, and on a block basis for Type 3. Type 1 is limited to 9600 bps; the others are not speed-limited. Line control, control character recognition, code translation, and user recovery functions are performed by the control program.

The Type 3 Scanner performs data transfer functions on a cycle-steal basis, halting the control program for a complete machine cycle. The control program resumes operation at the conclusion of the data transfer unless another cycle-steal request is pending. An interrupt can occur on buffer boundaries (up to 254 characters), by unique control character, or by specific error conditions. Type 3 supports only LIB Type 1, 8, 9 and 10, provides control character recognition for BSC and SDLC line controls, and performs ASCII to EBCDIC (and the converse) code translation when operating under BSC line control.

Channel Adapters are divided into two groups: those designed for the Emulation Mode of operation but also usable in the Network Control Mode (Types 1 and 4), and those designed for the Network Control Mode of operation only (Types 2 and 3). The Channel Adapter Type 1 is a low-performance adapter and is limited to the Base Module of a 3705-I only, while Type 4 provides higher performance and can be used in a Base and Expansion Module of a 3705-I or 3705-II. Channel Adapter Types 2 and 3 provide a higher level of performance and can be used in both a Base and Expansion Module, but Type 3 is designed to support both processors of a "tightly coupled" multiprocessor system.

The various configuration restrictions add up to three basic configuration groups:

- A 3705-I Base Module with a Channel Adapter Type 1 and a Scanner Type 1. Irrespective of which model (letter series A through D) is chosen, additional Scanners cannot be added, and the maximum number of line Interface Bases accommodated is limited to the

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The composition of the respondents' networks can be summarized as follows:

	Overall	3705's used with 370's	3705's used with 360's
Number of responses	49	40 (82%)	6 (12%)
Number of controllers	67	57 (85%)	6 (9%)
Average number of lines per controller	32	32	28
Average number of terminals per controller	87	91	73
Average number of terminals per line	2.7	2.8	2.6

The largest configuration reported included 200 lines; the smallest, 5 lines. Terminal usage varied widely as well, with configurations ranging from 7 terminals per controller up to 500. The number of terminals per line included both multidrop arrangements and multiple terminals serviced through a single switched telephone network port. All but 7 of these 50 respondents were using the 3705 in the 270X emulation mode.

The users were particularly vocal in their comments. The comments about 3705 advantages were mainly in the areas of reliability (17 mentions), service (9 mentions), easy-to-use software (9 mentions), cost (7 mentions), and flexibility (5 mentions).

On the negative side, the users cited many of the same disadvantages and limitations that were reported in Datapro's 1974 user survey. Software led the list of complaints with 9 mentions, including poor software support and/or limited flexibility (7 mentions) and inadequate technical support (2 mentions). Two users cited problems with the Emulation Mode, and two users commented that the software documentation was hard to interpret. Throughput limitations were cited by three respondents. Only two users reported hardware problems.

The specific mentions of good and bad points should be taken with the overall ratings to get the total picture of how these 50 users felt about the 3705, since numerous users left the ratings stand by themselves without additional comment.

An overall assessment of the users' ratings seems to indicate that they are reasonably well satisfied but feel that more could be done with the software. □

four in the Base Module. However, a Channel Adapter Type 2 can be added in the first Expansion Module to provide an alternate data path. This configuration requires an Attachment Base Type I feature to accommodate the Type 1 Channel Adapter and Scanner. Alternatively, the Remote Program Loader features can be used in place of the Channel Adapter. This basic configuration can be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing functions.

- A 3705-I or -II Base Module with a Channel Adapter Type 1 and a Scanner Type 2 or 3. This configuration can be fully expanded with an additional Scanner Type 2 in each Expansion Module containing Line Interface Bases. A Channel Adapter Type 2 or 3 can be added to the first Expansion Module. An Attachment Base Type 2 is required for the first Scanner Type 2 or 3, and an Attachment Base Type 1 is required for the Channel Adapter Type 1. Alternatively, the Remote Program Loader can be used in place of the Channel Adapters. This configuration can also be used to support emulation of IBM 270X controllers, remote concentration, or full front-end processing. When emulating a 270X controller, the number of communications lines is restricted to the number of available multiplexer subchannels (255 maximum).

- A 3705-I or -II Base Module with a Channel Adapter Type 2, 3, or 4 and a Scanner Type 2 or 3 (3705-II only). This configuration can also be expanded fully with Expansion Modules, additional Type 2 or 3 Scanners, and a second Type 2, 3, or 4 Channel Adapter. An Attachment Base Type 2 is required to interface the first Type 2 or 3 Scanner. This configuration supports only front-end processing. Any combination of two Channel Adapters Type 2, 3, and 4 can be used, except that a Type 4 must be used in the Base Module when combined with a Type 2 or 3. Channel Adapters Type 2, 3, and 4 include the Attachment Base function, which precludes the use of a separate Attachment Base. The Type 2 and 3 Scanners can be combined in any arrangement, except that a Type 3 Scanner cannot be used in the Base Module of a 3705-I. The Type 2 or 3 Channel Adapter cannot be used in emulating the 270X controllers or for attachment to an IBM System/360.

Timing and interpretation of data signals on the communications lines can be provided by the modems or by a series of Business Machine Clocks. Clocks ranging from 45 to 2400 bits per second are available and are required for all asynchronous lines. Up to four can be installed with each Scanner, and at least one is required regardless of line types used. Clocks are program-assigned and can be shared among several lines.

Complete configuration of a 3705 system revolves around determination of the number of Line Interface Bases required. This sets the minimum model that will suffice. Larger models can be implemented to provide additional memory. The accompanying tables and diagram fully set forth the rules for determining the number and types of Line Interface Basis (LIB's) and Line Sets required for the types of lines that can be accommodated. Many of the Line Set types include internal modems.

CONNECTION TO HOST COMPUTER: The Type 1 Channel Adapter provides attachment to the byte multiplexer channel of an IBM System/360 (32K Model 30 and larger) or System/370 computer. The Type 2 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channel of an IBM System/370. The Type 3 Channel Adapter provides attachment to the selector, byte multiplexer, or block multiplexer channels of a pair of System/370 processors (Model 135 and larger) operating in a virtual mode as a tightly coupled multiprocessor system.

The Type 1 Channel Adapter transfers data one, two, three, or four bytes at a time over the attached byte multiplexer channel. The transfer rate appears to be in the neighborhood of 16,000 bytes per second. A separate transfer control operation is required of the 3705 control unit for each data burst transferred.

The Type 2 Channel Adapter always operates in the burst mode, with two-byte transfers over an attached byte

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multiplexer channel and multi-byte transfers over an attached block multiplexer or selector channel. It can sustain a data rate of 276,000 bytes per second. Data is transferred in blocks, and except for initiation and termination of a transfer operation, data transfers interrupt the 3705 central control unit only for the memory cycles required to access and move the data.

The Type 3 Channel Adapter has a performance level equivalent to that of the Type 2, but includes an automatic two-processor switch for symmetric support of tightly coupled System/370 multiprocessor configurations. The Type 3 can also be used to provide alternate-path capability by connecting both sides of the switch to two channels of a single processor. The Type 3 also includes a remote switch attachment capability through the configuration control panel of a System/370 158 MP or 168 MP or from a 2925 Model 10 Remote Switching Console.

The Type 4 Channel Adapter transfers data in a burst mode of up to 32 bytes at a time over the attached byte multiplexer channel. This adapter can be used only with Type 2 or 3 Scanners and is required when using the Type 3 Scanner in Emulation Mode.

In configurations having two Channel Adapters, connection can be made to two channels of the same host processor or to two different host processors. In a mixed configuration (i.e., one Type 1 and one Type 2 Channel Adapter), one must be disabled during operations. This configuration is useful in allowing operation under either the emulation mode (i.e., 2701/2/3) or full 3705 mode; both modes cannot be active simultaneously. In configurations having two Type 2 Channel Adapters, only one can be active at a time, but the active channel can be designated under program control; if connection is made to two host processors, either processor can initiate a switch between Channel Adapters.

A manual two-channel switch can be added to Channel Adapter Type 1, 2, or 4. Thus, the 3705-I (Models B through D) or 3705-II (Models F through H) can be attached to up to four input/output channels in up to four host processors. In all cases, only one input/output path exists at any one time.

TRANSMISSION SPECIFICATIONS

The accompanying tables summarize the capabilities of the 3705 for accommodating various types of communications lines and techniques.

A wide range of Line Sets is available, but configurations are not as complex to resolve as Table 2 would tend to indicate at first glance. A couple of examples will illustrate this point.

Suppose you wished to interface a communications line coming from an IBM terminal employing SDLC line protocol. All told, there are 12 different Line Sets that could be used, depending on other parameters. But if you also wished to implement internal data sets, and planned to transmit at 2400 bps in a half-duplex, point-to-point arrangement over a leased voice-grade line, the choices would reduce to Line Set 5A. A Bisync terminal with the same operating parameters could also be interfaced with Line Set 5A. Line protocol considerations are handled by the program.

If you wished to accommodate a line to a Bisync terminal operating at 4800 bps using an external modem, the choice would immediately resolve to Line Set ID. (Bisync terminals cannot operate in a full-duplex mode.)

Operation over the switched telephone network or over a multipoint or point-to-point leased facility will govern the selection of modems. The number of lines to be implemented will also have an effect on selection between internal and external modem arrangements. More lines can be accommodated by using external modems, but the maximum number permitted using internal modems is not all that restrictive, except in a few cases such as Line Sets 5A, 5B, 11A, and 11B.

Restrictions on the usage of the various Line Sets are clearly indicated in Table 2.

SOFTWARE

The program stored in memory controls all functions of the 3705. Many functions such as control character recognition and error procedures are defined and controlled by software. In previous, hard-wired controllers, such as the IBM 2701, 2702, and 2703, these functions were fixed once a particular set of adapters was selected. The 3705 is not totally independent, however. Functions are executed in response to commands issued by the host processor. Indeed, all control ultimately resides with the host processor, including program loading.

The control program residing in the memory of the 3705 is generated on an IBM System/360, System/370 non-virtual, or System/370 virtual computer system through a macro-assembly/link-edit procedure. Generated control programs are loaded into the 3705 memory over the I/O channel connection or over a communications line if the Remote Program Load feature is implemented). The support package for the 360/370 includes the macro assembler, a load program, and a dump routine.

Two types of control programs can be generated. One, which is called NCP for Network Control Program (NCP/VS in virtual environments), provides front-end processing functions that can relieve the host processor of much of the overhead associated with managing multiple data communications lines. The other, which is called EP for Emulation Program (EP/VS for virtual environments) allows a 3705 to replace multiple 2701, 2702, and 2703 controllers with little or no modification of user application programs; operation of the host processor when EP is active is identical with activity under the previous 270X hard-wired controllers, and none of the potential benefits of front-ending is realized. NCP/VS includes provisions for running NCP and EP simultaneously.

NCP, like most general-purpose operating systems, requires a generation procedure to define the hardware (i.e., communications lines and terminals) configuration available and to specify which of the optional facilities will be included. IBM has implemented a macro language for specification of NCP. The language is divided into three types of macros. Systems macros define the 3705 configuration parameters, such as memory size, buffer sizes, and type of channel adapter installed, and any optional control facilities to be included, such as checkpoint/restart and on-line terminal testing. Configuration macros define the makeup of the network and supply information pertinent to each individual type of terminal, including composition of multipoint line operations. Block-handling macros specify any processing to be done in the 3705 on the blocks of data exchanged between the 3705 and the host processor. At present, the only processing macros supplied by IBM provide for insertion of date and time for next correction involving backspaces to correct entries, but the assembler can be used to create additional macros. A framework is provided for structuring routines into symbolically named groups and sets

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and for controlling the point of execution of each component.

Extensive provisions can be included in NCP for accommodating transient or permanent failures of the communications lines and for gathering statistics on detected errors.

Many of the functions can be controlled dynamically through commands issued by the host processor, including specification of the network configuration by activating and deactivating devices, lines, and groups of lines. In addition, terminal ID, polling, and addressing characters can be modified, the frequency and duration of polling and transmission among the terminals or components of a multipoint line or multi-component terminal can be modified, and the block processing routines associated with a particular terminal can be switched.

NCP/VS provides all the capabilities of NCP plus some valuable additions. One of the principal benefits is the capability to operate in the EP mode and NCP mode concurrently; i.e., a portion of the lines can be operated in the 270X mode while the others operate under NCP. This capability is particularly valuable during the cutover of applications from 270X operation to front-end processing with the 3704, and is referred to as Partitioned Emulation Programming Extension or PEP. The other major expansion of NCP capabilities is the operation of the 3705 as a remote concentrator.

PEP can now support concurrent operation in a dual-processor environment. One CPU supports communication via VTAM or TCAM through VTAM, and is attached via a Type 2 or 3 Channel Adapter; communications are supported under the NCP mode. The other CPU supports communication via a non-VTAM control program which operates under the Emulation Program, and is attached to the same 3705 via a Channel Adapter Type 1; communications are supported under the EP mode of PEP. Control of the dual-CPU PEP operation is performed using the operator control facility of the host CPU operating with the NCP mode of PEP. Functions include: IPL 3705, Dump 3705, and line switching between the EP and NCP modes of PEP. Lines assigned to the NCP portion of PEP are under control of the VTAM facility; lines assigned to the EP portion of PEP are controlled by the Operator Control facility operating with the EP portion of PEP.

A new release of NCP/VS supports the added features on the 3705-I and 3705-II. The Emulation Program is also modified to support the added features and the 3705-II.

NCP/VS operates through the new access method, VTAM, in DOS/VS environments and through either VTAM, TCAM, or a combination in OS/VS environments. The combination mode of operation eases conversion requirements.

VTAM is acknowledged by IBM to be the principal access method for telecommunications support under DOS/VS and OS/VS. BTAM and QTAM will not be extended, and enhancements for TCAM will be in the environment provided by VTAM under OS/VS. The chief feature of VTAM is dynamic sharing of network resources. Application programs working through VTAM have access to any terminal, line, or 3704/3705 controller in the network; for example, different application programs can initiate transmission and reception with terminals located on the same multipoint communications line. By the same token, multiple application programs can have access to the same data base. One component of VTAM is TOLTEP, an on-line testing program for exercising and testing the complete network.

The EP or Emulation Program makes the 3705 look like one or more 2701, 2702, and/or 2703 controllers to the host processor. It offers no operational benefits over the earlier controllers. User programs now written for the 270X series will work with a 3705 under EP with some restrictions. Some of the 270X features not supported include transmission with older, 4-of-8-code terminals, 6-bit Transcode, ASCII transparency, Parallel Data Adapter (2701), transmission at 230,400 bps, second channel interface, and programmable two-processor switch. However, many of the more common RPQ's are supported.

In a dual-processor environment, the Emulation Program is modified to support two channel Adapter Type 4's on one 3705 to permit operation over two channels of the same or separate host computers.

In general, identical software support is provided for the 3704 and 3705. Operational differences exist primarily because of the smaller main memory of the 3704, which limits the number of lines and programming features that can be accommodated at any one time.

First deliveries of NCP and NCP/VS (operating through TCAM) were made in the fall of 1973. Delivery of NCP/VS operating through VTAM corresponds to the schedule for VTAM delivery: fall of 1974 for DOS/VS and OS/VS1, and March 1975 for OS/VS2.

The 3704/3705 System Support Programs for generation of 3704/3705 control programs require at least a 64K virtual region under DOS/VS and a 192K virtual region under OS/VS1 or VS2. Program generation requires 16K under DOS and 48K to 50K under OS. EP or EP/VS programs will run in the smallest 3705 (16K memory), whereas NCP or NCP/VS programs require at least a Series 2 (48K) 3705.

REMOTE CONCENTRATION: When the 3705 is configured as a remote concentrator, the Remote Program Loader feature replaces the Channel Adapter. This feature permits loading NCP/VS into the 3705 main memory over the communications line connecting the 3705 with a 3704 or 3705 at the host computer site. The line can be a full-duplex leased voice-hand line operating synchronously at up to 7200 bps (Line Set 1H) or a half-duplex wide-band facility operating at up to 50,000 bps (Line Set 1G). All data transferred between the remote and local 370X pair is transmitted over this line. The Remote feature also permits running the diagnostic aids at the remote site without involving the host computer.

Configuration of a remote concentrator arrangement follows the normal 3704 rules, with the maximum number of lines that can be connected to terminals reduced, of course.

Several other features are available to supplement remote location of a 3705. Extended Environment allows operation at temperatures of between 50 and 100 degrees F. This feature requires installation of Internal Air Circulation 1 and 2 (for the first and second block of core storage, respectively) in the Base Module and each Expansion Module. Remote Power Off includes a capability for turning the power off in response to a command received over the communications line; power can be restored only from the unit's control panel. Unit Protection provides a physical locking capability for the 3705's control panel that prevents any switches except

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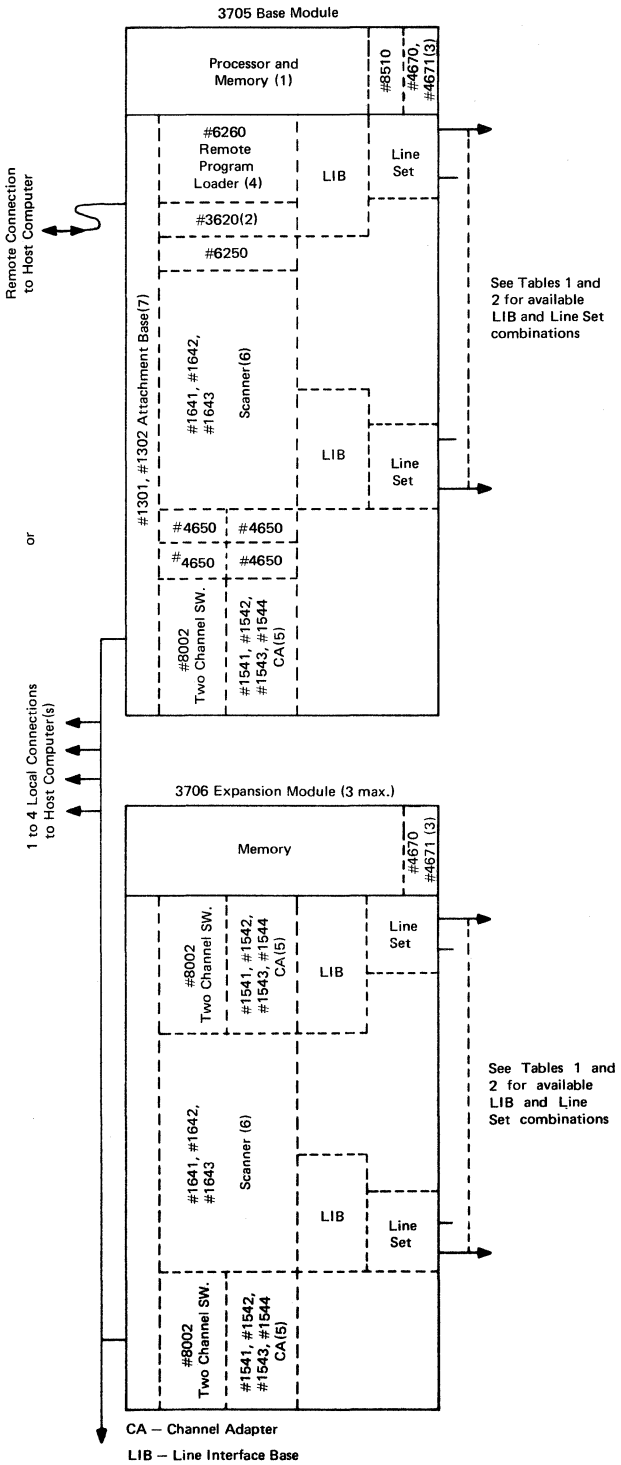
IBM 3705 Communications Controller
(Versions I and II)



-II CONFIGURATION

(1) Memory capacity in the 3705-I is 16K to 48K bytes in base module and 32K to 64K bytes in each expansion module. Maximum 3705-I system capacity is 240K bytes. In the 3705-II, all memory is located in base module in 32K byte increments to a maximum of 256K bytes.

(2) Extended environment available for all models except A1, B1, C1, DI. Applies to base module in A2 model, otherwise to last expansion module.

(3) Air circulation for first and second block of memory for each base or expansion module.

(4) Maximum of 1 program loader per system. Cannot be installed with channel adapter type 1, 2, 3, or 4; or Scanner Type 3; or LIB, Type 5 or 11.

(5) In general, 1 Channel Adapter (CA) Type 1, 2, 3 or 4 can be installed in the first expansion module except that Types 1 and 4 are mutually exclusive. Emulation mode requires CA Type 1 or 4.

(6) One Scanner Type 1, 2 or 3 can be installed in each of the four modules, subject to the following limitations:
- If Type 1 Scanner is installed, no additional Scanners of any Type can be added to the system.
- Scanner Type 1 cannot be used in the 3705-II.
- Scanner Type 3 cannot be installed in a 3705 system with a CA Type 4.
- Scanner Type 3 cannot be installed in base module of 3705-I.

(7) One or two attachment bases are required as follows:
- Scanner Type 1 with CA Type 1—Attachment Base Type 1;
- Scanner Type 2 or 3 with CA Type 1—Attachment Base Type 1 and 2;
- Scanner Type 2 or 3 with CA Type 2, 3, 4—Attachment Base Type 2;
- Attachment Base Type 1 can be used only with a CA Type 1 in the 3705-II.

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Power On and Power Off from being altered without a key; this feature can also be used in a locally connected 3705.

PRICING

The 3705 can be acquired by purchase, short-term rental, or under IBM's Extended Term Lease Plan, which was introduced with the 3705. In the following price list, maintenance charges are included in the figures for both the short-term rental and Extended Term Plan; a separate arrangement is available for purchased units, and the figures are shown.

Under the short-term plan, overtime usage is charged at 10 percent of the regular hourly rates. Under the Extended Term Plan, there are no overtime charges. The initial lease period for the Extended Term Plan is 24 months, and the term is extendable indefinitely in increments of one year or one time for less than a year. However, charges for early termination of the Extended Term Plan range from two to five times the monthly rental, depending on how long the lease has been in effect; equipment can be upgraded without incurring termination charges.

	Monthly Rental*			
	Short Term	Extended Term	Purchase	Monthly Maint.
3705-I Communications Controller				
Model A1 (16K bytes, 64 lines)	$1,287	$1,095	$ 40,800	$179
Model A2 (48K bytes, 64 lines)	1,845	1,570	58,550	217
Model B1 (16K bytes, 160 lines)	1,698	1,445	54,100	200
Model B2 (48K bytes, 160 lines)	2,262	1,925	71,850	237
Model B3 (80K bytes, 160 lines)	2,826	2,405	89,600	276
Model B4 (112K bytes, 160 lines)	3,384	2,880	107,350	314
Model C1 (16K bytes, 256 lines)	2,133	1,815	67,400	219
Model C2 (48K bytes, 256 lines)	2,691	2,290	85,150	259
Model C3 (80K bytes, 256 lines)	3,249	2,765	102,900	296
Model C4 (112K bytes, 256 lines)	3,813	3,245	120,650	335
Model C5 (144K bytes, 256 lines)	4,365	3,715	138,400	373
Model C6 (176K bytes, 256 lines)	4,923	4,190	156,150	411
Model D1 (16K bytes, 352 lines)	2,550	2,170	80,700	240
Model D2 (48K bytes, 352 lines)	3,108	2,645	98,450	278
Model D3 (80K bytes, 352 lines)	3,672	3,125	116,200	318
Model D4 (112K bytes, 352 lines)	4,236	3,605	133,950	355
Model D5 (144K bytes, 352 lines)	4,794	4,080	151,700	394
Model D6 (176K bytes, 352 lines)	5,352	4,555	169,450	432
Model D7 (208K bytes, 352 lines)	5,916	5,035	187,200	470
Model D8 (240K bytes, 352 lines)	6,474	5,510	204,950	509
Unit Protection (8510)	35*	35*	35	NC
3705-II Communications Controller				
Model E1 (32K bytes, 64 lines)	1,204	1,025	38,230	250
Model E2 (64K bytes, 64 lines)	1,381	1,175	43,630	270
Model E3 (96K bytes, 64 lines)	1,557	1,325	49,030	302
Model E4 (128K bytes, 64 lines)	1,733	1,475	54,430	328
Model E5 (160K bytes, 64 lines)	1,909	1,625	59,830	354
Model E6 (192K bytes, 64 lines)	2,086	1,775	65,230	380
Model E7 (224K bytes, 64 lines)	2,262	1,925	70,630	406
Model E8 (256K bytes, 64 lines)	2,438	2,075	76,030	432
Model F1 (32K bytes, 160 lines)	1,616	1,375	51,530	271
Model F2 (64K bytes, 160 lines)	1,792	1,525	56,930	297
Model F3 (96K bytes, 160 lines)	1,968	1,675	62,330	323
Model F4 (128K bytes, 160 lines)	2,144	1,825	67,730	349
Model F5 (160K bytes, 160 lines)	2,321	1,975	73,130	375
Model F6 (192K bytes, 160 lines)	2,497	2,125	78,530	401
Model F7 (224K bytes, 160 lines)	2,673	2,275	83,930	427
Model F8 (256K bytes, 160 lines)	2,849	2,425	89,330	453
Model G1 (32K bytes, 256 lines)	2,027	1,725	64,830	292
Model G2 (64K bytes, 256 lines)	2,203	1,875	70,230	318
Model G3 (96K bytes, 256 lines)	2,379	2,025	75,630	344
Model G4 (128K bytes, 256 lines)	2,556	2,175	81,030	370
Model G5 (160K bytes, 256 lines)	2,732	2,325	86,430	396
Model G6 (192K bytes, 256 lines)	2,908	2,475	91,830	422
Model G7 (224K bytes, 256 lines)	3,084	2,625	97,230	448
Model G8 (256K bytes, 256 lines)	3,261	2,775	102,630	474
Model H1 (32K bytes, 352 lines)	2,438	2,075	78,130	313
Model H2 (64K bytes, 352 lines)	2,614	2,225	83,530	339
Model H3 (96K bytes, 352 lines)	2,791	2,375	88,930	365
Model H4 (128K bytes, 352 lines)	2,967	2,525	94,330	391
Model H5 (160K bytes, 352 lines)	3,143	2,675	99,730	417
Model H6 (192K bytes, 352 lines)	3,319	2,825	105,130	443
Model H7 (224K bytes, 256 lines)	3,496	2,975	110,530	469
Model H8 (256K bytes, 352 lines)	3,672	3,125	115,930	495
Unit Protection (8510)	35*	35*	35*	NC
Attachment Bases				
Type 1 (1301)	19	16	641	0.50
Type 2 (1302)	19	16	641	0.50

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	Monthly Rental*			
	Short Term	Extended Term	Purchase	Monthly Maint.
Channel Adapters				
Type 1 (1541)	$110	$94	$3,555	$14.00
Type 2 (1542)	202	172	6,470	14.00
Type 3 (1543)	407	346	12,910	17.00
Type 4 (1544)	176	150	5,800	13.50
Two Channel Switch (8002)	65	55	2,090	3.50
Communications Scanners				
Type 1 (1641)	58	49	1,880	9.00
Type 2 (1642)	196	167	6,250	14.00
Type 3 (1643)	687	585	22,640	52.00
Business Machine Clock (4650)	12	10	424	1.00
Communication Line Attachment Features				
Line Interface Base Type 1 (4701):	43	37	1,455	4.00
Line Set Type 1A (4711)	19	16	641	2.00
Line Set Type 1B (4712)	20	17	676	2.00
Line Set Type 1C (4713)	19	16	641	2.00
Line Set Type 1D (4714)	41	35	1,355	4.50
Line Set Type 1E (4715)	32	27	1,030	2.50
Line Set Type 1F (4716)	65	55	2,090	7.50
Line Set Type 1G (4717)	83	71	2,695	8.50
Line Set Type 1H (4718)	71	60	2,295	14.00
Line Set Type 1J (4719)	43	37	1,455	3.00
Line Set Type 1S (4720)	92	78	3,020	9.50
Line Interface Base Type 2 (4702):	43	37	1,455	3.50
Line Set Type 2A (4721)	32	27	1,030	5.00
Line Interface Base Type 3 (4703):	79	67	2,515	3.00
Line Set Type 3A (4731)	25	21	850	2.00
Line Set Type 3B (4732)	25	21	850	2.00
Line Interface Base Type 4 (4704):	49	42	1,665	4.00
Line Set Type 4A (4741)	43	37	1,455	4.50
Line Set Type 4B (4742)	43	37	1,455	7.00
Line Set Type 4C (4743)	43	37	1,455	7.00
Line Interface Base Type 5 (4705):	110	94	3,555	7.50
Line Set Type 5A (4751)	65	55	2,075	11.00
Line Set Type 5B (4752)	58	49	1,860	10.00
Line Interface Base Type 6 (4706):	110	94	3,555	7.50
Line Set Type 6A (4761)	71	60	2,295	14.00
Line Interface Base Type 7 (4707)	209	178	6,675	26.00
Line Interface Base Type 8 (4708):	43	37	1,455	5.00
Line Set Type 8A (4781)	46	39	1,490	7.00
Line Set Type 8B (4782)	59	50	1,920	8.50
Line Interface Base Type 9 (4709):	43	37	1,455	3.50
Line Set Type 9A (4791)	65	55	1,785	14.00
Line Interface Base Type 10 (5000):	49	42	1,685	3.00
Line Set Type 10A (4784)	83	71	2,685	8.00
Line Interface Base Type 11 (5001):	98	83	3,120	4.00
Line Set Type 11A (4754)	98	83	3,120	15.00
Line Set Type 11B (4755)	90	77	2,900	12.50
Line Interface Base Type 12 (5002):	42	36	1,190	4.00
Line Set Type 12A (4785)	116	99	3,265	22.00
Line Set Type 12B (4786)	129	110	3,605	24.50
Remote Concentrator Features				
Extended Environment (3620)	25	21	832	NC
Internal Air Circulation 1 (4670)	12	10	416	NC
Internal Air Circulation 2 (4671)	6	5	207	NC
Remote Power Off (6250)	12	10	416	0.50
Remote Program Loader (6260)	262	223	8,320	41.00

* Includes monthly maintenance.
**Single-Use Charge, one time.

NC—No charge. ■

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