



IBM System/360 Model 44



field engineering announcement



IBM 2044 Processing Unit

The IBM SYSTEM/360 MODEL 44 handles both scientific applications and data acquisition and control applications.

- *Scientific:* The ability to execute various types of numerical analysis requiring a high-speed arithmetic capability.
- *Data Acquisition and Control:* The ability to provide automatic monitoring and control of continuous operation.

Instruction Set

Basic Instructions: The Model 44's basic instructions, a compatible subset of the System/360 instruction set, include the following:

- Half-word fixed point
- Full-word fixed point
- Logical
- Input/output
- Status switching and control

Optional Feature Instructions: The instruction set can be expanded to include the System/360 short and long precision floating-point arithmetic instructions.

Compatibility: Complete instruction compatibility and identical results are obtained between the Model 44 and

Extension Storage: A non-program addressable section of main storage. Extension storage has a 1.0 micro-second access time and is used by the Model 44's control circuitry as temporary storage. Various extension storage locations may contain:

- Data for the 16 general registers.
- Data for the low-order words of the floating-point registers.
- Control words, data addresses, and byte count for each multiplexor channel's subchannels.

Input/Output

The Model 44 adapters and channels are physically integrated in the processing unit. The following types of input/output adapters, channels, and devices are offered:

Adapters

Two adapters in the Model 44 permit direct attachment of the Console Printer-Keyboard and the Single Disk Storage Drive that are standard I/O devices on every Model 44. These adapters can be connected through either type of channel to the CPU.

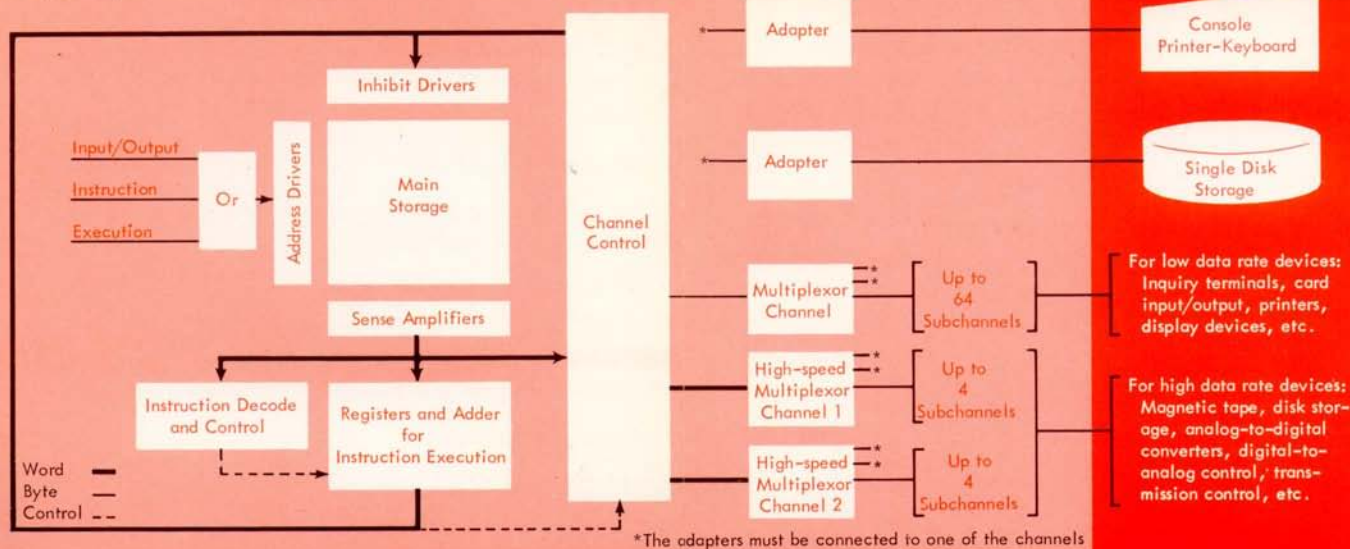
Channels

The optimum rates assume that none of the channels are starting, stopping, command chaining, data chaining, or transferring in channel.

| | Optimum Byte Rates | |
|----------------------------------|--------------------|----------------|
| | Burst Mode | Multiplex Mode |
| Multiplexor Channel | 200 KC | 50 KC |
| High-Speed Multiplexor Channel 1 | 400 KC * | 200 KC |
| High-Speed Multiplexor Channel 2 | 400 KC * | 200 KC |

* A single High-speed Multiplexor Channel can sustain a 500 KC data rate in burst mode.

Multiplex Mode means that several subchannels and their associated I/O devices may be operating simultaneously if the devices are in byte-multiplex-mode. Naturally, data bytes to or from main storage are being interspersed based on each device's data rates and requirements.



Data Flow of IBM System/360 Model 44

other models of the System/360 using a comparable instruction set and main storage. Of course, the object program should not contain time dependent loops, and comparable input/output facilities should be available.

Data Formats

The byte, the basic unit of data for all models of System/360, consists of eight bits. Data representations in the Model 44 are:

| | |
|--------------------------------------|-----------------|
| Instruction length | 2 bytes |
| | 4 bytes |
| Fixed-point half-word | 2 bytes |
| Fixed-point full-word | 4 bytes |
| Main storage data | 4 bytes |
| Main storage address | (15 to 17 bits) |
| General register data | 4 bytes |
| Floating-point register data | 8 bytes |
| Register address | (4 bits) |
| Floating-point short, precision data | 4 bytes* |
| Floating-point long, precision data | 8 bytes* |

*The System/360 floating-point notation for sign and characteristics is the leftmost byte of a floating-point word. The remaining bytes are the fraction (significant digits) notation.

Processing Unit

The design of the Model 44 processing unit has been optimized for its scientific computing capability. The basic data paths and registers are four bytes wide. The basic cycle time of the processing unit is 250 nanoseconds ($\frac{1}{4}$ microsecond).

Optional Feature: The 16 general registers used for calculations are normally located in a non-program-addressable extension of main storage and have a 1.0-microsecond access time. But, as a feature, the 16 general registers are implemented in distinct circuit components and have a 250-nanosecond access time; thus resulting in an increased internal performance for fixed-point arithmetic.

Main Storage

The main storage of the Model 44 is a four-byte-wide core storage with a 1.0-microsecond read/write cycle. Three storage sizes offer the following capacities:

| | | |
|------------|---------------|--------------|
| Model 44 E | 32,768 bytes | (2^{15}) |
| Model 44 F | 65,536 bytes | (2^{16}) |
| Model 44 G | 131,072 bytes | (2^{17}) |

A priority system enables the main storage to be shared by the object program and the overlapped input/output data-transfers with a minimum interference rate.

Burst Mode means that the channel's facilities are being monopolized to sustain the data transfer with one I/O device.

Standard I/O Devices

- Console Printer-Keyboard for operator/system communication and control.
- Single Disk Storage Drive for storage of over one million bytes on an interchangeable disk pack. Provides the system with random access auxiliary storage of programs, compilers, diagnostics, and monitor.

Optional I/O Devices

- Card Read-Punch devices for on-line card input/output.
- Printers for high-speed printed output.
- Additional Disk Storage facilities are available.
- Display devices for cathode ray tube display in alphabetic and graphic form.
- Tape Units for magnetic tape input/output.
- Data Control for the attachment of analog converters and control devices.
- Transmission Control for input/output with private or common carrier transmission lines.

Service Aids

- SLT circuits and packaging techniques are used throughout.
- Each byte of main storage and I/O data channels are parity checked.
- The system control panel provides:
 - Power controls
 - Operator controls
 - Status indicators
 - Store/display facilities
 - Condition indicators
 - System check indicators
 - Usage meters