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System/360, Model 30
1401 Compatibility Feature

This publication discusses the 1401 compatibility feature for the IBM System/360, Model 30. This special feature provides a means of rapid and simplified transfer from 1401-oriented applications to the System/360, Model 30.

Refer to IBM System/360 System Summary (Form A22-6810) and the IBM System/360 Principles of Operation (Form A22-6821) for complete description and operation procedures for the System/360.

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This feature, using the facilities of the System/360 with the IBM 2030 Processing Unit, expedites the transfer of 1401-oriented applications to the System/360, Model 30. This allows programming effort to be directed to the development and preparation of new applications.

This feature is intended as an aid to 1401 users in their initial use of the System/360 data processing systems. New applications should be programmed for the System/360, rather than for the 1401 compatibility feature.

The 1401 compatibility feature:

- Reduces the reprogramming burden
- Reduces the inconvienence of program testing
- Reduces conversion and parallel runs
- Allows programming effort to be directed to new application preparation and development.

Only the differences from the standard System/360, Model 30, operations and functions are discussed here.

With this feature, the System/360, Model 30, can execute 1401 instructions several times faster than a 1401 system can. However, when operating in the 1401 compatibility mode, the system's internal processing speeds are approximately one half the System/360 mode speed. Job throughput performance depends on the complement of I/O devices used.

The 1401 compatibility feature on the System/360, Model 30, permits the execution of 1401 object programs written in accordance with established IBM procedures and manuals, using comparable I/O devices included for the feature. All IBM 1401 programming systems operate with this feature by using the proper I/O devices. Initial formatting of IBM 2311 Disk Storage files should be performed using System/360 programming systems.

A sound, formalized procedure should be used to examine existing 1401 programs to establish their status, and to determine the existence of possible problem areas such as unorthodox programming.

Carefully reevaluate programs that use timing loops or that have been optimized to take fullest advantage of specific 1401 timing relationships, to determine the possible limitations. This is due mainly to the difference in processing speed between the 1401 and the System/360, Model 30, and the I/O input buffering that is possible with the System/360.

System/360 facilities that do not pertain to the 1401 compatibility feature cannot be utilized by a 1401 application being run on the system.

To achieve full benefit of the capabilities of this feature, the operator personnel should attend the System/360, Model 30, console operator's course before system installation.

A comparable System/360, Model 30, can assume the functions of any 1401 system having the following I/O units:

IBM 1402 Card Reader-Punch
IBM 1403 Printer
IBM 1407 Console Inquiry Station
IBM 1311 Disk Storage Drive
IBM 729 or 7330 Magnetic Tape Units.

The 729/7330, 1311, and 1407 units cannot be attached to the System/360, but their functions are provided by similar units attached to the system.

COMPATIBILITY INCLUSIONS

The basic 1401 Compatibility Feature includes the following functions and devices:

All 1401 Storage Capacities (See Core-Storage Requirements section)
All Basic 1401 Op Codes
Bit Test
High-Low-Equal Compare
Multiply and Divide
Sense Switches
Advanced Programming
IBM 1402 Card Reader-Punch
IBM 1403 Printer
Additional Print Control
Expanded Print Edit
Print Storage
Process Overlap.

SPECIAL FEATURES

The following special features are available as options to augment the 1401 compatibility feature. These sub-features to the compatibility feature are:

Column Binary

Magnetic Disk—This permits processing 1311 magnetic disk-file records when the system is in 1401 compatibility mode using the IBM 2311 Disk Storage Drive.

Magnetic Tape—This permits processing 729/7330 magnetic tape records when the system is in 1401 compatibility mode using the 2400 tape units.

The seven-track magnetic tape feature, a physical modification of a tape unit, is also an addition to the tape control unit. It allows processing of seven-track tape on IBM 2400 tape drives. Nine-track magnetic tapes cannot be processed on IBM 2400 drives having this feature. The feature can be removed when it is no longer required. The 1401 compatibility feature permits operation with both seven- and nine-track tape.

IBM 1407 Console Inquiry Station—This allows input/output through the 1050 typewriter console.

When the following IBM System/360 special features are installed, they become available for use with the 1401 compatibility feature:

Adapter, 51-Column Interchangeable Read Feed
Punch Feed Read Control
Space Suppression
Preferred Character Set.

COMPATIBILITY EXCLUSIONS

The following units and features can not presently be used with the 1401 compatibility feature:

IBM 1009 Data Transmission Unit
IBM 1011 Paper Tape Reader
IBM 1012 Paper Tape Punch
IBM 1404 Printer
IBM 1301 Disk Storage
IBM 1405 Disk Storage
IBM 1409 Console Auxiliary
IBM 1412 Magnetic Character Reader
IBM 1418 Optical Character Reader
IBM 1419 Magnetic Character Reader
IBM 1428 Alphameric Character Reader
IBM 1447 Console Inquiry Station
Local or remote-terminal operations utilizing the IBM 1447-1050 system and its components
IBM 7340 Hypertape Drive
IBM 7641 Hypertape Control
IBM 7710 Data Communication Unit
Compressed Tape
Direct Data Channel
Numeric Print Control
Serial I/O Adapter.

Card, file I/O, and console typewriter are attached to the multiplexor channel. Magnetic tape is attached through either the multiplexor or the first selector channel, on a mutually exclusive basis (one or the other).

CORE-STORAGE REQUIREMENTS

An 8,192-byte System/360, Model 30, can accommodate a 1401 object program requiring up to 8,000 positions of core storage. A 16,384-byte System/360, Model 30, can accommodate a 1401 program requiring up to 16,000 positions of core storage.

System/360 core storage above 16,000 positions is not available to the system when it is being operated in the 1401 compatibility mode.

Character Representation

The characters of the 1401 application are mapped directly into the System/360, Model 30, as 8-bit bytes as follows:

Bits 2 through 7 are used to represent any 1401 character.
Bits 0 and 1 are used to represent the 1401 word mark.

When in the 1401-compatibility mode, the processing unit uses BCD character coding.

OVERLAP OPERATION

Since buffering is provided, overlap is unnecessary for card read and punch functions.

The 1401 processing-overlap instructions are executed as follows:

1401 Instructions	Executed As
Overlap On	No Operation
Overlap On and Branch	Unconditional Branch
Overlap Off	No Operation
Overlap Off and Branch	Unconditional Branch
Read/Write Tape in Overlap Mode	Tape Unit on the Selector Channel Will Operate
Branch on Reader Busy	No Branch
Branch on Punch Busy	No Branch
Branch on Tape or I/O Busy	Same as 1401 Execution

INITIALIZATION

A specially produced initialization deck accompanies the System/360, Model 30, equipped with the 1401 compatibility feature. This deck is used each time the system is used in 1401 compatibility mode. It is normally reproduced several times and placed in front of any 1401 program to be run on the system.

Examples of setup information entered by initialization control cards include: status of the check-stop-switch function, tape densities, and I/O unit-selection numbering.

MODE SWITCHING

Mode switching is accomplished by a manual switch.

CONSOLE OPERATING CONSIDERATIONS 1401 COMPATIBILITY MODE

The IBM System/360, Model 30, console differs from the 1401 console. A template is provided to facilitate interpretation of the lights, switches, and dials when the system is being used in the 1401 compatibility mode.

Since some of the console procedures differ from the 1401, operators should attend the IBM System/360 console operator's class before system installation.

Machine Errors

The IBM 2030 Processing Unit checking circuits remain active during a 1401 compatibility run. When the System/360, Model 30, stops after a machine check, the type of error is displayed in the check indicators.

Input/Output Errors

Those input/output errors that stop a 1401 system will also stop the 2030. A coded byte displayed in the R-register indicates the type of error.

Program Errors

Program errors, such as invalid Op code, that will stop a machine will be indicated by a coded digit in the R-register lights.

Programmed Halt

When the processor is stopped by a programmed halt, a coded byte is displayed in the R-register. The I-address is displayed in the M- and N-register lights.

Display of Storage Address Registers

These registers can be displayed by using the standard 2030 procedure.

Character Display

Characters can be displayed by using the standard 2030 procedure.

Alter Star

These storage address registers can be altered by using the standard 2030 procedure.

Alter Character

Characters in core storage can be altered by using the standard 2030 procedure.

Start and Stop

Start key—Use the 2030 start key.
Start-reset key—Use the 2030 load key with the unique unit-select address.
Stop key—Use the 2030 stop key.

Check-Stop Switch

The only check-stop-switch function available is for the 1401 I/O check-stop switch. The setting of this switch is determined by a control card in the initialization deck.

Tape Density

Density settings are entered by control card or can be entered manually.

Sense Switches

The status of these 1401 controls is entered by dialing the desired sense switch on the dial switches on the 2030 console and then pressing the interrupt key.

CONSOLE FUNCTIONS NOT AVAILABLE

Displays

Overlap Light
Op-Register Light
Bit-Display Light
Instruction-Length Light
B-Light
A-Light

Keys and Switches

A- and B-Aux Register Key-Lights
O-Address Register Key-Lights
I/E Mode Switch
Storage Print-Out
Storage Scan
Tape Select and Diagnostic Switch
Backspace Key
Check-Stop Switch
Disk-Write Switch

1402 CARD READER-PUNCH

This unit is attached to the System/360 through a buffer. Although buffering of this unit does not affect the programming aspects of the system, it does affect the restart procedures.

Operating Differences

Note the following operational differences between 1401 mode and System/360 mode.

Non-Process Run-Out Key (Read)

Operate the reader start key after removing cards from the read hopper. Note: Do not operate the end-of-file key.

Non-Process Run-Out Key (Punch)

Operate the punch start key after removing cards from the punch hopper.

Load Key

Operate the reader start key, enter the unit address, and operate the console load key.

Check-Reset Key

Not available. Check conditions are reset by the next read or punch operation.

Last-Card Switch (Sense Switch A)

This switch is on if the end-of-file key is operated. Sense switch-A function (last-card switch) is not operational on the console.

Restart Procedure

Restart procedures involving buffered units are different than for unbuffered units. (Refer to System/360 Restart Procedure.)

1402 Special Features

Early Card Read

This function is provided by the System/360, Model 30.

Read-Punch Release

This feature is made obsolete by the use of buffered units. A start-read-feed or start-punch-feed instruction is treated as a No-Op.

51-Column Interchangeable Read Feed

This is available as a special feature of the System/360, Model 30.

Punch Feed Read

This is available as a special feature on the System/360, Model 30. The effect of buffering is lost when using this feature.

1403 PRINTER

The 1401 compatibility feature can use either a 1403 or 2201 printer. Although the printer is buffered on the IBM System/360, there are no programming or operational differences.

1403 Special Features

The following special features are available as options on the System/360, Model 30, and thus become available to the 1401 compatibility feature:

Auxiliary Ribbon-Feeding Feature
Interchangeable Chain-Cartridge Adapter
Preferred Character Set.

729/7330 MAGNETIC TAPE UNIT

The 729/7330 tape units are replaced by the 2400 series of tape units which can operate with either seven- or nine-track tape.

Magnetic tapes can be attached to either the multiplexor or selector channels on a mutually exclusive basis (one or the other, but not both). Tape process overlap (special feature) is only provided if the tape units are to be attached to the selector channel.

The tape units attached to the System/360 do not have any external means of setting the unit address and tape density. In normal (System/360) mode, these functions are under automatic control and do not require manual selection. Unit address and density settings for the tape units are communicated to the 1401 compatibility feature under control of the Initial Program Load (IPL) by a control card, or it can be changed manually by using the console.

When in 1401 compatibility mode, tape information is in BCD form, regardless of the capabilities of the tape drive (seven- or nine-track).

Magnetic Tape Special Features

The seven-track feature is a prerequisite when reading seven-track magnetic tapes. Note that if a magnetic tape unit has the seven-track feature installed, the unit cannot be operated in the nine-track mode.

With this feature, data being handled will be converted to the seven-bit format as it is written, and reconverted to the nine-bit byte format used in the system.

When the seven-track feature is installed, the IRG will be .75 inch rather than .6 inch.

1311 DISK STORAGE DRIVE

Although these units cannot be attached to the system, compatibility is provided by the IBM 2311 Disk Storage Drive attached to the System/360, Model 30, via the multiplexor channel.

The disk pack is loaded initially through the use of System/360 programming systems. The record format used by the 1401 compatibility feature is different than that used in either normal 1311 or normal 2311 files. Reformatting is required before file records can be used by normal System/360 programming support.

IBM 2311 Disk Storage Drive capacity above the capacity of a 1311 is not available to the system when it is being operated in 1401 compatibility mode.

Several methods of converting existing disk-file data are possible. The information can be punched into cards or written on magnetic tape. During this transfer, part or all record-format changing can be accomplished, depending on the core storage available for such manipulation and the length and complexity of the disk-file records. As the data is read into the new system, the remaining portion of the record-format conversion, if any, can be accomplished.

Although the 1401 compatibility feature can use only the 2311 storage device, all of the other IBM data storage devices, in addition to the 2311, are available when in System/360, Model 30 mode.

1407 CONSOLE INQUIRY STATION

The functions of the 1407 in run mode are available through equivalent procedures on the 1050 typewriter console.

The functions of the 1407 alter and character-display modes are not available in the 1401 compatibility mode.

The following list gives the corresponding 1050 operation or indication:

1407 Functions	1050 Equivalents
Request Key	Request Key
Enter Light	Proceed Light
Respond Key	Operate Alternate Code Key and 5-Key
Type-Out Key	Not available
Clear Key-Light	During a read-into-storage operation, this function is performed by operating the Alternate Code Key and the 0-Key.
	During a write-out-of-storage operation, this function is not available.

1401 RPQ FEATURES

When the System/360, Model 30, with the 1401 compatibility feature is to assume the applications of an existing 1401 system having RPQ features, these RPQ features must be submitted for consideration.

GENERAL INFORMATION

When reprogramming becomes necessary because of application expansion, the job should be programmed to take advantage of the superior capabilities of the System/360.

The 1401 compatibility feature should not be used to test new or corrected 1401 programs.

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