



Systems Reference Library

IBM System/360 Disk Operating System

1401/1440/1460 Emulator Programs

Compatibility Support/30

Compatibility Support/40

Program Number for CS/30: 360N-EU-484

Program Number for CS/40: 360N-EU-485

This publication contains information on the emulation of 1401, 1440, and 1460 object programs under the control of the Disk Operating System. Compatibility Support/30 and Compatibility Support/40 allow emulation of these programs on the IBM System/360 Models 30 and 40, respectively. Compatibility Support/30 comprises the IBM 1401/1440/1460 Emulator Program, Number 360N-EU-484, and applicable Compatibility Features for the Model 30. Compatibility Support/40 comprises the 1401/1440/1460 Emulator Program, Number 360-EU-485, and the applicable Compatibility Features for the Model 40. In addition, the 1401, 1440, and 1460 object programs can be run on the IBM System/360 Model 25 using the 1401/1440/1460 Emulator Program for Compatibility Support/30 in conjunction with applicable Compatibility Features for the Model 25.

General information concerning machine requirements, program generation, simulation techniques, data formats, control cards, and programming considerations is included, as are detailed explanations of Operator Service Functions, operating procedures, console messages, and special instructions added by the Compatibility Features for the Models 30 and 40.

The 1400 Emulator Programs under DOS allow the user to run 1401/1440/1460 programs, with little or no reprogramming, under the Disk Operating System in conjunction with the Compatibility Features. This allows 1400 programs to be run in a stacked job environment, mixed with System/360 jobs.

Note: All information in the body of this manual concerning the IBM 3420 Magnetic Tape Unit is for planning purposes only.



PREFACE

This publication provides information concerning the 1401/1440/1460 Emulator Programs under the Disk Operating System. The information is presented in eight sections.

The "Introduction" section contains a general description of the capabilities of the Emulator Programs and the levels of programming support; a description of the running of the Emulator Programs as background programs in a multiprogramming environment; and the minimum configuration required to operate the Emulator Programs under DOS, the devices from which problem programmers can request I/O operations for the Emulator Programs, additional features supported by the Emulator Programs, and the DOS units and features that cannot be utilized while the Emulator Programs are operating.

The "Program Generation" section contains information on the use of keyword macros to generate and assemble the Emulator Programs, the macro parameter values used to generate the Emulator Programs, and messages issued during Emulator-Program generation.

The "Simulation of IBM 1401/1440/1460 Facilities" section describes the layout of the Emulator Programs in main storage; the use of the registers by the Emulator Pro-

grams; program restrictions and limitations that the user must consider; information on unit-record, magnetic-tape, and disk-storage operations; I/O error recovery, buffering, and device independence, and simulation of I/O devices for which there is no hardware compatibility; and Emulator-Program support of I/O operations for card read punch, printer, magnetic tape, disk, and console inquiry, as well as an explanation of the differences in printer graphics.

The "Control Cards" section explains the use and format of all control cards used with the Emulator Programs.

The "Programming Considerations" section describes the calling of System/360 inquiry programs from the Core-Image Library and their execution while under control of the Emulator Programs, the ability to catalog and fetch programs from the Core-Image Library, the purpose and cataloging of overlay sections, use of the // FETCH card, and the procedure for fetching a program.

The "Operator Service Functions" section describes the available functions and how they are used, as well as discussing operator responses to system messages.

Fourth Edition (September, 1970)

This is a major revision of, and obsoletes, C27-6940-3. This revision incorporates minor clarifications requested by APARS and reader's comments. It also includes a more detailed description of the Emulator Program messages. Changes to the text and to illustrations are indicated by a vertical line to the left of the change.

This edition applies to Release 24 of IBM System/360 Disk Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest System/360 SRL Newsletter, Form N20-0360, for the editions that are applicable and current.

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Copies of this and other IBM publications can be obtained through IBM branch offices.

A form for reader's comments appears at the back of this publication. Address any additional comments concerning the contents of this publication to IBM Corporation, Programming Publications, Department 636, Neighborhood Road, Kingston, New York 12401

The "Appendix" section is organized as follows:

Appendix A presents a list of the Emulator-Program macro keyword parameters and a summary of their usage in tabular form.

Appendix B describes the six special System/360 instructions and the System/360 Diagnose instruction provided for use with the 1401/1440/1460 Basic Compatibility Feature.

Appendix C describes the use of the Programmed Mode Switch subfeature and the four special System/360 instructions provided with the subfeature.

Appendix D describes the two methods used by the Model 40 Emulator Program for fetching 1400 instructions, I-Fetch and I-Fetch at A-Address, and the special Diagnose instructions provided by the 1401/1440/1460 DOS Compatibility Feature for use by the Model 40 Emulator Program.

Appendix E presents character-conversion tables to illustrate the representation of BCD graphics in simulated storage and the buffer areas.

Appendix F provides a Model 40 address conversion table designed to aid the user in reading 1400 data and instructions as they appear in a System/360 storage dump.

Appendixes G and H present the algorithm for estimating the total storage requirement for the Emulator Programs on the Models 30 and 40, respectively, including a sample worksheet for computing the storage requirements.

Appendix I presents a sample program for use with Models 30 and 40. The sample program is designed to be executed either with a user-assembled Emulator Program, or with an Emulator Program described in the appendix.

Appendix J presents special programming considerations for the Model 25 users of the 1401/1440/1460 Emulator Program (360N-EU-484) under DOS.

Appendix K presents detailed descriptions of the console messages issued by the Emulator Programs.

PREREQUISITE PUBLICATIONS

Readers of this publication should be familiar with the information contained in the following IBM System/360 Disk Operating System (DOS) publications:

IBM System/360 Disk and Tape Operating Systems: Concepts and Facilities, GC24-5030

IBM System/360 Disk and Tape Operating Systems: Utility Program Specifications, GC24-3465

IBM System/360 Disk Operating System: Data Management Concepts, GC24-3427

IBM System/360 Disk Operating System: System Control and System Service Programs, GC24-5036

IBM System/360 Disk Operating System: System Generation and Maintenance, GC24-5033

IBM System/360 Disk Operating System: Operating Guide, GC24-5022

Model 30 users should be familiar with the following publications:

IBM System/360 Model 30 Operator's Guide, GA24-3373

IBM System/360 Model 30; 1401/1440/1460 Compatibility Feature, GA24-3255

Model 40 users should be familiar with the following publications:

IBM System/360 Model 40 Operating Procedures, GA22-6911

IBM System/360 Model 40 Functional Characteristics, GA22-6881

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GENERAL DESCRIPTION

This section contains general information concerning the 1401/1440/1460 Emulator Programs under the Disk Operating System. Compatibility Support/30 and Compatibility Support/40 allow emulation of 1401, 1440, and 1460 object programs on the IBM System/360 Models 30 and 40, respectively. Compatibility Support/30 comprises the following:

- IBM 1401/1440/1460 Emulator Program for the Model 30
- IBM 1401/1440/1460 Basic Compatibility Feature (#4456)
- IBM Programmed Mode Switch Subfeature (#5856)

Compatibility Support/40 comprises the following:

- IBM 1401/1440/1460 Emulator Program for the Model 40
- IBM 1401/1440/1460 DOS Compatibility Feature (#4460)
- IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462)

The IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) for the Model 40 provides the capability to relocate the Model 40 Emulator Program.

Note: When the 1401/1440/1460 DOS Compatibility Feature (#4460) is installed, operation of Model 40 Emulator Program 360C-EU-074 with the 1401/1460 Compatibility Feature (#4457) is excluded.

In addition, the 1401/1440/1460 Emulator Program for Compatibility Support/30 can be used to run 1401, 1440, and 1460 object programs on the IBM System/360 Model 25 in conjunction with the following Model 25 Compatibility features:

- 1400 Series Compatibility Feature (#4440)
- 1401/1440/1460 DOS Compatibility Feature (#4470)

Discussions within this publication of the 1401/1440/1460 Emulator Program for the Model 30 are generally applicable to the Model 25. However, Model 25 users must be

familiar with the programming considerations described in Appendix J.

The Emulator Programs allow 1400 object programs to be run in a DOS stacked-job environment, mixed with System/360 jobs. All initialization required by the Compatibility Features is handled by the Emulator Programs except for the initialization (and clearing) of disk packs, which is performed by an option in the DOS Initialize Disk Utility program. All of the 1400 CPU instructions are executed by the Compatibility Features, except the Move Characters and Edit (MCE) and Move Characters and Suppress Zeros (MCS) instructions on the Model 40. The Emulator Programs use the physical input/output control system (PIOCS) capabilities of DOS to simulate the 1400 I/O instructions. In addition, when the 1400 end-of-job halt is recognized, the Emulator Programs call DOS Job Control to provide transition to the next job. 1400 error conditions optionally cause a halt to allow operator intervention or an abnormal end of job with a 1400-style main storage dump, followed by a release to end of job.

There are three main levels of support for the Emulator Programs. They are as follows:

- 1400 UNIT RECORD: Support for 1400 card programs and for reading and punching Binary Coded Decimal (BCD) and binary data is provided.
- 1400 TAPE: Support is provided for 1400 tape operations under the Emulator Programs. This support enhances the performance of 1400 original equipment, and requires no reprogramming of 1400 programs written consistent with 1400 System Reference Library (SRL) manuals published by IBM.
- 1400 DISK: Support is provided for 1311 Disk Storage Drives and 1301 and 1405 Disk Storages. Some 1316 Disk Packs previously used on 1400 devices can be used on System/360 devices. Since the 1311 disk drives write at a density different from that used on 2311 disk drives, data written on a 1311 cannot be read by a 2311, and vice versa, without reformatting. Disk programming support offers full upward and downward compatibility between the Model 30 and Model 40 Emulator Programs. Information on disk compatibility is given in the Section on "Direct Access Simulation."

Note: Input data is represented in a form known as the 8-bit representation of BCD as shown in Table 15. This representation is referred to throughout this publication as BCDIC-8, and is compatible with previous emulation representations.

MULTIPROGRAMMING CONSIDERATIONS

In a multiprogramming environment the Emulator Programs under DOS can run in any partition. In order to efficiently utilize this feature, it may be desirable to assign SYSRDR and SYSIPT (the combination known as SYSIN) to a magnetic-tape unit or disk extent. If SYSIN is assigned to a magnetic tape or disk, that device must input all of the control cards that normally are included in the job stream. A standard file-to-file utility program that recognizes a /* card as the end of data can be used to place the job stream on a magnetic tape or disk, where the /* card of the job stream contains a nonblank in card column 4.

If SYSIPT is assigned to a magnetic tape or disk, that device must contain 80-byte unblocked records (key length equals zero, if on disk). Records of greater length cause a channel program check, and the program is aborted due to an I/O error.

The assignment of SYSIN to a magnetic tape or disk for the background program also makes the card reader available to read the control cards and data cards for a foreground program. This has the effect of reducing the number of statements entered by the operator from the console type-writer.

Most 1400 unit-record output (card and printer) can be produced through concurrent peripheral operations by assigning the card punch SYSPCH and/or the printer SYSLST to either a magnetic tape or disk. The manner in which this feature is implemented is described in detail under "General Comments on I/O Simulation" in the "Simulation of IBM 1401/1440/1460 Facilities" section. SYSPCH and SYSLST may be assigned to the same tape unit by assigning SYSOUT to that unit; they must be assigned, however, to different extents when assigned to a disk unit.

If the Emulator Program does not fit into the partition, a storage protection check occurs and DOS cancels the job with message OP77I. On the Model 30, the values of the SEND and MPGBLK parameters determine the beginning and ending locations of System/360 storage in which the Emulator Program and 1400 simulated storage will reside. On the Model 40, the RELOC parameter determines the beginning location of

System/360 storage for 1400 simulated storage. The main phase of the Emulator Program begins immediately following 1400 simulated storage. When running the CS/40 Emulator Program in a foreground partition, the partition must begin at least 2K bytes below the location of 1400 simulated storage for that partition. Thus, partition size allocations must be evaluated before assembling the Emulator Program.

Only one copy of the Emulator Program can run on the Model 30 at any one time. Three Emulator Programs can run concurrently on the Model 40. To run Emulator Programs in either foreground partition on the Model 30 or the Model 40, the MPS parameter in the DOS SUPVR macro must be specified as BJB. The DOS, Single Program-Initiation (SPI) mode of operation is not supported.

FOREGROUND EXECUTION CONSIDERATIONS

The load point of the Model 40 Emulator Program is determined by the value of RELOC. If RELOC=0, or is defaulted, the Emulator Program is then assumed to begin at location 16,384. If RELOC#0, or is not defaulted, the value specified by RELOC determines where the Emulator Program is to be loaded.

In the Model 30 Emulator Program, the load point is determined by the value of SEND. If SEND=0, or is defaulted, the Emulator Program is then assumed to run in the background partition. If SEND#0 it's value is used as the load point. The "MPGBLK=nn" parameter should be used if a foreground partition is to begin at the end of the Emulator Program. When specifying SEND=0 the Emulator Program can still be link edited to a foreground partition by the use of the ACTION (F1 or F2) statement. One should be familiar with the purpose of this statement before attempting to use it. Also care should be taken to ensure that the Emulator Program will not overlay 1400 storage by its being reallocated.

For a more detailed discussion of the above mentioned parameters see "Description of General Parameters".

MINIMUM REQUIREMENTS

The minimum requirements for the Emulator Programs under DOS are the same as for a 24K Model 30, or a 32K Model 40 Disk Operating System and the 1400 Compatibility Features, except that 1400 disks need not be on the multiplexor channel and 1400 tapes need not be on a single selector channel. The Model 30 1400 I/O Compatibility Features for unit-record equipment are

not required by the Model 30 Emulator Program.

The following are the features required for a minimum Model 30 configuration for the Emulator Program under DOS:

- An IBM System/360 Model 30 with a 2030 Processing Unit containing 24,576 (24K) bytes of main storage (the amount is variable and depends on the features of the Model 30 Emulator Program and DOS that are included)
- 1401/1440/1460 Basic Compatibility Feature (#4456)
- Programmed Mode Switch (#5856)
- Decimal Arithmetic Feature (#3237)
- Storage Protection Special Feature (#7520) (for multiprogramming)
- File Scan Feature (#4385) (supported in Move-mode only, but not required)
- Magnetic Tapes (#4467 for multiplexor and #4468 for selector channels, required for 1400 overlap operations)
- I/O Compatibility Features for customer-engineer diagnostics of supported devices (recommended, but not required):

Column Binary (#1990)

1402/1403 (#4463) or 1442/1443 (#4464) Attachment

Console Inquiry Station (#4465)

Disk Storage Drives (#4466)

The following are the features required for a minimum Model 40 configuration for the Emulator Program under DOS:

- An IBM System/360 Model 40 with a 2040 Processing Unit containing 32,768 (32K) bytes of main storage
- 1401/1460 Compatibility Feature (#4457)
- 1401/1440/1460 DOS Compatibility Feature (#4460) (see Note 4)
- 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) (required only if the Emulator Program is to be relocated.)
- Decimal Arithmetic Feature (#3237)
- 1311 Disk Compatibility Feature (#9710)

- File Scan Feature (#4385) (supported in Move-mode only, but not required)
- Storage Protection Special Feature (#7520) (for multiprogramming)

The configuration may range from a card-oriented System/360 Model 30 to a maximum configuration of disk, tape, and tele-processing. One of the purposes of emulation under DOS is to provide complete flexibility of external devices for the user who needs to grow and needs system availability to do so. In addition to the features previously listed the following are specific requirements for a minimum Model 30 or Model 40 machine configuration for the Emulator Programs:

- Standard instruction set (see Note 1)
- One I/O channel (either multiplexor or selector) (see Note 2)
- One card reader (1442, 2501, 2520, or 2540) (see Note 3)
- One card punch (1442, 2520, or 2540) (see Note 3)
- One printer (1403, 1404, or 1443) (see Note 3)
- One 1052 Printer-Keyboard
- 1051 Attachment (#7915) and 1051 Control Unit with CPU Attachment (#3130) for the Model 30
- 1052 Adapter (#7920) for the Model 40
- One 2311 Disk Storage Drive or 2314 Direct Access Storage Facility for DOS system residence
- Whatever systems configuration is required for operation of the user's DOS

Note 1: System/360 language translators may require extended instruction sets.

Note 2: System/360 telecommunications require a multiplexor channel and at least one selector channel.

Note 3: One 2400- or 3200-Series Magnetic Tape Unit (7- or 9-track) may be substituted for this device. (If SYSIPT, SYSPCH, and/or SYSLST are assigned to 7-track tape units, the Data Conversion Feature is required.)

Note 4: When the 1401/1440/1460 DOS Compatibility Feature (#4460) is installed, the operation of the Model 40 Emulator Program 360C-EU-074 is excluded on the system.

Table 1. Input/Output Device Correspondence

1401/1440/1460 I/O Device ¹	System/360 I/O Device
IBM 1402 or 1442 Card Read Punch or 1444 Card Punch	IBM 2501 Card Reader or 1442, 2520, or 2540 Card Read Punch
IBM 1403, 1404, or 1443 Printer	IBM 1403, 1404, or 1443 Printer
IBM 729, 7330, or 7335 Magnetic Tape Unit	IBM 2401, 2402, or 3420 (Model 3 or 5) Magnetic Tape Unit, or 2403, 2404, or 2415 Magnetic Tape Unit and Control
IBM 1407 Console Inquiry Station or 1447 Console	IBM 1052 Printer-Keyboard
IBM 1301 or 1405 Disk Storage or 1311 Disk Storage Drive	IBM 2311 Disk Storage Drive or 2314 Direct Access Storage Facility

¹ 1400 program reading on more than one reader, punching on more than one punch, or printing on more than one printer is not supported.

Table 2. Input/Output Feature Correspondence

1401/1440/1460 I/O Feature	System/360 I/O Feature
IBM 1402 Punch Feed Read and Control Unit (#5890 and #5895)	IBM 2540 Punch Feed Read (#5890); Punch Feed Read Control (#5895) on the 2821 Control Unit ¹
IBM Column Binary Feature (#1990), or IBM Binary Transfer (#1468) and Bit Test (#1470) Features, or IBM Card Image Features (#1531 and 9035)	IBM Column Binary Feature (#1990), on the 2821 Control Unit if 2540 Card Read Punch, or IBM Card Image Feature (#1531) if 2501 Card Reader or 2520 Card Read Punch, or IBM Card Image Feature (#1532) if 1442 Card Read Punch
IBM 1402 51-Column Interchangeable Read Feed (#4150) and Feed Adapter (#1013)	IBM 2540 51-Column Interchangeable Read Feed (#4151) ²
IBM 1403 Preferred Character Set (#5523) and Adapter (#5524) IBM 1416 Interchangeable Train Cartridge equipped with Preferred Character Set Print chain	IBM 1403 Universal Character Set ³ for Model 2 (#8641) or Model N1 (#8640) with prerequisite Interchangeable Train Cartridge Adapter or Interchangeable Train Cartridge, and appropriate Universal Character Set Adapter for the 2821 Control Unit
IBM Scan Disk (#6396)	IBM File Scan (#4385) installed on the 2841 Storage Control Unit (supported in Move-mode only)

¹ If stacker selection of punch-feed-read cards or 1444 stacker selection is to be simulated, the 2540 Compatibility Attachment (#8065) must be installed on the 2821 Control Unit.

² When this feature is installed, reading speed is permanently reduced from 1000 cpm to 800 cpm.

³ With this feature, printing speed is dependent upon the number of characters in the character set and unprintable characters in the print-line (see IBM 2821 Control Unit, Form A24-3312).

INPUT/OUTPUT DEVICES

1400 programs operating with emulation under DOS can request I/O operations on the following System/360 devices:

- 1442 Card Read Punch
- 2501 Card Reader
- 2520 or 2540 Card Read Punches
- 1403 Printer
- 1404 Printer (for continuous-forms and cut-card operations)
- 1443 Printer
- 1052 Printer-Keyboard (for operator communications)
- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2400-Series Magnetic Tape Units
- 3400-Series Magnetic Tape Units

Input/output device correspondence between a 1401, 1440, or 1460 system and System/360 Model 30 or Model 40 is listed in Table 1.

ADDITIONAL FEATURES

Additional features supported by the Emulator Programs under DOS are:

- Timer Feature
- Simultaneous Read-While-Write Tape Control (2404 or 2804)
- Any channel configuration up to one multiplexor channel and two selector channels
- Tape Switching Unit (2816)
- Universal Character Set

Input/output feature correspondence between a 1401, 1440, or 1460 system and System/360 Model 30 or Model 40 is listed in Table 2.

1401/1440/1460 Basic Compatibility Features (Model 30 and Model 40)

The Emulator Program under DOS in conjunction with the 1401/1440/1460 Basic Compatibility Feature for the Model 30, and the 1401/1440/1460 DOS Compatibility Feature for the Model 40, provides support for all 1401, 1440, and 1460 standard opera-

tions and instructions, plus the following special features:

Advanced Programming for the 1401
Bit Test
Column Binary*
Expanded Print Edit
51-Column Interchangeable Read Feed*
High-Low-Equal Compare
Multiply-Divide
Print Storage
Additional Print Control
Punch-Feed Read*
Space Suppression
Sense Switches
Scan Disk*
Direct Seek for the 1311
Track-Record for the 1311
Binary Transfer for the 1460*
Indexing and Store Address Register for the 1460

* Refer to Table 2.

In addition to the preceding features, the 1401/1440/1460 DOS Compatibility Feature provides support for Processing Overlap on the Model 40. Processing Overlap is not available as such on the Model 30, but overlap is provided by the Emulator Program for tape, disk, and 1400 unit record devices.

EMULATOR/DOS EXCLUSIONS

The following IBM units and features, supported by DOS, are not supported by the Model 30 or Model 40 Emulator Programs under DOS:

- 1445 Printer
- Paper Tape Devices
- 2321 Data Cell Drive
- 1285 and 1287 Optical Readers
- 1259, 1412, and 1419 Magnetic Character Readers
- 7770 and 7772 Audio Response Units
- Selective Tape Listing Features (1403) for continuous paper tapes
- Teleprocessing Devices

In addition, the Emulator Programs do not support the IBM 1401 Processing System, Model G.

Note: The 1259, 1412, and 1419 Magnetic Character Readers require special consideration if utilized while the Emulator Programs under DOS are operating. See the section on "Programming Restrictions and Considerations" for additional details.

PROGRAM GENERATION

PREPARATORY PROCEDURES

GENERAL DESCRIPTION

The Emulator Program under DOS for the Model 30 or Model 40 is distributed as a set of macros to enable the user to specify, through the utilization of macro parameters, the exact characteristics desired in the Emulator Program. In general, these parameters fall into two categories:

- Characteristics of the System/360 and the 1400 being simulated
- Options desired by the user, such as Operator Service Functions

The Emulator Program under DOS may be tailored to fulfill all of the requirements of an installation or may be tailored to the requirements of a particular job. Although only one Emulator Program need be generated for any installation, under certain circumstances more than one generation is desirable. If the storage requirements exceed the available storage, separate generations are required, each specifying only those parameters actually needed for that particular job or application. The storage requirements can be calculated using the information in Appendixes G and H. Each Emulator Program is assembled by the user under a different name and may be executed as required.

If the System/360 has 64K of available storage, any option may be selected without regard to storage requirements except for unusually large tape I/O buffers or when storage is to be reserved for multiprogramming. On a 32K system, a disk-only or tape-only Emulator Program may be generated along with most options. The amount of tape I/O buffer area depends on block size and the number of tape drives to be simulated. For large tape blocks, the maximum number of tape drives that can be simulated may be less than six. The simulation of tape/disk systems in 32K requires careful analysis of storage requirements. Under this condition, it is advisable to list the individual requirements of various programs and perform a "trial" generation or calculate the storage requirements. The two major limiting factors are based on the size of the 1400 system to be simulated and the size of the tape buffer area.

The Model 30 Emulator Program under DOS is composed of 12 macros, one of which is considered to be the mainline that selec-

tively calls the other 11 macros as needed. The Model 40 Emulator Program under DOS is composed of 14 macros, one of which is considered to be the mainline that selectively calls the other 13 macros as needed. These mainline macros are cataloged in the user's Source Statement Library under the names EU30 and EU40. The Model 30 and Model 40 Emulator-Program macros are described in Table 3, which contains a list of the Source Statement Library name, card identification, and the function of each macro.

Before the Emulator Program can be executed, the following must be considered during DOS Supervisor generation:

- The EU parameter in the SUPVR macro instruction must be specified as YES unless relocation of 1400 simulated storage is desired on the Model 40. In this case the EU parameter must be specified as RELOC.
- The CPU model designation (MODEL=30 or MODEL=40) must be specified in the CONFIG macro instruction.
- If the Emulator Operator service functions are to be requested by the external INTERRUPT key for the background or by the console REQUEST key (MSG F1 or MSG F2) for the foreground, the OC parameter in the FOPT macro instruction must be specified as YES.
- If SYSLST, SYSIPT, or SYSPCH may be assigned to a disk extent, the SYSFIL parameter in the FOPT macro instruction must be specified as a 2311 or 2314.
- If an Emulator Program is to be run in the foreground, the MPS parameter in the SUPVR macro instruction must be specified as BJP.

EMULATOR PROGRAM GENERATION

The Disk Operating System (DOS) contains all the macros necessary for generating a 1401/1440/1460 Emulator Program under DOS. These macros are cataloged in the DOS Source Statement Library.

The assembly of the Emulator Program under DOS tailored to meet the user's specifications is indicated in Figure 1. The sequence of cards is important. The Emulator Program under DOS is a standard assembly language program and requires the

Table 3. Model 30 and Model 40 Emulator-Program Macros

Name	Card ID (cols. 73-76)	Function
EU30/EU40	A484/A485	Mainline; calls all other macros internally. All user parameters are analyzed in this macro. \$\$B-message transients are included here.
EU3ER/EU4ER	E484/E485	Processes 1400 error conditions. Contains the exit for user modifications for nonsupported devices.
EU3RD/EU4RD	R484/R485	Processes 1400 Card-Read instructions.
EU3PH/EU4PH	P484/P485	Processes 1400 Card Punch and Stacker Select instructions.
EU3PT/EU4PT	L484/L485	Processes 1400 printer instructions.
EU3MS/EU4MS	M484/M485	Processes miscellaneous 1400 I/O instructions (Forms Control, Branch on I/O, etc.).
EU3TP/EU4TP	T484/T485	Processes all 1400 magnetic-tape instructions.
EU3DK/EU4DK	D484/D485	Processes 1301, 1311, and 1405 disk instructions.
EU3EJ/EU4EJ	J484/J485	Emulator Program End-of-Job routine.
EU3OS/EU4OS	S484/S485	Emulator Program Operator Service routines.
EU3CG/EU4CG	G484/G485	Emulator Program Catalog-Option routine.
EU3FT/EU4FT	F484/F485	Emulator Program Fetch-Option routine.
EU4IN	I485	Contains the branch table entries and performs the scan for completion of the 1400 Move Characters and Edit (MCE) and Move Characters and Suppress Zeros (MCS) instructions. (Model 40 Emulator Program only.)
DIAG	X485	Provides a mnemonic for coding and assembly ease in programming the 1401/1440/1460 DOS Compatibility Feature. (Model 40 Emulator Program only.)

standard control cards in addition to those indicated. An object-module deck, however, must be punched. Therefore, the // OPTION CATAL statement must not be used.

Following the last parameter statement for each Emulator Program assembly, an end statement must be included in the group of cards as follows:

```
euname EU30[EU40] parama,...    x
                        paramy,    x
                        paramz
                        ACOMP01
END
```

These cards should be followed by standard /* and /& cards.

The output of the assembly consists of linkage-editor control cards followed by the Emulator Program object deck. The output of an EU30 assembly is illustrated in Figure 1. Figure 2 illustrates how the assembly output must be rearranged to perform the required cataloging of EU40 to the Core-Image Library. It should be noted that // ASSGN cards are not included; they must be provided if required by the user.

```

// JOB      EUJOB1
// OPTION  LIST,DECK,XREF
// EXEC    ASSEMBLY
euname     EU30      euparam1,...X
                    euparamn
/*          END  ACOMP01
/8

```

Consists of the output of EUJOB1:

```

// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
| PHASE euname, + (SEND param value),NOAUTO
  INCLUDE, (ACOMP00)
  PHASE eunameX, ACOMP00+nnn
  INCLUDE, (ACOMP01)
  PHASE $$$BEU3M1,+0
  INCLUDE, ($$BEU3M1)
  PHASE $$$BEU3M2,+0
  INCLUDE, ($$BEU3M2)
  PHASE eunameB, ATRNAREA
  INCLUDE, (eunameB)
  and 'PHASE' and 'INCLUDE' cards
  for any of 11 other transients
  which are generated
  INCLUDE
*** REPLACE WITH OBJECT DECK
/*
  ENTRY EUENTRY
// EXEC LNKEDT
/8
(emulator object module)

```

Note: nnn = size of emulator communications region (variable)

NOAUTO is specified to prevent Automatic Library Lookup from being performed in this phase.

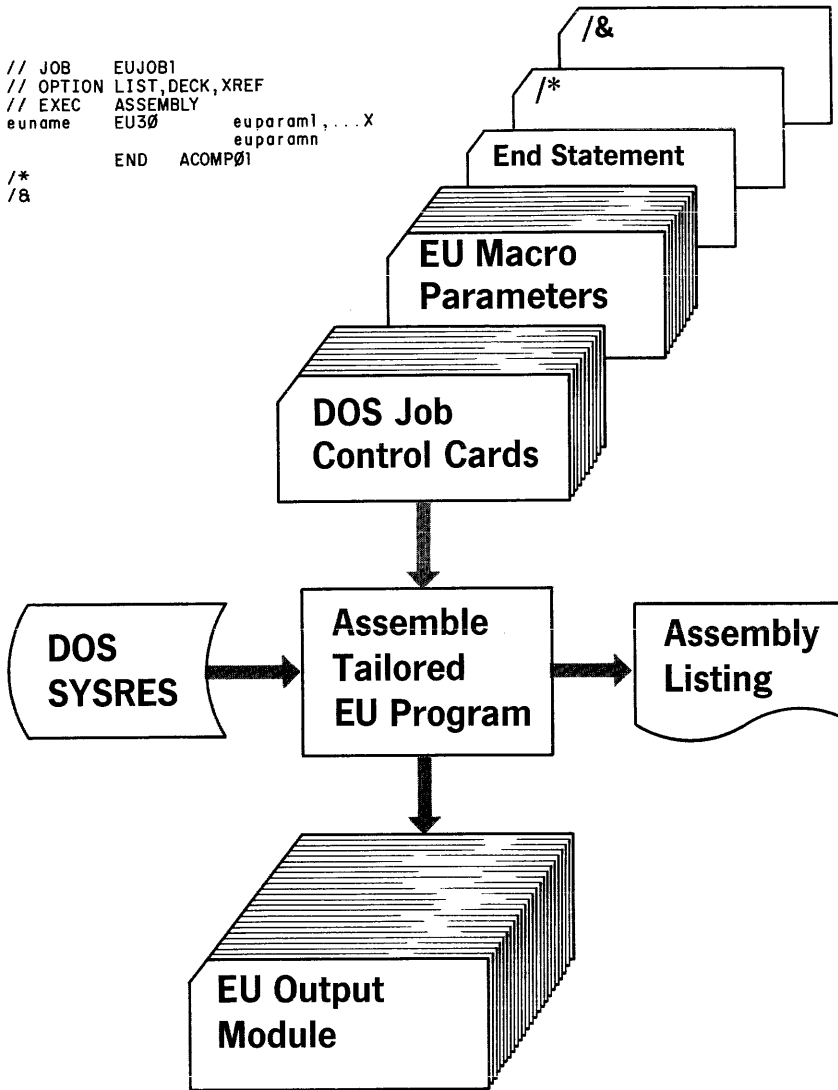


Figure 1. Assembly of User-Tailored Emulator Program Under DOS for the Model 30

PROGRAM_GENERATION_CONSIDERATIONS

The Model 30 or Model 40 Emulator Program under DOS is assembled and tailored to the user's particular needs by means of macro generation. The macro parameter values used to generate the program must be composed by the user in a manner similar to the way in which a define-the-file (DTF) macro instruction is composed. Continuation cards are allowed in the preparation of these parameters, with each parameter separated by a comma.

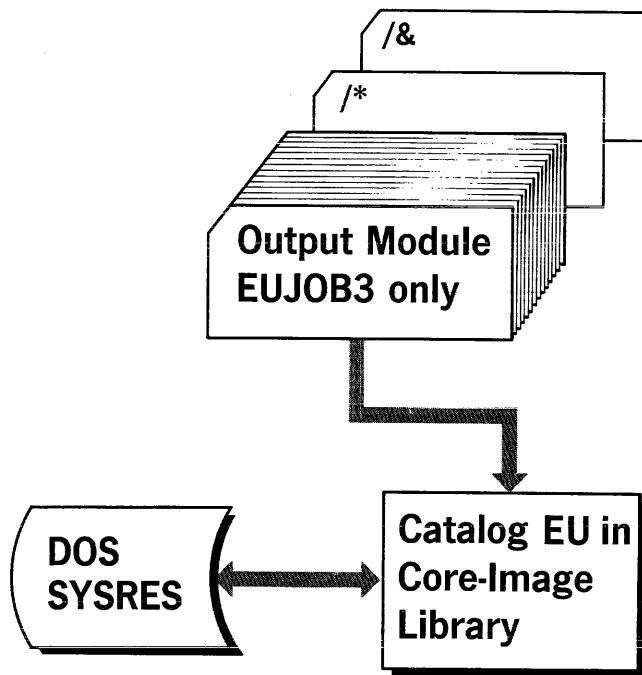
The symbolic parameters follow the // EXEC ASSEMBLY card, as shown in Figure 1. The first of these cards must have a program name punched in the label field (starting in column 1) and EU30 or EU40 punched in the operation field:

```

euname EU30
      OR
euname EU40

```

The "euname" parameter provides the name under which the object module of the user's Emulator Program is cataloged in the Core-Image Library. Therefore, it is the name that appears in the // EXEC card whenever the Emulator Program is executed. The name may consist of one to seven characters. No embedded blanks or special characters may appear in the name, and the first character must be an alphabetic character. An X is appended by the Emulator Program to the name to form the name of a second phase of the Emulator Program, which is then called



```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
PHASE euname,+ (RELOC parameter value x 1024),NOAUTO
INCLUDE,(ACOMP00)
PHASE eunameX,+ (RELOC+IZ21400 parameter values x 1024)
INCLUDE,(ACOMP01)
PHASE $$BEU4M1,+0
INCLUDE,($$BEU4M1)
PHASE $$BEU4M2,+0
INCLUDE,($$BEU4M2)
INCLUDE
(emulator object module)
/*
ENTRY EUENTRY
// EXEC LNKEDT
/&
```

Figure 2. Cataloging of a Model 40 Emulator Program into the Core-Image Library

by the first phase. Other letters (A, B, C, D, E, F, L, M, Q, S, T, or Z) are also appended to the name to form the names of transient phases which are called by the second phase when requested. The parameters may be inserted in any sequence, following the rules for the writing of macro statements of the keyword variety.

CAUTION: Since transient phase names are modified versions of the specified Emulator Program name, care should be exercised when assigning names for multiple Emulator Programs. For example: If an Emulator Program, EMNAME, is generated, a second Emulator Program should not be assigned the name EMNAME since a transient phase, EMNAME, would also be created. The transient phase, EMNAME, would replace the generated copy of the Emulator Program, EMNAME.

DESCRIPTION OF GENERAL PARAMETERS

CATALOG={YES}
{NO}

If this parameter is included, the generated version of the Emulator Program under DOS is capable of producing a System/360 object module from a 1400 object deck. This module can be executed only under the Emulator Program. FETCH=YES need not be included in the same assembly. If the CATALOG parameter is omitted or NO is specified, the System/360 object module cannot be produced from a 1400 object deck.

EOJAADR=nnnnn

This parameter is used to specify the contents of the 1400 A-Storage Address Register (A-STAR) at normal end-of-job (EOJ) halts. If this or the following parameter ("EOJBADR=nnnnn") is coded with a standard value (for example, 00999), the Emulator Program automatically calls in DOS Job Control upon encountering a 1400 end-of-job halt. Valid entries are in the range of 00000 through 15999. The entry is compared to the contents of the 1400 A-STAR each time a 1400 halt is trapped by the Compatibility Feature and before the printing of the 1400 registers. If a match occurs, the Emulator Program automatically goes to its EOJ and issues a DOS EOJ macro that calls DOS Job Control for the next System/360 job that is to be batched in the background partition (see "EOJBADR=nnnnn"). If this parameter is omitted, the routine to test for A address is not generated.

EOJBADR=nnnnn

This is the same as the preceding parameter ("EOJAADR=nnnnn"), except the value of the B-Storage Address Register (B-STAR) is checked. If this parameter is omitted, the routine to test for B address is not generated.

If only one of these two parameters is included, only that compare is made to satisfy EOJ. If both parameters are included, both compares must be equal to satisfy EOJ. If neither parameter is included, no test for EOJ is made and message EC81I or EC82I is displayed unless the I-STAR option (parameter "hhhhh") in the // 1400 control card is provided. (See "The // 1400 Control Card" in the "Control Cards" section for a description of this parameter.)

ERROPNG={YES}
{NO}

If this parameter is included, the Emulator Program interprets a 1400 operation code of

G with a wordmark as a request for a "snapshot" dump of 1400 storage. This invalid op code can be patched by the user into 1400 programs run under test mode. Control is returned to the next sequential instruction in the 1400 program. If this parameter is omitted or NO is specified, an operation code of G with a wordmark is treated as invalid. If PTR1400=1404, PTR360=1404, or PTRLNG=100, this parameter must be omitted or specified as NO.

FETCH={YES}
{NO}

If this parameter is specified, the generated version of the Emulator Program is capable of executing 1400 programs that have been cataloged in the Core-Image Library. 1400 programs so cataloged may be called from the Core-Image Library and executed only by the Emulator Program. (1400 programs cannot be called by Job Control.) CATALOG=YES need not be included in the same version of the Emulator Program that fetches. (See "Cataloging 1400 Programs Into the Core-Image Library" in the "Programming Considerations" section.) The inclusion of this parameter does not preclude the use of a generated Emulator Program from loading a 1400 object program from cards or tape. If this parameter is omitted or NO is specified, the 1400 programs are not fetched from the Core-Image Library.

HALTS={YES}
{NO}

If this parameter is included with the operand YES, the operator may call for the Sense Switch Operator Service routine in response to a halt message or through the external INTERRUPT key for the background or by the console REQUEST key (MSG F1 or MSG F2) for the foreground while in Compatibility mode (Dial F must be set at CI for the Model 30). If this parameter is omitted or NO is specified, the routine is not generated.

IOCDATE={ 82 }
{ 195 }
{ BOTH }
{ NO }

The 1400 input/output control system (IOCS) requires a date in the form "yyddd" to be available in main storage during label checking. By specifying this parameter, the Emulator Program moves the date from the DOS communication region to the respective 1400 storage location 82-86, 195-199, or both.

The method of loading the program determines when the move occurs. The move occurs before a program is loaded from

cards, but after a program is fetched from the Core-Image Library. Clear Storage cards must be removed from card decks since they clear the IOCDATE that was placed there by the Emulator Program. The bootstrap card, however, should be retained. If this parameter is omitted or NO is specified, the date is not moved.

MPGMBLK={nn}
{0}

This parameter is used only for the Model 30 Emulator Program to specify the number of 2K (2,048 bytes) blocks of storage to be reserved for multiprogramming (foreground partitions). If MPGMBLK does not equal zero, the Emulator Program allocates 1400 program storage "nn" 2K blocks below the highest System/360 main storage location specified. The Emulator Program allocates storage from the top of memory down, and from the value in the SEND parameter up, in the following manner:

- (a) Highest storage location available from the "SIZ360=nn" parameter, specified by $1024 * SIZ360$ (minus 256 if $SIZ360=64$).
- (b) Highest 1400 storage location specified by the value of (a) minus $2048 * MPGMBLK$.
- (c) 1400 storage location 0 specified by the value of (b) minus $1000 * SIZ1400$. Therefore, values (a), (b), and (c) allocate storage from the top of storage down at Emulator-Program generation time.
- (d) The size of the Emulator Program depends on the parameters specified and is linkage-edited according to the value of the SEND parameter.
- (e) Tape I/O buffer areas are allocated above the Emulator Program (value (d)), and the size of the area is indicated by the "BUFSIZE=nnnnn" parameter.

OSADDR={YES}
{NO}

If this parameter is specified, the facility for converting 1400 decimal addresses to their System/360 hexadecimal equivalents is included in the Emulator Programs. This is done to facilitate address-stopping in 1400 programs. If this parameter is omitted or NO is specified, the facility for 1400-address conversion is not generated.

Note: Address conversion for the Model 40 is also provided in tabular form in Appendix F.

OSALTER={YES}
{NO}

If this parameter is specified, the facility for altering the current 1400 instruction address through the console typewriter is included in the Emulator Programs. This is done to allow the operator to perform a 1400-program branch. If this parameter is omitted or NO is specified, the facility for altering the 1400 instruction address is not included.

OSDSPLY={YES}
{nn}
{NO}

If this parameter is specified, the facility for displaying 1400 storage on SYSLOG in blocks of 100 bytes (YES) or less ("nn") is included in the Emulator Programs. If this parameter is omitted or NO is specified, the display facility is not included.

OSDUMP={YES}
{NO}

If this parameter is specified as YES, the facility for dumping 1400 storage on the simulated printer device in standard 1400 format, whenever desired by the operator, is included in the Emulator Programs. (See "Available Functions" in the section on "Operator Service Functions".) Additionally a System/360 main storage dump is provided if the test-mode option in the // 1400 control card is specified as "S". If the OSDUMP parameter is omitted or NO is specified, the dumping facility is not included. If PTR1400=1404, PTR360=1404, or PTRLNG=100, this parameter must be omitted or specified as NO.

OSENTER={YES}
{NO}

If this parameter is specified, the facility for altering 1400 storage through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the alteration facility is not included.

OSINQRY={1400}
{YES}
{NO}

If this parameter is specified with 1400, the facility for simulating the setting of the 1400 Q latch is included in the Emulator Programs. Also, support for 1400 Read and Write Console Printer instructions is included. If this parameter is specified with YES, the above facilities and the a-

bility to execute a System/360 native-language inquiry program are included in the Emulator Programs. If this parameter is omitted or NO is specified, none of the above facilities are included. However, if the 1400 program includes Read Console Printer instructions, message EC97I is issued, and the operator service functions may be used to obtain read-to-console messages. (See message EC97I in the section on "Console Messages.")

RELOC={0}
{nnn}

This parameter is used only with the Model 40 Emulator Program. It is to be used in conjunction with the IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) and EU=RELOC in the SUPVR macro instruction of the DOS Supervisor. RELOC will relocate 1400 simulated storage to the value specified by "nnn" where "nnn" is a multiple of the 16K byte boundary on which 1400 simulated storage is to be relocated. Acceptable values for "nnn" are 16, 32, 48, 64, 80, 96, and 112. The default value is 0 which provides operations without the relocation feature with 1400 simulated storage fixed at decimal location 16,384.

When the Model 40 Emulator Program is executed in the foreground, consideration must be given to the DOS register save areas that occupy the first 88 to 120 bytes of a foreground partition. Therefore, the foreground must begin on a 2K byte boundary below the beginning of 1400 simulated storage.

The Model 40 Emulator Program allocates storage in the following manner:

- (a) If RELOC is equal to 0, 1400 simulated storage location 0 is 16,384. Otherwise, 1400 simulated storage location 0 is 1024*RELOC.
- (b) The amount of simulated storage allocated is the value of 1024*SIZ1400.
- (c) The total disk and tape buffer size then is calculated from the BUFSIZE, DISKDR, and SECTORS parameters. These buffers are allocated immediately above the Model 40 Emulator Program.
- (d) The size of Model 40 Emulator Program depends on the parameters specified and is linkage-edited immediately above 1400 simulated storage.
- (e) The Emulator Program will automatically add any space between the end of the Emulator Program and the next 2,048 byte boundary to the user's tape buffer pool.

SEND={0
 {nnnnn}}

This parameter is used only with the Model 30 Emulator Program. When specified, SEND=nnnnn indicates the load point of the Emulator Program. SEND must be specified to execute the Emulator Program in a foreground partition. To determine the value for nnnnn, determine the starting address of that partition in decimal and add 88 bytes decimal to it for the DOS foreground save area. If FP=YES has been specified in the CONFIG macro of the supervisor generation, add another 32 bytes decimal to this figure for the floating point register save area. For example, if a foreground partition has been, or is to be, assigned to start at 32K, the decimal starting address of the foreground partition is 32,768. Adding 88 bytes, SEND is now equal to 32,856 and, if FP=YES is specified in the DOS Supervisor, add another 32 bytes. The total of 32,888 bytes decimal is the SEND address. The Emulator Program will then be assembled to begin execution at this address.

If the Emulator Program is to be executed in the background, the value for SEND should correspond to the value specified on the SEND macro for the Supervisor Assembly. If SEND is defaulted or is specified as zero, the Emulator Program will be defaulted to execution in the background partition. SEND, if specified, will also force the assembler to assign Emulator Program storage addresses identical to those at object time. Thus, a System/360 storage dump of the Emulator Program can be related directly to the Emulator Program listing.

SIZ1400={nn
 {16}}

This parameter is used to specify the storage size of the 1400 system to be simulated. Allowable values for "nn" are 2, 4, 6, 8, 10, 12, 14, and 16. If this parameter is omitted, "nn" is assumed to be 16.

Note: 1400 programs that require more storage than has been specified for the SIZ1400 parameter may not execute properly. See also restriction 19 on page 22 and consideration 19 on page 24.

SIZ360={nnn
 {64}}

This parameter is used to specify the storage size of the user's System/360. Allowable values for "nnn" on the Model 30 are 24, 32, 48 and 64. Allowable values for "nnn" on the Model 40 are 32, 64, 128, 192 and 256. If this parameter is omitted, the assumed value for "nnn" is 64.

SYSIO={ipl
 {000}}

This parameter must be specified if the user wishes to support device independence for 1400 unit-record devices. "i", "p", and "l", represent SYSIPT, SYSPCH, and SYSLST, respectively, and each may have a value of 0 through 3. The meanings of the values are:

- 0 - Associated device may be assigned only to unit record.
- 1 - Associated device may alternately be assigned to a unit-record device or a magnetic-tape drive (9-track or 7-track with the Data Conversion Feature for SYSLST).
- 2 - Associated device may alternately be assigned to a unit-record device, a magnetic-tape drive, a 2311, or 2314 disk drive.
- 3 - Associated device may alternately be assigned to a unit-record device, a 2311, or 2314 disk drive.

If this parameter is omitted, the assumed value for "ipl" is 000.

Note: If "i", "p", or "l" is specified as a 2 or 3, a 2311 or 2314 disk drive must be specified in the SYSFIL parameter of the POPT macro during DOS Supervisor generation. If SYSFIL=2314 is specified, DISKTYP=2314 must also be specified (refer to DISKTYP parameter under "Description of Disk Parameter").

SYSROPT={YES
 {NO}}

This parameter is used to specify whether or not the user wants the Emulator Program to change from input on SYSRDR to input from SYSIPT during the execution of a 1400 program. If the SYSROPT parameter is specified YES, the // IP control card is optional, but must be in the customer's deck if he wishes the job stream transferred from input on SYSRDR to SYSIPT during 1400 program execution. However, if the // IP control card is used, the SYSROPT parameter must be specified YES. If specified as YES, the Emulator job control cards are read on SYSRDR, and then, the 1400 program, data, and read operation control cards are read on SYSRDR until a // IP card is encountered. The // IP control card transfers card read simulation to SYSIPT. If this parameter is omitted or NO is specified, all Emulator job control cards, the 1400 program, data, and read operation control cards are read on SYSIPT. SYSRDR and SYSIPT may be specified as either card reader, disk or tape.

TIMER={YES}
{NO}

This parameter specifies the availability of the interval timer to log the time of day on beginning and ending messages. Emulator-Program use of the timer in this manner does not prevent a foreground program from using the timer for interval interrupts. If this parameter is omitted or NO is specified, the timer is not used.

USRPROG={YES}
{NO}

This parameter is used to specify that the user wishes to insert a user-written routine to handle operation codes not supported by the Emulator Program. If this parameter is omitted or NO is specified, the entry to the user-written routine is not generated. If specified YES, the user-written routine must be included at assembly time. (See "User-Written Simulation Routines" section.)

DESCRIPTION OF CARD READER AND PUNCH PARAMETERS

COLBINP={YES}
{NO}

This parameter is used to specify whether or not the user wants column-binary support for the card punch. If COLBINP=YES is specified, support for Punch-Column-Binary or Card Image instructions is generated. If COLBINP=NO is specified or if this parameter is omitted, any such instructions are treated as invalid op codes.

COLBINR={YES}
{NO}

This parameter is used to specify whether or not the user wants column-binary support for the card reader. If COLBINR=YES is specified, support for Read-Column-Binary or Card Image instructions is generated. If COLBINR=NO is specified or if this parameter is omitted, any such instructions are treated as invalid op codes.

COL51={YES}
{NO}

This parameter is used to specify whether or not the user wants 51-Column Interchangeable-Read-Feed feature support for the 1402/2540 card reader. If COL51=YES is specified, support for reading 51-column cards is generated. If COL51=NO is specified or if this parameter is omitted, the 51-Column Interchangeable-Read-Feed feature is not supported. This parameter pertains to the 1402/2540 card reader only.

PCH1400={1442}
{1444}
{1402}

This parameter is used to specify the 1400 punch to be simulated. If this parameter is omitted, it is assumed that the 1400 punch to be simulated is a 1402.

Note: If a 1440 is being emulated, this parameter must be coded PCH1400=1442 or 1444. This is so that punching can occur from any location in 1400 storage and be terminated by a groupmark with wordmark.

PCH360={1442}
{2520}
{2540}

This parameter is used to specify the System/360 punch. If this parameter is omitted, it is assumed that the System/360 punch is a 2540.

PFR={YES}
{COM}
{NO}

This parameter is used to specify whether or not the user wants his Emulator Program to use the Punch-Feed-Read (PFR) feature. If PFR=YES is specified, the Emulator Program provides support for 1402 Punch and Punch-Feed-Read (PFR) instructions, or 1442 read, stacker select (READRSS=YES), and punch operations utilizing the Punch-Feed-Read feature of the 2540. Specify PFR=COM and PUNCHSS=YES when simulating both 1402 punch-feed-read and stacker select operations with the 2540 Compatibility Attachment (#8065) installed on the 2821 Control Unit. If 1402 punch-feed-read is supported and 1402 stacker select is not supported, use PFR=YES. If PFR=NO is specified or if this parameter is omitted, any PFR instructions are treated as invalid operation codes. If PFR is used, separate routines for PFR and normal punching are generated so that the normal punch overlap is not lost if the 1400 program does not require any PFR instruction emulation.

PUNCHSS={YES}
{NO}

This parameter specifies whether or not the user wants his Emulator Program to be able to simulate 1402 or 1444 punch stacker selection. (1442 punch stacker selection is supported by READRSS.) If coded as NO or if omitted, all punch stacker select commands are treated as No-Ops, or as unconditional branches if stacker selection and branch. A parameter ("d") must be inserted in the // 1400 control card (see "The // 1400 Control Card" in the "Control Cards" section) for each 1400 program in which 1402 or 1444 punch stacker selection

is to be simulated. Punch stacker selection is handled in this manner for 1402 or 1444 simulation because if it is to be simulated but the 1400 program does not, in fact, issue stacker select instructions, all punch overlap is lost.

READRSS={YES}
{NO}

This parameter indicates whether or not the user wishes to support reader stacker selection or all 1442 stacker selection. If coded NO or omitted, all Reader-Stacker, or all 1442-Stacker instructions are treated as No-Ops or unconditional branches. If coded YES, the generated version of the Emulator Program has the ability to simulate 1402 reader, or 1442 reader punch stacker selection, but cannot automatically do so. A parameter ("c") must be included in the 1400 control card (see "The // 1400 Control Card" in the "Control Cards" section) for each 1400 control card for each 1400 program in which reader stacker selection is to be simulated. Also, a // LC control card should be included. (See item 7 in the section on "Considerations.") This parameter is not recommended if the System/360 reader is a 2540 or 2520, since simulated stacker selection reduces card read speed, and hence reduces throughput.

RDR1400={1442}
{1402}

This parameter is used to specify the 1400 reader to be simulated. If this parameter is omitted, it is assumed that the 1400 reader is a 1402.

Note: If a 1440 is being emulated, this parameter must be coded RDR1400=1442. This is so that reading can occur from any location in 1400 storage and be terminated by a groupmark with wordmark.

RDR360={1442}
{2501}
{2520}
{2540}

This parameter is used to specify the System/360 reader. If this parameter is omitted, it is assumed that the System/360 reader is a 2540.

SSQUANT={ONE}
{MANY}

This parameter applies only when RDR360=2540 is specified and the user wishes to support reader stacker selection (READRSS=YES). Normally, the Emulator Programs handle several Stacker Select commands following a Read command. Only the last Stacker Select command, however, is effective.

No card movement occurs until the next card is encountered. This method is inefficient for users who have only one Stacker Select command following the Card Read.

If the value ONE is specified, the Emulator-Program routine initiates a card feed when it encounters the first Stacker Select command. Subsequent Stacker Select commands are ignored. If the value MANY is specified, or if the parameter is omitted, normal handling of Stacker Select commands is generated.

This parameter is ignored if READRSS=YES is not specified. If READRSS=YES is not specified, or if it is specified and the SSQUANT parameter is omitted, the absence of a Stacker Select command causes the Emulator Program to wait until the next 1400 Read is encountered.

Note: If reader stacker selection is required, maximum throughput can only occur when a Stacker Select command follows most or all Read Card commands and SSQUANT=ONE is specified.

DESCRIPTION OF TAPE PARAMETERS

BLKSIZu={nnnnn}
{00000}

This parameter is used to specify the maximum block length plus one that is normally read or written in Move mode on 1400 tape drive "u" ("u" is 1 through 6). "nnnnn" is the size of an area (maximum block length plus one) of System/360 main storage set aside for use as a tape buffer associated with a given drive. If this parameter is omitted for a given drive number, the assumed value is zero.

The value given by this parameter may be changed at execution time through the use of a // TAPE control card. Normally, the user should include as many "BLKSIZu=nnnnn" parameters as he has 1400 drives to be simulated, although the user with abundant main storage may wish to include a "BLKSIZu=nnnnn" for each drive that is accessed by 1400 programs. Load-mode operations do not depend on "BLKSIZu=nnnnn" parameters. (See "BUFSIZE=nnnnn".)

BUFSIZE={nnnnn}
{00000}

This parameter is used to specify the total main storage to be set aside by the Model 30 or Model 40 Emulator Program for use as tape buffers for Move-mode operations. This amount should not be less than the sum of the "BLKSIZu=nnnnn" values, and may not

be increased at object time. If this parameter is omitted, the assumed value is zero. The area defined by this parameter may be considered to be a pool of buffers that is divided among the 1400 tapes on line in a given job according to (1) the values given in the "BLKSIZu=nnnnn" parameters or (2) the revised values given by a // TAPE control card(s) at object time. Because Load-mode operations must be assumed to include the reading and writing of very large (checkpoint) blocks, each Load-mode operation has access to the entire area defined by "BUFSIZE=nnnnn". The user should be aware that 16K 1400 checkpoints require a buffer size in excess of 16,000 bytes since each wordmark in storage generates a word separator character in addition to the character associated with the wordmark when written out on tape.

For the Model 40, the Emulator Program will automatically add any space between the end of the Emulator Program and the next 2,048 byte boundary to the user's tape buffer pool.

OSTAPE= {YES }
 {NO }

If this parameter is specified, the facility for dynamically changing and/or displaying 1400 magnetic-tape drive assignments through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the facility for changing tape-drive assignments is not included.

TAPEDR= {n }
 {0 }

This parameter is used to specify the number of physical tape units that the user has on his 1400, where "n" is a value from 1 to 6. If this parameter is omitted, the assumed value for "n" is 0.

TAPEMOD=MXEDPAR

This parameter must be included if the user's 1400 program requires the capability to read and/or write both BCD and binary records (mixed-parity records) on either a 7- or 9-track tape. This parameter may also be specified to read or write either even- or odd-parity records if it is desired to process tape errors in the 1400 program. (See parameter "y" in the // TAPE control card.) However, when this parameter is specified, tape reading on an applicable drive is not overlapped. If this parameter is omitted, the assumed mode for 7-track tapes is translator on and converter off, and the density is as specified on the DOS // ASSGN control card; for 9-track tapes even parity is assumed.

TAPERRS= { LST }
 { LOG }
 { LSTCHAR }
 { LOGCHAR }
 { NO }

1400 hardware permits the reading of tape error blocks by means of an operator-initiated diagnostic read. The block of tape may then be scanned for out-of-parity characters, and the operator has the choice of correcting the characters and allowing the 1400 to process the block or of bypassing the error block. No direct equivalent to the diagnostic read exists in System/360 hardware, but the Emulator Program is able to approximately simulate the feature when a data-check condition is logged by DOS. The meanings of the values are:

LST - The error block is printed on the device simulating the 1400 printer in EBCDIC after the block has been translated for unprintable characters and may then be printed in hexadecimal.

LOG - Same as LST, except all printing occurs on SYSLOG. This is advisable if SYSLST is to be assigned to a magnetic device.

LSTCHAR - An EBCDIC-only printout of the error block on SYSLST, with asterisks replacing unprintable characters.

LOGCHAR - An EBCDIC-only printout of the error block on SYSLOG, with asterisks replacing unprintable characters.

Note: If PTR360=1404 is specified, LST and LSTCHAR facilities are not included.

After printing the error block, the operator is given the choice of allowing the 1400 to process the block or bypass the block. If the parameter is omitted or NO is specified, the only option available to the operator in the event of a tape data check is to ignore the data and bypass the block, or to cancel the job. No printout of the block in error occurs.

TAPEu=SYSn

This parameter is used to assign a DOS programmer logical unit (SYS000 - SYS221) to a 1400 tape unit, where "u" is the 1400 tape unit assignment (a number from 1 to 6). Assignments can be made for each of the six 1400 tape unit assignments. Several 1400 tape units can be assigned to the same programmer logical unit, but only during Emulator Program generation. The assignments may be changed during program execution if

OSTAPE=YES is specified. (See TAPE function in the "Operator Service Functions" section.) The default values for unsigned values of "u" are:

"u"	Programmer Logical Unit
1	SYS011
2	SYS012
3	SYS013
4	SYS014
5	SYS015
6	SYS016

TAPLDM= {YES}
{NO}

This parameter must be included if tape Load-mode operations are to be simulated. If this parameter is omitted or NO is specified, tape Load-mode operations are not simulated. It should be noted that 1400 IOCS opens tape operations in the Load mode even though 1400 IOCS Move mode is specified.

DESCRIPTION OF DISK PARAMETERS

DISKDR= {n
130n
1405
0}

This parameter is used to specify the number and type of 1400 direct-access storage devices (DASDs) to be simulated on 2311 or 2314. To simulate 1311 drives only, the acceptable values for "n" are 1 through 5, and indicate the number of 1311 drives to be simulated. To simulate one module of a 1301 and also "n" 1311 drives, the correct value is "130n". To simulate one module of a 1301, the correct value for "130n" is 1300. To simulate a 1405, the value should be 1405. The following are given as examples:

DISKDR=5 All five 1311 drives to be simulated

DISKDR=1303 One 1301 module and three 1311 drives to be simulated (Drives 0, 2, and 4)

Note: When less than five 1311 drives are specified, the low-numbered 1400 drives are assumed.

DISKDR=1300 One 1301 module to be simulated (no 1311)

DISKDR=1405 1405 only to be simulated

Note: 1405 and 1301/1311 disk drives are mutually exclusive.

If this parameter is omitted, the default value for the parameter is 0 and indicates that no disks are to be simulated.

DISKTYP= {2314}
{2311}

This parameter is used to specify the type of System/360 device that is to simulate the 1400 disk unit. It also applies to SYSIPT, SYSPCH, and SYSLST when they are assigned to disk. If this parameter is omitted, the assumed value is 2311.

DISKu=SYSnnn

This parameter is used to assign a DOS programmer logical units (SYS000 - SYS221) to 1311 Disk Storage Drives, or to a 1405 Disk Storage. The proper values for "u" are 1 to 5 for 1311 Disk Storage Drives, 1 and 2 for Model 1 1405 Disk Storages, and 1 to 4 for Model 2 1405 Disk Storages. When simulating a 1311 on a 2311 or 2314, the default values for "u" are:

"u"	1400 Drive	Programmer Logical Unit
1	0	SYS001
2	2	SYS002
3	4	SYS003
4	6	SYS004
5	8	SYS005

When simulating a 1405 on a 2311, the default values for "u" are:

"u"	1405 Sector Address	Programmer Logical Unit
1	00000-24999 (Models 1 and 2)	SYS001
2	25000-49999 and 2)	SYS002
3	50000-74999 (Model 2 only)	SYS003
4	75000-99999 only)	SYS004

When simulating a 1405 on a 2314, the default values for "u" are:

"u"	1405 Sector Address	Programmer Logical Unit
1	00000-49999 (Models 1 and 2)	SYS001
2	50000-99999 (Model 2 only)	SYS002

The assignments may be changed during program execution time if OSDISK=YES is specified.

DVOL= {YES}
{NO}

This parameter, when specified as YES, provides the facility for verifying the volume serial number of disk packs accessed by the Emulator Program. Verification is performed for each disk pack specified on a // DVOL control card or initiated by the

operator using the operator service functions. Volume serial number verification is recommended to avoid the possibility of the 1400 program accessing the wrong disk pack in the DOS multiprogramming environment. If this parameter is omitted, or NO is specified, verification is not performed.

D1301u=SYSnnn

This parameter is used to assign DOS programmer logical units (SYS000 - SYS221) to a 1301 Disk Storage. The proper values for "u" are 1 to 5 for emulation on a 2311, and 1 to 3 for emulation on a 2314. These assignments are required only when DISKDR=130n is specified. When simulating a 1301 on 2311s, the default values for "u" are:

"u"	1301 Sector Address	Programmer Logical Unit
1	000000-039999	SYS001
2	040000-079999	SYS002
3	080000-119999	SYS003
4	120000-159999	SYS004
5	160000-199999	SYS005

When simulating a 1301 on a 2314, the default values for "u" are:

"u"	1301 Sector Address	Programmer Logical Unit
1	000000-079999	SYS001
2	080000-159999	SYS002
3	160000-199999	SYS003

OSDISK={YES}
{NO }

If this parameter is specified, the facility for changing 1400 disk-drive assignments in mid-program through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the facility for changing disk-drive assignments is not included.

SCAN={YES}
{NO }

This parameter is used to specify that 1311 Scan Disk instructions are issued in the 1400 programs. If this parameter is omitted or NO is specified, 1311 Scan Disk instructions are not supported.

SCAN360={YES}
{NO }

If the user has the File Scan Feature, this parameter is used in conjunction with the SCAN=YES parameter to implement the 1400 Scan Disk Feature on System/360 direct-access storage devices. If SCAN360=NO is specified or if this parameter is omitted, the Emulator Program performs the Scan Disk function.

SECTORS={nnn}
{020 }

This parameter is used to determine the disk I/O buffer size and dictates the simulation technique to be employed. Valid entries of "nnn" range in value from 001 through 020 for the Model 30 Emulator Program and 001 through 100 for the Model 40 Emulator Program. This value indicates the maximum number of sectors that can be read or written in one physical I/O operation. Program requests for disk I/O exceeding the number of sectors specified in this parameter cause two or more physical I/O operations to be executed. If this parameter is omitted, the assumed value for "nnn" is 020, which should be used, storage permitting. The only reason for specifying less than 020 is to conserve main storage. If TRACKOP=YES or OSINQRY=YES is specified, the assumed value 020 should be specified.

TRACKOP={YES}
{NO }

This parameter must be specified if track operations on 1311, 1301, or 1405 are to be simulated. If this parameter is included, the "SECTORS=nnn" parameter, if included, should be given a value of 020. If this parameter is omitted or NO is specified, track operations are not simulated.

VERIFY={YES}
{NO }

If this parameter is included, disk records written by the Emulator Programs are verified. Verification is accomplished in the standard System/360 manner (cyclic redundancy check). If this parameter is omitted or NO is specified, the 1400 Write Disk Check command is treated as a No-Op, except the simulated Write Disk Check Interlock switch is released.

DESCRIPTION OF PRINTER PARAMETERS

CARRCTL={YES}
{NO }

This parameter is used to specify whether or not the user wants to support the carriage-control tape pointer option. If CARRCTL=YES is specified, an image of the printer carriage-control tape is retained in main storage and a pointer is used to indicate the position of the carriage. Use of this parameter: (1) eliminates the need for moving the channel-9 or channel-12 punch up one line, and (2) allows complete simulation of variable-line and preprinted-form printing when SYSLST is assigned to tape or disk. If CARRCTL=NO is specified or if this parameter is omitted, the program uses the DOS "LINECT=nn" method to

control the printer spacing when SYSLST is assigned to tape or disk.

EDITINV={YES}
{NO}

This parameter is used only with Model 40 Emulator Program, and provides support for Inverted Print Edit. If required, the user specifies this parameter as EDITINV=YES. Inverted Print Edit is primarily used in countries outside the U.S.A., such as in France where 1000 francs, 5 centimes is represented as 1.000,05. The default for this parameter is NO.

PTRASGN={SYSnnn}
{SYSLST}

This parameter is used to assign the System/360 printer to a specific programmer logical unit (SYS000 - SYS221). This parameter must be used if PTR360=1404 is specified. It also may be used when job control statements directed to SYSLST are not desired on the printer, such as on pre-printed forms. PTRASGN=SYSnnn must identify a printer; no support is provided for tape or disk. The default for this parameter is SYSLST.

PTRLNG={nnn}
{132}

This parameter is used to specify the length of the print line on the 1400, where "nnn" is 100, 120, or 132 for the 1403, 120 or 144 for the 1443, or 132 for the 1404. PTRLNG must not be greater than the number of print positions on the System/360 printer. Also, when PTRLNG=100 is specified, the actual line-length assignment on the System/360 device is 120 characters (padded by blanks). If this parameter is omitted, it is assumed that the print line is 132 characters long.

PTR1400={1443}
{1404}
{1403}

This parameter is used to specify the 1400 printer to be simulated. If this parameter is omitted, it is assumed that the 1400 printer is a 1403. 1404 should be specified only if cut-card operations are to be simulated; if continuous forms only are printed on the System/360, 1403 should be specified. If 1404 is specified, a 1404 must be installed on the System/360, and the OSDUMP and ERROPNG parameters must be omitted or specified as NO.

Note: If a 1440 is being emulated, this parameter must be coded PTR1400=1443. This is so that printing can occur from any location in 1400 storage and be terminated by a groupmark with wordmark.

PTR360={1443}
{1404}
{1403}

This parameter is used to specify the System/360 printer. If this parameter is omitted, it is assumed that the System/360 printer is a 1403.

MACRO NOTE MESSAGES

The following messages could be issued during Model 30 or Model 40 Emulator-Program system generation and are self-explanatory:

BLKSIZu PARAMETER INCORRECTLY SPECIFIED
BUFSIZE PARAMETER INCORRECTLY SPECIFIED
BUFSIZE TOO SMALL FOR STANDARD BLOCKSIZES,
BUFSIZE ASSUMED AS SUM OF BLOCKSIZES
CARRCTL NOT SUPPORTED IF PTR1400 IS A 1404
CARRCTL PARAMETER INCORRECTLY SPECIFIED
CATALOG PARAMETER INCORRECTLY SPECIFIED
COLBINP PARAMETER INCORRECTLY SPECIFIED
COLBINR PARAMETER INCORRECTLY SPECIFIED
COL51 PARAMETER INCORRECTLY SPECIFIED
DISKDR PARAMETER INCORRECTLY SPECIFIED
DISKTYP PARAMETER INCORRECTLY SPECIFIED
DISKu PARAMETER INCORRECTLY SPECIFIED
DVOL PARAMETER INCORRECTLY SPECIFIED
D1301u PARAMETER INCORRECTLY SPECIFIED
EDITINV INCORRECTLY SPECIFIED
EOJAADR PARAMETER INCORRECTLY SPECIFIED
EOJBADR PARAMETER INCORRECTLY SPECIFIED
ERROPNG NOT SUPPORTED IF PTR1400 EQ 1404 OR
PTRLNG EQ 100
ERROPNG PARAMETER INCORRECTLY SPECIFIED
FETCH PARAMETER INCORRECTLY SPECIFIED
GENERATION TERMINATED
HALTS PARAMETER INCORRECTLY SPECIFIED
IOCDATE PARAMETER INCORRECTLY SPECIFIED
MPGMBLK PARAMETER INCORRECTLY SPECIFIED
OSADDR PARAMETER INCORRECTLY SPECIFIED
OSALTER PARAMETER INCORRECTLY SPECIFIED
OSDISK PARAMETER INCORRECTLY SPECIFIED
OSDSPLY PARAMETER INCORRECTLY SPECIFIED
OSDSPLY SPECIFIED GREATER THAN 100, 100
ASSUMED
OSDUMP NOT SUPPORTED IF PTR1400 EQ 1404 OR
PTRLNG EQ 100
OSDUMP PARAMETER INCORRECTLY SPECIFIED
OSENTER PARAMETER INCORRECTLY SPECIFIED
OSINQRY PARAMETER INCORRECTLY SPECIFIED
OSTAPE PARAMETER INCORRECTLY SPECIFIED
PCH1400 AND PTR1400 PARAMETERS INCORRECTLY
SPECIFIED
PCH1400 PARAMETER INCORRECTLY SPECIFIED
PCH360 PARAMETER INCORRECTLY SPECIFIED
PFR PARAMETER INCORRECTLY SPECIFIED
PROGRAM NAME INCORRECTLY SPECIFIED
PTRASGN PARAMETER INCORRECTLY SPECIFIED
PTRLNG PARAMETER INCORRECTLY SPECIFIED
PTR1400 PARAMETER INCORRECTLY SPECIFIED
PTR360 PARAMETER INCORRECTLY SPECIFIED
PUNCHSS PARAMETER INCORRECTLY SPECIFIED
RDR1400 PARAMETER INCORRECTLY SPECIFIED
RDR360 MUST BE 2540 IF COL51=YES

RDR360 PARAMETER INCORRECTLY SPECIFIED
READRSS PARAMETER INCORRECTLY SPECIFIED
RELOC PARAMETER INCORRECTLY SPECIFIED
SCAN OR SCAN360 INCORRECTLY SPECIFIED
SCAN PARAMETER INCORRECTLY SPECIFIED
SCAN360 PARAMETER INCORRECTLY SPECIFIED
SECTORS PARAMETER INCORRECTLY SPECIFIED
SEND PARAMETER INCORRECTLY SPECIFIED
SIZ1400 PARAMETER INCORRECTLY SPECIFIED
SIZ360 PARAMETER INCORRECTLY SPECIFIED
SSQUANT PARAMETER INCORRECTLY SPECIFIED
SYSIO PARAMETER INCORRECTLY SPECIFIED
SYSROPT PARAMETER INCORRECTLY SPECIFIED
TAPE PARAMETERS INCORRECTLY SPECIFIED
TAPEDR PARAMETER INCORRECTLY SPECIFIED

TAPEMOD PARAMETER INCORRECTLY SPECIFIED
TAPERRS DISPLAY NOT SUPPORTED IF PTR1400 EQ
1404
TAPERRS PARAMETER INCORRECTLY SPECIFIED
TAPE1 PARAMETER INCORRECTLY SPECIFIED
TAPE2 PARAMETER INCORRECTLY SPECIFIED
TAPE3 PARAMETER INCORRECTLY SPECIFIED
TAPE4 PARAMETER INCORRECTLY SPECIFIED
TAPE5 PARAMETER INCORRECTLY SPECIFIED
TAPE6 PARAMETER INCORRECTLY SPECIFIED
TAPLDMD PARAMETER INCORRECTLY SPECIFIED
TRACKOP PARAMETER INCORRECTLY SPECIFIED
TIMER PARAMETER INCORRECTLY SPECIFIED
USRPROG PARAMETER INCORRECTLY SPECIFIED
VERIFY PARAMETER INCORRECTLY SPECIFIED

SIMULATION OF IBM 1401/1440/1460 FACILITIES

STORAGE LAYOUT

The Emulator Program under DOS for the Model 30 is designed to reside in main storage at the location determined by the SEND parameter. The Emulator Program consists of an initialization phase and a main phase. The initialization phase initializes the interphase communication region, and remains in main storage only until the first Programmed Mode Switch (PMS) supervisor call (SVC). It then fetches the main phase, which overlays all but the interphase communication region. The main phase is made up of individual modules that simulate the various 1400 processes and an area for transient routines. The System/360 tape and disk buffer area begins immediately after the main phase and may extend to the beginning of the 1400 simulated storage area.

Figure 3 shows the storage allocation for a Model 30 Emulator Program with SEND=0 and 4K of 1400 storage. (The algorithm for estimating the total storage requirement for a Model 30 Emulator Program, as a function of the parameters specified at generation time, is presented in Appendix G.)

The Model 40 Emulator Program consists of an initialization phase and a main phase. The initialization phase is loaded at the same location as the starting location of simulated 1400 storage which is determined by the RELOC parameter. The end of the DOS supervisor area must not exceed this location. The main phase is loaded immediately above 1400 simulated storage.

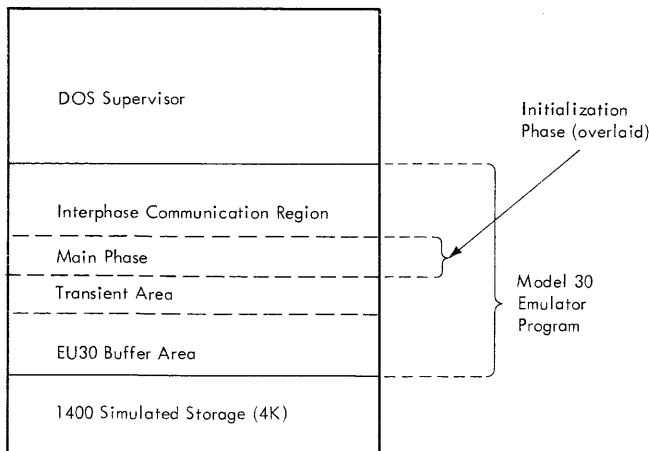


Figure 3. Typical Storage Map of Model 30 Emulator Program With 4K of 1400 Storage

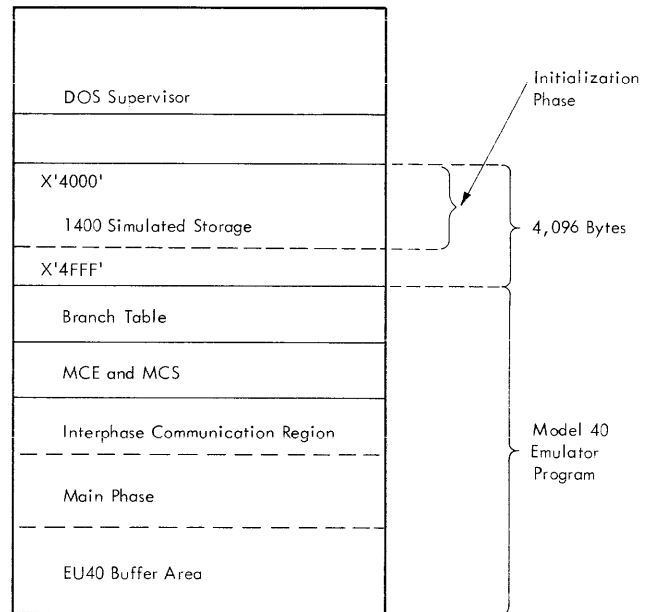


Figure 4. Typical Storage Map of Model 40 Emulator Program With 4K of 1400 Storage

The initialization phase fetches the main phase which copies the branch table and the interphase communication region from the initialization phase into the storage locations above 1400 simulated storage. The main phase, which is made up of individual modules that simulate the various 1400 processes, then clears 1400 simulated storage. The System/360 disk and tape buffer areas begin immediately after the main phase.

Figure 4 shows the storage allocation for a Model 40 Emulator Program with RELOC=0 and 4K of 1400 storage. (The algorithm for estimating the total storage requirement for a Model 40 Emulator Program, as a function of the parameters specified at generation time, is presented in Appendix H.)

REGISTER USAGE

The utilization of the general purpose registers by the Model 30 Emulator Program is illustrated in Table 4. Usage for the Model 40 is shown in Table 5. All general purpose registers may be used by user routines if registers 0 through 14 are saved and restored.

Table 4. Use of Registers by Model 30 Emulator Program

Register	Use by Model 30 Emulator Program
0 and 1	Temporary computations.
2, 3, 4, 11, 12, & 15	Base registers.
5	Temporary computations.
6	Holds address of 1400 instruction that caused the program-mode switch when the Emulator Program branched to a simulation routine.
7, 8, & 10	Used within individual routines.
9	Holds 1400 offset address throughout execution.
13	Holds address of Emulator Communications Region.
14	Used for Branch and Link.

Table 5. Use of Registers by Model 40 Emulator Program

Register	Use by Model 40 Emulator Program
0	1400 Instruction Address Register.
1	1400 A-Address and B-Address Registers.
2, 3, & 4	Base registers.
4	Used for Edit Get/Put Diagnose instructions.
5 & 6	Temporary computations.
7	Used by Compatibility Feature to store sense-switch settings.
8, 9, & 11	Used by Compatibility Feature.
10	Branch Table Pointer.
12 & 13	Temporary computations.
14 & 15	Subroutine linkage.

PROGRAMMING RESTRICTIONS AND CONSIDERATIONS

RESTRICTIONS

Before an installation utilizes the Model 30 or Model 40 Emulator Programs under DOS, the user must consider the following programming restrictions:

1. Time-dependent programs may not yield results identical to those obtained on a 1400 system.
2. The Model 30 and Model 40 Emulator Programs do not check for an effective address greater than the main storage capacity of the 1400 system. The Model 40 hardware always assumes a 16K 1400 main storage, except for 1400 Clear Storage, Set Wordmark, and Clear Wordmark instructions. Therefore, for the Model 40 Emulator and for a 16K 1400 memory simulated on a Model 30 Emulator, addresses between 0 and 15,999 are valid; addresses greater than 15,999 cause a wraparound.
3. Simulated 1400 locations 0000 and 0100 are not used by the Model 30 and Model 40 Emulator Programs for timing control of read and punch operations as they are on a 1400 system. The contents of these locations are undisturbed by the Model 30 and Model 40 Emulator Programs.
4. Programs cataloged under the Model 30 Emulator Program may not be executed on the Model 40 Emulator Program, and vice versa.
5. 1050 control codes are not supported.
6. The Selective Tape Listing Feature is not emulated for printers.
7. Reassignment of SYSIO to magnetic devices restricts I/O operations. (See Item 10 under "Considerations.")
8. Stacker selection to the RP3 pocket is not supported when SYSPCH is assigned to tape or disk.
9. Catastrophic 1400 processing errors can result in System/360 program checks, which may occur in lieu of 1400 "process errors."
10. When a Divide instruction is executed by the Model 40 Emulator Program, high-order blanks in the dividend field are converted to zeros.
11. The cataloging of overlay programs on the Model 40 Emulator Program is restricted because of the non-contiguous layout of simulated 1400 storage.

12. Read release operations on the card reader are not supported.
13. When the System/360 punch unit is not a 1442, the 1442 Punch-Column-Skip instruction cannot be used in conjunction with the Card-Image-Punch instruction for the same card, nor can both BCD and Card Image data be punched into the same card.
14. Multiple readers, punches, or printers are not supported (such as the second 1442 on the 1440), nor is concurrent punching on both a 1442 and 1444 supported.
15. Stacker select operations are limited by the System/360 card devices. (See Table 8, Note 5.)
16. Since the 2540 has an additional pre-stacker station on the read side, operations involving merging into the RP3 pocket of punched and read cards may not be consistent with the original 1400 program.
17. While simulating the 1442 on the 2540, the Punch-Feed-Read Feature will not support card image reading or punching, or the catalog facilities.
18. Load-mode, file-scan operations using System/360 File Scan Feature are not supported. Simulation support is provided but, due to the difference in scan arguments, accurate results are not always guaranteed.
19. The SIZ1400 parameter must be specified as one of the actual 1400 storage sizes for programs whose coding is dependent upon actual machine size (e.g., AUTOCODER programs).
20. On the Model 40 invalid disk seeks with no d-modifier will not be emulated as seeks, but rather as move operations. Therefore, modifications to programs with such instructions will be required.
21. When executing more than one Model 40 Emulator Program, each specifying RELOC#0, the EDITINV parameters for the concurrently executing Emulator Programs should be the same. If the EDITINV parameters are not the same for the concurrently executing Emulator Programs, the character editing is determined by the last initiated Emulator Program.
22. If an attempt is made to execute an Emulator Program in a DOS/SPI mode of operation, the Emulator Program issues message EC21I and is terminated. The

DOS/SPI mode of operation is not supported.

CONSIDERATIONS

Before an installation utilizes the Model 30 or Model 40 Emulator Program, the user must take into account the following programming considerations:

1. The Model 30 and Model 40 Emulator Programs clear 1400 storage between catalog runs. Therefore, multiphase 1400 programs that require the presence of data or instructions from a previous phase may not be executed correctly after cataloging.
2. Programs with undetected programming errors may not yield results identical to those obtained on a 1400 system.
3. Data prepared for input to the Emulator Programs by System/360 programs must be restricted to the 64-character BCD set.
4. The Emulator Programs move the date ("yyddd") from the DOS communication region into 1400 locations 82-86 and/or 195-199 and set wordmarks if the parameter "IOCDATE=x" is specified. These are the locations where the disk and tape 1400 input/output control system (IOCS) routines expect the current date. If the 1400 program is loaded from cards, this move occurs before the program is loaded; therefore, the user should remove the clear-storage cards from his 1400 object decks except for 1400 cataloging. (When the 1400 program is loaded from the Core-Image Library, the date is moved after the program has been fetched.)
5. The 1400 tests for unit-record and disk errors are not effective since the DOS supervisor performs error checking.
6. Magnetic ink character reader (MICR) devices in foreground partitions may not operate correctly when the Model 30 or Model 40 Emulator Program is in operation. In the execution of 1400 instructions, it is possible to stay in execution time in excess of safe time for stacker selection on MICR devices, although the probability of this occurring is low. The problem is caused by extremely long data fields. Examples of this condition are shown in Table 6. An example of the use of the table is as follows: If a user is on a Model 30 with a 1.5 microsecond memory, and is executing a 1400 opera-

tion of Load Character to A-Field Wordmark having a field length of 314 characters, the operation is executed with less than a millisecond delay. (An initial assessment of the problem can be obtained from Table 7, "Performance Ratios.") These timings should be evaluated together with the timings shown for MICR devices in IBM System/360 Disk Operating System, Performance Estimates, Form GC24-5032, for any potential timing conflict.

7. When READRSS=YES is specified, and when either stacker selection or 1442 read-punch updating is being performed, the // LC control card should be placed just prior to the last card of the 1400 data file.
8. Since tape errors are handled by DOS, user-written 1400 error recovery procedures are not executed unless mixed parity is specified for tape in the // TAPE control card.
9. It is possible to saturate a disk pack when SYSLST or SYSPCH is assigned to a disk extent. DOS issues a warning when the residual capacity of the

extent is reached if the SYSFIL parameters of "n₁" and "n₂" in the FOPT macro are properly assigned at DOS system generation.

10. Reassignment of SYSIO is not available for Column Binary, or Card Image Read, or Punch operations, or 1442 Read Punch updating. (Refer to Table 8.)
11. A /* card must appear in the job stream for every 1400 program, whether or not the program has any card input. This is because the Emulator Programs read ahead on the card reader, or the device assigned to SYSIPT, before they know if the 1400 program contains a Read instruction.
12. 1400 disk files written on either stacked or unstacked packs under the Model 30 Emulator Program are compatible with files written under the Model 40 Emulator Program, and vice versa. In addition, disk files created by the stand-alone compatibility on Models 25 and 30 are accepted by the Model 30 and the Model 40 Emulator programs as unstacked packs. (Disk files created by the Emulator

Table 6. Example of Field Lengths Affecting MICR Devices

1400 Instructions	DELAY					
	1.5 uSEC MODEL 30		2.0 uSEC MODEL 30		2.5 uSEC MODEL 40	
	<1MSEC	<4MSEC	<1MSEC	<4MSEC	<1MSEC	<4MSEC
Load Characters (LCA)	La=314	La=1314	La=231	La=981	La=312	La=1274
Move Characters (MLC)	La=251	La=1051	La=184	La=784	La=260	La=1060
Move Record (MRCM)	La=252	La=1052	La=185	La=785	La=131	La=531
Move & Binary Encode (MBC)	La=178	La=750	La=131	La=559	La=115	La=468
Move & Binary Decode (MBD)	La=220	La=926	La=153	La=653	La=115	La=468
Multiply	La=5; Lb=11	La=13; Lb=27	La=4; Lb=9	La=11; Lb=23	La=6; Lb=13	La=16; Lb=33
Divide	La=2; Lb=5	La=7; Lb=15	See Note 7	La=7; Lb=9	La=4; Lb=9	La=9; Lb=19
Edit	La=23; Lb=36	La=131; Lb=150	La=2; Lb=26	La=65; Lb=100	Emulator Program edit No MICR Delays	

Notes:

1. La=Length of A-Field.
2. Lb=Length of B-Field.
3. Instructions listed are those most likely to have large data fields.
4. All Model 30 1401 Addresses are assumed to be over 4K.
5. All Model 30 1401 A and B Addresses are assumed to be indexed.
6. No special characters are assumed to be in any data field.
7. Unable to execute this instruction in less than 1 millisecond.

Table 7. Performance Ratios

Original Computer		Under DOS	
		IBM 1401	IBM 1460
Model 30	Processing (1.5 micro-second storage)	Approx. 3.5 times as fast.	Approx. 1.8 times as fast.
	I/O	Depends on specific units involved.	Depends on specific units involved.
Model 40	Processing (except for MCE instruction)	Approx. 4.5 times as fast.	Approx. 2.3 times as fast.
	MCE instruction	Approx. 5 times slower.	Approx. 10 times slower.
	I/O	Depends on specific units involved.	Depends on specific units involved.

programs are not accepted by the Model 25 or 30 stand-alone compatibility if 1400 labels are being processed.) However, only Move-mode files written under the stand-alone emulation on the Model 40 are compatible with unstacked packs produced under the Model 40 Emulator Program.

If the user desires to take advantage of the stacked pack capabilities of the Emulator Programs under DOS, the user can perform a 1400 disk-to-tape operation under stand-alone emulation. Then, perform a tape-to-disk operation with the Emulator Programs under DOS to recreate the files on stacked packs. This technique can also be used to convert Load-mode files written under the stand-alone emulation on the Model 40 to either stacked or unstacked packs.

- 13. A Scan Disk operation is not stopped by cylinder overflow, but only by a match or the sector count going to zero.
- 14. The Write Disk Check operation, a disk-file-to-main-storage compare, is a System/360 cyclic check of the data on the 2311/2314.
- 15. A check is not made to determine if all records written on a specific track are written in the same mode.
- 16. 1400 programs that depend on wrong-length-record checks or cylinder overflow may not run correctly. These conditions, as well as other disk error conditions, are not passed to the 1400 program.
- 17. If SYSLST is assigned to disk, the maximum actual data length is 120

characters (121 including the control character). If SYSLST is assigned to tape, the maximum actual data length is 144 characters (145 including the control character). The first character of each record corresponds to the Carriage-Control command that is the System/360 Channel Command Word (CCW) command byte (known as type A in the Multiprogramming Support (MPS) utility macro instructions). For this reason, the magnetic-tape unit must be either a 9-track unit, or a 7-track unit with the Data Conversion Feature. DOS job control writes 121-character records with an ASA control character (known as type D in the MPS utility macro instructions). See the publication IBM System/360 Disk and Tape Operating Systems: Utility Programs Specifications, Form GC24-3465.

- 18. The higher-order position of the address portion of the disk control field is assumed to be 0. File-protection techniques using the high-order position of this address may not be effective. (Example: Normal address and normal address plus x00, 000 are treated as the same address.)
- 19. 1400 programs that depend on the absence of a feature may not be emulated properly (see "Additional Features" in the "Introduction" section). For example, because the Emulator Program under DOS appears as a 16,000-position system to the 1400 program, programs written for use on 1400 systems with lesser storage capacity may require modification. The SIZ1400 parameter must be specified as one of the actual 1400 memory sizes for programs generating coding dependent upon actual machine size (e.g., 1400 auto-coder program).

Table 8. Unit-Record Operation Correspondence

1400 Unit and Operation \ System/360 Unit	2540	1442 Model M1	1442 Model M2	2501 Model B1,B2	2520 Model B1	2520 Model B2,B3	Magnetic Devices (SYSIO)
1402							
Reading only	YES	YES	N/A	YES	YES	N/A	YES
Punching only	YES	YES ¹	YES ¹	N/A	YES ¹	YES ¹	YES
Reading & Punching	YES	NO ²	N/A	N/A	NO ²	N/A	YES ^{1,2}
Punch Feed Read	YES ³	NO	N/A	N/A	NO	N/A	NO
Reader Stacker Select	YES	YES ⁴	N/A	N/A	YES ⁴	N/A	N/A
Punch Stacker Select	YES	YES ⁴	N/A	N/A	YES ⁴	YES ⁴	YES
PFR Stacker Select	YES ⁵	NO	N/A	N/A	NO	N/A	NO
Read 51-Col Cards	YES ⁶	N/A	N/A	N/A	N/A	N/A	NO
1442							
Reading only	YES	YES	N/A	YES	YES	N/A	YES
Punching only	YES ⁷	YES ⁸	YES	N/A	YES ⁸	YES	YES
Read data cards, then Punch into blank cards	YES ⁷	YES ⁸	N/A	N/A	YES ⁸	N/A	NO
Read & Punch same card ⁹	YES ¹⁰	YES ⁸	N/A	N/A	YES ⁸	N/A	NO
Reader Stacker Select	YES	YES	N/A	N/A	YES	YES	N/A
Punch Stacker Select	YES	YES	N/A	N/A	YES	YES	YES
1444							
Punching	YES	YES	YES ¹¹	N/A	YES	YES ¹¹	YES
Stacker Select	YES	YES	N/A	N/A	YES	YES	YES
Note: N/A=not applicable because of hardware limitations.							
¹ EU executes one additional feed before the first Punch command is executed.							
² Permissible if punching follows all reading; i.e., data to be read followed by blank cards. EU executes one additional feed before the first Punch command is executed.							
³ If the PFR features are installed on the 2540 (#5890) and the 2821 Control Unit (#5895).							
⁴ Cards selected to the 1 or 4 pocket go into stacker 2; cards selected to the 2 or 8, and NR and NP cards go into stacker 1.							
⁵ If the 2540 Compatibility Attachment (#8065) is installed on the 2821 Control Unit.							
⁶ If the 51-Column Interchangeable Read Feed (#4151) is installed on the 2540.							
⁷ This applies only when punching into blank cards. 1440 Read instructions require a blank data card in the read unit to simulate initial movement to the punch station of a 1442. Punch-and-Stop and Punch-and-Skip instructions are not simulated on the 2540 without the PFR feature.							
⁸ If punching is required in the program, the // 1400 card must indicate this by the omission of operand "d".							
⁹ Punching the same card on a 1442 (1400) allows the simulation of Punch-and-Stop, Punch-and-Skip, Punch-and-Feed, and Read Card instructions.							
¹⁰ Permissible only if the PFR feature is installed. PFR=YES and PCH1400=1442 must be specified and a // PR card must be used as the last card in the reader to switch reading from the reader to the punch side. Card-image reading or punching cannot be simulated in this way.							
¹¹ EU executes one additional feed before punching begins to accommodate the devices with reading capability. Therefore the first card will be a blank card.							
¹² Two tape drives needed, one for SYSIPT and one for SYSPCH.							

20. The Emulator Program operator service functions may be requested through the INTERRUPT key only when OC=YES is specified in the FOPT macro parameter during DOS Supervisor generation.
21. On nine-track tapes, a substitute blank character (1401/1440/1460 A-bit only) is never converted to a blank.
22. The DOS copy and restore disk utility programs cannot be used for stacked disk packs. When these operations are required, 1400 disk-to-tape and 1400 tape-to-disk operations must be performed for each half of the stacked pack using the Emulator Programs under DOS.
23. When executing a 1440 program that issues a read command to eject the last card during 1442 file closing, one blank card must be placed after the last data card if not reading ahead, or two blank cards after the /* card if reading ahead.
24. The Model 30 and Model 40 Emulator Programs do not provide System/360 disk or tape file label creation, verification, or protection. If a user's 1400 program does not perform these functions, a 1400 or System/360 tape or disk file could be destroyed without operator notification.

Disk file protection can be attained only through 1400 programming. However, if user label checking is not used in the 1400 program, then the following techniques should be used to afford volume protection.

- Use the DOS Clear Disk Utility Program to format all 1400 files and specify an unexpired date in the DLBL or DLAB statement. This creates a VTOC entry for the file, and thus, protects the file from other System/360 programs.
 - Use the // DVOL control card and specify DVOL=YES when generating the user's Emulator Program. By initializing all user disk volumes with different and unique volume serial numbers, the DVOL facility insures that the correct volume is being used.
25. When simulating a 1442 on the 2540, the user must clear the previous read information before issuing punch and stop instruction. Otherwise, repunching the same data read causes a 2540 hole count error, and message EC51D PFR PUNCH ERROR is issued.

26. Programs which rely on tape to be initially positioned at other than load point may not execute properly. CS30/40 assumes all tapes to be rewound and at load point.

TIMING INFORMATION

Throughput under emulation is not dictated so much by the Emulator as it is by the 1400 program being executed. It is the mix of CPU operations (executed by Read Only Storage), I/O operations (executed by program support), and the amount of interference from higher-priority partitions that determines total throughput. Assuming a normal distribution of the above considerations, a minimum throughput of one to one with the original equipment can be expected. However, this will vary by application.

A comparison of processing times using a representative sample of 1400 instructions under the Model 30 and Model 40 Emulator Programs with the 1401/1460 is presented in Table 7. The estimated processing times are based on the assumptions that the timer is off and that there is no multiprogramming.

GENERAL COMMENTS ON I/O SIMULATION

In general, all I/O error recovery is attempted in System/360 mode. The 1400 program is not notified of I/O errors and need not include error tests. The exception to this situation is when mixed-parity 7-track tapes have been specified. Either standard DOS operator intervention messages from the physical input/output control system (PIOCS) or Emulator Program initiated error-recovery messages are displayed when necessary.

In effect, all I/O is double-buffered since the Emulator Program reads and writes from its own I/O areas in System/360 main storage. Hence, the Emulator Program usually is a card read ahead, a punch or print behind, a tape read ahead, and a tape write behind. Disk read operations are not overlapped nor read ahead, but disk write and verify operations are written behind. Data is always passed between the I/O areas of the Emulator and the I/O areas of the 1400.

I/O device independence is provided for all 1400 unit-record devices. The Emulator Program simulates requests for unit-record I/O (card reader, card punch, and printer) from a comparable unit-record device or magnetic-tape or disk unit. This enables the user to efficiently utilize the System/360 in a multiprogramming environment for both 1400 and System/360 programs, while reducing the total processing time required for most commercial 1400 applications.

USER-WRITTEN SIMULATION ROUTINES

It is possible for the user to include his own System/360 routine to support I/O devices which are not supported by the Emulator Programs. The user-written simulation routine can be used to process 1400 instructions that use any of the unassigned operation codes given in Table 9. These codes are normally considered to be invalid by the Emulator Programs and are treated as 1400 program errors. However, if `USRPROG=YES` is specified at Emulator Program generation time, control is passed to the user-written simulation routine when the Emulator Program encounters any of these unassigned codes. The user's routine should test for those codes which are supported in his simulation routine. (Note: 1400 instructions which contain emulated operation codes are not passed to the user-written simulation routine unless an error is detected in that instruction.) Desired codes can be processed in any manner. Upon completion of the processing, control can be returned to the Emulator Program for the Model 30 to continue normal processing with the instruction:

```
BR 14 (normal return)
```

or to the Emulator Program for the Model 40 to either the 1400 NSI or to I-Fetch at A-address with the instructions:

```
BR 14 (Back to 1400 NSI)
B 4(14) (Back to I-Fetch at
A-address)
```

For all undesired codes, control should be returned to the Emulator Program for the Model 30 with the instruction:

```
B 4(14) (Error--Abort job)
```

or to the Emulator Program for the Model 40 with the instruction:

```
B 8(14) (Error--Abort job)
```

In the Model 30 Emulator Program the address of the 1400 instruction to be executed is contained in register 6. The instruction is in 1400 simulated storage. All 1400 instructions and data are represented in 1400 simulated storage as shown in Table 15. Also, the user must use the special compatibility feature instructions given in Appendix B when moving data between 1400 simulated storage and the user's System/360 routine.

In the Model 40 Emulator Program, 1400 instructions are not directly accessible. Instead, the compatibility feature, when encountering one of the operation codes shown in Table 9, performs the following functions:

Table 9. Unassigned Operation Codes

Unassigned Operation Code	Model 40 Operation Code Number (Hexadecimal)
No word mark	00
+ Plus	01
(Left parenthesis	02
< Less than	03
# Group mark	04
- Minus	05
\$ Dollar sign	06
* Asterisk	07
) Right parenthesis	08
; Semicolon	09
Δ Delta	0A
△ A bit only	0B
~ Word separator	0C
\ Backward slash	0D
# Segment mark	0E
bl Blank	0F
: Colon	10
> Greater than	11
✓ Tape mark	20
† Record mark	30
I	40
J	44
T	50
X	60
O Letter O	80
0 Zero	90

- Inserts a hexadecimal "operation code number" into byte 3 of register 0. Table 9 lists the operation codes and the corresponding operation code number for one-, two-, seven-, or eight-position instructions. The operation code number for four- or five-position instructions is the ones complement of the number listed in Table 9.
- Places the A address, if any, into bytes 0 and 1 of register 1.
- Places the B address, if any, into bytes 2 and 3 of register 1.
- Places the d-modifier, if any, into byte 2 of register 0.
- Places the address of the next sequential 1400 instruction into bytes 0 and 1 of register 0.

Data in simulated 1400 storage and the d-modifier in register 0 are represented as indicated in Table 14. The 1400 addresses in registers 1 and 0 are represented in the Emulator "hddd" format, where "h" is a hexadecimal digit and "d" is a packed-decimal digit. (For example: The 1400 address 13,444 (U4D in BCD) is a hexadecimal "D444" in the "hddd" format.) When moving data between 1400 simulated storage and the user's simulation routine, the user

must use the special compatibility feature instructions given in Appendix D. General purpose register 15 contains the address of the simulation routine and can be used as a base register.

All user-written routines must save and restore registers 0 through 15, and the routines must be cataloged in the Assembler Source Statement Library. To catalog a program in the Assembler Source Statement Library, the following sequence of cards must be used:

```
// JOB      CATALOG
// EXEC     MAINT
CATALS A.progname
BKEND
      .
      .
      .
      }      User-written routine
      .
      .
      .
BKEND
/*
/8
```

To include the user-written routine in the Emulator Program, the following sequence of cards must be used when generating the Emulator Program:

```
// JOB
// OPTION LIST
// EXEC     ASSEMBLY
MACRO
USRPROG
COPY progname
MEND
euname     EU30[EU40]
      .
      .
      .
      }      Emulator Program parameters
      .
      .
      .
END        ACOMP01
/*
/8
```

The name "progname" is the name used to catalog the user-written routine in the Assembler Source Statement Library.

Note: Any CSECTS generated in the user's routine must be added by means of user-inserted INCLUDE cards placed after the 'INCLUDE, (ACOMP01)' card (punched by the emulator) at link-edit time, unless AUTO-LINKING procedures are employed.

SIMULATION OF I/O DEVICES

CARD READ PUNCH SIMULATION

Reader stacker selection is optionally supported. Because card read speed is reduced when such simulation is specified, the user is advised to employ it only when essential. Cards are read ahead except when simulating reader stacker selection, or 1442 read-punch updating.

Two methods are used to read cards. The method used depends on whether overlapped operations are possible. When it is, cards are preread into buffer areas and the standard /* DOS data delimiter card is used to provide a last card indication for the preceding data card. However, cards are not preread by the Emulator Program during 1442 read-punch-update simulation or during read-stacker-select simulation. In the case of no prereading, the 1400 program initiates the physical reading of the card. To inform the Emulator Program of a pending end-of-file condition, the // LC Emulator control card must be placed before the last data card in the deck. Although the // LC card is required only when preread operations will not occur, it is suggested that both the // LC and /* cards be used. This procedure will relieve the user from having to distinguish each time whether there is a preread operation or not. The system makes this distinction and ignores the // LC card during preread operations.

When reading ahead and not stacker selecting, a Reader Stacker Selection instruction will be treated as a No-Operation (No-Op), and a Reader Stacker Selection and Branch as an unconditional branch. It should be noted that it is possible to name a stacker for all input cards in the // 1400 control card.

Punch stacker selection is optionally supported. Unless a 1401/1460 program is known to include stacker selection for all or most punch instructions, punch stacker selection should not be simulated. This is because punch overlapping is lost if the Emulator Program expects a stacker select following a punch and does not get one.

A 1402 and/or a 1442 can be simulated on a card-read-punch or magnetic-tape or disk unit extent attached to the System/360 subject to the limitations of Table 8. Eighty columns will be read and punched into or from 1400 locations 1 to 80 and 101 to 180, respectively, if a 1402 is being simulated. Either 80 columns or the number of columns preceding a groupmark with a wordmark are read into or punched from the B-Address of a 1442 instruction if that device is being simulated.

If PDR1400=1442, PCH360=2540, and PFR=YES are specified, the instructions to read and punch the same card can be emulated if the PFR feature is installed on the 2540 Card Read Punch. READRSS=YES is required when simulating stacker selection. A // PF card conditions the program to read all following cards from the punch side. Consequently, all data cards should be on the punch side of the 2540, and a blank card should be placed in front of the first data card. The data cards are not read ahead, and the // LC card and a blank card should

follow the last data card. After the user end-of-job routine, DOS controls card reading and thus reinitializes the read functions to normal. Programs with overlays cannot be cataloged if using this option.

1402 punch-feed-read operations may be simulated on a 2540 with both the Punch-Feed-Read feature and the 2540 Compatibility Feature. The Compatibility Feature is required only when simulating stacker selection (PUNCHSS=YES) of punch-feed-read cards. A blank card should be placed in front of the first data card.

Because standard DOS or Emulator Program initiated operator-intervention messages are given in the case of card errors, 1400 Branch on Punch-Error or Read-Error instructions are normally treated as No-Ops. However, on the Model 40 the Branch on Read Error indication optionally can be returned to the 1400 program. 402/403 MLP code conversion is automatic on the Model 40 and optional on the Model 30. Refer to parameter c of the // 1400 card in the "Control Cards" section.

1400 Card-Read instructions may be simulated on any card reader or magnetic-tape or disk unit assigned to SYSIPT. The Emulator Program checks for the type of device assigned to SYSIPT at execution time and constructs proper I/O commands for that particular device. If the unit assigned to SYSIPT is a magnetic-tape or disk unit, all records must contain 80-byte unblocked records, and disk records must be organized either as a standard sequential file (EXTENT Type 1) or as a split-cylinder sequential file (EXTENT Type 128) with a key length of zero and a data length of 80. All disk records must be contained within one extent, specified in the standard manner; however, multireel magnetic-tape files are supported. The Emulator Program rewinds and unloads a tape unit upon encountering a tapemark.

The 51-Column Interchangeable Read Feed feature is supported by the utilization of a // 51 control card, which is the last 80-column card before the first 51-column card. This card causes the Emulator Program to issue console message EC03D. After the operator has mounted the device on the 2540 Card Read Punch and readied the reader, he enters START in response to message EC03D to continue processing. The // 51 control card conditions the program to move columns 15-65 of the card buffer area into 1400 storage. When the 51-column feature is being utilized, column-binary and punch-feed-read operations are excluded. Stacker selection is limited by the device to the R1 and R2 pockets; therefore, parameter "c" of the // 1400 control card must not be a 2. (See "The // 1400 Control Card" in the "Control Cards" section.) SYSIPT must be the 2540 Card Read Punch.

The Column-Binary or Card-Image feature utilizes a // CB control card to cause all following cards to be read in data mode 2.

If the 1400 program has normal BCD Read instructions, the data is translated to data mode 1 when loaded into 1400 storage. Unrecognized characters are replaced with blanks. This facility could be used for bypassing data checks. The // CB control card must immediately precede the first column-binary data card. When the Column-Binary feature is being utilized, 51-column and PFR operations are excluded for that run. SYSIPT must be on the card reader. Column-Binary or Card-Image-Punch instructions do not require control cards, and are executed in the correct mode when encountered.

Note: These cards are punched in 1400 column binary representations and can only be read by 1400, or simulated 1400 devices or emulators.

1400 Card-Punch instructions may be simulated on any card punch or magnetic-tape or disk unit assigned to SYSPCH within the physical limitations of the device (see Table 8). The Emulator Program checks for the type of device assigned to SYSPCH at execution time and constructs proper I/O commands for that particular device. If SYSPCH is assigned to a magnetic-tape or disk unit, either 80- or 81-character records are written unblocked.

If the symbolic parameter PUNCHSS=NO is specified at assembly time or no punch stacker selection is indicated in the // 1400 control card, 80-character records are written unblocked on the magnetic unit. If the symbolic parameter PUNCHSS=YES for 1444 or 1402 simulation, or if READRSS=YES for 1442 simulation and the // 1400 control card indicates that punch stacker selection is to be simulated, 81-character records are written unblocked on the magnetic unit. The first character of each 81-character record corresponds to the Stacker Select command that is the standard extended American Standard Association (ASA) code (V is pocket 1, W is pocket 2). Since ASA codes provide for only two possible pockets for stacker selection, 1402 Card-Punch instructions directing the output to pocket 8 (read-punch pocket) contain the code V.

When SYSPCH is assigned to a magnetic-tape unit, multireel output files are supported as the Emulator Program writes a single tapemark at the end of the reel, rewinds, and unloads the unit upon detection of an end-of-reel condition. A tapemark is written at the beginning of the next reel. Upon termination of the 1400 program (either normally or abnormally), the Emulator Program writes a /* delimiter followed by a character other than blank in column 4. It then writes a single tapemark to indicate end of file, then backspaces one record (past the tapemark) so that the

next job in the job stream may continue to use the unit for SYSPCH, or the unit may be rewound and unloaded to preserve the integrity of the file. No tape labels are written by, nor are any tape labels required by the Emulator Program. The tape unit is presumed to be properly positioned to write the first record prior to the execution of the 1400 program. If SYSPCH is assigned to a disk unit, 80- or 81-character records are written unblocked within one extent. All disk records have a key length of zero. Proper DLBL and EXTENT cards must be submitted to DOS prior to the assignment of SYSPCH to a disk unit; therefore, no label checking is required by the Emulator Program. File organizations supported include standard sequential (EXTENT Type 1) and split-cylinder sequential (EXTENT Type 128). If end of extent is reached prior to the termination of the 1400 program, console message EC74I is displayed followed by message EC83I, and the 1400 program is abnormally terminated. The Emulator Program does not close a disk file assigned to SYSPCH upon termination of a 1400 program; therefore, the operator must issue a standard CLOSE command to SYSPCH upon completion of the job stream. The number of records written on each disk track is 25 for the 2311 and 39 for the 2314. The user should calculate his file requirements to ensure that the assigned extent contains sufficient space to hold the file prior to the execution of the program.

PRINTER SIMULATION

All printer operations are supported except selective tape listing. This operation may be added by the user if desired. 1401 and 1460 combination I/O instructions are supported.

As in the case of reader punches, a 1403 and/or a 1443 may be supported on either device (or a magnetic-tape or disk unit) attached to a System/360.

If a 1403 is to be simulated, 132 positions are printed from 1400 locations 201 to 332, unless otherwise indicated by the PTRLN3 parameter. If a 1443 is being simulated, 120 or 144 positions or the characters preceding a groupmark are printed from the B-Address of a 1443 instruction, whichever is specified in the PTRLNG parameter.

To achieve maximum overlap, Branch-On-Carriage-Overflow instructions do not cause the Emulator Program to wait for printer device end. Therefore, the 1400 program does not know of a channel-overflow condition until it has executed the Print command (or Space command) after the command that caused the overflow. This requires

that the channel-12 hole be moved up one line in the carriage tape from its 1400 position. The channel-overflow latch remains set until the 1400 program executes a Skip command or, if a 1440 is being emulated, a Branch-On-Overflow instruction.

When the CARRCTL=YES parameter option is specified, the Emulator Program maintains a carriage-control-tape image area in main storage. As printer operations are performed, a pointer in this area indicates the position of the print line on the page. This area is checked for overflow and channel indications rather than interrogating the printer indicators. When the user wishes to utilize the carriage-control-tape image option, he uses the // CCTL control cards at 1400-program execution time (see "The // CCTL Control Cards" in the "Control Cards" section). The proper carriage-control tape still must be placed in the printer to provide the skip to channel punches. The // CCTL control card 9 and 12 punches must correspond to those on the System/360 carriage control tape (i.e., the channel 9 and 12 holes must be moved up one line in either case from its 1400 position).

Since all I/O error recovery is done in System/360 mode, a 1400 branch on printer error or branch on printer busy is treated as a No-Op.

1404 cut-card operations are simulated only on a 1404. Thus, both PTR1400 and PTR360 must specify a 1404 and PTRASGN must specify a programmer logical unit other than the default value SYSLSL. A bill-feed-read operation, as well as any valid combination instruction, causes 30 bytes to be transferred to 1400 storage. During bill-feed-read operations, the carriage-control-tape-image option provided by the // CCTL card is discontinued and the bill-feed-read operations are not overlapped. If continuous forms operations are to be simulated, parameters PTR1400 and PTR360 must specify a 1403, therefore, a different generation of the Emulator Program must be used.

1400 printer instructions (excluding 1404 bill-feed operations) may be simulated on any printer or magnetic-tape or disk unit assigned to SYSLSL. The Emulator Program checks for the type of device assigned to SYSLSL at execution time and constructs proper I/O commands for that particular device. If SYSLSL is assigned to a magnetic-tape unit, records are written unblocked, and have a length dependent on the line length specified in the PTRLNG parameter. The record length is equal to PTRLNG + 1. (Exception: when PTRLN3=100, the record length is 121 characters.) The first character of each record corresponds

to the Carriage-Control command that is the System/360 Channel Command Word (CCW) command byte (known as type A in the multipro-

gramming support (MPS) utility macro instructions). For this reason, the magnetic-tape unit must be either a 9-track unit or a 7-track unit with the Data Conversion Feature. DOS Job Control writes 121-character records with an ASA control character (known as type D in the MPS utility macro instructions).

The Emulator Program uses the type-A forms control character for throughput efficiency. Since most 1400 forms-control commands are of the form "write a line and space" or "skip after printing," the use of ASA codes causes two records to be written for each 1400 command (one for the line of print, the other for the forms movement after printing). Type -A control characters provide the print-and-space-after facility in one record. Multireel output files are supported since the Emulator Program writes a single tapemark at the end of the reel, rewinds, and unloads the unit upon detection of an end-of-reel condition. A tapemark is written on the beginning of the next reel. Upon termination of the 1400 program (either normally or abnormally), the Emulator Program writes a single tapemark to indicate end of file, then backspaces one record (past the tapemark) so that the next job in the job stream may continue to use the unit for SYSLSST, or the unit may be rewound and unloaded to preserve the integrity of the file. No tape labels are written by, nor are any tape labels required by the Emulator Program. The tape unit is presumed to be properly positioned to write the first record prior to the execution of the 1400 program.

If SYSLSST is assigned to a disk unit, 121-character records are written unblocked within one extent (key length zero, data length 121). The first character of each record corresponds to the Carriage-Control command, followed by the first 120 print positions. The remaining 12 print positions are truncated. DOS Job Control messages may be bypassed, except that all records are 121 bytes in length; therefore, the user must separate the records in some other manner, such as testing the first character of each record (forms-control character). Proper DLBL and EXTENT cards must be submitted to DOS prior to the assignment of SYSLSST to a disk unit; therefore, no label checking is required by the Emulator Program. File organization supported includes standard sequential (EXTENT Type 1) and split-cylinder sequential (EXTENT Type 128). If end of extent is reached prior to the termination of the 1400 program, console message EC73I is displayed, and the 1400 program is abnormally terminated. The Emulator Program does not close a disk file assigned to SYSLSST upon termination of the 1400 program; therefore, the operator must issue a standard CLOSE

command to SYSLSST upon completion of the job stream. The number of records written on each disk track is 19 for the 2311 and 32 for the 2314. The user should calculate his file requirement to ensure that the assigned extent contains sufficient space to hold the file prior to the execution of the 1400 program. It should be noted that the 1400 Printer commands, which cause immediate spacing or skipping without writing a line, cause a record to be written.

If SYSLSST is assigned to either tape or disk, and the CARRCTL=YES parameter option is not specified, the standard DOS line-count facility (initialized for each job to the value of the "LINECT=nn" parameter of the SET card, or to the standard value) is used to simulate end-of-form conditions (channel 9 or channel 12 in the carriage-control tape, but not both). As each line is written, the count is decremented by the number of lines spaced (e.g., a write and space two lines after print decrements the count by two). Since the number of lines skipped when simulating a skip to channels 2 through 11 cannot be predicted, the count is decremented by one. It is not desirable to assign SYSLSST to a magnetic unit when the 1400 program prints a variable number of lines between form skips and a pre-printed form is being used. To calculate the value to be used in the DOS "LINECT=nn" parameter, the number of lines written from the channel-1 punch in the carriage-control tape to the channel-12 punch are counted, and to this are added the number of lines spaced between the two punches plus one for each immediate skip to channels 2 through 11.

MAGNETIC-TAPE SIMULATION

All magnetic-tape operation codes for the 1400 programs are supported. Process overlap is treated in the same manner as described in the publication IBM System/360 Model 30 1401/1440/1460 Compatibility Feature, Form GA24-3255.

7-track tapes should be specified to run the appropriate parity with the translator on and the converter off. Mixed even- and odd-parity tapes can be simulated only with a loss of read ahead capability.

The following specifications, which are made in the DOS ASSGN card for assigning a logical I/O unit to a physical device, are used to specify mode settings for 7-track and 9-track tapes. The first six entries are valid only for 7-track tape. The last four entries are valid only for 9-track tape. If the mode setting is not specified in the ASSGN card, the system assumes odd parity at 800 bpi with the translator off and the converter on for 7-track tapes

which can cause invalid recording of data for emulation. X'C0' is the normal reset mode for a 9-track tape unit and specifies the maximum byte density for that device. X'C8' is an Alternate-mode setting for 9-track dual-density tapes only. The specifications are:

Setting	BPI	Parity
X'28'	200	even
X'38'	200	odd
X'68'	556	even
X'78'	556	odd
X'A8'	800	even
X'B8'	800	odd
X'C0'	800	single-density 9-track
X'C0'	1600	single-density 9-track (phase-encoded)
X'C0'	1600	dual-density 9-track (phase-encoded)
X'C8'	800	dual-density 9-track (phase-encoded)

The operations performed by the Emulator Program are read, write, and control operations. Therefore, all logical IOCS functions (i.e., label checking, blocking/deblocking, etc.) remain the responsibility of the 1400 program with one exception. This exception is that the Emulator Program provides error recovery if mixed parity has not been specified for the given drive. A Tape Error Recovery routine is provided to simulate an operator-initiated diagnostic read and storage scan.

Load-mode operations are supported, but they are not overlapped with processing or other tape operations. This is because Load-mode operations must support checkpoint records, which require the combining of all tape I/O buffers. A 16K 1400 checkpoint, as written by SORT 7, requires a System/360 I/O area in excess of 16,000 bytes. Checkpoint is, therefore, not feasible on a System/360 with less than 64K.

The Emulator Program does not support read-ahead operations if the tape being read contains mixed even- and odd-parity records. When the Emulator Program recognizes a Read in the wrong mode, it sets the 1400 error indicator and returns to the 1400 program; thus, read-ahead operations on tape are impractical with mixed-parity tapes. Tape error recovery is performed by the 1400 program and not by the Disk Operating System. If the user wants the 1400 program to handle tape error recovery on a particular tape drive, he should specify mixed parity even though mixed-parity records are not on the tape.

1400 tapes written or read by the Emulator Program are completely compatible with those written under machine compatibility or on a 1400 system (provided 7-track tapes are used). System/360 volume and header

labels are not supported by the Emulator Program.

Tape Error Recovery

A Tape Error Recovery routine is provided as an option and is used in conjunction with an IGNORE response to a standard DOS data-check message. This routine is available only if "TAPERRS=xxx" is specified when the Emulator Program is generated ("xxx" may be LST, LOG, LSTCHAR, or LOGCHAR in order to define where and in what format the display is to take place).

The Tape Error Recovery routine provides a simulation of the diagnostic read and storage scan operations used on 1400 systems. These operations are simulated using the System/360 I/O area, so changes are not made by the operator to 1400 storage.

When a data-check condition is detected (after the DOS supervisor has tried to reread the tape block), a standard DOS error message is displayed by the operating system on the console. The only valid responses to this DOS message are CANCEL or IGNORE. The IGNORE response returns control to the Emulator Program, since it is the System/360 problem program that issued the I/O request.

When the operator enters IGNORE, the tape block is displayed on SYSLSL or SYSLOG by the Emulator Program. The first four characters of each line indicate the System/360 storage address of the first byte displayed (in hexadecimal). This address is followed by ten 8-byte fields of data. Nonprintable characters are translated to an asterisk (*), except the 1400 groupmark, which is translated as a dollar sign(\$).

After printing the entire error block, the following messages are typed on SYSLOG:

```
either      EC60I MESSAGE RESPONSES ARE B=BYPASS,
            P=PROCESS
or          EC61I MESSAGE RESPONSES ARE B=BYPASS,
            P=PROCESS, H=HEX-DISPLAY
followed by EC62D TAPE BLOCK IN ERROR
```

The output of message EC60I or EC61I is determined by the options specified at Emulator system generation.

A response of B causes the tape block in error to be bypassed and not given to the 1400. Processing continues with the next block. The 1400 is not informed that a block has been bypassed.

A response of P causes the tape block to be passed to the 1400 as is. Control then is returned to the 1400 program.

A response of H causes the error block to be displayed in hexadecimal format exactly as it was read into System/360 main storage. Parity is, of course, corrected by the channel. After the hexadecimal display, the operator again has the option of responding with a B or P.

Magnetic-Tape Data Representation

Nine-Track Tape Data: The 9-track magnetic-tape output of 1400 compatibility applications is similar to the 9-track tape format used with normal System/360 operations, except that parity is represented by bit 1 of the byte. This allows for the processing of mixed-parity data on 9-track tape. With even parity, each 6-bit Binary Coded Decimal (BCD) character is represented by its corresponding BCDIC-8 bit configuration. (See Table 16.) Bit 1 of the BCDIC-8 character is always on (1). With odd parity, each 6-bit BCD character is represented by its corresponding BCDIC-8 character representation as shown in Table 15. Bit 1 of the 8-bit BCDIC-8 byte is off (0).

Example:

Even parity: xlxxxxxx

Odd parity: x0xxxxxx

where "x" may be either 1 or 0.

A tape error is recognized during even-parity operations when bit 1 is a 0 and during odd-parity operations when bit 1 is a 1. The 9-track, Normal-mode, odd-parity tape format is not compatible with conventional EBCDIC System/360 tape. Its sole purpose is to preserve character compatibility between Emulators; for example, when card-to-tape operations are being performed on a 1401 Emulator and the output is to be input to a 1410 Emulator.

Alternate mode provides for the recording of either 6-bit binary or BCD data in standard EBCDIC format on 9-track tape operating in Compatibility mode. Use of Alternate mode is desirable when processing 6-bit binary information with System/360 programs.

If specified at Emulator system generation, the Alternate tape mode of operation sets bit 1 to 1 (see Table 16, note 1). The input/output (external storage) EBCDIC should not be confused with the internal code used with the Compatibility Features.

Seven-Track Tape Data: Seven-track tape data is represented exactly as it is on 1400-series systems. Seven-track tape requires that the appropriate 7-Track Compatibility Feature be installed on the tape control unit to convert BCD data to EBCDIC, and that the 7-Track Read/Write Head be installed on the magnetic-tape unit.

DIRECT-ACCESS SIMULATION

The Emulator Programs support up to five 1311 Disk Storage Drives or one module of 1301 Disk Storage on 2311 Disk Storage Drives or, alternately, five 1311 drives and/or one module of a 1301 drive on 2314 Direct Access Storage Facilities. Alternately, a Model 1 or Model 2 1405 Disk Storage may be simulated. Simulation of the 1405, however, excludes simulation of 1301/1311. The five 1311 drives may be simulated on as few as two-and-a-half or as many as five disk packs on 2311s. // ASSGN cards may be used at object time to assign each 1311 to a 2311 or a 2314, and a parameter in the // 1400 control card specifies which half of the 2311 or which quadrant of a 2314 is to be used for the 1311 file(s). Hence, any 1311 can be simulated on either half of any installed 2311 or on any quadrant of a 2314, with the necessary assignments made at object time.

One module of 1301 Disk Storage requires five complete 2311 Disk Storage Drives or two-and-a-half disk packs on 2314 modules. These 2311 drives and 2314 modules must be separate and distinct from any 2311 drives and 2314 modules used to simulate 1311 Disk Storage Drives.

The programmer logical units to be used for 1311 and 1301 simulation are assigned according to assembly parameter cards. Unless changed by the user, the following assignments for 1301 simulation on a 2311 are assumed:

<u>1301 Sector Address</u>	<u>Programmer Logical Unit</u>
000000-039999	SYS001
040000-079999	SYS002
080000-119999	SYS003
120000-159999	SYS004
160000-199999	SYS005

Unless changed by the user, the following assignments are assumed for 1301 simulation on a 2314:

<u>1301 Sector Address</u>	<u>Programmer Logical Unit</u>
000000-079999	SYS001 (Module 1)
080000-159999	SYS002 (Module 2)
160000-199999	SYS003 (Module 3)

The assignment of these logical units to physical units is accomplished with the // ASSGN card used by DOS Job Control.)

Both 1311 and 1301 are simulated by writing 100-character records without keys, 20 to the track. (Track record uses one 2980-character record without a key.) (See "Disk-Pack Initialization" in this section.

A 1405 may be simulated in lieu of 1311 or 1301. In this instance, two 2311 drives or one module of a 2314 facility are required for a Model 1 and four 2311 drives or two modules of a 2314 facility for a Model 2. As with 1311 simulation, the programmer logical units are assigned in the macro generation. Each 2311 contains twenty-five thousand and each 2314 module contains fifty thousand 200-character records.

All disk operations are supported, including Load mode, track record, sector count overlay, and scan disk. Disk errors are handled in System/360 mode, so the 1400 is never informed of disk error conditions. Therefore, those programs that depend on error conditions from disk in order to run may not run correctly (e.g., cylinder overflow). Seek operations are overlapped with subsequent processing or other I/O operations, as are write operations. Read operations are not overlapped, since the assumption is made that processing is random in most cases. Write-check operations may be optionally accomplished by specifying VERIFY=YES at assembly time. In order to provide maximum overlap, this write check is not performed when requested by the 1400 program, but is done on a delayed basis. If VERIFY=YES is not specified at assembly time, the 1400 program Write-Check instruction is treated as a No-Operation. However, when specified, the time for performing disk write operations may be increased by as much as 50 percent. The 1311/1301 disk control field is updated by a write-check operation.

Disk-Pack Initialization

Emulator/DOS 1311 and/or 1301 disk routines are designed to operate with formatted 1316 (on the 2311) and 2316 (on the 2314) disk packs. That is, each track must be written with either 100-character or 2980-character records without keys prior to accessing it under the Emulator Programs. This may be done using the DOS Initialize Disk and Clear Disk utility programs, with or without the option for assigning cylinder 200 as a prime data cylinder, and specifying the appropriate parameters for clearing or initializing tracks or sectors. The only times that the option for assigning cylinder 200 as a prime data cylinder is selected is when the user wishes to simulate: (1) two 1311 drives on one 2311, (2) four 1311 drives on one 2314 module, or (3) one module of the 1301 on either a 2311 or 2314.

The Emulator Program reads and writes 100-character records when the 1400 program requests sector operations (either Move or Load mode) and 2980-character records when the 1400 program requests track-record operations (either Move or Load mode). When Load-mode operations are performed, the 1400 program either gets or puts the first 90 characters of the 100-character records or the first 2682 characters of the 2980-character records.

The reason the Emulator Programs do not read and write 90- or 2682- character records is that such an approach makes it impossible for the Emulator Programs to alternately use a track for both Move- and Load-mode operations, such as is done in 1400 disk sort programs. The Model 30 stand-alone Compatibility Feature and the Model 40 stand-alone Emulator Program write compatible move-mode records on the first half of a 1316 (i.e., cylinders 1 through 100). However, Model 40 stand-alone emulator load-mode records on the first half of a 1316 are not compatible with the Emulator Programs under DOS because these load-mode records are 90 or 2682 characters in length.

1311 Disk Initialization: the Emulator Programs under DOS use cylinders 1 through 100 to simulate a 1311 on the first half of a 2311, just as straight compatibility does. (Tracks 0 and 1 of cylinder 0 are reserved for the volume label and VTOC and are not used by the Emulator Programs.) In addition, the Emulator Programs under DOS use cylinders 101 through 200 to simulate a 1311 on the second half of a 2311. On a 2314, the Emulator Programs use cylinders 1 through 50 and heads 0 through 19 to simulate a 1311 on the first quadrant, cylinders 51 through 100 and heads 0 through 19 to simulate a 1311 on the second quadrant, cylinders 101 through 150 and heads 0 through 19 to simulate a 1311 on the third quadrant, and cylinders 151 through 200 and heads 0 through 19 to simulate a 1311 on the fourth quadrant.

Users who run their programs under 1400 emulation under DOS first must initialize their disk packs using the DOS Initialize Disk utility program. If the user desires to simulate two 1311 drives on a 2311 or four 1311 drives on a 2314, he must use the stacked-disk option in the DOS Initialize Disk program. Normally, the user then runs the DOS Clear Disk utility program for clearing and formatting unstacked packs. For stacked packs, he uses the stacked-disk option in the DOS Clear Disk utility program.

In using the stacked-disk option in the DOS Clear Disk utility program, the user should specify a high expiration date of

99365 to reserve an extent in the VTOC, thus preventing Emulator-allocated space from being allocated to another file.

Since cylinder 200 normally is used for alternate tracks, users desiring to simulate two 1311 drives on a 2311 (four on a 2314) or a 1301 on a 2311 or 2314 must use the stacked-disk option in the DOS Initialize Disk utility program to initialize the 1316 or 2316 packs for use by the Emulator Programs. Normally, the DOS Initialize Disk program assigns defective tracks to alternate tracks beginning on cylinder 200 and indicates the correct number of unassigned alternate tracks in the Format 4 label. Optionally, tracks 2 to 9 of cylinder 0 and cylinders 201 and 202 are assigned as alternate tracks, with cylinder 200 assigned as a prime data track. If the entire disk pack is dedicated to emulation under DOS (stacked), cylinder 200 is used as a data track. If the entire disk pack is not dedicated (unstacked), cylinder 200 is used as an alternate track. If a pack that formerly used cylinder 200 as a data track is released for open-shop use, the pack should be reformatted with the normal option of the DOS Initialize Disk utility program prior to release.

AUTOCODER/COBOL assemblies can be accomplished under the Emulator Programs with generally improved timings. The AUTOCODER system pack can be simulated on either half of a 2311 or either quadrant of a 2314 and should be preformatted to all 100-character records. It can be built under the Emulator Programs from standard card input, using normal 1400 system generation procedures.

1301 Disk Initialization: Users of a 1301 drive on the 2311/2314 should initialize the 2311/2314 drives with the DOS Initialize Disk utility program, using the option for cylinder 200. The 2311/2314 drives should be cleared with the DOS Clear Disk utility program, using the option for cylinder 200 and specifying a key length of 0 and a data length of 100 for sector operations and a key length of 0 and a data length of 2980 for full-track operations.

1405 Disk Initialization: 1405 disk routines are designed to operate with formatted 1316 or 2316 disk packs; however, all operations (sector and track) require 200-character records. Load-mode operations are accomplished in the same manner as described for the 1311. The disk packs should be initialized normally with the DOS Initialize Disk utility program. The user must clear the 1316 and 2316 disk packs to 200-character records (key length of zero) with the DOS Clear Disk utility program from cylinder 1, head 0 to cylinder 193, head 9 for the 2311, and cylinder 1, head 0

to cylinder 110, head 19 for the 2314. Cylinders 111 to 199 of the 2314 module are available to the user, as are cylinders 194 to 199 of the 2311.

CONSOLE INQUIRY SIMULATION

Read and Write Console Printer instructions in Move or Load mode are supported when OSINQRY=1400 or YES. A single console Read instruction transfers up to 50 characters including wordmarks entered from the console and places a groupmark with a wordmark after the last character entered. A single console Write instruction types 200 characters or those characters preceding a groupmark with a wordmark. Wordmarks in Load mode count as a character. Read Console Printer instructions in Load mode can be executed. However, a groupmark/wordmark in 1400 storage does not lock the Printer-Keyboard, and the operator may continue to type data. When the Emulator Program encounters a groupmark/wordmark in 1400 storage while transferring data, data transfer is stopped. In order to determine if a groupmark/wordmark has stopped data transfer, the DISPLAY operator service function can be used. The Emulator Program does not support the functional control character tabulate (I). The console inquiry Q latch function is also supported when OSINQRY=1400 or YES.

The 1052 Printer-Keyboard emulates the 1407 or 1447 Console Inquiry Station. The correlation of the functions of the 1407/1447 with those of the 1052 are shown in Table 10.

There are certain differences between the 1407/1447 graphics and those of the 1052. The 1407/1447 record mark (+), exclamation mark (!), and question mark (?) are not produced by the 1052. Substituted for these special characters are the lower-case alphabetic "x", "p", and "g", respectively. A wordmark is represented on the 1052 by an underscore (_) preceding the character associated with the wordmark. A word separator character is represented as a lower-case w. The graphics of the 1052 that are dissimilar to those produced by the 1407/1447 are listed in Table 11.

DIFFERENCES IN PRINTER GRAPHICS

Wherever possible the Emulator Program attempts to translate 1400 BCD graphic symbols to corresponding EBCDIC graphic symbols. On the other hand, a number of the 1400 BCD graphic symbols are not on the standard System/360 printer chains. The Emulator Program, therefore, translates these BCD symbols to EBCDIC symbols that can be printed.

Table 10. Correspondence of 1407/1447 Functions With 1052 Functions

1407 Function	1447 Function	1052 Function
REQUEST key	TYPE key	Console INTERRUPT key "EC40D TYPE IN FUNCTION" "INQUIRY 1400" reply ALTN CODING KEY AND "5" key (EOB)
ENTER light	PROCEED light	PROCEED light
RESPOND key	RELEASE key	ALTN CODING key and "5" key (EOB)
CLEAR key-light	CANCEL key-light	For Read Operation: ALTN CODING key and "0" key (CANCEL)

Table 11. Dissimilar Graphics: 1407/1447 vs. 1052

1407/1447 Character	Corresponding 1052 Character
:	'
✓	"
>	=
š	:
#	?
π	<
Δ	γ
[(
#	
<	+
\	>
])
?	g
!	p
b	space
~	w
#	x

Table 12. Translated Codes and Graphic Symbol Differences

Card Code	BCD Graphic Symbol	System/360 8-Bit Code Sent to the Printer	EBCDIC Graphic Symbol
12-8-5	[0100 0000	blank
12-8-6	<	0100 0000	blank
12-8-7	#	0100 0000	blank
12	ε +	0101 0000	ε
11-8-5]	0100 0000	blank
11-8-6	;	0100 0000	blank
11-8-7	Δ	0100 0000	blank
0-8-5	~	0100 0000	blank
0-8-6	\	0100 0000	blank
0-8-7	#	0100 0000	blank
8-2	š	0100 0000	blank
8-5	:	0100 0000	blank
8-6	>	0100 0000	blank
8-7	✓	0100 0000	blank
12-0	?	0101 0000	ε
11-0	!	0110 0000	-
0-8-2	#	0100 1110	+

Table 12 lists these "unprintable" BCD symbols and indicates the EBCDIC translation for each.

The Emulator Program uses a translation table (ALSTABLE) to translate these special BCD symbols. ALSTABLE can be modified to enable the Emulator Program to print any of the special BCD symbols that may be on a non-standard System/360 printer chain.

The Print Word Mark instruction is emulated as in the 1460 system. A groupmark character is printed in the wordmark line as "2"; a groupmark with wordmark as "3".

CONTROL CARDS

EMULATOR JOB CONTROL CARDS

The job control cards for 1400 programs appearing in a job stream should be as follows:

// JOB jobname

// ASSGN

If 1400 devices are reassigned.

// UPSI

The User Program Switch Indicator (UPSI) card is used to set 1400 sense switches. UPSI bits 0-6 coincide with sense switches A-G. A 1 in the appropriate bit position indicates that the sense switch should be initially set on for this run; a 0 indicates off. All sense switches are initialized off when a // JOB card is encountered. Sense switch A should not normally be set on for a run unless the user wants the first 1400 test for last card to be successful. The Emulator Program sets sense switch A on when it encounters a /* card.

// EXEC euname

"euname" is the name given by the user to his Emulator Program. It is the same name as that punched into the name field of the EU30/EU40 macro when it was generated.

// 1400

Always required. See "The // 1400 Control Card" in this section.

// TAPE

If nonstandard block sizes, mixed parity on 7-track, or 9-track compatibility is desired. See "The // TAPE Control Card" in this section.

// DVOL

Verification of a given volume serial number(s) for a disk pack(s) accessed by the Emulator Program is desired. See "The // DVOL Control Card" in this section.

// CCTL

If the carriage-control-tape image option is desired. See "The // CCTL Control Cards" in this section.

1400 object deck
or

// FETCH card
and/or

1400 data cards

/*

Always required.

/&

If end of job stream.

If DOS is logging job control statements (// OPTION LOG card before the // EXEC card), the Emulator control cards are printed on SYSLOG in card-image format. It is possible to correct Emulator Control card errors (on // 1400, // TAPE, // DVOL, and // CCTL cards) by typing a correct response on the console typewriter. If LOG is specified, the control card in error will be the last card printed on the console output. Information on an invalid control card is not accepted by the Emulator program. (See Operator Message EC29D.)

THE // 1400 CONTROL CARD

Each 1400 program to be executed under the Emulator Program requires, immediately following the // EXEC card, an Emulator control card of the following format:

// 1400 name,a,b,c,d,e,f₀f₂f₄f₆f₈,g,hhhhh

There can be only one // 1400 control card per job step. Until a valid // 1400 control card is read or the job is cancelled, any other card read is considered a control card error.

The card is free form in the same manner as all other job control cards. At least one blank must separate the "/" from the operation code (1400) and at least one blank must separate the operation code from the operands. The operands are positional and conform to the standard rules for writing positional parameters; that is, any or all operands may be omitted, but if one operand is omitted and a following operand

is included, the comma following the first operand must be included. Embedded blanks are not allowed.

For example:

// 1400

All operands have default values.

// 1400 PAYROL,,b,,,e

Operands "a", "c", "d", "f₀f₂f₄f₆f₈", "g", and "hhhhh" have default values.

// 1400 ,a,b

The name is blank and all operands after "b" have default values.

The meaning of the operands and their default values are:

name

specifies the name of the 1400 program to be executed. This name is used in logging the start and end of job messages, and is the name under which the 1400 program is cataloged in the Core-Image Library if cataloging is requested. This operand may consist of from 1 to 6 characters or may be omitted. If used in the catalog function, it should be 6 characters. Names less than 6 characters in length are left-justified and filled with blanks when they appear in the start and end messages. If "name" is greater than 6 characters, only the first 6 bytes are used.

a

specifies the 1400 load device. This parameter may be a 1, 2, C, D, or it may be omitted. Omitting this parameter is equivalent to making it a 1. The meanings of the values of "a" are:

1

specifies that the 1400 program is to be loaded from cards, or from SYSRDR if SYSROPT=YES was specified, or from the unit assigned to SYSIPT, and immediately follows the // 1400 control card, and // TAPE, // DVOL, and // CCTL control cards if included. If the user wishes to have the Emulator Program move the input/output control system (IOCS) date ("yyddd") into those positions in which 1400 logical IOCS expects it (82-86 and 195-199), he should remove the two clear-storage cards from his 1400 object program. The Emulator Program clears 1400 storage to blanks.

2

specifies that the 1400 program is to be loaded from the logical tape drive

corresponding to 1400 tape drive 1, just as if the operator had pressed the TAPE LOAD key on a 1400. In this case, data cards or, if no card input, a /* card immediately follows the // 1400 control card and any other associated control cards.

C

specifies that the 1400 program is to be loaded from cards, but is not to be executed. Instead, the Emulator Program punches a System/360 object module from the 1400 program that can be cataloged by the user into his Core-Image Library. The 1400 object deck (or overlay) must immediately follow the // 1400 control card. Overlay programs may not be cataloged on the Model 40.

D

specifies that the 1400 program is to be loaded from the Core-Image Library and executed. In this case, the // FETCH card, punched by the Emulator Program as a part of the catalog function, must immediately follow the // 1400 control card, or // TAPE, // DVOL, and // CCTL control cards if included. Otherwise, the job is cancelled.

b

when cataloging is not being done, this parameter is used to specify a 1400 storage dump on an abnormal job termination. If this parameter is omitted or if it is other than a 1, a 1400-style main storage dump accompanies abnormal job termination. In addition a System/360 main storage dump is provided if the test-mode option in the // 1400 control card is specified as "S". If "b" is a 1, no dump occurs. Parameter may be coded a 1 if preprinted forms are in SYSLST or SYSLST is assigned to a magnetic unit. This parameter takes on special meaning when the catalog option is being executed. By coding this parameter with a 1 (scan for 1728 blanks), the catalog routine will interpret this to mean that either a non-overlaying 1400 program, or the first (root) section of an overlaying 1400 program is being cataloged. This will conserve library space and improve retrieval time. Subsequent sections of overlaying 1400 programs must not specify a 1 in this parameter when cataloging. This parameter has its normal meaning when the 1400 program is actually executed.

c

specifies an input card stacker option for 1402 simulation or both the input and output stacker options for 1442

simulation. This parameter can be used to specify simulation of Read Stacker Select instructions or to specify a stacker for all input cards following the // 1400 control card up to and including the /* card. On the Model 40, the parameter is also used to specify a 1400 branch-on-reader-error option. In addition, this parameter is used on the Model 30 to request 402/403 MLP code conversion.

The proper values for "c" are 1, 2, 3, 4, 5, 6, 7, or omitted. If this parameter is omitted, all cards go into stacker 1.

If "c" is coded as a 1 or 2, all input cards are read ahead and directed to the R2 or RP3 stackers, respectively. This is the recommended coding, since card-read speed is maximized and full overlap occurs.

If "c" is coded as a 3, input cards are not read ahead, but are stacker-selected according to the 1400 program. (READRSS=YES must be specified when the Emulator Program is generated.) A // LC card must be placed just ahead of the last data card the 1400 program is to read. The card, which is not passed to the 1400, is directed to the R1 stacker. A /* card should be included following the last data card. It should be noted that a reduction in card throughput results if stacker selection is simulated. This parameter, if specified as 3, is ignored for a catalog operation.

If "c" is coded as a 4, 5, 6, or 7, the same stacker select options are provided as when the parameter is omitted, or coded as a 1, 2, or 3, respectively. In addition, on the Model 40, the 1400 branch-on-reader-error option is activated. When an invalid BCD character is encountered by the reader, control is returned to the 1400 program to process the reader error, and message EC49 is suppressed. On the Model 30, the 402/403 MLP codes are converted to numeric as they are encountered by the reader.

d

specifies either a punch stacker select option or a punch option depending on the 1400 device to be simulated. The meanings for the value of "d" are:

When simulating a 1402, "d" specifies a punch stacker select option for 1402 simulation. If "d" is a 1 and PUNCHSS=YES is specified when the Emu-

lator Program is generated, punch stacker selection is simulated. If "d" is other than a 1, or if it is omitted, all punched cards are directed to the normal punch stacker. Using this parameter for a program in which Punch Stacker Select commands are not issued results in a loss of punch overlap. If SYSPCH is assigned to a tape or disk device, 80- (no stacker selection) or 81-character (with stacker selection) records are written based on this parameter. In the latter case, the first character is the DOS code for stacker selection.

When simulating a 1442 card read punch, "d" specifies whether or not punching into the same card is required when a 1442 Card Read Punch is being simulated by a 1442 or 2520 Card Read Punch. If "d" is a 1, read punch update is desired and input cards are not read ahead. If "d" is omitted or specified as other than a 1, input cards are read ahead.

e

specifies a 1400 halt option. If "e" is a 1, operator restart is possible after 1400 halts other than end of job. (See "Operator Messages" in the "Console Messages" section.) If "e" is other than a 1, or if it is omitted, 1400 halts other than end of job are considered abnormal termination and result in the termination of the 1400 job. If OSDUMP=YES is specified at Emulator Program generation, a 1400-style main storage dump is provided.

f₀f₂f₄f₆f₈

specifies a disk part option. The five characters in the parameter correspond to 1311 disk drives 0, 2, 4, 6, and 8, respectively. A disk part option may be specified for each of the five drives starting with drive 0. If less than five are specified, the high-numbered drives are defaulted to 0. Each character of the parameter may be coded as either a 0 or a 1 for simulation on a 2311, and a 0, 1, 2, or 3 for simulation on a 2314.

For simulation on a 2311, a 0 indicates that the respective 1311 drive is to be simulated on the first 100 cylinders of the 2311 to which this file is assigned; that is, cylinders 1 through 100. A 1 indicates that the respective 1311 drive is to be simulated on cylinders 101 through 200 of its assigned 2311 unit. For simulation on a 2314, a 0 indicates that the respective 1311 drive is to be simulated on cylinders 1-50, using heads

0-19, of the first quadrant of the
2314 to which this file is assigned.

A 1 indicates that the respective 1311 drive is to be simulated on cylinders 51-100, using heads 0-19, of the second quadrant of the 2314 to which this file is assigned. A 2 indicates that the respective 1311 drive is to be simulated on cylinders 101-150, using heads 0-19, of the third quadrant of the 2314 to which this file is assigned. A 3 indicates that the respective 1311 drive is to be simulated on cylinders 151-200, using heads 0-19, of the fourth quadrant of the 2314 to which this file is assigned.

Examples:

- 01010 - 1311 disk drives 0, 4, and 8 are to be simulated on the first 100 cylinders of their assigned 2311 units, which must be different 2311 units. 1311 disk drives 2 and 6 are to be simulated on the second 100 cylinders of their assigned 2311 units, which must be different units.
- 01230 - 1311 disk drive 0 is to be simulated on cylinders 1-50, using heads 0-19, of the first quadrant of the assigned 2314. 1311 disk drive 2 is to be simulated on cylinders 51-100, using heads 0-19, of the second quadrant of the assigned 2314. 1311 disk drive 4 is to be simulated on cylinders 101-150, using heads 0-19, of the third quadrant of the assigned 2314. 1311 disk drive 6 is to be simulated on cylinders 151-200, using heads 0-19, of the fourth quadrant of the assigned 2314. 1311 disk drive 8 is to be simulated on cylinders 1-50, using heads 0-19, of the first quadrant of the assigned 2314, which must be a different 2314 than the unit to which drives 0, 2, 4, and 6 are assigned.

Note: Stacking of disk packs can reduce disk throughput to the 1400 program if sequential access organization is being used.

g specifies a test-mode option. This parameter is coded either S or T (or TEST). The meanings for the values are:

T specifies that the 1400 program is to be executed in the "Test Mode" which causes 1400 program errors to be trapped automatically to the Operator

Services routine in the Emulator Program. This permits the operator to attempt to restart the 1400 program using the operator service functions. A 1400 style storage dump is provided automatically if OSDUMP=YES is specified at Emulator Program generation.

S provides all of the "Test Mode" functions provided by "T". Additionally, provides a System/360 main storage dump following 1400-style storage dumps.

If "g" is coded other than an S or T, or if it is omitted, 1400 program errors result in an abnormal job termination.

hhhhh End-of-job instruction address (I-STAR) option. When the Emulator Program is generated, standard end-of-job halt indications can be specified through the EOJAADR and EOJBADR parameters. If the user has standard end-of-job halts, the Emulator Program will automatically transfer control to DOS Job Control upon encountering a halt instruction whose A and/or B address equaled the values specified by the EOJAADR and EOJBADR parameters. The "hhhhh" parameter, issued at execution time, enables the user to supply the instruction address of the end-of-job halt unique to the particular 1400 program. The EOJ halt instruction address is always compared first to the contents of the A- and/or B-address registers (if the parameters were specified) and then is compared with the value supplied in this parameter. All comparisons are made upon encountering a 1400 halt instruction but before its execution is completed. This parameter is specified as a five-digit decimal number with leading zeros and having a maximum value of 15999.

THE // TAPE CONTROL CARD

Standard tape I/O buffer assignments are made when the Emulator Program is generated through the "BLKSIZu=nnnn" parameters, where "u" refers to the 1400 tape unit number. These standard buffer assignments may be changed at execution time through the use of the // TAPE control card. The general format of the // TAPE control card is as follows:

// TAPE u₁=nnnnn,y,u₂=nnnnn,y,...

The card is free form in the same manner as all other job control cards. At least one

blank must separate the "/" from the operation code (TAPE) and at least one blank must separate the operation code from the operand(s). The operands are positional and must be separated from each other by a comma; the first blank encountered terminates the operands. The remainder of the card may be used for comments. As many // TAPE control cards as desired may be used. However, cards that decrease buffer size from the standard values must precede cards that increase buffer size. Continuation cards are not allowed. The tape buffers are reset to the standard values upon termination of each 1400 program. The meaning of the operands are as follows:

u specifies the number (from 1 to 6) of the 1400 tape unit to be assigned to the I/O buffer area.

nnnnn specifies the amount of storage to be allocated for the tape I/O buffer. This value must exceed by at least one byte the physical block size of all records read or written from this unit in the Move mode.

y specifies the mode of 7- or 9-track tape that is being used. "y" may be either an A or B. The meanings for these values are:

A For 7-track tape; either even, odd, or mixed parity as determined by the mode specified in the 1400 program instruction.

For 9-track tape; either even, odd, or mixed parity as determined by the mode specified in the 1400 program instruction. Parity is indicated by the setting of bit 1. For example:

even parity: X1XXXXXX
odd parity: X0XXXXXX

where X may be either a 0 or 1.

B For 7-track tape; the mode specified in the DOS // ASSGN card.

For 9-track tape; alternate mode (Bit 1 = 1). For example:

even parity: X1XXXXXX
odd parity: X1XXXXXX

where X may be either a 0 or 1.

"A" may be specified only when TAPEMOD=MXEDPAR is specified at Emulator Program generation. When "A" and "MXEDPAR" are

specified, tape errors are passed to the 1400 program for processing.

If parameter "y" is omitted, "B" is assumed. Even though the "y" parameter is positional, if the "y" parameter is omitted, the comma must be omitted.

Examples:

// TAPE 3=1000,A

1400 tape drive 3 is allotted 1000 bytes of the tape buffer area, which allow a maximum of 999 characters to be read or written as one physical block on 1400 tape unit 3 in the Move mode. In addition, 1400 tape unit 3 is assigned to a tape to be written in mixed, odd or even parity.

// TAPE 1=0,2=580

1400 tape drive 1 is not used in this program, freeing the standard block size for unit 1 for use by any other unit. 1400 tape drive 2 is allotted 579 bytes of the tape buffer area.

THE // DVOL CONTROL CARD

The optional // DVOL control card identifies the volume serial numbers of disk packs for which volume serial number verification is to be performed by the Emulator Program at initialization time. To use this option, the DVOL=YES parameter must be specified at Emulator Program generation time. Verification is performed between the data specified in the control card and the unique volume serial number in the Standard Volume Label. The general format of the // DVOL control card is as follows:

// DVOLyyyy DISKn=xxxxxx,...

Where "yyyy" is the 1400 DASD device type for which verification of volume serial number is to be performed. "yyyy" must be specified as either a type 1301, 1311, or 1405.

The card is free form in the same manner as all other job control cards. At least one blank must separate the "/" from the operation code (DVOL) and at least one blank must separate the operation code from the operand(s). As many // DVOL control cards as desired may be used; continuation cards, however, are not allowed. The meaning of the operand is as follows:

DISKn

specifies the 1400 disk drive on which the disk pack is mounted. "n" is the 1400 disk drive number (0, 2, 4, 6, or 8). See the "DISKu=SYSnnn and D1301u=SYSnnn" parameters under "Description

of Disk Parameters" in the "Program Generation" section.

xxxxxx

specifies the volume serial number (six alphanumeric characters).

Although the use of the // DVOL control card is optional, it is recommended that the volume serial number verification capability be used to avoid the possibility of the 1400 program accessing the wrong disk pack in the DOS multiprogramming environment. Additional verification may be performed at the operator's option for 1311 direct-access storage devices assigned through the DVOL DISKn and DVOL DISKn=xxxxxx operator service functions. (See "Available Functions" in the Operator Service Functions section.) The operator initiated option is not available for 1301 and 1405 direct-access storage devices because they are considered fixed devices that are not changeable during execution of a 1400 program.

THE // CCTL CONTROL CARDS

The // CCTL control cards provide the Emulator Program with the carriage-control-tape image. The CARRCTL=YES parameter option must be specified at Emulator-Program generation time to use this option. If only one card is needed to define the carriage-control-tape image, the // CCTL control card should be used. If two cards are needed, the // CCTL1 and // CCTL2 control cards should be used. A CCTL1 card must be read before a CCTL2 card is considered valid. If a CCTL1 card is read, there must be a CCTL2 card or the job will be cancelled. The formats of the // CCTL control cards are as follows:

1	3	4	9	10	80
//	CCTL	'Lines 1-69 of the carriage tape image' (up to 69 lines)			

1	3	4	9	10	80
//	CCTL1	'Lines 1-69 of the carriage tape image' (up to 69 lines)			

1	3	4	9	10	74	80
//	CCTL2	'Lines 70-132 of the carriage tape image' (up to 63 lines)				

Note: 132 lines is the maximum form size for the 1403 or 1443 printer.

The card is free form in the manner of other job control cards. At least one blank must separate the "/" from the operation CCTL (or CCTLn) and at least one blank must separate the operation from the carriage tape image. An apostrophe is used to delimit the image in each card. Although the card is free form, it is suggested that the apostrophe be in column 10 of the first card to simplify the positioning of the control punches. If this is done, adding 10 to the line number of the control tape will determine the line location on the card. Thus, tape line 4 would be positioned in column 14 (see Figure 5). Frequently, carriage-control tapes are made with the form image repeated several times. One image in the // CCTL card(s) is all that the Emulator Program requires, however, the form image may be repeated exactly as on the carriage-control tape. Each column in the card represents a line on the carriage-control tape, and the rows of the card correspond to the channels of the tape. The punches are as follows:

Card Punch	12	11	0	1	2	3	4	5	6	7	8	9
Channel Punch	12	11	10	1	2	3	4	5	6	7	8	9

A maximum of two punches is allowed in each card column; if there are two punches, one must be a 12 or 9 punch.

At 1400-program execution time, the Emulator Program automatically initializes the carriage-control tape on the printer to channel 1.

A carriage-control tape and a // CCTL control card for an 11-inch form to be printed at 6 lines per inch is illustrated in Figure 5. A carriage control tape and // CCTL control cards for a 14-inch form to be printed at 6 lines per inch is illustrated in Figure 6.

READ OPERATION CONTROL CARDS

Six read operation control cards are used by the Emulator Programs to control 1400 program read operations. These cards, when required, must be placed at appropriate positions in the 1400 program data cards.

The read operation control cards (with the exception of the // FETCH card) are prepared by the user in a standard format. All cards are punched with a // in columns 1 and 2, a blank in column 3, and the operation code in columns 4 and 5. The // FETCH card is punched in the proper format by the Emulator Program during cataloging operations. The functions of the control cards are as follows:

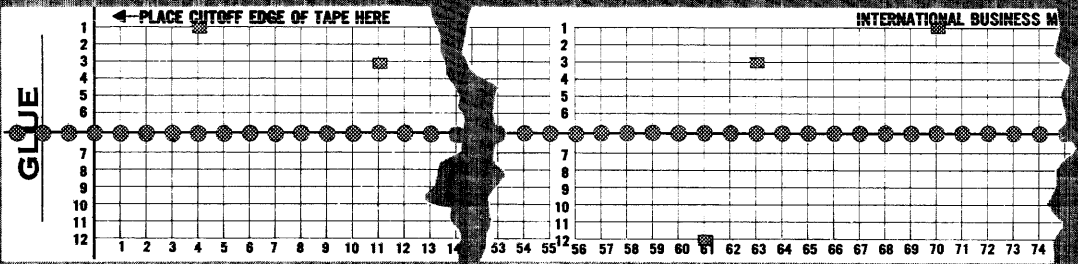
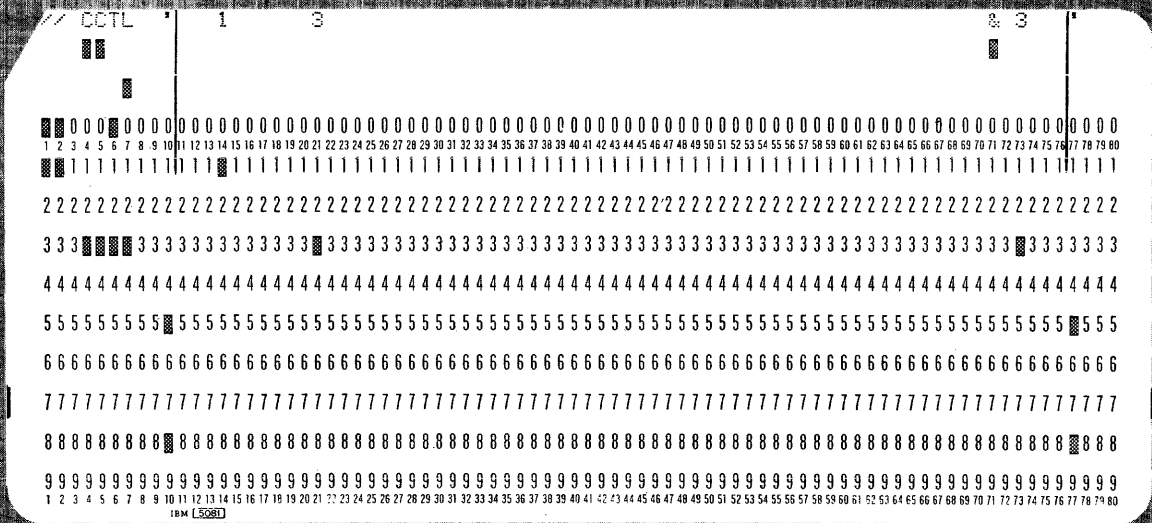


Figure 5. Carriage-Control Tape and // CCTL Control Card for 11-Inch Form

// CB - This card is required only when performing column-binary operations. The control card must be placed following the // 1400, // TAPE, // CCTL, and // DVOL emulator job control cards, and prior to the first column-binary data card. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

// FETCH - This card is automatically produced by the Emulator Programs during a catalog run of a 1400 program. The card is required only when executing a cataloged 1400 program. (For more details, see "Fetching" in the section on "Programming Considerations.")

// LC - This card is used as a data delimiter card, and is required by the Emulator Program when performing either 1442 read-punch-update simulation, or read-stacker-select simulation. This card is placed just prior to the last data card in the deck. Although this card is not required for other opera-

tions, it is suggested that both the // LC and the conventional /* cards be used. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

// IP - This card is required when the user desires to read Emulator job control cards from SYSRDR and 1400 programs or data from SYSIPT. If the SYSROPT parameter is specified YES, the // IP control card is optional, but must be in the customer's deck if he wishes the job stream transferred from input on SYSRDR to SYSIPT during 1400 program execution. However, if the // IP control card is used, the SYSROPT parameter must be specified YES. Upon encountering the // IP control card, reading operations are transferred from SYSRDR to SYSIPT. Thus, when this card is used, SYSRDR and SYSIPT should be assigned to separate devices. The SYSIO parameter must specify SYSIPT on the desired type of device (SYSIO=i00). The // IP control card is placed in the SYSRDR job stream

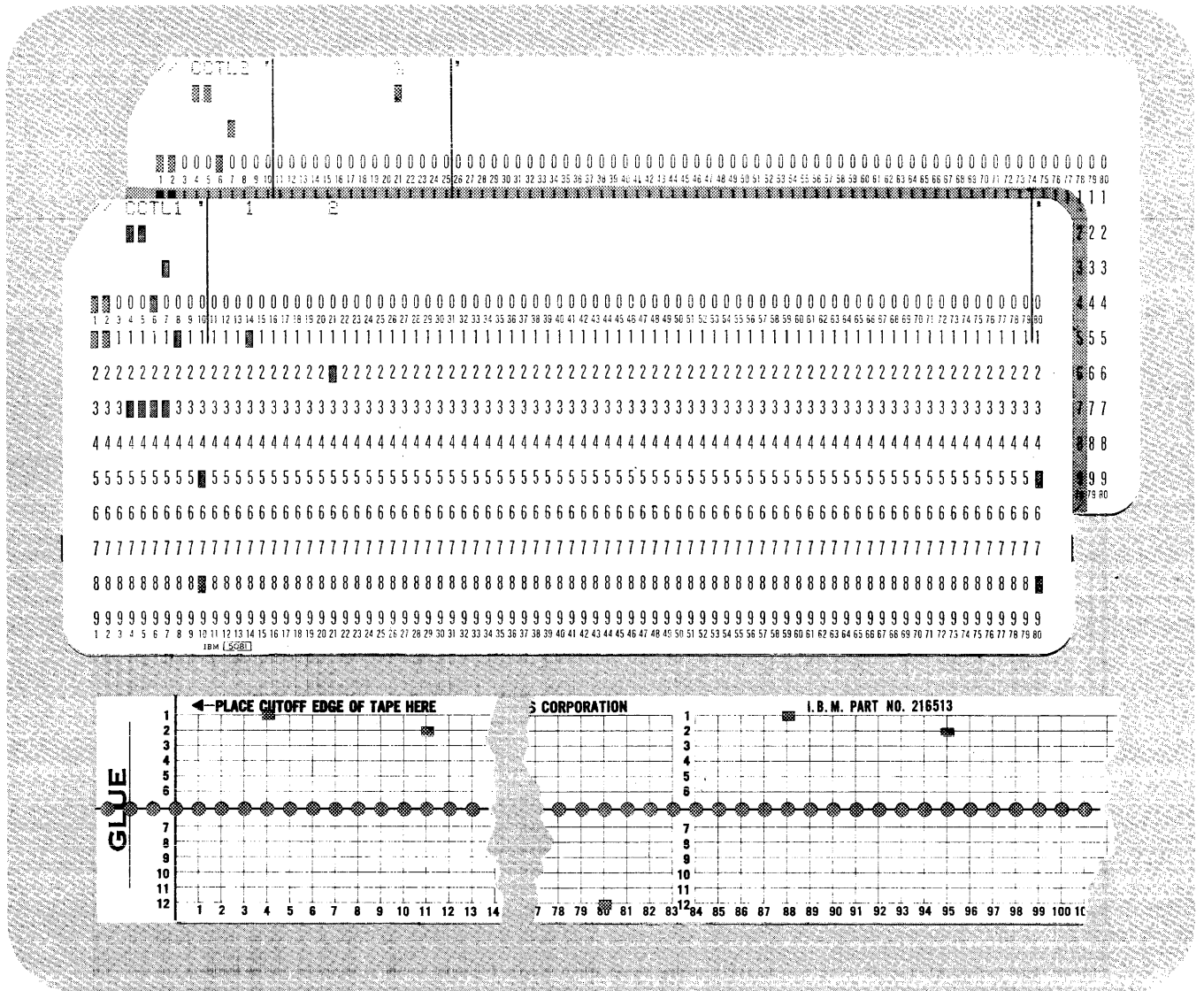


Figure 6. Carriage-Control Tape and // CCTL Control Cards for 14-Inch Form

following the // 1400, // TAPE, // CCTL, and // DVOL emulator job control cards. The only read operation control card that may be included in the same program as this control card is the // FETCH card. The // FETCH card may either precede or follow the // IP card. Reading operations are returned to SYSRDR by the DOS Supervisor following 1400 end of job.

// PR - This card is required only when simulating 1442 punch-feed-read operations on a System/360 2540 Card Read Punch. Since cards are not preread during punch-feed-read operations, a // LC card must also be included. The // PR card conditions the Emulator Program, to read all of the following cards from the punch side of the 2540. Thus, all data

cards, including the // LC control card and the conventional /* card must be on the 2540. For proper operation a blank card must be placed in front of the first data card.

// 51 - This card is required only when performing 51-column cut card operations. The control card must be placed just prior to the first 51-column data card. The control card causes an operator message to be issued requesting the operator to mount the 51-Column Interchangeable Read Feed Feature.

The control cards // CB, // IP, // PR, and // 51 are mutually exclusive and combinations of these cards in the same 1400 program are not supported.

PROGRAMMING CONSIDERATIONS

INQUIRY

Standard System/360 inquiry programs can be called from the Core-Image Library and executed while under control of the Emulator Program if OSINQRY is specified at Emulator system generation. This should not be confused with the multiprogramming facilities of DOS, since the inquiry program is called as a background program phase. All 1400 program processing is stopped while an inquiry program is being executed. Inquiry programs that have already been written in Assembly Language require minor modifications to be linkage-edited and called under the Emulator Program because certain programming considerations must be met:

- The inquiry program must be linkage-edited with the generated Emulator Program. The PHASE card required for the inquiry program is as follows:

```
PHASE progname,INQPROG
```

where INQPROG is a label defined in the Emulator Program as an ENTRY. The "progname" must adhere to standard phase name restrictions and is the name used by the operator when requesting an INQUIRY.

- The program must not exceed 2,980 bytes of storage; it may, however, contain multiple overlay phases.
- Upon completion of the inquiry program, when the user would normally code the EOJ macro, control is passed back to the Emulator Program, and in turn back to the 1400 program, by executing the following instructions:

```
L 1,=V(INQEXIT)  
BR 1
```

- Any I/O device may be used except the card reader and the magnetic-tape units used by the 1400 program. Disk-storage drives may be referenced by the inquiry program without interfering with the 1400 program. The user is cautioned against altering data on disk that is being referenced by the 1400 program because the result of the 1400 program may not agree with expected control totals.

CATALOGING

CATALOGING 1400 PROGRAMS INTO THE CORE-IMAGE LIBRARY

One of the major benefits of System/360 operating systems is the ability to catalog and fetch programs from the Core-Image Library rather than having to load each program from the card reader. Emulation under DOS provides this function for the compatibility user. Through the use of the Emulator Program, 1400 programs may be converted into System/360 object modules. These object modules are then cataloged in the Core-Image Library in the normal DOS manner. Thereafter, the Emulator Program is able to fetch 1400 programs as they are needed in the job stream. The 1400 programs may be in any form of object deck that is loadable from the card reader. However, only 1400 programs for the Model 30 may consist of overlays.

Briefly, the method for converting a 1400 object deck into a System/360 object module is as follows. The 1400 program (or overlay section) is allowed to load itself into System/360 main storage in the normal manner under control of the Emulator Program. Immediately following the 1400 END or XFR card is a /* card. This /* card signals to the Emulator Program that the 1400 program or overlay has been loaded. Because the Emulator Program is a card read ahead of the 1400, the situation at that point is that the END or XFR card has been passed to 1400 storage, but control has not yet been returned to the 1400 Compatibility Feature. Hence, the 1400 program has been effectively cut off just at the point at which it was to execute the program.

The Emulator Program can therefore save the current 1400 address registers and, providing the 1400 storage area can be restored to the way it now looks and the address registers returned, 1400 processing may be restarted at any time in the future. 1400 storage may be saved easily if it is punched out in the form of an object module. The Emulator Program translates what it finds in the 1400 storage area into ESD, TXT, END, and ENTRY cards.

There are two methods of representing 1400 storage as an object module. The method chosen by the user is indicated to the Emulator Program at execution time by use of the // 1400 control card parameters "a" and "b". (Refer to the section on

// 1400 Control Card for a description of these parameters.)

Method 1 - Scan for 1728 Blanks: This method should be used for 1400 programs which do not contain overlays. This method punches an object module from 1400 storage as a series of non-contiguous phases. Any area of 1728 or more consecutive blanks is not cataloged in the DOS Core-Image Library. Since the Emulator Program initializes all of 1400 storage to blanks prior to loading the 1400 program, this should present no problems to the user. This method offers:

- Conservation of space in the DOS Core-Image Library
- Fast retrieval due to the low number of phases to be loaded

Method 2 - Scan for 100 Blanks: This method should be used when 1400 overlay programs are to be cataloged on the Model 30. (1400 overlay programs on the Model 40 are restricted due to the non-contiguous layout of simulated 1400 storage.) This method also punches an object module from 1400 storage as a series of non-contiguous phases. Any area of 100 or more consecutive blanks is not cataloged in the DOS Core-Image Library. This approach yields a greater number of phases than Method 1, and the Emulator Program will abort cataloging if the number of internal phases exceeds 27. However, this method offers the ability to catalog most 1400 overlay programs on the Model 30.

For both methods, scanning of 1400 storage is contiguous from the start of 1400 storage to the end. As soon as a character other than a blank with no wordmark is discovered, a phase is assumed to begin, and the scan of main storage continues. Eventually, another blank with no wordmark is found. At that point, the address of the last nonblank is saved as being the tentative phase end, and the scan continues. If 100 (or 1728) consecutive blanks are found, the phase is considered to have ended at the last nonblank. If less than 100 (or 1728) consecutive blanks are found, the tentative phase end address is updated, and the phase is assumed to include embedded blanks. This causes no problems for the Model 30 Emulator Program since 1400 storage addresses run contiguously. For the Model 40 Emulator Program, however, all of the storage area is cleared to 1400 blanks and, even though 1400 addresses are noncontiguous, memory is scanned sequentially on the assumption that some blank areas can be eliminated.

In short, a 1400 storage load is punched by the Emulator Program as one or more

internal phases. Each phase is considered to be terminated by either 100 (or 1728) consecutive blanks or the highest 1400 storage address.

The user should keep two important facts in mind. First, that a 1400 storage load may be either an entire program or merely an overlay. An Emulator-Program catalog run is required for each overlay in a program and is done using Method 2. Second, that a nonblank (such as a record mark or blank with a wordmark) that is preceded and followed by at least 100 blanks is cataloged as a separate phase. This could lead to inefficient use of the Core-Image Library and should be avoided where possible.

The Emulator Program used to catalog a 1400 program need not be the same that fetches it. Nor is it necessary for 1400 storage to occupy the same absolute System/360 addresses in the Model 30 Emulator Program since Model 30 1400 storage is relocatable. Programs cataloged by the Model 30 Emulator Program, however, cannot be fetched and executed by the Model 40 Emulator Program, and vice versa.

OVERLAY PROGRAM CONSIDERATIONS

Normally, each 1400 program overlay section must be cataloged in a separate run of the Model 30 Emulator Program. This requires that the user know his 1400 object decks well enough to determine where overlay transfer cards are located. The user should have little difficulty, however, since the overlays were planned in the writing of the 1400 program.

In at least two instances, overlay programs occur when the user does not plan for them. The 1400 input/output control system (IOCS) on disk, when assembling disk IOCS (DIOCS) entries for a program using magnetic tape, causes an overlay in order to create a character in the program that is not readable from a card (substitute blank). Similarly, all 1400 COBOL programs in which constants are defined in the Working Storage or Constants Sections, include an overlay. In this instance, the overlay is used to move the values of the constants to the main storage positions that they occupy during execution of the program. Neither of these cases require separate cataloging, even though an overlay is involved, nor does the overlay restriction apply for the Model 40. In effect, the overlay may be ignored. The reason for this is evident from a consideration of the purpose of the overlay. The sole purpose of the overlay is to arrange 1400 storage prior to beginning execution of the program. Therefore, if it is feasible or possible to load main

storage directly as desired, no overlay is necessary. Hence, COBOL programs in which the user has not entered AUTOCODER in order to cause a deliberate overlay may be considered to be non-overlapping. Similarly, tape or disk AUTOCODER programs in which the user has not specifically programmed an overlay may also be considered non-overlapping.

The method described for cataloging overlay programs will work for all overlays on the Model 30 except when:

1. An overlay segment attempts to selectively alter (through the use of ORG statements or patching) coding that existed in a previous segment unless at least 100 bytes of blanks exist between segments.
2. The programming practice of initializing counters set up in a previous overlay through the technique of "loading" zeroes is employed.
3. The index register area is overlaid by subsequent phases. (The Model 30 Emulator Program solves this problem during actual execution by saving and restoring the 1400 index registers before and after loading subsequent segments of overlaying programs.) The saving and restoring of 1400 index registers by the Emulator Program causes the user problems if reinitialization of the 1400 index registers is actually desired.

Therefore, programs in the above categories will not execute correctly, and thus, should not be cataloged.

In summary, programs cataloged with the Model 30 Emulator Program cannot be executed with the Model 40 Emulator Program, and vice versa. In addition, since 1400 storage is cleared between catalog runs, those multiphase 1400 programs that require 1400 data or instructions to be resident in 1400 storage as a result of a previous phase cause difficulty to the user and are, therefore, restricted. Also, overlay programs on the Model 40 are restricted from cataloging due to the non-contiguous nature of simulated 1400 storage.

PROCEDURES FOR CATALOGING 1400 PROGRAMS

If the 1400 program to be emulated on the Model 30 has one or more deliberately programmed overlays, the program must be separated into its overlay sections. Each

section must be cataloged as a separate run of the Emulator Program. Therefore, clear storage, bootstrap and loader (if AUTOCODER on disk) cards must be supplied for overlay sections. Overlay programs on the Model 40 should not be cataloged due to the non-contiguous layout of simulated 1400 storage.

The // 1400 card must include, at a minimum, a program name and a C for the load device, as follows:

```
// 1400 myname,C
```

The remaining parameters may be included if desired. The program name may be from 1 to 6 characters in length. It is used as the first six characters of the phase name under which the phases that go to make it up are cataloged in the Core-Image Library. If the program name is less than six characters in length, it is padded with the letter X. This name must be unique for each catalog run, even though separate runs are required for overlay programs. Immediately following the last card of the object deck (or an XFR card in the case of an overlay) must be a /* card. The makeup of a deck for a 1400 catalog run is illustrated in Figure 7. SYSPCH must be assigned to a punch unit for the 1400 catalog function.

As illustrated in Figure 8, the output of a catalog run consists of one or more Linkage Editor job steps. If the program or overlay is contiguous, there is only one Linkage Editor job step. If there are at least 100 (or 1728) consecutive blanks embedded in the coding, there is more than one step. Each step consists of a PHASE card, an INCLUDE card, an ESD card, one or more TXT cards, an END card, an ENTRY card, a /* card, and a // EXEC LNKEDT card. Following the cards making up the last step are a /% card and // FETCH card. The // FETCH card is used by the Emulator Program when the program is to be fetched from the Core-Image Library and executed after the cataloging run is completed.

The // FETCH card should be removed and held aside. The remaining cards may then be preceded by standard DOS Job Control cards and processed as normal input by the DOS Linkage Editor. This results in the 1400 program being cataloged in the Core-Image Library.

The following error message is issued during a 1400 catalog run if the number of phases to catalog exceeds 27:

```
EC84I TOO MANY PHASES TO CATALOG
```

The 1400 catalog run produces punched output of System/360 main storage (in DOS Object format) and is used as input to a normal DOS catalog run.

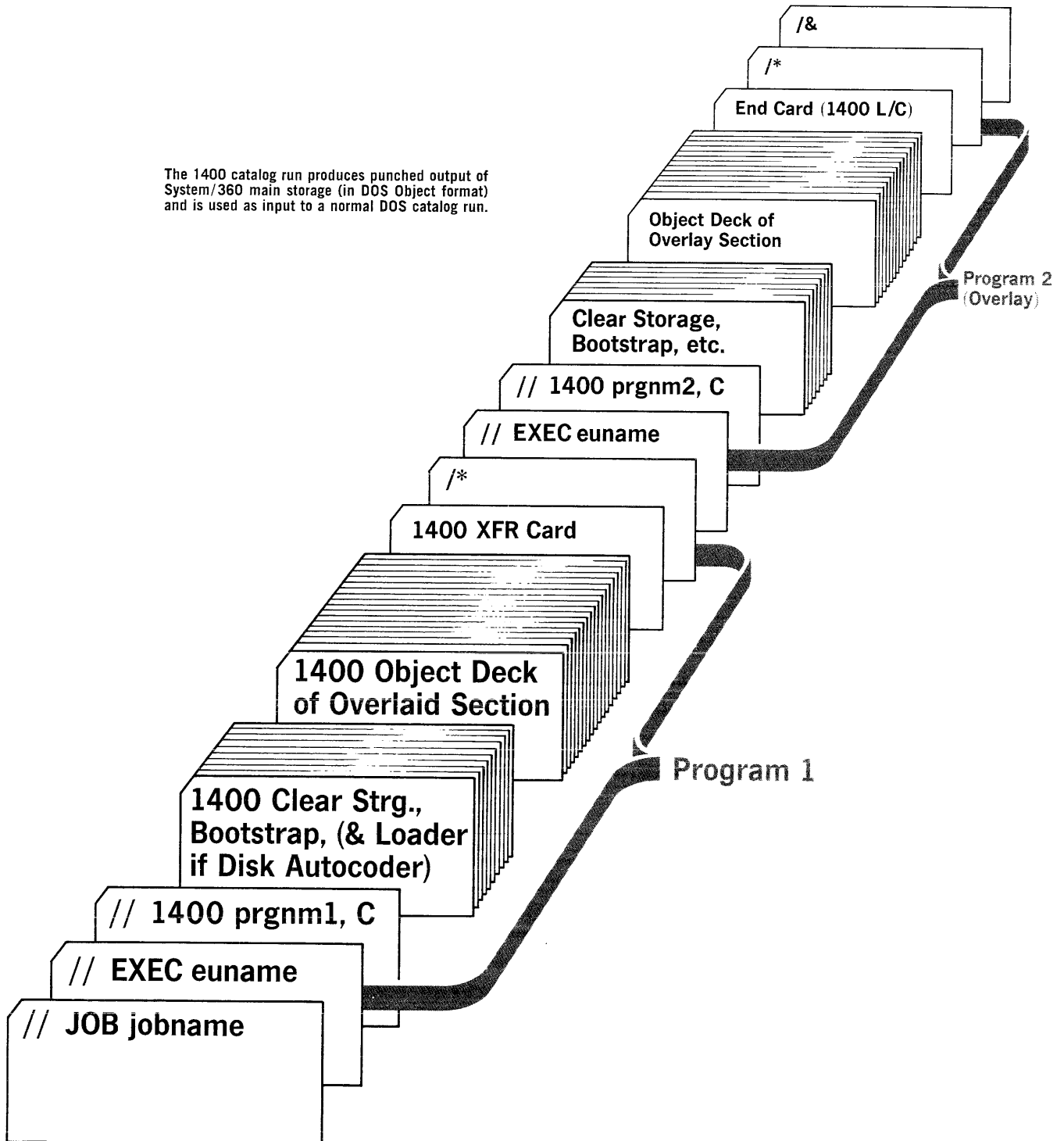


Figure 7. 1400 Catalog Run for a 1400 Program With One Overlay

FETCHING

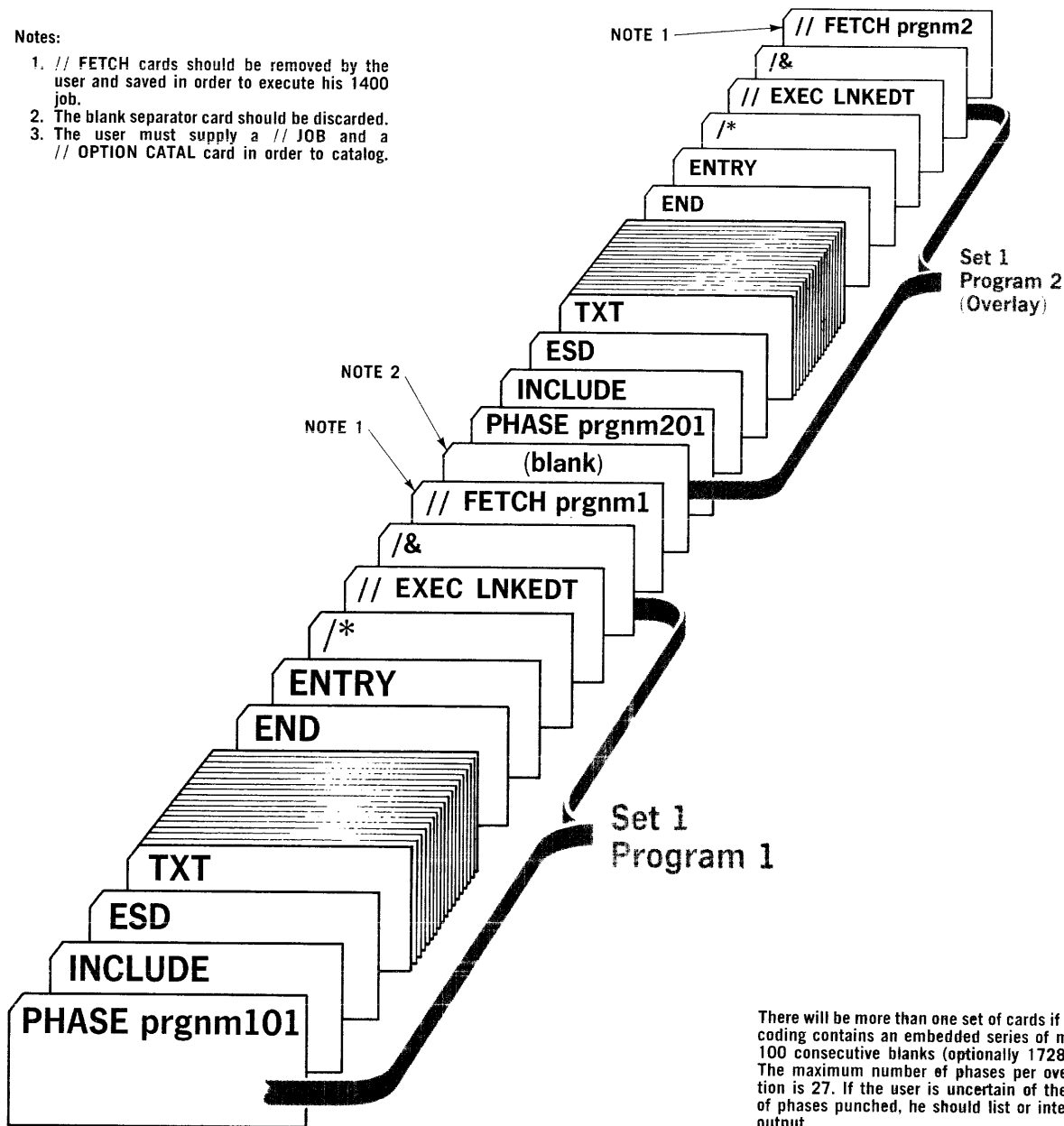
FETCHING 1400 PROGRAMS FROM THE CORE-IMAGE LIBRARY

The // FETCH card produced by the 1400 catalog run and used in the fetch run provides the Emulator Program with the phase

names that make up the phases in the 1400 program or overlay section. It also carries the 1400 I-, B-, and A-Storage Address Registers for restarting the 1400 program, and the origin address of each phase in the program or overlay. With this information, the Emulator Program can do a series of loads (using the LOAD macro instruction)

Notes:

1. // FETCH cards should be removed by the user and saved in order to execute his 1400 job.
2. The blank separator card should be discarded.
3. The user must supply a // JOB and a // OPTION CATAL card in order to catalog.



There will be more than one set of cards if the 1400 coding contains an embedded series of more than 100 consecutive blanks (optionally 1728 blanks). The maximum number of phases per overlay section is 27. If the user is uncertain of the number of phases punched, he should list or interpret the output.

Figure 8. Output of the 1400 Catalog Run in Figure 7

until all phases are in main storage. The address registers can then be loaded and a switch made to Compatibility mode.

PROCEDURES FOR FETCHING 1400 PROGRAMS

If the 1400 program to be fetched consists of one or more overlays, two or more // FETCH cards are required. Otherwise, only one // FETCH card is needed. The sequence of cards for a fetch run is illustrated in Figure 9. The // 1400 card must include a D for the load device. The other parameters may be included as required.

(Note: The name in the // 1400 card is used only to log the starting and ending messages on the console or in a 1400 storage dump if one occurs. It is not used in fetching the program.)

A standard method of coding in an overlay program in which the section of code to be overlaid reads a variable number of data cards is to test for a comma in column 1 of each card. When the test is successful, all data cards have been read, and the card in the read area is the first card of the overlay. The first card of the overlay is always some form of bootstrap card.

If the 1400 reads cards while executing its first overlay section, it must be able to recognize an "end-of-data" condition. (See example in text for one method of accomplishing this.)

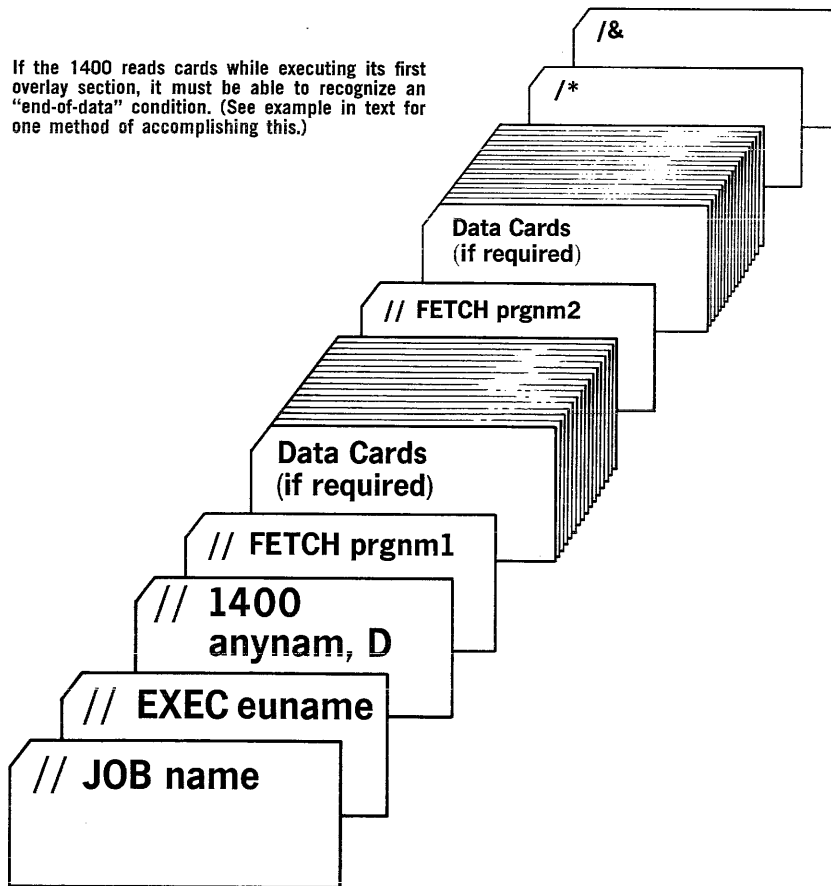


Figure 9. Executing a 1400 Program From the Core-Image Library

This method may be simulated when 1400 programs are being fetched by including the bootstrap card between the end of the data cards and the next // FETCH card, as follows:

```
// JOB jobname
// EXEC euname
// 1400 prgnam,D,...
// CCTL (optional)
// DVOL (optional)
// FETCH ..... (Fetch card for first
                section)
data cards
.
.
.
last data card
bootstrap card
// FETCH ..... (Fetch card for second
                section)
```

It should be emphasized again that the bootstrap card indicated in the example is only required when an overlay recognizes its "end-of-data" condition by having read the first card of the next overlay.

A /* card should not normally be included following a group of data cards read by other than the last overlay section of a program. This is because it has the effect of setting the 1400 last-card latch on, a situation that is impossible if an overlay section of the object deck follows the data cards.

Note that, when IOCDATE is 82 or 195 or both, the Emulator Program loads the date in 1400 addresses 82 through 86 or addresses 195 through 199 or both. This is done after the 1400 program has been fetched and will cause what is already in those positions to be overlaid.

OPERATOR_SERVICE_FUNCTIONS

AVAILABLE_FUNCTIONS

Many of the Operator Service Functions are optional features of the 1401/1440/1460 Emulator Programs under the Disk Operating System (DOS) and are included in the generated program if specified in the symbolic parameters. During the execution of a 1400 program under the Model 30 Emulator, dial F on the operator's panel of the 2030 Central Processing Unit (CPU) should be positioned to CI. This allows external interrupts (INTERRUPT key) to be handled while the system is in Compatibility mode (COMP MODE light on). For the Model 40, no special dial F considerations are necessary. The Operator Service routine is entered by pressing the external INTERRUPT key when the Emulator Program is running in the background partition or by pressing the console REQUEST key (MSG F1 or MSG F2) when the Emulator Program is running in the foreground partition. OC=YES must be specified in the FOPT macro at DOS Supervisor generation. In addition, the Operator Service routine is entered through recognition of a 1400 halt if parameter 'e' on the // 1400 card is specified as '1' and the halt is not specified as either an EOJAADR, EOJBADR, or the EOJ I-address in the // 1400 card. When operator services following a halt message are not specified, the 1400 program is canceled on recognition of any halt other than a specified end-of-job halt. Additionally, when the 1400 program is being executed in "Test mode" (described in the "Control Cards" section under "The // 1400 Control Card") and the Emulator Program recognizes any error condition, the Operator Service Function routine is entered automatically. Alphabetic characters may be entered in either upper or lower case except characters g, p, x and w. These characters, when entered in lower case, represent a question mark (?), exclamation mark (!), the 1407/1447 record mark (), and a word separator (), respectively.

When the Operator Service Functions have been entered, the following message is displayed:

EC40D TYPE IN FUNCTION

The operator then types in the function he wants. Five functions are always included with the Operator Service routine macro (EU30S/EU40S); these are: CANCEL, END, RESET, START, and STATUS. An end-of-block (EOB) entry (alternate coding key and numeric 5 key) will perform the same func-

tion as the response START. RESET is available only when the Operator Service routine is entered as a result of a 1400 halt. CANCEL and END are valid responses to any Emulator Program message requesting a reply.

The following Operator Service Functions are available with the typed responses below:

ADDRESS

This is included only if OSADDR=YES is specified. The ADDRESS function converts a decimal 1400 address into its corresponding System/360 hexadecimal address (including offset), and can be used to determine where to alter main storage via the console or where to set the dials when the SAR STOP switch is used to address-stop 1400 programs. The operator types in ADDRESS followed by at least one blank and a valid 1400 address in the range 1 to 15999. The Operator Service Function responds with the converted hexadecimal address. For example:

```
(System)    EC40D TYPE IN FUNCTION
(Operator)  ADDRESS 1579
(System)    EC41I HEX ADDRESS = 47AA
```

ALTER

This function is included if the parameter OSALTER=YES is specified. The ALTER function causes the 1400 I-, A-, and B-Storage Address Registers to be altered to the address that follows the word ALTER. This may be used to alter the instruction address of a 1400 program, to effect a branch, or to place a valid address in a register destroyed by a 1400 process error. At least one blank must precede the address. For example:

```
(System)    EC40D TYPE IN FUNCTION
(Operator)  ALTER 632
(System)    EC80I 1400 STATUS: I=00632;
           A=00632;B=00632.
           INSTN BLOCK=xxxxxxx
(System)    EC40D TYPE IN FUNCTION
```

Since all storage address registers are set to the same value, the alter address should not be the address of a 1400 Store B-Register (SBR) instruction or to an address where 1400 chaining is being used.

CANCEL

This response to any Emulator Program message causes the 1400 program to be terminated with an end of job. If OSDUMP=YES was specified at Emulator Program generation, a 1400-style storage dump is provided on SYSLSST unless a no-dump option (a "1") is specified in parameter "b" of the // 1400 control card. When a 1400-style storage dump is provided, a System/360 main storage dump also is provided if the test-mode option in the // 1400 control card is specified as "S".

DELETE

The operator wishes to discontinue volume serial number checking on a specific 1400 drive identified as DISKn in messages EC75I and EC76I, and allow the 1400 program to process any 1311 disk pack mounted on that 1400 drive. In order to use the DELETE function, the operator must first reply DSPLYV to message EC75I. For example:

(System) EC75I WRONG PACK, MOUNT 134A21
DISK 0 ON DR 192

(Operator) DSPLYV

(System) EC76I DISK 0 ON DR 192 SERIAL
NO.=111222

(System) EC40D TYPE IN FUNCTION

(Operator) DELETE

Volume serial number checking will be discontinued on 1400 drive DISK 0 until re-initiated using the DVOL DISKn=xxxxxx operator service function. The DELETE function should be used with caution when performing write operations.

DISK

This function is included if the parameter OSDISK=YES is specified. Two separate functions of DISK may be requested depending on the operator responses:

(System) EC40D TYPE IN FUNCTION

(Operator) DISK
or
DISK n (where n=0, 2, 4, 6, or 8)

The response DISK causes a display only of message DISK n ON SYSxxx, PART n for each drive on the system, and then message EC40D is reissued. For example:

(System) EC40D TYPE IN FUNCTION

(Operator) DISK

(System) EC44I DISK 0 ON SYSxxx, PART n
DR 190
EC44I DISK 2 ON SYSxxx, PART n
DR 191
EC44I DISK 4 ON SYSxxx, PART n
DR 191
EC44I DISK 6 ON SYSxxx, PART n
DR 192
EC44I DISK 8 ON SYSxxx, PART n
DR 192

The response DISK n, where n is the drive number, displays one specific disk assignment (DISK n) and allows the operator to retain or change the assignment. When the assignment is changed, disk verification is automatically performed. It then displays the new assignment, if it was changed. For example:

(System) EC40D TYPE IN FUNCTION

(Operator) DISK 0

(System) EC44D DISK 0 ON SYS003,
PART 0 DR 191

The operator may then change the assignment or leave it as it is. If he wishes to change the assignment, he types in the programmer logical unit ("SYSnnn") to which he wants the 1400 disk drive assigned, followed by a 0 or 1 (2311) or 0, 1, 2, or 3 (2314) to indicate which half (2311) or quadrant (2314) of the new device is to be used for the file. For example:

(Operator) SYS021,1

(System) EC44I DISK 0 ON SYS021, PART 1

This operator response causes 1400 disk drive 0 to be assigned to the second half or quadrant of SYS021. However, if the operator was satisfied with the current assignment, he could respond with START (or EOB). This causes the drive assignment to remain as listed. The assignment is again displayed if the disk drive assignment was changed, and the system reissues message EC40D.

If verification of the volume serial number for a disk pack accessed by the Emulator Program is specified through utilization of a // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) or initiated through operator entry of DVOL DISKn=xxxxxx, the disk

verification (see message EC75I in the "Console Messages" section) is included in the DISK function. For example:

```
(System)    EC40D TYPE IN FUNCTION

(Operator)  DISK 0

(System)    EC44D DISK 0 ON SYS003, PART 0
           DR 191

(Operator)  SYS022,1

(System)    EC44I DISK 0 ON SYS022, PART 1
           DR 191

(System)    EC75I WRONG PACK, MOUNT ABCDEF
           DISK 0 ON DR 191

(Operator)  DVOL DISK0=123456
```

DISPLAY

This function is included only if the parameter OSDSPY=YES or "OSDSPY=nn" is specified when the Emulator Program is generated. The display function prints 100 or "nn" positions of 1400 storage on the console typewriter. The address is entered by the operator at least one space beyond the word DISPLAY. The 1400 zoned zeros are typed as follows:

" " is typed as "x", "?" is typed as "g", and "!" is typed as "p". (See Table 11 for additional graphic differences.) For example:

```
(System)    EC40D TYPE IN FUNCTION

(Operator)  DISPLAY 2347

(System)    _M%U3500R_B60gL_Bp50K_.123456_|
```

DSPLYV

The operator wishes to display the volume serial number of the disk pack referenced in message EC75I (see "Operator Messages" in the "Console Messages" section). This response is valid only if preceded by message EC75I. For example:

```
(System)    EC75I WRONG PACK, MOUNT 134A21
           DISK 0 ON DR 191

(System)    EC40D TYPE IN FUNCTION

(Operator)  DSPLYV

(System)    EC76I DISK 0 ON DR 191 SERIAL
           NO.=111222
```

DUMP

This function is included only if the parameter OSDUMP=YES is specified when the Emulator Program is generated. The dump function provides a formatted storage printout of the 1400 program on the printer assigned to SYSLST. The 1400 program name, taken from the // 1400 control card, is printed along with the date on the top of the dump. The entire 1400 storage is printed in bands of 100 except when the band consists of all blanks without wordmarks. Additionally, a System/360 main storage dump is provided if the test-mode option in the // 1400 control card is specified as "S". For example:

```
(System)    EC40D TYPE IN FUNCTION

(Operator)  DUMP
```

A wordmark is shown as a 1 below the character with which it is associated. A groupmark in 1400 storage appears as a blank character in the upper portion of the band, with a 2 below. A wordmark with groupmark appears as a blank character in the upper portion of the band, with a 3 below.

DVOL DISKn

The operator wishes to initiate verification of the volume serial number of the disk pack mounted on 1400 disk drive "n" (0, 2, 4, 6, or 8) with the volume serial number specified by the // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) or as modified by operator entry.

DVOL DISKn=xxxxxx

The operator wishes to initiate verification of the volume serial number of the disk pack just mounted, where "n" is the 1400 disk drive (0, 2, 4, 6, or 8) on which the pack is mounted and "xxxxxx" is the volume serial number (six alphanumeric characters). "xxxxxx" supersedes the volume serial number specified in the // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) or in the previous operator entry for that disk drive.

END

This response to any Emulator Program message causes the 1400 program to be terminated with an end of job. No storage dump occurs.

ENTER

This function is included only if the parameter OSENER=YES is included when the Emulator Program is generated. The ENTER function allows the operator to change the contents of 1400 storage beginning at the 1400 address specified in the response. Entered data or instructions replace any groupmarks/wordmarks which may be present in affected 1400 storage. The first position typed is entered by the operator at least one space beyond the word ENTER. For example:

(System) EC40D TYPE IN FUNCTION

(Operator) ENTER 653

(System) EC42D DATA

The operator can now enter up to 50 characters. The data to be entered is typed using the special character "_" to indicate that a wordmark is associated with the next character typed. The special character "_" is included in the 50 character count, but when entered at the specified main storage address, it is associated with the next character so that the two characters enter a single-byte location. Alphabetic characters G, P, X, and W must be entered in upper case. Special characters must be entered as indicated in Table 11. The form is similar to the condensed loader format of 1400 disk assembler output. For example, if the operator wishes to enter a branch to 1400 location 3101 at 1400 location 653:

(System) EC40D TYPE IN FUNCTION

(Operator) ENTER 653

(System) EC42D TYPE DATA

(Operator) _BA01

INQUIRY

Two separate functions of INQUIRY may be specified at Emulator system generation: INQUIRY and INQUIRY phasename. If OSINQRY=1400 is specified, then the INQUIRY function is available. If OSINQRY=YES is specified, both INQUIRY and INQUIRY phasename are available. INQUIRY: To inform the 1400 program that the operator has performed the function equivalent to pressing the TYPE or REQUEST key on a 1400; that is, the 1400 Q latch is set on for testing by the 1400 program with a BIN xxx, Q. This function must be selected in order to support a 1400 program that is testing for operator inquiry. In this instance, the operator types in INQUIRY (with no operand)

and is thus able to set on the 1400 Q latch. INQUIRY phasename: To call a System/360 program from the Core-Image Library, execute this program, and then return to the 1400 program. If a System/360 program is to be fetched and executed, the response INQUIRY is followed by the name of the System/360 phase to be executed. For example:

(System) EC40D TYPE IN FUNCTION

(Operator) INQUIRY
or
INQUIRY phasename

See "Inquiry" in the "Programming Considerations" section for further details.

NEWPAC

In response to messages EC75I or EC78D (see "Operator Messages" in the "Console Messages" section), the operator wishes to change disk packs. After mounting the correct disk pack and entering this response, verification of the volume serial number of the newly mounted disk pack with the volume serial number of the 1400 disk drive specified in the // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) is performed. This response is valid only if preceded by messages EC75I or EC78D.

RESET

This function is equivalent to pressing the START-RESET and then START keys on the 1400. RESET is available only when the Operator Service routine is entered as a result of a 1400 halt. To reread an error card after a 1400 program error halt, see the RETRY function.

RETRY

This function is used to reread an error card. If input cards are being edited by the 1400 program, and normal operating procedure calls for invalid 1400 cards to cause a halt, at which time the operator is to run out the reader, the operator should correct the card and reinsert it; this response must be made. This special halt response is necessary because the Emulator Program is a card read ahead of the 1400 and already has the next card that the 1400 is to read in its buffer. The buffer, therefore, must be emptied and reloaded in order to reread a card. RETRY is available only when the Operator Service routine is entered as a result of a 1400 halt. The

procedure for using this response is as follows:

1. The error card is the third card in a 2540 stacker or the last card in a 1442 stacker before the operator performs a nonprocess runout. The operator should then nonprocess run out the cards in the reader transport.
2. The operator should then correct the error card and place it, as well as all cards behind it, into the reader for processing.
3. The operator then responds with RETRY to continue the program. Sense switch A is reset off at this time.

If the 1400 program is simulating reader stacker selection, the operating procedures are the same, except that the error card is the first card run out when the operator performs a nonprocess runout.

START

This function is included if any Operator Service Functions have been specified, and is the method used to exit from the service routines unless EOJ is desired. An end-of-block (EOB) entry (alternate coding key and numeric 5 key) will provide the same function as the response START. Control is returned to the next sequential 1400 instruction in the interrupted program.

STATUS

This response to message EC40D causes the display of message EC80I, which displays the status of the 1400 storage address registers.

SWITCH

This function is used to set sense switches. This reply is valid only if HALTS=YES is specified when the Emulator Program is generated. Upon selection of this function, sense switches B through G are turned off. The desired switches are turned on by entering their alphabetic representations. An entry of a blank by means of typewriter spacebar results in sense switches B through G remaining off. The following example shows how this function may be used.

```
(System) EC82I HALT
(System) EC40D TYPE IN FUNCTION
(Operator) SWITCH
(System) EC46I S-SW ON = C EF
(System) EC45D TYPE S-SW
(Operator) BDF
(System) EC46I S-SW ON = B D F
```

Message EC40D is then retyped, and the operator may respond with any of the valid Operator Service Function responses.

TAPE

This function is included only if the parameter OSTAPE=YES is included when the Emulator Program is generated. Two separate functions of TAPE may be requested depending on the operator response:

```
(System) EC40D TYPE IN FUNCTION
(Operator) TAPE
           or
           TAPE n (where n=1,2,3,4,5 or 6)
```

The response TAPE causes a display of message EC43I TAPE n ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI which provides the current programmer logical unit assignment (SYSnnn), the maximum block size (MAX BLK=xxxxx), the device address (DR cuu), the designation for 7- or 9-track tapes (n TR), and the tape density (yyy BPI) for each drive (TAPE n). For example:

```
(System) EC40D TYPE IN FUNCTION
(Operator) TAPE
(System) EC43I TAPE 1 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
           EC43I TAPE 2 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
           EC43I TAPE 3 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
           EC43I TAPE 4 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
           EC43I TAPE 5 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
           EC43I TAPE 6 ON SYSxxx, MAX
              BLK=xxxxxx DR cuu, n TR,
              yyy BPI
```

The response TAPE n, where n is the drive number to be changed (a digit from 1 to 6), displays one specific tape assignment, and then, awaits a response from the operator as to whether he is satisfied with the current assignment or desires to change it. The operator may change the assignment by typing the programmer logical unit ("SYSnnn") to which he wants the 1400 tape drive assigned, or leave the current assignment by entering START (or EOB). For example:

```
(System)   EC40D TYPE IN FUNCTION
(Operator) TAPE 1
(System)   EC43D TAPE 1 ON SYS011, MAX
           BLK=00725 DR 191, 7 TR,
           556 BPI
(Operator) SYS022
(System)   EC43I TAPE 1 ON SYS022, MAX
           BLK=00725 DR 191, 7 TR,
           556 BPI
```

In this example, the operator desired to change the assignment for 1400 tape drive 1

from SYS011 to SYS022. It is important that SYS022 is previously assigned to the proper physical unit. It should be noted that the maximum block size cannot be increased at this time.

GENERAL COMMENTS

Except for data entered under the ENTER option, and responses to the 1400 Read Console Printer command (M%T0xxxR or L%T0xxxR), both of which must be specified in upper case (except special characters), all operator input in the Operator Service Function routines may be typed in either upper or lower case (except special characters). The end-of-block (ALTN CODING key and 5 key) terminates the operator input and releases it to the CPU in the normal manner. Operator errors not yet released by an end of block may be canceled by the CANCEL function (ALTN CODING key and numeric 0 key). The entire input message must then be retyped. The use of the BACKSPACE key is not supported by the Emulator Programs under DOS.

APPENDIX A: EMULATOR-PROGRAM PARAMETERS

Parameter	Required By	Remarks
BLKSIZE= { nnnn } { 0000 }		Indicates standard block size (plus one byte) for 1400 tape units. "u" is 1400 unit number (1-6). "nnnn" is one larger than the normal block length associated with the unit. Default is 0000.
BUFSIZE= { nnnnn } { 00000 }	1400 magnetic tape	Indicates total storage area to be reserved by the Emulator Program for tape buffers. Default is 0000.
CARRCTL= { YES } { NO }	Carriage-control pointer option	Indicates carriage-control tape pointer option. Default is NO.
CATALOG= { YES } { NO }		Indicates 1400 programs to be cataloged in the Core-Image Library. Default is cataloging not available.
COLBINP= { YES } { NO }	1400 Column-Binary or Card-Image Punch instructions	Indicates that 1400 Column-Binary/Card-Image Punch instructions are to be emulated. Default is NO.
COLBINR= { YES } { NO }	1400 Column-Binary or Card-Image Read instructions	Indicates the 1400 Column-Binary/Card-Image Read instructions are to be emulated. Default is NO.
COL51= { YES } { NO }	51-column cards	Indicates 51-Column Interchangeable Read Feed feature support. Default is NO.
DVOL= { YES } { NO }	1400 DASD	Indicates verification of volume serial number of disk pack accessed by the Emulator Program. Default is NO.
DISKDR= { n 130n 1405 0 }	1400 DASD	"n" is number of 1311 drives to be simulated. "130n" indicates one module of 1301 storage in addition to "n" 1311 drives to be simulated. 1405 indicates Model 1 or 2 (mutually exclusive of 1301 and 1311). Default is "n"=0 (no disk).
DISKTYP= { 2314 } { 2311 }	1400 DASD	Indicates type of System/360 disk unit. Default is 2311.
DISKu=SYSnnn	1400 DASD	"u" is 1-5 for 1311 and 1-4 for 1405. "nnn" is the programmer logical unit for device "u". Default is SYS001-SYS005 for the respective values of "u" from 1-5.
D1301u=SYSnnn	1400 DASD	"u" is 1-5 for 1301 on a 2311 and 1-3 for 1301 on a 2314. "nnn" is the programmer logical unit for device "u". Default is SYS001-SYS005 for 2311 and SYS001-SYS003 for 2314.

Parameter	Required By	Remarks
EDITINV= {YES} {NO }		Indicates support of Inverted Print Edit. Default is NO.
EOJAADR= nnnnn		Indicates A-address (5 digits) of standard 1400 end-of-job halt. No default, not generated if not specified.
EOJBADR= nnnnn		Indicates B-address (5 digits) of standard 1400 end-of-job halt. No default, not generated if not specified.
ERROPNG= {YES} {NO }		Indicates 1400 storage dump when 1400 op code <u>G</u> is detected. Default <u>G</u> is treated as invalid op code.
FETCH= {YES} {NO }		Allows 1400 programs to be called from Core-Image Library. Default is no fetch routine is generated.
HALTS= {YES} {NO }		Changes sense switches on 1400 halts or operator service. Default is change of switches not performed.
IOCDATE= {82 } {195 } {BOTH } {NO }		Moves required date to 1400 storage from DOS communication region. Default is movement of date not performed.
MPGMBLK= {nn } {0 }		Indicates number of 2K (2048) blocks of storage reserved for foreground programs. "nn" must be less than or equal to 20 for the Model 30 Emulator Program Default is 0.
OSADDR= {YES} {NO }		Converts 1400 addresses to hexadecimal. Default is conversion not performed.
OSALTER= {YES} {NO }		Changes 1400 address registers. Default is register change not performed.
OSDISK= {YES} {NO }		Changes 1400 disk-drive assignments. Default is assignment changes not performed.
OSDSPLY= {YES } {nn } {NO }		Displays 1400 storage. "nn" is number of bytes per display. Default is display not performed.
OSDUMP= {YES} {NO }		Dumps 1400 storage onto SYSLST. Default is dump not performed.
OSENTER= {YES} {NO }		Alters 1400 storage from console. Default is alteration of storage not performed.

Parameter	Required By	Remarks
OSINQRY={1400} {YES} {NO}	1407/1447 Console Inquiry Station	Performs 1400 Read and Write Console Printer instructions, and simulates the Q latch when "1400" is specified. Performs the preceding and executes System/360 inquiry programs when "YES" is specified. Default is none of the above functions performed.
OSTAPE={YES} {NO}		Changes 1400 tape-drive assignments. Default is tape assignment changes not performed.
PCH1400={1444} {1442} {1402}	Other than 1402	Indicates type of 1400 card punch. Default is 1402.
PCH360={1442} {2520} {2540}	Other than 2540	Indicates type of System/360 card punch. Default is 2540.
PFR={YES} {COM} {NO}		Indicates if the punch-feed-read feature is to be implemented. Default is NO.
PTRASGN=SYSnnn	1404	1404 cut-card operations and indicates reassignment of printer from SYSLST. Default is SYSLST.
PTRLNG={nnn} {132}		Indicates length of 1400 print line. "nnn" is 100, 120, or 132 for the 1403, 120 or 144 for the 1443, or 132 for the 1404. Default is 132.
PPR1400={1443} {1404} {1403}	Other than 1403	Indicates type of 1400 printer. Default is 1403.
PPR360={1443} {1404} {1403}	Other than 1403	Indicates type of System/360 printer. Default is 1403.
PUNCHSS={YES} {NO}		Indicates 1402 punch stacker selection support. Default is NO.
READRSS={YES} {NO}		Indicates reader stacker selection or 1442 reader-punch-stacker selection. Default is NO.
RDR1400={1442} {1402}	1442	Indicates type of 1400 card reader. Default is 1402.
RDR360={1442} {2501} {2520} {2540}	Other than 2540	Indicates type of System/360 card reader. Default is 2540.
RELOC={0} {nnn}		Indicates the location of the first byte of 1400 simulated storage on the Model 40. Also used to calculate the Emulator's load point.
SCAN={YES} {NO}	1400 Scan Disk	Indicates 1311 Scan Disk instructions in 1400 program. Default is Scan Disk not performed.

Parameter	Required By	Remarks
SCAN360={YES} {NO}	1400 Scan Disk	If File Scan feature is installed, used in conjunction with SCAN=YES to implement 1400 Scan Disk feature. Default is a software simulation of Scan Disk function.
SECTORS={nnn} {020}	Less than 20	Indicates number of sectors the Emulator Program may read per revolution, where "nnn" is 001-020 for the Model 30 Emulator Program and 001-100 for the Model 40 Emulator Program. Default is 020.
SEND={0 {nnnnn}		Indicates load point for the Model 30 Emulator Program. Used to generate assembly listing addresses identical to those at object program execution time. Not used on the Model 40.
SIZ1400={nn} {16}	Other than 16K	Indicates 1400 main storage size, where "nn" is any <u>even</u> number between 2 and 16. Default is 16.
SIZ360={nnn} {64}	Other than 64K	Indicates System/360 main storage size, where "nn" is 24, 32, or 64 for the Model 30 Emulator Program and 32, 48, 64, 128, or 256 for the Model 40 Emulator Program. Default is 64.
SSQUANT={ONE} {MANY}		Applies only when reader stacker selection is desired. The default is MANY.
SYSIO={ipl} {000}	Other than 000	Indicates assignment of 1400 unit-record devices to tape or disk, where "i", is SYSIPT, "p" is SYSPCH, and "1" is SYSLST. 0 indicates unit-record device only. 1 indicates unit-record or tape device, 2 indicates unit-record, tape, or disk device, and 3 indicates unit-record or disk device. Default is 000.
SYSROPT={YES} {NO}		Indicates that job stream can be transferred from card input on SYSRDR to tape or disk on SYSIPT during 1400 program execution. If the SYSROPT parameter is specified YES, the // IP control card is optional, but must be in the customer's deck if he wishes the job stream transferred from card input on SYSRDR to tape or disk on SYSIPT during 1400 program execution. However, if the // IP control card is used, the SYSROPT parameter must be specified YES. Default is all input from SYSIPT.
TAPEDR={n} {0}	1400 magnetic tape	Indicates number (1-6) of 1400 tape units. Default is 0.
TAPEMOD=MXEDPAR		Indicates mode of 9- or 7- track tape. Default is even parity, Normal mode.

Parameter	Required By	Remarks
TAPERRS= { LST LOG LSTCHAR LOGCHAR NO }		Indicates simulation of 1400 diagnostic tape read and storage scan. (CHAR indicates display in character mode only.) Default is simulation not performed.
TAPEu=SYSnnn	1400 magnetic tape	"u" is 1-6. A programmer logical unit must be assigned to all six 1400 tape units. The same logical unit may be assigned to more than one tape unit. "nnn" is the programmer logical unit for device "u". Default is SYS011-SYS016 for the respective values of "u" from 1-6.
TAPLOMD= { YES NO }	1400 magnetic tape in Load mode	Indicates tape Load-mode operations. Default is Load-mode operations not performed.
TIMER= { YES NO }		Indicates availability of timer on System/360 and time of day to log for 1400 jobs. Default is timer not available.
TRACKOP= { YES NO }	1311, 1301, or 1405 track operations	Indicates track operations on 1311, 1301, or 1405. Default is track operations not performed.
USRPROG= { YES NO }	User-written routine	Indicates block of user code to be inserted for non-standard Emulator Program functions. Default is entry to user program not generated.
VERIFY= { YES NO }		Verifies disk records written. Default is disk verification not performed.

addition, if $W_2 = 9$, a groupmark with wordmark (GMWM) is inserted in position 0081 of compatibility storage. If $W_2 = 2$, the first tape instruction performed ignores GMWMS in storage. This instruction also performs the following functions after auxiliary storage loading is completed:

- Tests the allow-I/O-traps bit (Programmed Mode Switch control) in auxiliary storage. If the bit is off, the multiplexor channel is inhibited from byte interleaving, all I/O interruptions are prohibited, and external interruptions are enabled.
- Note:** The allow-I/O-traps bit should always be off unless the Programmed Mode Switch (PMS) subfeature is installed.
- Generates a unique character (8F) in the main storage location that is one less than that corresponding to compatibility-storage location 0000. This character serves to detect a low-main-storage wraparound condition when operating in Compatibility mode.
 - Switches to 1400 Read Only Storage (ROS) control and initiates a 1400 instruction read-out at the address specified in the auxiliary-storage A backup locations for the I and J registers (1400 instruction counter). This initial address need not be in the 1400 portion of main storage, but it may not be in main-storage hexadecimal address 0000.
 - Scans 1400 storage and sets all invalid 1400 characters to blank (hexadecimal 40).

The Compatibility Feature Initialize Mode instruction has the following Format:

SI

99	W_1	W_2	B_1	D_1
0	7	8	11	12
15	16	19	20	31

Condition Code:
Unchanged

Program Interruption:
Addressing

Timing:
65 + (4 x 512) + (6 times number of 1400 characters) microseconds + 3 microseconds for tape load, or + 238 microseconds for 1402 card load (80 column), or + 240 microseconds for

1402 card load (51 column), or + 240 microseconds for 1442 card load.

Compatibility Feature Mode Set (CFMS)

This compatibility instruction is defined by the contents of W_1 being equal to 1. W_2 is interpreted as follows:

W_2	<u>Interpreted As</u>
0	No initialization required
1	Initialize for 1402 card load
2	Initialize for 1401 tape load
9	Initialize for 1442 card load

If $W_2 = 1$ or 9, positions 0001 through 0080 of compatibility storage are cleared to blanks and a wordmark is inserted in location 0001. In addition, if $W_2 = 9$, a groupmark with wordmark (GMWM) is inserted in position 0081 of compatibility storage. If $W_2 = 2$, the first tape instruction performed ignores GMWMS in storage. This instruction performs the same functions as the CFIM instruction, except that auxiliary storage is not initialized and no storage scan is performed. In brief, the CFMS instruction does the following (see the CFIM instruction for details):

- Tests the allow-I/O-traps bit.
- Allows detection of any low-order 1400-mode storage wraparound conditions.
- Switches control to 1400-mode.

Therefore, the CFMS instruction is used when auxiliary storage has been previously initialized and no changes are required to begin another Emulator Program. The CFMS instruction also may be used to return system control to the 1400 ROS after a system interruption when the PMS subfeature is used. In this latter case, W_2 would be equal to 0.

The Compatibility Feature Mode Set instruction has the following format:

SI

99	W_1	W_2	B_1	D_1
0	7	8	11	12
15	16	19	20	31

Condition Code:
Unchanged

Program Interruption:
Addressing

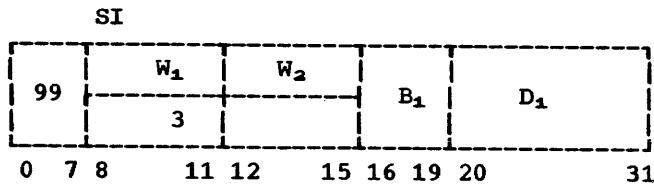
Timing:
63 microseconds

Compatibility Feature Store Variables (CFSV)

This instruction can be used to alter any of the 64 bytes of 1400 auxiliary storage. It transfers four bytes from main storage, beginning with the effective address specified by B₁ and D₁, to four contiguous 1400 auxiliary-storage locations specified by W₂ (see Table 13). For this instruction, W₁ contains a hexadecimal value of 3.

Most variables contained in 1400 auxiliary storage, such as 1400 instruction address, tape densities, and unit address assignments, can be changed with this instruction.

The Compatibility Feature Store Variables instruction has the following format:



Condition Code:
Unchanged

Program Interruption:
Addressing

Timing:
44 microseconds

Table 13. 1400 Auxiliary Storage Bytes Defined by W₂

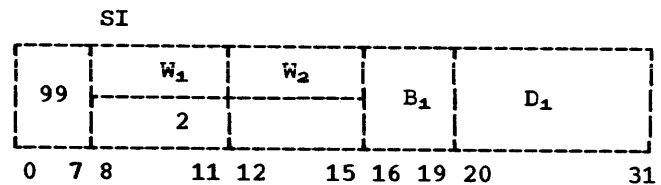
Bytes Defined	W ₂ for 1400 Auxiliary Storage A	W ₂ for 1400 Auxiliary Storage B
80 through 83	0000 (0)	1000 (8)
84 through 87	0001 (1)	1001 (9)
88 through 8B	0010 (2)	1010 (A)
8C through 8F	0011 (3)	1011 (B)
90 through 93	0100 (4)	1100 (C)
94 through 97	0101 (5)	1101 (D)
98 through 9B	0110 (6)	1110 (E)
9C through 9F	0111 (7)	1111 (F)

Although no specification checking is performed, a 256-byte boundary in main storage must not be crossed during instruction execution.

Compatibility Feature Load Variables (CFLV)

This Compatibility-mode instruction is defined by W₁ being equal to a hexadecimal value of 2. The CFLV instruction loads main storage, beginning with the effective address specified by B₁ and D₁, from the four contiguous bytes of 1400 auxiliary storage specified by W₂. The specifications of W₂ for this instruction are shown in Table 13.

The Compatibility Feature Load Variables instruction has the following format:



Condition Code:
Unchanged

Program Interruption:
Addressing

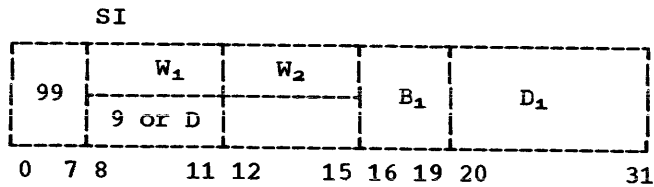
Timing:
44 microseconds

A main-storage 256-byte boundary must not be crossed during execution of this instruction.

Compatibility Feature Store Constants (CFSC)

This instruction transfers the contents of main storage locations beginning with the effective address specified by B₁ and D₁ to the 16 contiguous 1400 auxiliary-storage locations specified by W₁ and W₂. W₁ is used to define the instruction function and must contain the hexadecimal value 9 or D. If W₁ contains a 9, W₂ refers to a starting address in 1400 auxiliary storage A. If W₁ contains a D, W₂ refers to a starting address in 1400 auxiliary storage B. W₂ provides the high-order hexadecimal digit of the starting address in 1400 auxiliary storage. The low-order hexadecimal digit of the starting address is always zero. If W₂ contains the value 7, the starting address in 1400 auxiliary storage is 70, and the locations 70 through 7F are loaded with the information starting at the main storage location defined by B₁ and D₁.

The Compatibility Feature Store Constants instruction has the following format:



Condition Code:
Unchanged

Program Interruption:
Addressing

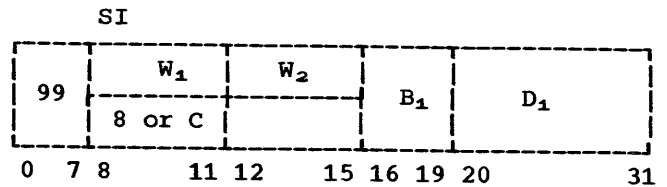
Timing:
106 microseconds

Compatibility Feature Load Constants (CFLC)

This instruction loads the main storage locations beginning with the effective address specified by B₁ and D₁ from the 16 contiguous bytes of 1400 auxiliary storage specified by W₁ and W₂. W₂ is used to define the instruction function and must contain the hexadecimal value 8 or C. If W₁ contains an 8, data is fetched from 1400 auxiliary storage A. If W₁ contains a C, data is fetched from 1400 auxiliary storage

B. W₂ provides the high-order hexadecimal digit of the starting address in 1400 auxiliary storage. The low-order hexadecimal digit of the starting address is always zero. If W₂ contains the value 7, the starting address in 1400 auxiliary storage is 70, and the locations 70 through 7F are loaded with the information starting at the main storage location defined by B₁ and D₁.

The Compatibility Feature Load Constants instruction has the following format:



Condition Code:
Unchanged

Program Interruption:
Addressing

Timing:
106 microseconds

APPENDIX C: MODEL 30 PROGRAMMED MODE SWITCH SUBFEATURE SPECIAL INSTRUCTIONS

The Programmed Mode Switch (PMS) subfeature allows 2030 programs and Model 30 Emulator Programs to reside in storage coincidentally and to be executed in an interleaved manner by providing the capability to switch the processor between Compatibility mode and 2030 mode under control of the 2030 program.

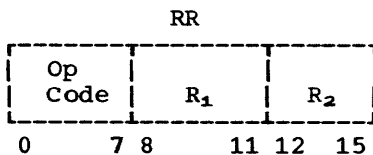
Special System/360 instructions are provided to control and facilitate communication between the 2030 program and the 1400 programs. These special System/360 instructions are enabled and disabled as in the Basic Compatibility Feature by way of the System/360 Diagnose instruction. Mnemonics are not included in the assembler language.

If the system is not equipped with the PMS subfeature, the Model 30 1400 Emulator Program under DOS cannot be used.

The PMS subfeature includes the following instructions, which facilitate the transfer of data between 2030-program data areas:

- Compatibility Feature Move To Compatibility (CFMT)
- Compatibility Feature Move From Compatibility (CFMF)
- Compatibility Feature Load To Compatibility (CFLT)
- Compatibility Feature Load From Compatibility (CFLF)

The four special System/360 instructions have the RR format, which is illustrated as follows:



The general register specified by R₁ contains the destination address. The source address is specified by R₂.

Compatibility Feature Move to Compatibility (CFMT)

This instruction moves data from the source address (2030 storage) to the destination address (compatibility storage). Wordmarks in the source field are

not moved; wordmarks in the destination field remain undisturbed.

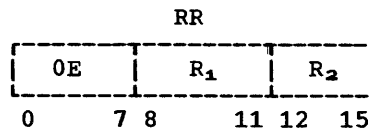
The move to compatibility is similar to a tape-move operation in the 1400, except that information is moved from the 2030 storage area to the area reserved for the 1400 portion of the program. The binary address specified by general register R₂ is the source address in the 2030 storage area. The binary address specified by general register R₁ is the destination address in the 1400 main-storage area. The low-order 16 bits of the general register specified by R₁ + 1 is the count and is decremented for each byte transferred from the 2030 main-storage area.

The two addresses are incremented by 1 and the count is decremented by 1 in the specified general purpose register after each byte is moved.

The count is checked for zero before each byte transfer. If it is zero, the operation is terminated and a groupmark (GM) is inserted in the destination field. The operation is also terminated on detection of a groupmark with wordmark (GMWM) in the destination field, in which case no character is moved.

The destination address is always updated to 1 beyond the GMWM or GM address at the end of the move. The effective 1400 B-Storage Address Register is set to this address.

The Compatibility Feature Move to Compatibility instruction has the following format:



Condition Code:

- 00 - Operation terminated by count zero
- 01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
Addressing
Program

Timing:

65 + (5 times number of characters transferred) microseconds. Add 3

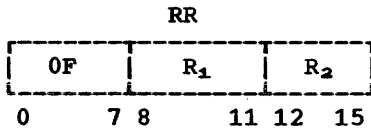
microseconds for each wordmark in the destination field.

Compatibility Feature Move From Compatibility (CFMF)

This instruction is identical to the CFMT instruction, with the following exceptions:

- The movement of data is reversed.
- GMWM detection is done on the source field.
- When a GMWM terminates the instruction, the source address is incremented to 1 beyond the GMWM address, and the destination address remains unchanged. The effective 1400 B-Storage Address Register is set to this (source) address.
- No groupmark is inserted in the destination field on termination by count.

The Compatibility Feature Move From Compatibility instruction has the following format:



Condition Code:

- 00 - Operation terminated by count zero
- 01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
Addressing
Program

Timing:

62 + (5 times number of characters transferred) microseconds. Add 3 microseconds for each wordmark in the destination field.

Compatibility Feature Load to Compatibility (CFLT)

This instruction moves data from the source address (2030 storage) to the destination address (compatibility storage).

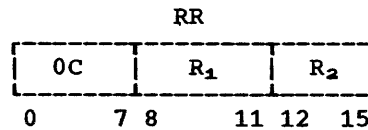
This function is similar to a tape-load operation from 2030 storage to 1400 storage. The binary address specified by general register R₂ is the source address, and the binary address specified by general register R₁ is the destination address. The low-order 16 bits in general register

R₁ + 1 is a count of the number of bytes to be handled in the source field.

Wordmarks in the source field are not moved. Wordmarks in the destination field are cleared. When a word separator character is detected in the source field, however, the count is decremented by 1, the source address is incremented by 1, no character transfer takes place, and a wordmark is inserted with the first character following in the source field that is not also a word separator.

Termination on GMWM detection or count and setting of the condition register is identical to that of the CFMT instruction. The effective 1400 B-Storage Address Register is set to the final destination address.

The Compatibility Feature Load to Compatibility instruction has the following format:



Condition Code:

- 00 - Operation terminated by count zero
- 01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
Addressing
Program

Timing:

65 + (4 times number of characters transferred) microseconds. Add 2 microseconds for each wordmark in the source field.

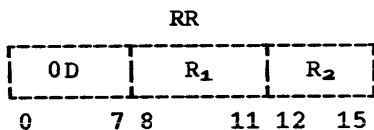
Compatibility Feature Load From Compatibility (CFLF)

This instruction is identical to the CFLT instruction, with the following exceptions:

- The movement of data is from 1400 storage to 2030 storage.
- Wordmarks in the source field cause a word separator character to be inserted in the destination field. The destination address is incremented by 1, the count is decremented by 1, and the source address remains unchanged.
- GMWM detection is done on the source field.

- When a GMWM terminates the operation, the source address is incremented to 1 beyond the GMWM, and the destination address remains unchanged. The effective 1400 B-Storage Address Register is set to this source address.
- No groupmark is inserted on termination by count.

The Compatibility Feature Load From Compatibility instruction has the following format:



Condition Code:

- 00 - Operation terminated by count zero
- 01 - Operation terminated by GMWM in 1400 storage

Program Interruptions:

- Addressing
- Program

Timing:

61 + (5 times number of characters transferred) microseconds. Add 4 microseconds for each wordmark in the destination field, and add 10 microseconds for each wordmark in the source field.

APPENDIX D: MODEL 40 SPECIAL INSTRUCTIONS

This appendix contains a brief description of the functions performed by a group of machine instructions that are intended for use by the Model 40 Emulator Program and are available for modifying the Model 40 Emulator Program for specific applications. To use these instructions properly, it is necessary that the user be thoroughly familiar with the internal operation and logic of the Model 40 Emulator Program.

The 1401/1440/1460 DOS Compatibility Feature executes 1400 instructions and performs other functions, such as updating the simulated 1400 registers. If the 1400 instruction to be emulated is not a Move Character and Edit (MCE), a Move Character and Suppress Zeros (MCS), an instruction related to input/output, a Halt, or any of the Branch on I/O Indicator instructions, the 1401/1440/1460 DOS Compatibility Feature executes the instruction without using the Emulator Program. After execution of an instruction, the 1401/1440/1460 DOS Compatibility Feature obtains (fetches) the next 1400 instruction. There are two methods of fetching the 1400 instructions: fetch the next sequential instruction (I-Fetch) and fetch the instruction located at the address of the A operand (I-Fetch at A-Address).

I-FETCH

I-Fetch performs the following operations:

- Gets the contents of the simulated Instruction Address Register (IAR)
- Converts the address in the IAR to the effective address in simulated storage that contains the instruction to be interpreted
- Fetches the instruction
- Updates and restores the simulated IAR
- Performs any indexing required for the instruction
- Converts the effective 1400 addresses of the operands obtained to their System/360 addresses in simulated storage
- Examines the operation code to determine whether the instruction can be

executed by the 1401/1440/1460 DOS Compatibility Feature alone or requires a branch to the Emulator Program

I-FETCH AT A-ADDRESS

I-Fetch at the A-address performs the same operations as I-Fetch, except that the address in the A-Address Register (AAR) is used, instead of the address in the IAR, to obtain the address of the next instruction. After the instruction is fetched, the address of the next instruction is stored in the simulated IAR. This is the process used for executing 1400 Branch instructions.

DIAGNOSE INSTRUCTIONS

The 1401/1440/1460 DOS Compatibility Feature provides special Diagnose instructions for use by the Emulator Program in executing 1400 instructions, converting addresses, providing character translation, inserting groupmarks and tapemarks, and returning control to the 1401/1440/1460 DOS Compatibility Feature. These instructions include the following:

- Multiway Branch
- Scatter/Gather
- Clear Entire 1400 Storage to Blanks
- Clear 1400 Locations 0-80 to Blanks
- Address Modify
- Scatter/Gather Binary Data
- Return to 1401: I-Fetch
- Return to 1401: I-Fetch at A-Address
- Scan for Groupmark with Wordmark in 1400 Storage
- Edit Analyze
- Edit Get, Put

The Diagnose instructions communicate with the 1401/1440/1460 DOS Compatibility Feature through the general purpose registers (GPRs).

The Diagnose instructions have the following format:

- Byte 1 - operation code (hexadecimal 83)
- Byte 2 - control byte (variable)
- Bytes 3 and 4 - absolute Read-Only-Storage address of the link to the 1401/1440/1460 DOS Compatibility Feature (hexadecimal 0741)

A description of each Diagnose instruction follows.

Multiway Branch

The hexadecimal representation of this instruction is 83000741. This instruction causes a branch to a subroutine after determining the branch address by a table-lookup operation. A specified character is compared to the entries in a table in Emulator-Program storage; the program branches to the address formed by combining the table function with a specified base address when an equal compare is recognized. After each unequal compare of search and table arguments, the table argument is tested for zero. A zero table argument signals the end of the table; the current search argument is ignored and program execution continues at the next sequential instruction after the Diagnose. To execute this Diagnose instruction, GPRs 8 and 9 must be initialized as follows:

	Bytes 0 and 1	Bytes 2 and 3
GPR 8	Search Table Address	Search Argument Address
GPR 9		Base Address

Search Table Address: This is the binary address of the beginning of a table (high order) consisting of a series of 2-byte entries, each situated on a halfword boundary. Byte 1 of each entry is the table argument to be compared to the search argument. Byte 2 is a binary relative address that is added to the base address when an equal compare occurs. The sum of the relative address and the base address is loaded into the current program status word (PSW) as a new instruction counter (IC).

Search Argument Address: This is the binary address of the search argument in Emulator-Program storage.

Base Address: This address forms the address of the next Emulator-Program instruction when combined with the relative address found in the table.

Scatter/Gather

The hexadecimal representation of this instruction is 83100741. Since simulated 1400 storage is not contiguous, and 1400 internal BCD is not represented the same as in the System/360 buffers, this instruction is necessary to move data between Emulator-Program storage and the simulated 1400 storage. This instruction also translates between BCDIC-8 and the simulated 1400 internal code in which instructions and data are represented in simulated 1400 storage (see Table 14).

Scatter performs the following:

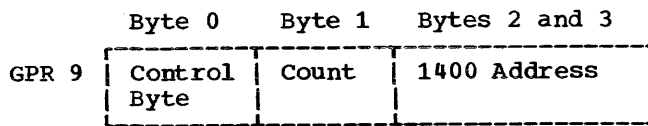
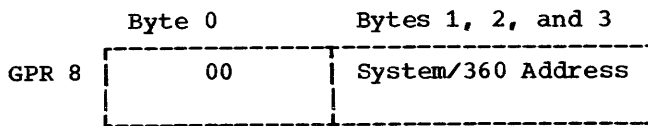
- Moves characters from contiguous Emulator-Program storage to noncontiguous 1400 storage
- Translates these characters from BCDIC-8 to simulated 1400 internal code
- Sets a condition code at termination of Scatter operation to indicate results of the operation
- Returns to the next Emulator-Program instruction if no invalid characters are found
- If an invalid character is detected, a "+" character (X0000000) is inserted in 1400 storage for that character, operation continues to termination and exits to branch table entry 31.

Gather performs the following functions:

- Moves characters from noncontiguous 1400 storage locations to contiguous locations in Emulator-Program storage
- Translates these characters from simulated 1400 internal code to BCDIC-8
- Sets a condition code at termination of Gather operation to indicate results of the operation
- Returns to the next instruction of the Emulator-Program

Data is represented in buffer areas in BCDIC-8, as shown in Table 15. When this data is scattered to 1400 storage, it remaps into the representation as shown in Table 14. When it is gathered, into the buffer from 1400 storage, it remaps into BCDIC-8 again.

To execute this Diagnose instruction, GPRs 8 and 9 must be initialized as follows:



System/360 Address: This is the System/360 buffer address from where data is to be taken (scattered) or to where data is to be placed (gathered).

Control Byte: This byte determines the manner of the scatter or gather and the status of the 1400 B-Address Register (BAR), in GPR1 or GPR9. Bits 1, 2, 3, 5, and 6 are always zero. If bit 4 contains a 1, the BAR contains the updated 1400 address used in the scatter or gather operation. GPR 8 (System/360 address) is updated as used. If bit 4 is 0, the BAR remains unchanged, and GPR 9 contains the updated 1400 address used in the scatter or gather operation. Bits 0 and 7 have the following meanings:

Bits	Operation
0 0	Gather characters in Load mode. The characters from simulated 1400 internal code with wordmarks are translated to BCDIC-8 with wordmarks.
0 1	Scatter characters in Move mode. The characters are translated from BCDIC-8 to simulated 1400 internal code. Bit 0 of the 1400 storage locations remains unchanged. This has the effect of leaving wordmark bits unchanged in 1400 storage while moving new characters into these locations.
1 0	Gather characters in Move mode. Simulated 1400 internal code characters with wordmarks are translated to BCDIC-8 without wordmarks.
1 1	Scatter characters in Load mode. BCDIC-8 characters with wordmarks are translated to simulated 1400 internal code.

Count: This field specifies the number of characters to be moved minus 1. For example, a count field containing hexadecimal 0A causes 11 characters to be moved. The scatter/gather operation is restricted to 256 characters per operation. The count field is unchanged by this operation.

1400 Address: This is the address, in "hddd" form, of the lowest 1400 address of the data field, where "h" is a hexadecimal digit and "d" is a decimal digit.

Condition Codes: The following condition codes are set at the termination of a Scatter operation:

- 00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character scattered plus 1.
- 01 - The operation has been terminated because a groupmark wordmark (GMWM) has been found in 1400 storage before the internal count has been decremented to zero. The 1400 address points to the GMWM plus 1. GPR8 points to the last System/360 character that was scattered plus 1.

The following condition codes are set for a Gather operation:

- 00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character gathered plus 1.
- 01 - The operation has been terminated because a GMWM has been found in 1400 storage before the internal count was decremented to zero. The GMWM has not been gathered to the Emulator Program storage. The 1400 address pointer to the GMWM plus 1. GPR8 points to the last character gathered to the System/360 storage plus 1, i.e., where the GMWM would be if it had been moved.

Scatter/Gather Load Mode Tape

The hexadecimal representation of this instruction is 83100741. Since simulated 1400 storage is not contiguous, this instruction is necessary to move data between Emulator-Program storage and simulated 1400 storage, translating the data between BCDIC-8 and the simulated 1400 internal code in which instructions and data are represented in simulated 1400 storage (see Table 14). The instruction also performs a conversion between word separators and wordmarks.

Scatter Load Mode Tape performs the following:

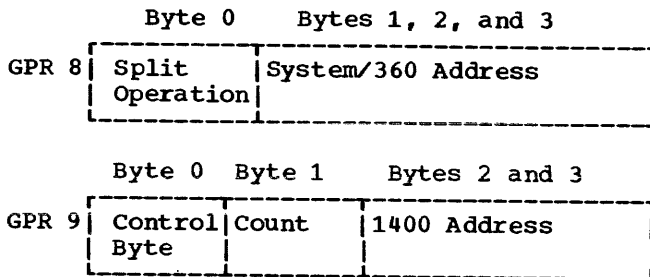
- Moves characters from contiguous Emulator-Program storage to noncontiguous 1400 storage

- Translates these characters from BCDIC-8 to simulated 1400 internal code
- Converts word separators to wordmarks (only the first of a series of word separators is utilized)
- Tests for invalid characters, setting a condition code of 10 upon detection and inserting a "+" character (X0000000) in 1400 storage for that character
- Returns to the next instruction of the Emulator Program

Gather Load Mode Tape performs the following:

- Moves characters from noncontiguous 1400 storage to contiguous Emulator-Program storage
- Translates these characters from simulated 1400 internal code to BCDIC-8
- Converts wordmarks to word separators
- Returns to the next instruction of the Emulator Program

To execute this Diagnose instruction, GPRs 8 and 9 must be initialized as follows:



Split Operation: This byte (byte 0 of GPR 8) is used to indicate a split operation, where the last character read from Emulator-Program storage was a word separator. If bit 4 of byte 0 of GPR 8 is not a zero when Scatter Load Mode Tape is entered, a wordmark is placed at the first character in simulated 1400 storage. This byte of GPR 8 must be initialized at 0, and hardware will automatically set this byte for split operation.

System/360 Address: This is the System/360 buffer address from where data is to be taken (scattered) or to where data is to be placed (gathered).

Control Byte: This byte determines whether the operation is a scatter or a gather, the scatter/gather is a load-mode tape operation, and the status of the B-Address Register (BAR), GPR 8 (System/360 address), and GPR 9 (1400 address). Bits 0, 1, 2, 5, and 6 are always zero. If bit 3 contains a 1, Scatter/Gather Load Mode Tape is indicated. If bit 4 contains a 1, the BAR contains the updated 1400 address used in the scatter or gather operation. GPR 8 (System/360 address) is updated as used. If bit 4 contains a 0, the BAR remains unchanged, and GPR 9 contains the updated 1400 address used in the scatter or gather operation. If bit 7 contains a 0, the operation is a gather; if bit 7 contains a 1, the operation is a scatter.

Count: This field specifies the number of characters to be moved minus 1. For example, a count field containing hexadecimal 0A causes 11 characters to be moved. The scatter/gather operation is restricted to 256 characters per operation. The count field is unchanged by this operation.

1400 Address: This is the address, in "hddd" form, of the lowest 1400 address of the data field.

Condition Codes: The following condition codes are set at the termination of a Scatter operation:

- 00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character scattered plus 1.
- 01 - The operation has been terminated because a groupmark wordmark (GMWM) has been found in 1400 storage before the internal count was decremented to zero. The 1400 address points to the GMWM plus 1. GPR8 points to the last System/360 character that was scattered plus 1.
- 10 - An invalid 1400 character has been detected during the scatter and the internal count has been decremented to zero. The 1400 address in GPR1 or GPR9 points to the last character scattered plus 1.
- 11 - An invalid 1400 character has been detected during the scatter and the scatter has been terminated by a GMWM in 1400 storage before the internal count was decremented to zero. The 1400 address in GPR1 or GPR9 points to the GMWM plus 1.

GPR8 points to the last System/360 character scattered plus 1.

1010 ddddd Decrement by one
1011 ddddd Decrement under count

Clear Entire 1400 Storage to Blanks

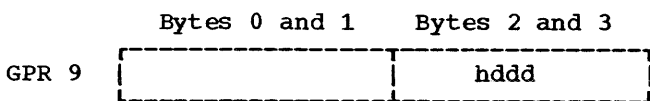
The hexadecimal representation of this instruction is 83300741. This Diagnose instruction uses the 1401/1440/1460 DOS Compatibility Feature to clear the entire simulated 1400 storage to blanks. No register initialization is necessary.

Clear 1400 Locations 0-80 to Blanks

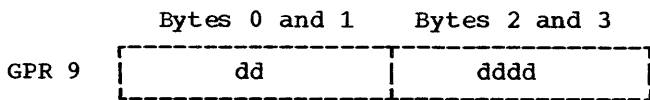
The hexadecimal representation of this instruction is 83400741. This Diagnose instruction uses the 1401/1440/1460 DOS Compatibility Feature to clear the simulated 1400 card read area to blanks. No register initialization is necessary.

Address Modify

The hexadecimal representation of this instruction is 839x0741, where "x" (bits 12-15) is set to one of eight possible configurations for specific address modification. This Diagnose instruction uses the 1401/1440/1460 DOS Compatibility Features to increment or decrement by one or under count a 1401-type address in the form "hddd" or a six-digit decimal address in the form "dddddd" in GPR 9 where "h" is a hexadecimal digit and "d" is a decimal digit. In order for this instruction to be executed, GPR 9 must be initialized as follows:



or



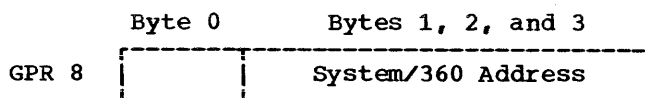
The count, if required, is in binary form in bytes 2 and 3 of GPR 8 and should be one less than the number desired to be incremented or decremented.

The possible configurations for bits 12-15, with the resulting format and address modification, are:

Bits 12-15	Format	Modification
0000	hddd	Increment by one
0001	hddd	Increment under count
0010	dddddd	Increment by one
0011	dddddd	Increment under count
1000	hddd	Decrement by one
1001	hddd	Decrement under count

Scatter/Gather Binary Data

The hexadecimal representation of this instruction is 83A00741 for Scatter and 83B00741 for Gather. This Diagnose instruction transfers 160 bytes of binary data between Emulator-Program storage and 1400 storage locations 401, 501, 402, 502, etc. Translation between BCDIC-8 and simulated 1400 internal code representation is accomplished during the transfer. After the operation, control is returned to the 1401/1440/1460 DOS Compatibility Feature through branch table entry 16 for Scatter or entry 5 for Gather. In order for this instruction to be executed, GPR 8 must be initialized as follows:



System/360 Address: This is the binary address of the lowest location of the binary data in Emulator-Program storage. After completion of the operation, this address will have been incremented by 160.

Return to 1400: I-Fetch

The hexadecimal representation of this instruction is 83D00741. This Diagnose instruction returns control from the Emulator Program to the 1401/1440/1460 DOS Compatibility Feature. The Compatibility Feature then performs an I-Fetch for the next 1400 instruction. No register initialization is necessary.

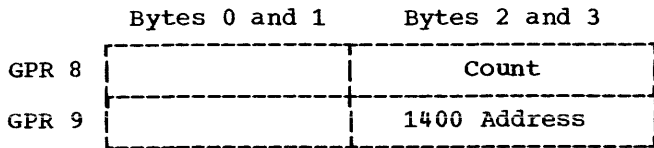
Return to 1400: I-Fetch at A-Address

The hexadecimal representation of this instruction is 83E00741. This Diagnose instruction executes a 1400 branch by returning control from the Emulator Program to the 1401/1440/1460 DOS Compatibility Feature. The Compatibility Feature then performs an I-Fetch at the address in the AAR for the next 1400 instruction. No register initialization is necessary.

Scan for Groupmark with Wordmark in 1400 Storage

The hexadecimal representation of this instruction is 83600741. This Diagnose instruction uses 1401/1440/1460 DOS Compatibility Feature to scan for a groupmark with wordmark under count. The scan is from left to right. In order for this

instruction to be executed, GPRs 8 and 9 must be initialized as follows:



Count: This field specifies, in binary form, the number of positions to be scanned minus 1. This binary value should not exceed the decimal value of 16,000. A starting count of hexadecimal FFFF results in an error. After the operation is completed, the residual count in GPR 8 is the original count minus the number of positions scanned. The scan is stopped when the count is reduced from hexadecimal 0000 to hexadecimal FFFF, unless the groupmark with wordmark is found earlier. The condition code is set as follows:

- 00 Specifies the groupmark with wordmark was found at the count.
- 01 Specifies the groupmark with wordmark was found before the count.
- 10 Specifies the size of 1400 storage (16K) was exceeded.
- 11 Specifies the groupmark with wordmark was not found.

1400 Address: This is the address, in "hddd" format, of the first 1400 location to be scanned. After the operation is completed, GPR 9 contains an address one greater than the last position scanned, whether or not the scan was stopped by an end-of-count or groupmark-with-wordmark-found condition.

Examples: Assuming a starting 1400 address of 0401 in bytes 2 and 3 of GPR 9, and a starting count of hexadecimal 0009 in bytes 2 and 3 of GPR 8, the following results are produced after the operation is completed:

GMWM Addr.	Residual Count	Residual Addr. in GPR 9	CC
0410	FFFF	0411	00
0409	0000	0410	01
Not in field	FFFF	0411	11

Assuming a starting 1400 address of 15, 996 in bytes 2 and 3 of GPR 9, and the same starting count of hexadecimal 0009 in bytes 2 and 3 of GPR 8, the following results are produced:

GMWM Addr.	Residual Count	Residual Addr. in GPR 9	CC
Not in field	000	0000	10

Edit Analyze

The hexadecimal representation of this instruction is 83700741. This Diagnose instruction uses the 1401 character in byte 3 of GPR 7 as an action control. This byte of data is called the "control byte" in the following text.

The Edit Analyze instruction has two courses of action, depending on whether or not the control byte has a wordmark.

If the control byte has no wordmark, then its bit 0 is set to a 1, and the resulting character is used as the low-order byte of a table address. The second byte of this address is taken from byte 0 of GPR 7. The remaining high-order positions of the table address are taken from the high-order positions of the current instruction counter (IC). The table address is used to fetch a character from System/360 storage. This character is used as the low-order byte of a branch address. The second byte of the branch address is taken from byte 0 of the current IC. The high-order positions of the branch address are set to a 0. This address is then inserted into the IC of the current PSW, which effects a branch.

If the control character has a wordmark, then bit 0 remains a 1, and a branch address is formed in the same manner as described in the previous paragraph. However, instead of a branch to this address being executed, the branch address is placed in bytes 0 and 1 of GPR 7. The current IC is then used to fetch the next instruction.

Edit Get, Put

The hexadecimal representation of this instruction is 832x0741, where "x" (bits 12-15) is set to one of four possible configurations for four specific operations. In all four operations, a character is fetched from 1400 storage and put in byte 3 of a GPR. If the character has a wordmark, the condition code is set to 1; otherwise, the condition code is set to 0. The possible configurations for bits 12-15 are:

- 1011 Specifies GET A, MOD AAR -1. In this operation, the 1400-character address is in the current 1400 AAR. After the character is fetched, the AAR is decremented by one. The character is placed in byte 3 of GPR 4.

0111	Specifies GET B, NO MODIFY. In this operation, the 1400-character address is in the current 1400 BAR. The BAR is unchanged after the operation. The character is placed in byte 3 of GPR 7.		replaces the current BAR); the character at the resulting address is fetched to byte 3 to GPR 7. The condition code is set to 0 if the fetched character has <u>no</u> wordmark; otherwise, it is set to 1.
1110	Specifies PUT B, MOD BAR -1, GET NEXT B. In this operation, the character in byte 3 of GPR 7 is transferred to 1400 storage (to the address specified by the BAR). The BAR is then decremented by one (and	1100	Specifies PUT B, MOD BAR +1, GET NEXT B. This operation is identical to PUT B, MOD BAR -1, GET NEXT B, except that the BAR is incremented (instead of decremented) by one.

APPENDIX E: CHARACTER CONVERSION TABLES

Table 14. Eight-Bit Representation of BCD Graphics in Simulated 1400 Storage for the Model 40

	WITHOUT WORDMARK								WITH WORDMARK							
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	+	-	̄	bl	?	!	‡	0	+	-	̄	bl	?	!	‡	0
0001					A	J	/	1					A	J	/	1
0010					B	K	S	2					B	K	S	2
0011					C	L	T	3					C	L	T	3
0100					D	M	U	4					D	M	U	4
0101					E	N	V	5					E	N	V	5
0110					F	O	W	6					F	O	W	6
0111					G	P	X	7					G	P	X	7
1000					H	Q	Y	8					H	Q	Y	8
1001					I	R	Z	9					I	R	Z	9
1010																
1011	.	\$,	#					.	\$,	#				
1100	π	*	%	@					π	*	%	@				
1101	[]	~	:	.				[]	~	:	.			
1110	<	;	\	>					<	;	\	>				
1111	≠	Δ	≠	✓					≠	Δ	≠	✓				

Table 15. Eight-Bit Representation of BCD Graphics in Simulated 1400 Storage for the Model 30, and Buffer Areas for Models 30 and 40

4567 ↓	WITH WORDMARK ₁				WITHOUT WORDMARK ₂				WITH WORDMARK ₁				WITHOUT WORDMARK ₂			
	0123 →															
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	bl	+	-		bl	+	-		?	!	+	0	?	!	+	0
0001			/				/		A	J		1	A	J		1
0010									B	K	S	2	B	K	S	2
0011									C	L	T	3	C	L	T	3
0100									D	M	U	4	D	M	U	4
0101									E	N	V	5	E	N	V	5
0110									F	O	W	6	F	O	W	6
0111									G	P	X	7	G	P	X	7
1000									H	Q	Y	8	H	Q	Y	8
1001									I	R	Z	9	I	R	Z	9
1010				ḃ				ḃ								
1011	.	\$,	#	.	\$,	#								
1100	π	*	%	@	π	*	%	@								
1101	[]	~	:	[]	~	:								
1110	<	;	\	>	<	;	\	>								
1111	≠	Δ	#	√	≠	Δ	#	√								

₁Representation for odd-parity, 9-track tapes.
₂Representation for even-parity, 9-track tapes.

APPENDIX F: MODEL 40 ADDRESS CONVERSION TABLE

Normally the area of Model 40 Emulator-Program main storage from hexadecimal 4000 to 7FFF is reserved for simulated 1400 storage. This area of 16,384 bytes provides 16 thousand 1400 character positions.

Because of addressing differences between the 1400 and System/360, consecutive 1400 addresses do not necessarily correspond to consecutive System/360 addresses. For example, data in 1400 locations 096, 097, and 098 are actually stored in System/360 bytes 0421E, 0421F, and 04618, respectively. The following address conversion table will aid the user in reading 1400 data and instructions as they appear in a System/360 storage dump. The 1400 addresses in decimal and their equivalent System/360 addresses in hexadecimal are shown in the table. Only even addresses are shown; the equivalent System/360 address of odd 1400 addresses is always one greater than the previous even address.

If RELOC has been specified and the IBM 1401/1440/1460 Relocatable DOS compatibility feature (#4462) is installed, a relocation factor must be added to the S/360 address portion of the conversion table. The following table indicates the possible parameters for RELOC and the corresponding hexadecimal value that must be added to the S/360 address.

RELOC Parameters	Hexadecimal value to be added
16	0000
32	4000
48	8000
64	C000
80	10000
96	14000
112	18000

For example, if RELOC=32, then data at 1400 locations 096, 097, and 098 are actually stored in System/360 bytes 0821E, 0821F, and 08618, respectively.

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
00 04000	02 04002	04 04004	06 04006	08 04008	10 04010	12 04012	14 04014	16 04016	18 04018	
20 04020	22 04022	24 04024	26 04026	28 04028	30 04030	32 04032	34 04034	36 04036	38 04038	
40 04040	42 04042	44 04044	46 04046	48 04048	50 04050	52 04052	54 04054	56 04056	58 04058	
60 04060	62 04062	64 04064	66 04066	68 04068	70 04070	72 04072	74 04074	76 04076	78 04078	
80 04208	82 0420A	84 0420C	86 0420E	88 04608	90 04218	92 0421A	94 0421C	96 0421E	98 04618	
100 04100	102 04102	104 04104	106 04106	108 04108	110 04110	112 04112	114 04114	116 04116	118 04118	
120 04120	122 04122	124 04124	126 04126	128 04128	130 04130	132 04132	134 04134	136 04136	138 04138	
140 04140	142 04142	144 04144	146 04146	148 04148	150 04150	152 04152	154 04154	156 04156	158 04158	
160 04160	162 04162	164 04164	166 04166	168 04168	170 04170	172 04172	174 04174	176 04176	178 04178	
180 04308	182 0430A	184 0430C	186 0430E	188 04708	190 04318	192 0431A	194 0431C	196 0431E	198 04718	
200 04200	202 04202	204 04204	206 04206	208 0400A	210 04210	212 04212	214 04214	216 04216	218 0401A	
220 04220	222 04222	224 04224	226 04226	228 0402A	230 04230	232 04232	234 04234	236 04236	238 0403A	
240 04240	242 04242	244 04244	246 04246	248 0404A	250 04250	252 04252	254 04254	256 04256	258 0405A	
260 04260	262 04262	264 04264	266 04266	268 0406A	270 04270	272 04272	274 04274	276 04276	278 0407A	
280 04228	282 0422A	284 0422C	286 0422E	288 04628	290 04238	292 0423A	294 0423C	296 0423E	298 04638	
300 04300	302 04302	304 04304	306 04306	308 0410A	310 04310	312 04312	314 04314	316 04316	318 0411A	
320 04320	322 04322	324 04324	326 04326	328 0412A	330 04330	332 04332	334 04334	336 04336	338 0413A	
340 04340	342 04342	344 04344	346 04346	348 0414A	350 04350	352 04352	354 04354	356 04356	358 0415A	
360 04360	362 04362	364 04364	366 04366	368 0416A	370 04370	372 04372	374 04374	376 04376	378 0417A	
380 04328	382 0432A	384 0432C	386 0432E	388 04728	390 04338	392 0433A	394 0433C	396 0433E	398 04738	
400 04400	402 04402	404 04404	406 04406	408 0400C	410 04410	412 04412	414 04414	416 04416	418 0401C	
420 04420	422 04422	424 04424	426 04426	428 0402C	430 04430	432 04432	434 04434	436 04436	438 0403C	
440 04440	442 04442	444 04444	446 04446	448 0404C	450 04450	452 04452	454 04454	456 04456	458 0405C	
460 04460	462 04462	464 04464	466 04466	468 0406C	470 04470	472 04472	474 04474	476 04476	478 0407C	
480 04248	482 0424A	484 0424C	486 0424E	488 04648	490 04258	492 0425A	494 0425C	496 0425E	498 04658	
500 04500	502 04502	504 04504	506 04506	508 0410C	510 04510	512 04512	514 04514	516 04516	518 0411C	
520 04520	522 04522	524 04524	526 04526	528 0412C	530 04530	532 04532	534 04534	536 04536	538 0413C	
540 04540	542 04542	544 04544	546 04546	548 0414C	550 04550	552 04552	554 04554	556 04556	558 0415C	
560 04560	562 04562	564 04564	566 04566	568 0416C	570 04570	572 04572	574 04574	576 04576	578 0417C	
580 04348	582 0434A	584 0434C	586 0434E	588 04748	590 04358	592 0435A	594 0435C	596 0435E	598 04758	
600 04600	602 04602	604 04604	606 04606	608 0400E	610 04610	612 04612	614 04614	616 04616	618 0401E	
620 04620	622 04622	624 04624	626 04626	628 0402E	630 04630	632 04632	634 04634	636 04636	638 0403E	
640 04640	642 04642	644 04644	646 04646	648 0404E	650 04650	652 04652	654 04654	656 04656	658 0405E	
660 04660	662 04662	664 04664	666 04666	668 0406E	670 04670	672 04672	674 04674	676 04676	678 0407E	
680 04268	682 0426A	684 0426C	686 0426E	688 04668	690 04278	692 0427A	694 0427C	696 0427E	698 04678	
700 04700	702 04702	704 04704	706 04706	708 0410E	710 04710	712 04712	714 04714	716 04716	718 0411E	
720 04720	722 04722	724 04724	726 04726	728 0412E	730 04730	732 04732	734 04734	736 04736	738 0413E	
740 04740	742 04742	744 04744	746 04746	748 0414E	750 04750	752 04752	754 04754	756 04756	758 0415E	
760 04760	762 04762	764 04764	766 04766	768 0416E	770 04770	772 04772	774 04774	776 04776	778 0417E	
780 04368	782 0436A	784 0436C	786 0436E	788 04768	790 04378	792 0437A	794 0437C	796 0437E	798 04778	
800 04408	802 0440A	804 0440C	806 0440E	808 0460A	810 04418	812 0441A	814 0441C	816 0441E	818 0461A	
820 04428	822 0442A	824 0442C	826 0442E	828 0462A	830 04438	832 0443A	834 0443C	836 0443E	838 0463A	
840 04448	842 0444A	844 0444C	846 0444E	848 0464A	850 04458	852 0445A	854 0445C	856 0445E	858 0465A	
860 04468	862 0446A	864 0446C	866 0446E	868 0466A	870 04478	872 0447A	874 0447C	876 0447E	878 0467A	
880 0460C	882 0462C	884 0464C	886 0466C	888 0460E	890 0461C	892 0463C	894 0465C	896 0467C	898 0461E	
900 04508	902 0450A	904 0450C	906 0450E	908 0470A	910 04518	912 0451A	914 0451C	916 0451E	918 0471A	
920 04528	922 0452A	924 0452C	926 0452E	928 0472A	930 04538	932 0453A	934 0453C	936 0453E	938 0473A	
940 04548	942 0454A	944 0454C	946 0454E	948 0474A	950 04558	952 0455A	954 0455C	956 0455E	958 0475A	
960 04568	962 0456A	964 0456C	966 0456E	968 0476A	970 04578	972 0457A	974 0457C	976 0457E	978 0477A	
980 0470C	982 0472C	984 0474C	986 0476C	988 0470E	990 0471C	992 0473C	994 0475C	996 0477C	998 0471E	

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
1000 04080	1002 04082	1004 04084	1006 04086	1008 04088	1010 04090	1012 04092	1014 04094	1016 04096	1018 04098	1020 04080
1020 040A0	1022 040A2	1024 040A4	1026 040A6	1028 040A8	1030 040B0	1032 040B2	1034 040B4	1036 040B6	1038 040B8	1040 040C0
1040 040C0	1042 040C2	1044 040C4	1046 040C6	1048 040C8	1050 040D0	1052 040D2	1054 040D4	1056 040D6	1058 040D8	1060 040E0
1060 040E0	1062 040E2	1064 040E4	1066 040E6	1068 040E8	1070 040F0	1072 040F2	1074 040F4	1076 040F6	1078 040F8	1080 04288
1080 04288	1082 0428A	1084 0428C	1086 0428E	1088 04688	1090 04298	1092 0429A	1094 0429C	1096 0429E	1098 04698	1100 04180
1100 04180	1102 04182	1104 04184	1106 04186	1108 04188	1110 04190	1112 04192	1114 04194	1116 04196	1118 04198	1120 041A0
1120 041A0	1122 041A2	1124 041A4	1126 041A6	1128 041A8	1130 041B0	1132 041B2	1134 041B4	1136 041B6	1138 041B8	1140 041C0
1140 041C0	1142 041C2	1144 041C4	1146 041C6	1148 041C8	1150 041D0	1152 041D2	1154 041D4	1156 041D6	1158 041D8	1160 041E0
1160 041E0	1162 041E2	1164 041E4	1166 041E6	1168 041E8	1170 041F0	1172 041F2	1174 041F4	1176 041F6	1178 041F8	1180 04388
1180 04388	1182 0438A	1184 0438C	1186 0438E	1188 04788	1190 04398	1192 0439A	1194 0439C	1196 0439E	1198 04798	1200 04280
1200 04280	1202 04282	1204 04284	1206 04286	1208 0408A	1210 04290	1212 04292	1214 04294	1216 04296	1218 0409A	1220 042A0
1220 042A0	1222 042A2	1224 042A4	1226 042A6	1228 040A8	1230 042B0	1232 042B2	1234 042B4	1236 042B6	1238 040B8	1240 042C0
1240 042C0	1242 042C2	1244 042C4	1246 042C6	1248 040C8	1250 042D0	1252 042D2	1254 042D4	1256 042D6	1258 040D8	1260 042E0
1260 042E0	1262 042E2	1264 042E4	1266 042E6	1268 040E8	1270 042F0	1272 042F2	1274 042F4	1276 042F6	1278 040F8	1280 042A8
1280 042A8	1282 042AA	1284 042AC	1286 042AE	1288 046A8	1290 042B8	1292 042BA	1294 042BC	1296 042BE	1298 046B8	1300 04380
1300 04380	1302 04382	1304 04384	1306 04386	1308 0418A	1310 04390	1312 04392	1314 04394	1316 04396	1318 0419A	1320 043A0
1320 043A0	1322 043A2	1324 043A4	1326 043A6	1328 041AA	1330 043B0	1332 043B2	1334 043B4	1336 043B6	1338 041BA	1340 043C0
1340 043C0	1342 043C2	1344 043C4	1346 043C6	1348 041CA	1350 043D0	1352 043D2	1354 043D4	1356 043D6	1358 041DA	1360 043E0
1360 043E0	1362 043E2	1364 043E4	1366 043E6	1368 041EA	1370 043F0	1372 043F2	1374 043F4	1376 043F6	1378 041FA	1380 043A8
1380 043A8	1382 043AA	1384 043AC	1386 043AE	1388 047A8	1390 043B8	1392 043BA	1394 043BC	1396 043BE	1398 047B8	1400 04480
1400 04480	1402 04482	1404 04484	1406 04486	1408 0408C	1410 04490	1412 04492	1414 04494	1416 04496	1418 0409C	1420 044A0
1420 044A0	1422 044A2	1424 044A4	1426 044A6	1428 040AC	1430 044B0	1432 044B2	1434 044B4	1436 044B6	1438 040BC	1440 044C0
1440 044C0	1442 044C2	1444 044C4	1446 044C6	1448 040CC	1450 044D0	1452 044D2	1454 044D4	1456 044D6	1458 040DC	1460 044E0
1460 044E0	1462 044E2	1464 044E4	1466 044E6	1468 040EC	1470 044F0	1472 044F2	1474 044F4	1476 044F6	1478 040FC	1480 042C8
1480 042C8	1482 042CA	1484 042CC	1486 042CE	1488 046C8	1490 042D8	1492 042DA	1494 042DC	1496 042DE	1498 046D8	1500 04580
1500 04580	1502 04582	1504 04584	1506 04586	1508 0418C	1510 04590	1512 04592	1514 04594	1516 04596	1518 0419C	1520 045A0
1520 045A0	1522 045A2	1524 045A4	1526 045A6	1528 041AC	1530 045B0	1532 045B2	1534 045B4	1536 045B6	1538 041BC	1540 045C0
1540 045C0	1542 045C2	1544 045C4	1546 045C6	1548 041CC	1550 045D0	1552 045D2	1554 045D4	1556 045D6	1558 041DC	1560 045E0
1560 045E0	1562 045E2	1564 045E4	1566 045E6	1568 041EC	1570 045F0	1572 045F2	1574 045F4	1576 045F6	1578 041FC	1580 043C8
1580 043C8	1582 043CA	1584 043CC	1586 043CE	1588 047C8	1590 043D8	1592 043DA	1594 043DC	1596 043DE	1598 047D8	1600 04680
1600 04680	1602 04682	1604 04684	1606 04686	1608 0408E	1610 04690	1612 04692	1614 04694	1616 04696	1618 0409E	1620 046A0
1620 046A0	1622 046A2	1624 046A4	1626 046A6	1628 040AE	1630 046B0	1632 046B2	1634 046B4	1636 046B6	1638 040BE	1640 046C0
1640 046C0	1642 046C2	1644 046C4	1646 046C6	1648 040CE	1650 046D0	1652 046D2	1654 046D4	1656 046D6	1658 040DE	1660 046E0
1660 046E0	1662 046E2	1664 046E4	1666 046E6	1668 040EE	1670 046F0	1672 046F2	1674 046F4	1676 046F6	1678 040FE	1680 042E8
1680 042E8	1682 042EA	1684 042EC	1686 042EE	1688 046E8	1690 042F8	1692 042FA	1694 042FC	1696 042FE	1698 046F8	1700 04780
1700 04780	1702 04782	1704 04784	1706 04786	1708 0418E	1710 04790	1712 04792	1714 04794	1716 04796	1718 0419E	1720 047A0
1720 047A0	1722 047A2	1724 047A4	1726 047A6	1728 041AE	1730 047B0	1732 047B2	1734 047B4	1736 047B6	1738 041BE	1740 047C0
1740 047C0	1742 047C2	1744 047C4	1746 047C6	1748 041CE	1750 047D0	1752 047D2	1754 047D4	1756 047D6	1758 041DE	1760 047E0
1760 047E0	1762 047E2	1764 047E4	1766 047E6	1768 041EE	1770 047F0	1772 047F2	1774 047F4	1776 047F6	1778 041FE	1780 043E8
1780 043E8	1782 043EA	1784 043EC	1786 043EE	1788 047E8	1790 043F8	1792 043FA	1794 043FC	1796 043FE	1798 047F8	1800 04488
1800 04488	1802 0448A	1804 0448C	1806 0448E	1808 0468A	1810 04498	1812 0449A	1814 0449C	1816 0449E	1818 0469A	1820 044A8
1820 044A8	1822 044AA	1824 044AC	1826 044AE	1828 046AA	1830 044B8	1832 044BA	1834 044BC	1836 044BE	1838 046BA	1840 044C8
1840 044C8	1842 044CA	1844 044CC	1846 044CE	1848 046CA	1850 044D8	1852 044DA	1854 044DC	1856 044DE	1858 046DA	1860 044E8
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1880 0468C	1882 046AC	1884 046CC	1886 046EC	1888 046E8	1890 0469C	1892 046BC	1894 046DC	1896 046FC	1898 0469E	1900 04588
1900 04588	1902 0458A	1904 0458C	1906 0458E	1908 0478A	1910 04598	1912 0459A	1914 0459C	1916 0459E	1918 0479A	1920 045A8
1920 045A8	1922 045AA	1924 045AC	1926 045AE	1928 047AA	1930 045B8	1932 045BA	1934 045BC	1936 045BE	1938 047BA	1940 045C8
1940 045C8	1942 045CA	1944 045CC	1946 045CE	1948 047CA	1950 045D8	1952 045DA	1954 045DC	1956 045DE	1958 047DA	1960 045E8
1960 045E8	1962 045EA	1964 045EC	1966 045EE	1968 047EA	1970 045F8	1972 045FA	1974 045FC	1976 045FE	1978 047FA	1980 0478C
1980 0478C	1982 047AC	1984 047CC	1986 047EC	1988 047E8	1990 0479C	1992 047BC	1994 047DC	1996 047FC	1998 0479E	

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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2020 04820	2022 04822	2024 04824	2026 04826	2028 04828	2030 04830	2032 04832	2034 04834	2036 04836	2038 04838	
2040 04840	2042 04842	2044 04844	2046 04846	2048 04848	2050 04850	2052 04852	2054 04854	2056 04856	2058 04858	
2060 04860	2062 04862	2064 04864	2066 04866	2068 04868	2070 04870	2072 04872	2074 04874	2076 04876	2078 04878	
2080 04A08	2082 04A0A	2084 04A0C	2086 04A0E	2088 04E08	2090 04A18	2092 04A1A	2094 04A1C	2096 04A1E	2098 04E18	
2100 04900	2102 04902	2104 04904	2106 04906	2108 04908	2110 04910	2112 04912	2114 04914	2116 04916	2118 04918	
2120 04920	2122 04922	2124 04924	2126 04926	2128 04928	2130 04930	2132 04932	2134 04934	2136 04936	2138 04938	
2140 04940	2142 04942	2144 04944	2146 04946	2148 04948	2150 04950	2152 04952	2154 04954	2156 04956	2158 04958	
2160 04960	2162 04962	2164 04964	2166 04966	2168 04968	2170 04970	2172 04972	2174 04974	2176 04976	2178 04978	
2180 04B08	2182 04B0A	2184 04B0C	2186 04B0E	2188 04F08	2190 04B18	2192 04B1A	2194 04B1C	2196 04B1E	2198 04F18	
2200 04A00	2202 04A02	2204 04A04	2206 04A06	2208 0480A	2210 04A10	2212 04A12	2214 04A14	2216 04A16	2218 0481A	
2220 04A20	2222 04A22	2224 04A24	2226 04A26	2228 0482A	2230 04A30	2232 04A32	2234 04A34	2236 04A36	2238 0483A	
2240 04A40	2242 04A42	2244 04A44	2246 04A46	2248 0484A	2250 04A50	2252 04A52	2254 04A54	2256 04A56	2258 0485A	
2260 04A60	2262 04A62	2264 04A64	2266 04A66	2268 0486A	2270 04A70	2272 04A72	2274 04A74	2276 04A76	2278 0487A	
2280 04A28	2282 04A2A	2284 04A2C	2286 04A2E	2288 04E28	2290 04A38	2292 04A3A	2294 04A3C	2296 04A3E	2298 04E38	
2300 04B00	2302 04B02	2304 04B04	2306 04B06	2308 0490A	2310 04B10	2312 04B12	2314 04B14	2316 04B16	2318 0491A	
2320 04B20	2322 04B22	2324 04B24	2326 04B26	2328 0492A	2330 04B30	2332 04B32	2334 04B34	2336 04B36	2338 0493A	
2340 04B40	2342 04B42	2344 04B44	2346 04B46	2348 0494A	2350 04B50	2352 04B52	2354 04B54	2356 04B56	2358 0495A	
2360 04B60	2362 04B62	2364 04B64	2366 04B66	2368 0496A	2370 04B70	2372 04B72	2374 04B74	2376 04B76	2378 0497A	
2380 04B28	2382 04B2A	2384 04B2C	2386 04B2E	2388 04F28	2390 04B38	2392 04B3A	2394 04B3C	2396 04B3E	2398 04F38	
2400 04C00	2402 04C02	2404 04C04	2406 04C06	2408 0480C	2410 04C10	2412 04C12	2414 04C14	2416 04C16	2418 0481C	
2420 04C20	2422 04C22	2424 04C24	2426 04C26	2428 0482C	2430 04C30	2432 04C32	2434 04C34	2436 04C36	2438 0483C	
2440 04C40	2442 04C42	2444 04C44	2446 04C46	2448 0484C	2450 04C50	2452 04C52	2454 04C54	2456 04C56	2458 0485C	
2460 04C60	2462 04C62	2464 04C64	2466 04C66	2468 0486C	2470 04C70	2472 04C72	2474 04C74	2476 04C76	2478 0487C	
2480 04A48	2482 04A4A	2484 04A4C	2486 04A4E	2488 04E48	2490 04A58	2492 04A5A	2494 04A5C	2496 04A5E	2498 04E58	
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2540 04D40	2542 04D42	2544 04D44	2546 04D46	2548 0494C	2550 04D50	2552 04D52	2554 04D54	2556 04D56	2558 0495C	
2560 04D60	2562 04D62	2564 04D64	2566 04D66	2568 0496C	2570 04D70	2572 04D72	2574 04D74	2576 04D76	2578 0497C	
2580 04B48	2582 04B4A	2584 04B4C	2586 04B4E	2588 04F48	2590 04B58	2592 04B5A	2594 04B5C	2596 04B5E	2598 04F58	
2600 04E00	2602 04E02	2604 04E04	2606 04E06	2608 0480E	2610 04E10	2612 04E12	2614 04E14	2616 04E16	2618 0481E	
2620 04E20	2622 04E22	2624 04E24	2626 04E26	2628 0482E	2630 04E30	2632 04E32	2634 04E34	2636 04E36	2638 0483E	
2640 04E40	2642 04E42	2644 04E44	2646 04E46	2648 0484E	2650 04E50	2652 04E52	2654 04E54	2656 04E56	2658 0485E	
2660 04E60	2662 04E62	2664 04E64	2666 04E66	2668 0486E	2670 04E70	2672 04E72	2674 04E74	2676 04E76	2678 0487E	
2680 04A68	2682 04A6A	2684 04A6C	2686 04A6E	2688 04E68	2690 04A78	2692 04A7A	2694 04A7C	2696 04A7E	2698 04E78	
2700 04F00	2702 04F02	2704 04F04	2706 04F06	2708 0490E	2710 04F10	2712 04F12	2714 04F14	2716 04F16	2718 0491E	
2720 04F20	2722 04F22	2724 04F24	2726 04F26	2728 0492E	2730 04F30	2732 04F32	2734 04F34	2736 04F36	2738 0493E	
2740 04F40	2742 04F42	2744 04F44	2746 04F46	2748 0494E	2750 04F50	2752 04F52	2754 04F54	2756 04F56	2758 0495E	
2760 04F60	2762 04F62	2764 04F64	2766 04F66	2768 0496E	2770 04F70	2772 04F72	2774 04F74	2776 04F76	2778 0497E	
2780 04B68	2782 04B6A	2784 04B6C	2786 04B6E	2788 04F68	2790 04B78	2792 04B7A	2794 04B7C	2796 04B7E	2798 04F78	
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2820 04C28	2822 04C2A	2824 04C2C	2826 04C2E	2828 04E2A	2830 04C38	2832 04C3A	2834 04C3C	2836 04C3E	2838 04E3A	
2840 04C48	2842 04C4A	2844 04C4C	2846 04C4E	2848 04E4A	2850 04C58	2852 04C5A	2854 04C5C	2856 04C5E	2858 04E5A	
2860 04C68	2862 04C6A	2864 04C6C	2866 04C6E	2868 04E6A	2870 04C78	2872 04C7A	2874 04C7C	2876 04C7E	2878 04E7A	
2880 04E0C	2882 04E2C	2884 04E4C	2886 04E6C	2888 04E0E	2890 04E1C	2892 04E3C	2894 04E5C	2896 04E7C	2898 04E1E	
2900 04D08	2902 04D0A	2904 04D0C	2906 04D0E	2908 04F0A	2910 04D18	2912 04D1A	2914 04D1C	2916 04D1E	2918 04F1A	
2920 04D28	2922 04D2A	2924 04D2C	2926 04D2E	2928 04F2A	2930 04D38	2932 04D3A	2934 04D3C	2936 04D3E	2938 04F3A	
2940 04D48	2942 04D4A	2944 04D4C	2946 04D4E	2948 04F4A	2950 04D58	2952 04D5A	2954 04D5C	2956 04D5E	2958 04F5A	
2960 04D68	2962 04D6A	2964 04D6C	2966 04D6E	2968 04F6A	2970 04D78	2972 04D7A	2974 04D7C	2976 04D7E	2978 04F7A	
2980 04F0C	2982 04F2C	2984 04F4C	2986 04F6C	2988 04F0E	2990 04F1C	2992 04F3C	2994 04F5C	2996 04F7C	2998 04F1E	

	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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3040	048C0	3042	048C2	3044	048C4	3046	048C6	3048	048C8	3050	048D0
3060	048E0	3062	048E2	3064	048E4	3066	048E6	3068	048E8	3070	048F0
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3010	04980	3102	04982	3104	04984	3106	04986	3108	04988	3110	04990
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3140	049C0	3142	049C2	3144	049C4	3146	049C6	3148	049C8	3150	049D0
3160	049E0	3162	049E2	3164	049E4	3166	049E6	3168	049E8	3170	049F0
3180	04B88	3182	04B8A	3184	04B8C	3186	04B8E	3188	04F88	3190	04B98
3200	04A80	3202	04A82	3204	04A84	3206	04A86	3208	0488A	3210	04A90
3220	04AA0	3222	04AA2	3224	04AA4	3226	04AA6	3228	048AA	3230	04AB0
3240	04AC0	3242	04AC2	3244	04AC4	3246	04AC6	3248	048CA	3250	04AD0
3260	04AE0	3262	04AE2	3264	04AE4	3266	04AE6	3268	048EA	3270	04AF0
3280	04AA8	3282	04AAA	3284	04AAC	3286	04AAE	3288	04EA8	3290	04AB8
3300	04B80	3302	04B82	3304	04B84	3306	04B86	3308	0498A	3310	04B90
3320	04BA0	3322	04BA2	3324	04BA4	3326	04BA6	3328	049AA	3330	04BB0
3340	04BC0	3342	04BC2	3344	04BC4	3346	04BC6	3348	049CA	3350	04BD0
3360	04BE0	3362	04BE2	3364	04BE4	3366	04BE6	3368	049EA	3370	04BF0
3380	04BA8	3382	04BAA	3384	04BAC	3386	04BAE	3388	04FA8	3390	04BB8
3400	04C80	3402	04C82	3404	04C84	3406	04C86	3408	0488C	3410	04C90
3420	04CA0	3422	04CA2	3424	04CA4	3426	04CA6	3428	048AC	3430	04CB0
3440	04CC0	3442	04CC2	3444	04CC4	3446	04CC6	3448	048CC	3450	04CD0
3460	04CE0	3462	04CE2	3464	04CE4	3466	04CE6	3468	048EC	3470	04CF0
3480	04AC8	3482	04ACA	3484	04ACC	3486	04ACE	3488	04EC8	3490	04AD8
3500	04D80	3502	04D82	3504	04D84	3506	04D86	3508	0498C	3510	04D90
3520	04DA0	3522	04DA2	3524	04DA4	3526	04DA6	3528	049AC	3530	04DB0
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3560	04DE0	3562	04DE2	3564	04DE4	3566	04DE6	3568	049EC	3570	04DF0
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3600	04E80	3602	04E82	3604	04E84	3606	04E86	3608	0488E	3610	04E90
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3700	04F80	3702	04F82	3704	04F84	3706	04F86	3708	0498E	3710	04F90
3720	04FA0	3722	04FA2	3724	04FA4	3726	04FA6	3728	049AE	3730	04FB0
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3800	04C88	3802	04C8A	3804	04C8C	3806	04C8E	3808	04E8A	3810	04C98
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3840	04CC8	3842	04CCA	3844	04CCC	3846	04CCE	3848	04ECA	3850	04CD8
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3052	048D2	3054	048D4	3056	048D6	3058	048D8	3060	048D9	3062	048D9
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3172	049F2	3174	049F4	3176	049F6	3178	049F8	3180	049F9	3182	049F9
3192	04B9A	3194	04B9C	3196	04B9E	3198	04B98	3200	04B99	3202	04B99
3212	04A92	3214	04A94	3216	04A96	3218	04A98	3220	04A99	3222	04A99
3232	04AB2	3234	04AB4	3236	04AB6	3238	04AB8	3240	04AB9	3242	04AB9
3252	04AD2	3254	04AD4	3256	04AD6	3258	04AD8	3260	04AD9	3262	04AD9
3272	04AF2	3274	04AF4	3276	04AF6	3278	04AF8	3280	04AF9	3282	04AF9
3292	04ABA	3294	04ABC	3296	04ABE	3298	04AB8	3300	04AB9	3302	04AB9
3312	04B92	3314	04B94	3316	04B96	3318	04B98	3320	04B99	3322	04B99
3332	04BB2	3334	04BB4	3336	04BB6	3338	04BB8	3340	04BB9	3342	04BB9
3352	04BD2	3354	04BD4	3356	04BD6	3358	04BD8	3360	04BD9	3362	04BD9
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3392	04BBA	3394	04BBC	3396	04BBE	3398	04BB8	3400	04BB9	3402	04BB9
3412	04C92	3414	04C94	3416	04C96	3418	04C98	3420	04C99	3422	04C99
3432	04CB2	3434	04CB4	3436	04CB6	3438	04CB8	3440	04CB9	3442	04CB9
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3472	04CF2	3474	04CF4	3476	04CF6	3478	04CF8	3480	04CF9	3482	04CF9
3492	04ADA	3494	04ADC	3496	04ADE	3498	04AD8	3500	04AD9	3502	04AD9
3512	04D92	3514	04D94	3516	04D96	3518	04D98	3520	04D99	3522	04D99
3532	04DB2	3534	04DB4	3536	04DB6	3538	04DB8	3540	04DB9	3542	04DB9
3552	04DD2	3554	04DD4	3556	04DD6	3558	04DD8	3560	04DD9	3562	04DD9
3572	04DF2	3574	04DF4	3576	04DF6	3578	04DF8	3580	04DF9	3582	04DF9
3592	04BDA	3594	04BDC	3596	04BDE	3598	04BD8	3600	04BD9	3602	04BD9
3612	04E92	3614	04E94	3616	04E96	3618	04E98	3620	04E99	3622	04E99
3632	04EB2	3634	04EB4	3636	04EB6	3638	04EB8	3640	04EB9	3642	04EB9
3652	04ED2	3654	04ED4	3656	04ED6	3658	04ED8	3660	04ED9	3662	04ED9
3672	04EF2	3674	04EF4	3676	04EF6	3678	04EF8	3680	04EF9	3682	04EF9
3692	04AFA	3694	04AFC	3696	04AFE	3698	04AF8	3700	04AF9	3702	04AF9
3712	04F92	3714	04F94	3716	04F96	3718	04F98	3720	04F99	3722	04F99
3732	04FB2	3734	04FB4	3736	04FB6	3738	04FB8	3740	04FB9	3742	04FB9
3752	04FD2	3754	04FD4	3756	04FD6	3758	04FD8	3760	04FD9	3762	04FD9
3772	04FF2	3774	04FF4	3776	04FF6	3778	04FF8	3780	04FF9	3782	04FF9
3792	04BFA	3794	04BFC	3796	04BFE	3798	04BF8	3800	04BF9	3802	04BF9
3812	04C9A	3814	04C9C	3816	04C9E	3818	04C98	3820	04C99	3822	04C99
3832	04CBA	3834	04CBC	3836	04CBE	3838	04CBA	3840	04C99	3842	04C99
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3912	04D9A	3914	04D9C	3916	04D9E	3918	04D98	3920	04D99	3922	04D99
3932	04DBA	3934	04DBC	3936	04DBE	3938	04DB8	3940	04D99	3942	04D99
3952	04DDA	3954	04DDC	3956	04DDE	3958	04DDA	3960	04D99	3962	04D99
3972	04DFA	3974	04DFC	3976	04DFE	3978	04DFA	3980	04D99	3982	04D99
3992	04FBC	3994	04FDC	3996	04FFC	3998	04FBC	4000	04D99	4002	04D99

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4040 05040	4042 05042	4044 05044	4046 05046	4048 05048	4050 05050	4052 05052	4054 05054	4056 05056	4058 05058	
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4080 05208	4082 0520A	4084 0520C	4086 0520E	4088 05608	4090 05218	4092 0521A	4094 0521C	4096 0521E	4098 05618	
4100 05100	4102 05102	4104 05104	4106 05106	4108 05108	4110 05110	4112 05112	4114 05114	4116 05116	4118 05118	
4120 05120	4122 05122	4124 05124	4126 05126	4128 05128	4130 05130	4132 05132	4134 05134	4136 05136	4138 05138	
4140 05140	4142 05142	4144 05144	4146 05146	4148 05148	4150 05150	4152 05152	4154 05154	4156 05156	4158 05158	
4160 05160	4162 05162	4164 05164	4166 05166	4168 05168	4170 05170	4172 05172	4174 05174	4176 05176	4178 05178	
4180 05308	4182 0530A	4184 0530C	4186 0530E	4188 05708	4190 05318	4192 0531A	4194 0531C	4196 0531E	4198 05718	
4200 05200	4202 05202	4204 05204	4206 05206	4208 0500A	4210 05210	4212 05212	4214 05214	4216 05216	4218 0501A	
4220 05220	4222 05222	4224 05224	4226 05226	4228 0502A	4230 05230	4232 05232	4234 05234	4236 05236	4238 0503A	
4240 05240	4242 05242	4244 05244	4246 05246	4248 0504A	4250 05250	4252 05252	4254 05254	4256 05256	4258 0505A	
4260 05260	4262 05262	4264 05264	4266 05266	4268 0506A	4270 05270	4272 05272	4274 05274	4276 05276	4278 0507A	
4280 05228	4282 0522A	4284 0522C	4286 0522E	4288 05628	4290 05238	4292 0523A	4294 0523C	4296 0523E	4298 05638	
4300 05300	4302 05302	4304 05304	4306 05306	4308 0510A	4310 05310	4312 05312	4314 05314	4316 05316	4318 0511A	
4320 05320	4322 05322	4324 05324	4326 05326	4328 0512A	4330 05330	4332 05332	4334 05334	4336 05336	4338 0513A	
4340 05340	4342 05342	4344 05344	4346 05346	4348 0514A	4350 05350	4352 05352	4354 05354	4356 05356	4358 0515A	
4360 05360	4362 05362	4364 05364	4366 05366	4368 0516A	4370 05370	4372 05372	4374 05374	4376 05376	4378 0517A	
4380 05328	4382 0532A	4384 0532C	4386 0532E	4388 05728	4390 05338	4392 0533A	4394 0533C	4396 0533E	4398 05738	
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4440 05440	4442 05442	4444 05444	4446 05446	4448 0504C	4450 05450	4452 05452	4454 05454	4456 05456	4458 0505C	
4460 05460	4462 05462	4464 05464	4466 05466	4468 0506C	4470 05470	4472 05472	4474 05474	4476 05476	4478 0507C	
4480 05248	4482 0524A	4484 0524C	4486 0524E	4488 05648	4490 05258	4492 0525A	4494 0525C	4496 0525E	4498 05658	
4500 05500	4502 05502	4504 05504	4506 05506	4508 0510C	4510 05510	4512 05512	4514 05514	4516 05516	4518 0511C	
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4560 05560	4562 05562	4564 05564	4566 05566	4568 0516C	4570 05570	4572 05572	4574 05574	4576 05576	4578 0517C	
4580 05348	4582 0534A	4584 0534C	4586 0534E	4588 05748	4590 05358	4592 0535A	4594 0535C	4596 0535E	4598 05758	
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4620 05620	4622 05622	4624 05624	4626 05626	4628 0502E	4630 05630	4632 05632	4634 05634	4636 05636	4638 0503E	
4640 05640	4642 05642	4644 05644	4646 05646	4648 0504E	4650 05650	4652 05652	4654 05654	4656 05656	4658 0505E	
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4680 05268	4682 0526A	4684 0526C	4686 0526E	4688 05668	4690 05278	4692 0527A	4694 0527C	4696 0527E	4698 05678	
4700 05700	4702 05702	4704 05704	4706 05706	4708 0510E	4710 05710	4712 05712	4714 05714	4716 05716	4718 0511E	
4720 05720	4722 05722	4724 05724	4726 05726	4728 0512E	4730 05730	4732 05732	4734 05734	4736 05736	4738 0513E	
4740 05740	4742 05742	4744 05744	4746 05746	4748 0514E	4750 05750	4752 05752	4754 05754	4756 05756	4758 0515E	
4760 05760	4762 05762	4764 05764	4766 05766	4768 0516E	4770 05770	4772 05772	4774 05774	4776 05776	4778 0517E	
4780 05368	4782 0536A	4784 0536C	4786 0536E	4788 05768	4790 05378	4792 0537A	4794 0537C	4796 0537E	4798 05778	
4800 05408	4802 0540A	4804 0540C	4806 0540E	4808 0560A	4810 05418	4812 0541A	4814 0541C	4816 0541E	4818 0561A	
4820 05428	4822 0542A	4824 0542C	4826 0542E	4828 0562A	4830 05438	4832 0543A	4834 0543C	4836 0543E	4838 0563A	
4840 05448	4842 0544A	4844 0544C	4846 0544E	4848 0564A	4850 05458	4852 0545A	4854 0545C	4856 0545E	4858 0565A	
4860 05468	4862 0546A	4864 0546C	4866 0546E	4868 0566A	4870 05478	4872 0547A	4874 0547C	4876 0547E	4878 0567A	
4880 0560C	4882 0562C	4884 0564C	4886 0566C	4888 0560E	4890 0561C	4892 0563C	4894 0565C	4896 0567C	4898 0561E	
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4920 05528	4922 0552A	4924 0552C	4926 0552E	4928 0572A	4930 05538	4932 0553A	4934 0553C	4936 0553E	4938 0573A	
4940 05548	4942 0554A	4944 0554C	4946 0554E	4948 0574A	4950 05558	4952 0555A	4954 0555C	4956 0555E	4958 0575A	
4960 05568	4962 0556A	4964 0556C	4966 0556E	4968 0576A	4970 05578	4972 0557A	4974 0557C	4976 0557E	4978 0577A	
4980 0570C	4982 0572C	4984 0574C	4986 0576C	4988 0570E	4990 0571C	4992 0573C	4994 0575C	4996 0577C	4998 0571E	

	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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	5020 050A0	5022 050A2	5024 050A4	5026 050A6	5028 050A8	5030 050B0	5032 050B2	5034 050B4	5036 050B6	5038 050B8	
	5040 050C0	5042 050C2	5044 050C4	5046 050C6	5048 050C8	5050 050D0	5052 050D2	5054 050D4	5056 050D6	5058 050D8	
	5060 050E0	5062 050E2	5064 050E4	5066 050E6	5068 050E8	5070 050F0	5072 050F2	5074 050F4	5076 050F6	5078 050F8	
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	5100 05180	5102 05182	5104 05184	5106 05186	5108 05188	5110 05190	5112 05192	5114 05194	5116 05196	5118 05198	
	5120 051A0	5122 051A2	5124 051A4	5126 051A6	5128 051A8	5130 051B0	5132 051B2	5134 051B4	5136 051B6	5138 051B8	
	5140 051C0	5142 051C2	5144 051C4	5146 051C6	5148 051C8	5150 051D0	5152 051D2	5154 051D4	5156 051D6	5158 051D8	
	5160 051E0	5162 051E2	5164 051E4	5166 051E6	5168 051E8	5170 051F0	5172 051F2	5174 051F4	5176 051F6	5178 051F8	
	5180 05388	5182 0538A	5184 0538C	5186 0538E	5188 05788	5190 05398	5192 0539A	5194 0539C	5196 0539E	5198 05798	
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	5240 052C0	5242 052C2	5244 052C4	5246 052C6	5248 050CA	5250 052D0	5252 052D2	5254 052D4	5256 052D6	5258 050DA	
	5260 052E0	5262 052E2	5264 052E4	5266 052E6	5268 050EA	5270 052F0	5272 052F2	5274 052F4	5276 052F6	5278 050FA	
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	5320 053A0	5322 053A2	5324 053A4	5326 053A6	5328 051AA	5330 053B0	5332 053B2	5334 053B4	5336 053B6	5338 051BA	
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	5660 056E0	5662 056E2	5664 056E4	5666 056E6	5668 050EE	5670 056F0	5672 056F2	5674 056F4	5676 056F6	5678 050FE	
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	5740 057C0	5742 057C2	5744 057C4	5746 057C6	5748 051CE	5750 057D0	5752 057D2	5754 057D4	5756 057D6	5758 051DE	
	5760 057E0	5762 057E2	5764 057E4	5766 057E6	5768 051EE	5770 057F0	5772 057F2	5774 057F4	5776 057F6	5778 051FE	
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	5960 055E8	5962 055EA	5964 055EC	5966 055EE	5968 057EA	5970 055F8	5972 055FA	5974 055FC	5976 055FE	5978 057FA	
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1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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6100 05900	6102 05902	6104 05904	6106 05906	6108 05908	6110 05910	6112 05912	6114 05914	6116 05916	6118 05918	
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6180 05B08	6182 05B0A	6184 05B0C	6186 05B0E	6188 05F08	6190 05B18	6192 05B1A	6194 05B1C	6196 05B1E	6198 05F18	
6200 05A00	6202 05A02	6204 05A04	6206 05A06	6208 0580A	6210 05A10	6212 05A12	6214 05A14	6216 05A16	6218 0581A	
6220 05A20	6222 05A22	6224 05A24	6226 05A26	6228 0582A	6230 05A30	6232 05A32	6234 05A34	6236 05A36	6238 0583A	
6240 05A40	6242 05A42	6244 05A44	6246 05A46	6248 0584A	6250 05A50	6252 05A52	6254 05A54	6256 05A56	6258 0585A	
6260 05A60	6262 05A62	6264 05A64	6266 05A66	6268 0586A	6270 05A70	6272 05A72	6274 05A74	6276 05A76	6278 0587A	
6280 05A28	6282 05A2A	6284 05A2C	6286 05A2E	6288 05E28	6290 05A38	6292 05A3A	6294 05A3C	6296 05A3E	6298 05E38	
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6360 05B60	6362 05B62	6364 05B64	6366 05B66	6368 0596A	6370 05B70	6372 05B72	6374 05B74	6376 05B76	6378 0597A	
6380 05B28	6382 05B2A	6384 05B2C	6386 05B2E	6388 05F28	6390 05B38	6392 05B3A	6394 05B3C	6396 05B3E	6398 05F38	
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6440 05C40	6442 05C42	6444 05C44	6446 05C46	6448 0584C	6450 05C50	6452 05C52	6454 05C54	6456 05C56	6458 0585C	
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6480 05A48	6482 05A4A	6484 05A4C	6486 05A4E	6488 05E48	6490 05A58	6492 05A5A	6494 05A5C	6496 05A5E	6498 05E58	
6500 05D00	6502 05D02	6504 05D04	6506 05D06	6508 0590C	6510 05D10	6512 05D12	6514 05D14	6516 05D16	6518 0591C	
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6680 05A68	6682 05A6A	6684 05A6C	6686 05A6E	6688 05E68	6690 05A78	6692 05A7A	6694 05A7C	6696 05A7E	6698 05E78	
6700 05F00	6702 05F02	6704 05F04	6706 05F06	6708 0590E	6710 05F10	6712 05F12	6714 05F14	6716 05F16	6718 0591E	
6720 05F20	6722 05F22	6724 05F24	6726 05F26	6728 0592E	6730 05F30	6732 05F32	6734 05F34	6736 05F36	6738 0593E	
6740 05F40	6742 05F42	6744 05F44	6746 05F46	6748 0594E	6750 05F50	6752 05F52	6754 05F54	6756 05F56	6758 0595E	
6760 05F60	6762 05F62	6764 05F64	6766 05F66	6768 0596E	6770 05F70	6772 05F72	6774 05F74	6776 05F76	6778 0597E	
6780 05B68	6782 05B6A	6784 05B6C	6786 05B6E	6788 05F68	6790 05B78	6792 05B7A	6794 05B7C	6796 05B7E	6798 05F78	
6800 05C08	6802 05C0A	6804 05C0C	6806 05C0E	6808 05E0A	6810 05C18	6812 05C1A	6814 05C1C	6816 05C1E	6818 05E1A	
6820 05C28	6822 05C2A	6824 05C2C	6826 05C2E	6828 05E2A	6830 05C38	6832 05C3A	6834 05C3C	6836 05C3E	6838 05E3A	
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6920 05D28	6922 05D2A	6924 05D2C	6926 05D2E	6928 05F2A	6930 05D38	6932 05D3A	6934 05D3C	6936 05D3E	6938 05F3A	
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6960 05D68	6962 05D6A	6964 05D6C	6966 05D6E	6968 05F6A	6970 05D78	6972 05D7A	6974 05D7C	6976 05D7E	6978 05F7A	
6980 05F0C	6982 05F2C	6984 05F4C	6986 05F6C	6988 05F0E	6990 05F1C	6992 05F3C	6994 05F5C	6996 05F7C	6998 05F1E	

	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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7020	058A0	7022	058A2	7024	058A4	7026	058A6	7028	058A8	7030	058B0
7040	058C0	7042	058C2	7044	058C4	7046	058C6	7048	058C8	7050	058D0
7060	058E0	7062	058E2	7064	058E4	7066	058E6	7068	058E8	7070	058F0
7080	05A88	7082	05A8A	7084	05A8C	7086	05A8E	7088	05E88	7090	05A98
7092	05A9A	7094	05A9C	7096	05A9E	7098	05E98				
7100	05980	7102	05982	7104	05984	7106	05986	7108	05988	7110	05990
7120	059A0	7122	059A2	7124	059A4	7126	059A6	7128	059A8	7130	059B0
7140	059C0	7142	059C2	7144	059C4	7146	059C6	7148	059C8	7150	059D0
7160	059E0	7162	059E2	7164	059E4	7166	059E6	7168	059E8	7170	059F0
7180	05B88	7182	05B8A	7184	05B8C	7186	05B8E	7188	05F88	7190	05B98
7192	05B9A	7194	05B9C	7196	05B9E	7198	05F98				
7200	05A80	7202	05A82	7204	05A84	7206	05A86	7208	0588A	7210	05A90
7220	05AA0	7222	05AA2	7224	05AA4	7226	05AA6	7228	058AA	7230	05AB0
7240	05AC0	7242	05AC2	7244	05AC4	7246	05AC6	7248	058CA	7250	05AD0
7260	05AE0	7262	05AE2	7264	05AE4	7266	05AE6	7268	058EA	7270	05AF0
7280	05AA8	7282	05AAA	7284	05AAC	7286	05AAE	7288	05EA8	7290	05AB8
7292	05ABA	7294	05ABC	7296	05ABE	7298	05EB8				
7300	05B80	7302	05B82	7304	05B84	7306	05B86	7308	0598A	7310	05B90
7320	05BA0	7322	05BA2	7324	05BA4	7326	05BA6	7328	059AA	7330	05BB0
7340	05BC0	7342	05BC2	7344	05BC4	7346	05BC6	7348	059CA	7350	05BD0
7360	05BE0	7362	05BE2	7364	05BE4	7366	05BE6	7368	059EA	7370	05BF0
7380	05BA8	7382	05BAA	7384	05BAC	7386	05BAE	7388	05FA8	7390	05BB8
7392	05BBA	7394	05BBC	7396	05BBE	7398	05FB8				
7400	05C80	7402	05C82	7404	05C84	7406	05C86	7408	0588C	7410	05C90
7420	05CA0	7422	05CA2	7424	05CA4	7426	05CA6	7428	058AC	7430	05CB0
7440	05CC0	7442	05CC2	7444	05CC4	7446	05CC6	7448	058CC	7450	05CD0
7460	05CE0	7462	05CE2	7464	05CE4	7466	05CE6	7468	058EC	7470	05CF0
7480	05AC8	7482	05ACA	7484	05ACC	7486	05ACE	7488	05EC8	7490	05AD8
7492	05ADA	7494	05ADC	7496	05ADE	7498	05ED8				
7500	05D80	7502	05D82	7504	05D84	7506	05D86	7508	0598C	7510	05D90
7520	05DA0	7522	05DA2	7524	05DA4	7526	05DA6	7528	059AC	7530	05DB0
7540	05DC0	7542	05DC2	7544	05DC4	7546	05DC6	7548	059CC	7550	05DD0
7560	05DE0	7562	05DE2	7564	05DE4	7566	05DE6	7568	059EC	7570	05DF0
7580	05BC8	7582	05BCA	7584	05BCC	7586	05BCE	7588	05FC8	7590	05BD8
7592	05BDA	7594	05BDC	7596	05BDE	7598	05FD8				
7600	05E80	7602	05E82	7604	05E84	7606	05E86	7608	0588E	7610	05E90
7620	05EA0	7622	05EA2	7624	05EA4	7626	05EA6	7628	058AE	7630	05EB0
7640	05EC0	7642	05EC2	7644	05EC4	7646	05EC6	7648	058CE	7650	05ED0
7660	05EE0	7662	05EE2	7664	05EE4	7666	05EE6	7668	058EE	7670	05EF0
7680	05AE8	7682	05AEA	7684	05AEC	7686	05AEE	7688	05EE8	7690	05AF8
7692	05AFA	7694	05AFC	7696	05AFE	7698	05EF8				
7700	05F80	7702	05F82	7704	05F84	7706	05F86	7708	0598E	7710	05F90
7720	05FA0	7722	05FA2	7724	05FA4	7726	05FA6	7728	059AE	7730	05FB0
7740	05FC0	7742	05FC2	7744	05FC4	7746	05FC6	7748	059CE	7750	05FD0
7760	05FE0	7762	05FE2	7764	05FE4	7766	05FE6	7768	059EE	7770	05FF0
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7792	05BFA	7794	05BFC	7796	05BFE	7798	05FF8				
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7820	05CA8	7822	05CAA	7824	05CAC	7826	05CAE	7828	05EAA	7830	05CB8
7840	05CC8	7842	05CCA	7844	05CCC	7846	05CCE	7848	05ECA	7850	05CD8
7860	05CE8	7862	05CEA	7864	05CEC	7866	05CEE	7868	05EEA	7870	05CF8
7880	05E8C	7882	05E8E	7884	05E8C	7886	05EEC	7888	05E8E	7890	05E9C
7892	05E9C	7894	05EDC	7896	05EFC	7898	05E9E				
7900	05D88	7902	05D8A	7904	05D8C	7906	05D8E	7908	05F8A	7910	05D98
7920	05DA8	7922	05DAA	7924	05DAC	7926	05DAE	7928	05FAA	7930	05DB8
7940	05DC8	7942	05DCA	7944	05DCC	7946	05DCE	7948	05FCA	7950	05DD8
7960	05DE8	7962	05DEA	7964	05DEC	7966	05DEE	7968	05FEA	7970	05DF8
7980	05F8C	7982	05F8E	7984	05F8C	7986	05FEC	7988	05F8E	7990	05F9C
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1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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8080 06208	8082 0620A	8084 0620C	8086 0620E	8088 06608	8090 06218	8092 0621A	8094 0621C	8096 0621E	8098 06618	
8100 06100	8102 06102	8104 06104	8106 06106	8108 06108	8110 06110	8112 06112	8114 06114	8116 06116	8118 06118	
8120 06120	8122 06122	8124 06124	8126 06126	8128 06128	8130 06130	8132 06132	8134 06134	8136 06136	8138 06138	
8140 06140	8142 06142	8144 06144	8146 06146	8148 06148	8150 06150	8152 06152	8154 06154	8156 06156	8158 06158	
8160 06160	8162 06162	8164 06164	8166 06166	8168 06168	8170 06170	8172 06172	8174 06174	8176 06176	8178 06178	
8180 06308	8182 0630A	8184 0630C	8186 0630E	8188 06708	8190 06318	8192 0631A	8194 0631C	8196 0631E	8198 06718	
8200 06200	8202 06202	8204 06204	8206 06206	8208 0600A	8210 06210	8212 06212	8214 06214	8216 06216	8218 0601A	
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8800 06408	8802 0640A	8804 0640C	8806 0640E	8808 0660A	8810 06418	8812 0641A	8814 0641C	8816 0641E	8818 0661A	
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8840 06448	8842 0644A	8844 0644C	8846 0644E	8848 0664A	8850 06458	8852 0645A	8854 0645C	8856 0645E	8858 0665A	
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8880 0660C	8882 0662C	8884 0664C	8886 0666C	8888 0660E	8890 0661C	8892 0663C	8894 0665C	8896 0667C	8898 0661E	
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8920 06528	8922 0652A	8924 0652C	8926 0652E	8928 0672A	8930 06538	8932 0653A	8934 0653C	8936 0653E	8938 0673A	
8940 06548	8942 0654A	8944 0654C	8946 0654E	8948 0674A	8950 06558	8952 0655A	8954 0655C	8956 0655E	8958 0675A	
8960 06568	8962 0556A	8964 0656C	8966 0656E	8968 0676A	8970 06578	8972 0657A	8974 0657C	8976 0657E	8978 0677A	
8980 0670C	8982 0672C	8984 0674C	8986 0676C	8988 0670E	8990 0671C	8992 0673C	8994 0675C	8996 0677C	8998 0671E	

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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9040 060C0	9042 060C2	9044 060C4	9046 060C6	9048 060C8	9050 060D0	9052 060D2	9054 060D4	9056 060D6	9058 060D8	
9060 060E0	9062 060E2	9064 060E4	9066 060E6	9068 060E8	9070 060F0	9072 060F2	9074 060F4	9076 060F6	9078 060F8	
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9100 06180	9102 06182	9104 06184	9106 06186	9108 06188	9110 06190	9112 06192	9114 06194	9116 06196	9118 06198	
9120 061A0	9122 061A2	9124 061A4	9126 061A6	9128 061A8	9130 061B0	9132 061B2	9134 061B4	9136 061B6	9138 061B8	
9140 061C0	9142 061C2	9144 061C4	9146 061C6	9148 061C8	9150 061D0	9152 061D2	9154 061D4	9156 061D6	9158 061D8	
9160 061E0	9162 061E2	9164 061E4	9166 061E6	9168 061E8	9170 061F0	9172 061F2	9174 061F4	9176 061F6	9178 061F8	
9180 06388	9182 0638A	9184 0638C	9186 0638E	9188 06788	9190 06398	9192 0639A	9194 0639C	9196 0639E	9198 06798	
9200 06280	9202 06282	9204 06284	9206 06286	9208 0608A	9210 06290	9212 06292	9214 06294	9216 06296	9218 0609A	
9220 062A0	9222 062A2	9224 062A4	9226 062A6	9228 060AA	9230 062B0	9232 062B2	9234 062B4	9236 062B6	9238 060BA	
9240 062C0	9242 062C2	9244 062C4	9246 062C6	9248 060CA	9250 062D0	9252 062D2	9254 062D4	9256 062D6	9258 060DA	
9260 062E0	9262 062E2	9264 062E4	9266 062E6	9268 060EA	9270 062F0	9272 062F2	9274 062F4	9276 062F6	9278 060FA	
9280 062A8	9282 062AA	9284 062AC	9286 062AE	9288 066A8	9290 062B8	9292 062BA	9294 062BC	9296 062BE	9298 066B8	
9300 06380	9302 06382	9304 06384	9306 06386	9308 0618A	9310 06390	9312 06392	9314 06394	9316 06396	9318 0619A	
9320 063A0	9322 063A2	9324 063A4	9326 063A6	9328 061AA	9330 063B0	9332 063B2	9334 063B4	9336 063B6	9338 061BA	
9340 063C0	9342 063C2	9344 063C4	9346 063C6	9348 061CA	9350 063D0	9352 063D2	9354 063D4	9356 063D6	9358 061DA	
9360 063E0	9362 063E2	9364 063E4	9366 063E6	9368 061EA	9370 063B8	9372 063F2	9374 063F4	9376 063F6	9378 061FA	
9380 063A8	9382 063AA	9384 063AC	9386 063AE	9388 067A8	9390 063F0	9392 063BA	9394 063BC	9396 063BE	9398 067B8	
9400 06480	9402 06482	9404 06484	9406 06486	9408 0608C	9410 06490	9412 06492	9414 06494	9416 06496	9418 0609C	
9420 064A0	9422 064A2	9424 064A4	9426 064A6	9428 060AC	9430 064B0	9432 064B2	9434 064B4	9436 064B6	9438 060BC	
9440 064C0	9442 064C2	9444 064C4	9446 064C6	9448 060CC	9450 064D0	9452 064D2	9454 064D4	9456 064D6	9458 060DC	
9460 064E0	9462 064E2	9464 064E4	9466 064E6	9468 060EC	9470 064F0	9472 064F2	9474 064F4	9476 064F6	9478 060FC	
9480 062C8	9482 062CA	9484 062CC	9486 062CE	9488 066C8	9490 062D8	9492 062DA	9494 062DC	9496 062DE	9498 066D8	
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9560 065E0	9562 065E2	9564 065E4	9566 065E6	9568 061EC	9570 065F0	9572 065F2	9574 065F4	9576 065F6	9578 061FC	
9580 063C8	9582 063CA	9584 063CC	9586 063CE	9588 067C8	9590 063D8	9592 063DA	9594 063DC	9596 063DE	9598 067D8	
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9620 066A0	9622 066A2	9624 066A4	9626 066A6	9628 060AE	9630 066B0	9632 066B2	9634 066B4	9636 066B6	9638 060BE	
9640 066C0	9642 066C2	9644 066C4	9646 066C6	9648 060CE	9650 066D0	9652 066D2	9654 066D4	9656 066D6	9658 060DE	
9660 066E0	9662 066E2	9664 066E4	9666 066E6	9668 060EE	9670 066F0	9672 066F2	9674 066F4	9676 066F6	9678 060FE	
9680 062E8	9682 062EA	9684 062EC	9686 062EE	9688 066E8	9690 062F8	9692 062FA	9694 062FC	9696 062FE	9698 066F8	
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9720 067A0	9722 067A2	9724 067A4	9726 067A6	9728 061AE	9730 067B0	9732 067B2	9734 067B4	9736 067B6	9738 061BE	
9740 067C0	9742 067C2	9744 067C4	9746 067C6	9748 061CE	9750 067D0	9752 067D2	9754 067D4	9756 067D6	9758 061DE	
9760 067E0	9762 067E2	9764 067E4	9766 067E6	9768 061EE	9770 067F0	9772 067F2	9774 067F4	9776 067F6	9778 061FE	
9780 063E8	9782 063EA	9784 063EC	9786 063EE	9788 067E8	9790 063F8	9792 063FA	9794 063FC	9796 063FE	9798 067F8	
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9880 0668C	9882 066AC	9884 066CC	9886 066EC	9888 066E8	9890 0669C	9892 066BC	9894 066DC	9896 066FC	9898 0669E	
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9920 065A8	9922 065AA	9924 065AC	9926 065AE	9928 067AA	9930 065B8	9932 065BA	9934 065BC	9936 065BE	9938 067BA	
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1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
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10220 06A20	10222 06A22	10224 06A24	10226 06A26	10228 0682A	10230 06A30	10232 06A32	10234 06A34	10236 06A36	10238 0683A				
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10340 06B40	10342 06B42	10344 06B44	10346 06B46	10348 0694A	10350 06B50	10352 06B52	10354 06B54	10356 06B56	10358 0695A				
10360 06B60	10362 06B62	10364 06B64	10366 06B66	10368 0696A	10370 06B70	10372 06B72	10374 06B74	10376 06B76	10378 0697A				
10380 06B28	10382 06B2A	10384 06B2C	10386 06B2E	10388 06F28	10390 06B38	10392 06B3A	10394 06B3C	10396 06B3E	10398 06F38				
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10440 06C40	10442 06C42	10444 06C44	10446 06C46	10448 0684C	10450 06C50	10452 06C52	10454 06C54	10456 06C56	10458 0685C				
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10780 06B68	10782 06B6A	10784 06B6C	10786 06B6E	10788 06F68	10790 06B78	10792 06B7A	10794 06B7C	10796 06B7E	10798 06F78				
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10960 06D68	10962 06D6A	10964 06D6C	10966 06D6E	10968 06F6A	10970 06D78	10972 06D7A	10974 06D7C	10976 06D7E	10978 06F7A				
10980 06F0C	10982 06F2C	10984 06F4C	10986 06F6C	10988 06F0E	10990 06F1C	10992 06F3C	10994 06F5C	10996 06F7C	10998 06F1E				

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11120 069A0	11122 069A2	11124 069A4	11126 069A6	11128 069A8	11130 069B0	11132 069B2	11134 069B4	11136 069B6	11138 069B8		
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11680 06AE8	11682 06AEA	11684 06AEC	11686 06AEE	11688 06EE8	11690 06AF8	11692 06AFA	11694 06AFC	11696 06AFE	11698 06EF8		
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12740 07740	12742 07742	12744 07744	12746 07746	12748 0714E	12750 07750	12752 07752	12754 07754	12756 07756	12758 0715E			
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12840 07448	12842 0744A	12844 0744C	12846 0744E	12848 0764A	12850 07458	12852 0745A	12854 0745C	12856 0745E	12858 0765A			
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12940 07548	12942 0754A	12944 0754C	12946 0754E	12948 0774A	12950 07558	12952 0755A	12954 0755C	12956 0755E	12958 0775A			
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13840 074C8	13842 074CA	13844 074CC	13846 074CE	13848 076CA	13850 074D8	13852 074DA	13854 074DC	13856 074DE	13858 076DA		
13860 074E8	13862 074EA	13864 074EC	13866 074EE	13868 076EA	13870 074F8	13872 074FA	13874 074FC	13876 074FE	13878 076FA		
13880 0768C	13882 076AC	13884 076CC	13886 076EC	13888 0768E	13890 0769C	13892 076BC	13894 076DC	13896 076FC	13898 0769E		
13900 07588	13902 0758A	13904 0758C	13906 0758E	13908 0778A	13910 07598	13912 0759A	13914 0759C	13916 0759E	13918 0779A		
13920 075A8	13922 075AA	13924 075AC	13926 075AE	13928 077AA	13930 075B8	13932 075BA	13934 075BC	13936 075BE	13938 077BA		
13940 075C8	13942 075CA	13944 075CC	13946 075CE	13948 077CA	13950 075D8	13952 075DA	13954 075DC	13956 075DE	13958 077DA		
13960 075E8	13962 075EA	13964 075EC	13966 075EE	13968 077EA	13970 075F8	13972 075FA	13974 075FC	13976 075FE	13978 077FA		
13980 0778C	13982 077AC	13984 077CC	13986 077EC	13988 0778E	13990 0779C	13992 077BC	13994 077DC	13996 077FC	13998 0779E		

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
14000 07800	14002 07802	14004 07804	14006 07806	14008 07808	14010 07810	14012 07812	14014 07814	14016 07816	14018 07818		
14020 07820	14022 07822	14024 07824	14026 07826	14028 07828	14030 07830	14032 07832	14034 07834	14036 07836	14038 07838		
14040 07840	14042 07842	14044 07844	14046 07846	14048 07848	14050 07850	14052 07852	14054 07854	14056 07856	14058 07858		
14060 07860	14062 07862	14064 07864	14066 07866	14068 07868	14070 07870	14072 07872	14074 07874	14076 07876	14078 07878		
14080 07A08	14082 07A0A	14084 07A0C	14086 07A0E	14088 07E08	14090 07A18	14092 07A1A	14094 07A1C	14096 07A1E	14098 07E18		
14100 07900	14102 07902	14104 07904	14106 07906	14108 07908	14110 07910	14112 07912	14114 07914	14116 07916	14118 07918		
14120 07920	14122 07922	14124 07924	14126 07926	14128 07928	14130 07930	14132 07932	14134 07934	14136 07936	14138 07938		
14140 07940	14142 07942	14144 07944	14146 07946	14148 07948	14150 07950	14152 07952	14154 07954	14156 07956	14158 07958		
14160 07960	14162 07962	14164 07964	14166 07966	14168 07968	14170 07970	14172 07972	14174 07974	14176 07976	14178 07978		
14180 07B08	14182 07B0A	14184 07B0C	14186 07B0E	14188 07F08	14190 07B18	14192 07B1A	14194 07B1C	14196 07B1E	14198 07F18		
14200 07A00	14202 07A02	14204 07A04	14206 07A06	14208 0780A	14210 07A10	14212 07A12	14214 07A14	14216 07A16	14218 0781A		
14220 07A20	14222 07A22	14224 07A24	14226 07A26	14228 0782A	14230 07A30	14232 07A32	14234 07A34	14236 07A36	14238 0783A		
14240 07A40	14242 07A42	14244 07A44	14246 07A46	14248 0784A	14250 07A50	14252 07A52	14254 07A54	14256 07A56	14258 0785A		
14260 07A60	14262 07A62	14264 07A64	14266 07A66	14268 0786A	14270 07A70	14272 07A72	14274 07A74	14276 07A76	14278 0787A		
14280 07A28	14282 07A2A	14284 07A2C	14286 07A2E	14288 07E28	14290 07A38	14292 07A3A	14294 07A3C	14296 07A3E	14298 07E38		
14300 07B00	14302 07B02	14304 07B04	14306 07B06	14308 0790A	14310 07B10	14312 07B12	14314 07B14	14316 07B16	14318 0791A		
14320 07B20	14322 07B22	14324 07B24	14326 07B26	14328 0792A	14330 07B30	14332 07B32	14334 07B34	14336 07B36	14338 0793A		
14340 07B40	14342 07B42	14344 07B44	14346 07B46	14348 0794A	14350 07B50	14352 07B52	14354 07B54	14356 07B56	14358 0795A		
14360 07B60	14362 07B62	14364 07B64	14366 07B66	14368 0796A	14370 07B70	14372 07B72	14374 07B74	14376 07B76	14378 0797A		
14380 07B28	14382 07B2A	14384 07B2C	14386 07B2E	14388 07F28	14390 07B38	14392 07B3A	14394 07B3C	14396 07B3E	14398 07F38		
14400 07C00	14402 07C02	14404 07C04	14406 07C06	14408 0780C	14410 07C10	14412 07C12	14414 07C14	14416 07C16	14418 0781C		
14420 07C20	14422 07C22	14424 07C24	14426 07C26	14428 0782C	14430 07C30	14432 07C32	14434 07C34	14436 07C36	14438 0783C		
14440 07C40	14442 07C42	14444 07C44	14446 07C46	14448 0784C	14450 07C50	14452 07C52	14454 07C54	14456 07C56	14458 0785C		
14460 07C60	14462 07C62	14464 07C64	14466 07C66	14468 0786C	14470 07C70	14472 07C72	14474 07C74	14476 07C76	14478 0787C		
14480 07A48	14482 07A4A	14484 07A4C	14486 07A4E	14488 07E48	14490 07A58	14492 07A5A	14494 07A5C	14496 07A5E	14498 07E58		
14500 07D00	14502 07D02	14504 07D04	14506 07D06	14508 0790C	14510 07D10	14512 07D12	14514 07D14	14516 07D16	14518 0791C		
14520 07D20	14522 07D22	14524 07D24	14526 07D26	14528 0792C	14530 07D30	14532 07D32	14534 07D34	14536 07D36	14538 0793C		
14540 07D40	14542 07D42	14544 07D44	14546 07D46	14548 0794C	14550 07D50	14552 07D52	14554 07D54	14556 07D56	14558 0795C		
14560 07D60	14562 07D62	14564 07D64	14566 07D66	14568 0796C	14570 07D70	14572 07D72	14574 07D74	14576 07D76	14578 0797C		
14580 07B48	14582 07B4A	14584 07B4C	14586 07B4E	14588 07F48	14590 07B58	14592 07B5A	14594 07B5C	14596 07B5E	14598 07F58		
14600 07E00	14602 07E02	14604 07E04	14606 07E06	14608 0780E	14610 07E10	14612 07E12	14614 07E14	14616 07E16	14618 0781E		
14620 07E20	14622 07E22	14624 07E24	14626 07E26	14628 0782E	14630 07E30	14632 07E32	14634 07E34	14636 07E36	14638 0783E		
14640 07E40	14642 07E42	14644 07E44	14646 07E46	14648 0784E	14650 07E50	14652 07E52	14654 07E54	14656 07E56	14658 0785E		
14660 07E60	14662 07E62	14664 07E64	14666 07E66	14668 0786E	14670 07E70	14672 07E72	14674 07E74	14676 07E76	14678 0787E		
14680 07A68	14682 07A6A	14684 07A6C	14686 07A6E	14688 07E68	14690 07A78	14692 07A7A	14694 07A7C	14696 07A7E	14698 07E78		
14700 07F00	14702 07F02	14704 07F04	14706 07F06	14708 0790E	14710 07F10	14712 07F12	14714 07F14	14716 07F16	14718 0791E		
14720 07F20	14722 07F22	14724 07F24	14726 07F26	14728 0792E	14730 07F30	14732 07F32	14734 07F34	14736 07F36	14738 0793E		
14740 07F40	14742 07F42	14744 07F44	14746 07F46	14748 0794E	14750 07F50	14752 07F52	14754 07F54	14756 07F56	14758 0795E		
14760 07F60	14762 07F62	14764 07F64	14766 07F66	14768 0796E	14770 07F70	14772 07F72	14774 07F74	14776 07F76	14778 0797E		
14780 07B68	14782 07B6A	14784 07B6C	14786 07B6E	14788 07F68	14790 07B78	14792 07B7A	14794 07B7C	14796 07B7E	14798 07F78		
14800 07C08	14802 07C0A	14804 07C0C	14806 07C0E	14808 07E0A	14810 07C18	14812 07C1A	14814 07C1C	14816 07C1E	14818 07E1A		
14820 07C28	14822 07C2A	14824 07C2C	14826 07C2E	14828 07E2A	14830 07C38	14832 07C3A	14834 07C3C	14836 07C3E	14838 07E3A		
14840 07C48	14842 07C4A	14844 07C4C	14846 07C4E	14848 07E4A	14850 07C58	14852 07C5A	14854 07C5C	14856 07C5E	14858 07E5A		
14860 07C68	14862 07C6A	14864 07C6C	14866 07C6E	14868 07E6A	14870 07C78	14872 07C7A	14874 07C7C	14876 07C7E	14878 07E7A		
14880 07E0C	14882 07E2C	14884 07E4C	14886 07E6C	14888 07E0E	14890 07E1C	14892 07E3C	14894 07E5C	14896 07E7C	14898 07E1E		
14900 07D08	14902 07D0A	14904 07D0C	14906 07D0E	14908 07F0A	14910 07D18	14912 07D1A	14914 07D1C	14916 07D1E	14918 07F1A		
14920 07D28	14922 07D2A	14924 07D2C	14926 07D2E	14928 07F2A	14930 07D38	14932 07D3A	14934 07D3C	14936 07D3E	14938 07F3A		
14940 07D48	14942 07D4A	14944 07D4C	14946 07D4E	14948 07F4A	14950 07D58	14952 07D5A	14954 07D5C	14956 07D5E	14958 07F5A		
14960 07D68	14962 07D6A	14964 07D6C	14966 07D6E	14968 07F6A	14970 07D78	14972 07D7A	14974 07D7C	14976 07D7E	14978 07F7A		
14980 07F0C	14982 07F2C	14984 07F4C	14986 07F6C	14988 07F0E	14990 07F1C	14992 07F3C	14994 07F5C	14996 07F7C	14998 07F1E		

1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360	1401 S/360
15000 07880	15002 07882	15004 07884	15006 07886	15008 07888	15010 07890	15012 07892	15014 07894	15016 07896	15018 07898		
15020 078A0	15022 078A2	15024 078A4	15026 078A6	15028 078A8	15030 078B0	15032 078B2	15034 078B4	15036 078B6	15038 078B8		
15040 078C0	15042 078C2	15044 078C4	15046 078C6	15048 078C8	15050 078D0	15052 078D2	15054 078D4	15056 078D6	15058 078D8		
15060 078E0	15062 078E2	15064 078E4	15066 078E6	15068 078E8	15070 078F0	15072 078F2	15074 078F4	15076 078F6	15078 078F8		
15080 07A88	15082 07A8A	15084 07A8C	15086 07A8E	15088 07E88	15090 07A98	15092 07A9A	15094 07A9C	15096 07A9E	15098 07E98		
15100 07980	15102 07982	15104 07984	15106 07986	15108 07988	15110 07990	15112 07992	15114 07994	15116 07996	15118 07998		
15120 079A0	15122 079A2	15124 079A4	15126 079A6	15128 079A8	15130 079B0	15132 079B2	15134 079B4	15136 079B6	15138 079B8		
15140 079C0	15142 079C2	15144 079C4	15146 079C6	15148 079C8	15150 079D0	15152 079D2	15154 079D4	15156 079D6	15158 079D8		
15160 079E0	15162 079E2	15164 079E4	15166 079E6	15168 079E8	15170 079F0	15172 079F2	15174 079F4	15176 079F6	15178 079F8		
15180 07B88	15182 07B8A	15184 07B8C	15186 07B8E	15188 07F88	15190 07B98	15192 07B9A	15194 07B9C	15196 07B9E	15198 07F98		
15200 07A80	15202 07A82	15204 07A84	15206 07A86	15208 0788A	15210 07A90	15212 07A92	15214 07A94	15216 07A96	15218 0789A		
15220 07AA0	15222 07AA2	15224 07AA4	15226 07AA6	15228 078AA	15230 07AB0	15232 07AB2	15234 07AB4	15236 07AB6	15238 078BA		
15240 07AC0	15242 07AC2	15244 07AC4	15246 07AC6	15248 078CA	15250 07AD0	15252 07AD2	15254 07AD4	15256 07AD6	15258 078DA		
15260 07AE0	15262 07AE2	15264 07AE4	15266 07AE6	15268 078EA	15270 07AF0	15272 07AF2	15274 07AF4	15276 07AF6	15278 078FA		
15280 07AA8	15282 07AA8	15284 07AAC	15286 07AAE	15288 07EA8	15290 07AB8	15292 07ABA	15294 07ABC	15296 07ABE	15298 07EB8		
15300 07B80	15302 07B82	15304 07B84	15306 07B86	15308 0798A	15310 07B90	15312 07B92	15314 07B94	15316 07B96	15318 0799A		
15320 07BA0	15322 07BA2	15324 07BA4	15326 07BA6	15328 079AA	15330 07BB0	15332 07BB2	15334 07BB4	15336 07BB6	15338 079BA		
15340 07BC0	15342 07BC2	15344 07BC4	15346 07BC6	15348 079CA	15350 07BD0	15352 07BD2	15354 07BD4	15356 07BD6	15358 079DA		
15360 07BE0	15362 07BE2	15364 07BE4	15366 07BE6	15368 079EA	15370 07BF0	15372 07BF2	15374 07BF4	15376 07BF6	15378 079FA		
15380 07BA8	15382 07BAA	15384 07BAC	15386 07BAE	15388 07FA8	15390 07BB8	15392 07BBA	15394 07BBC	15396 07BBE	15398 07FB8		
15400 07C80	15402 07C82	15404 07C84	15406 07C86	15408 0788C	15410 07C90	15412 07C92	15414 07C94	15416 07C96	15418 0789C		
15420 07CA0	15422 07CA2	15424 07CA4	15426 07CA6	15428 078AC	15430 07CB0	15432 07CB2	15434 07CB4	15436 07CB6	15438 078BC		
15440 07CC0	15442 07CC2	15444 07CC4	15446 07CC6	15448 078CC	15450 07CD0	15452 07CD2	15454 07CD4	15456 07CD6	15458 078DC		
15460 07CE0	15462 07CE2	15464 07CE4	15466 07CE6	15468 078EC	15470 07CF0	15472 07CF2	15474 07CF4	15476 07CF6	15478 078FC		
15480 07AC8	15482 07ACA	15484 07ACC	15486 07ACE	15488 07EC8	15490 07AD8	15492 07ADA	15494 07ADC	15496 07ADE	15498 07ED8		
15500 07D80	15502 07D82	15504 07D84	15506 07D86	15508 0798C	15510 07D90	15512 07D92	15514 07D94	15516 07D96	15518 0799C		
15520 07DA0	15522 07DA2	15524 07DA4	15526 07DA6	15528 079AC	15530 07DB0	15532 07DB2	15534 07DB4	15536 07DB6	15538 079BC		
15540 07DC0	15542 07DC2	15544 07DC4	15546 07DC6	15548 079CC	15550 07DD0	15552 07DD2	15554 07DD4	15556 07DD6	15558 079DC		
15560 07DE0	15562 07DE2	15564 07DE4	15566 07DE6	15568 079EC	15570 07DF0	15572 07DF2	15574 07DF4	15576 07DF6	15578 079FC		
15580 07BC8	15582 07BCA	15584 07BCC	15586 07BCE	15588 07FC8	15590 07BD8	15592 07BDA	15594 07BDC	15596 07BDE	15598 07FD8		
15600 07E80	15602 07E82	15604 07E84	15606 07E86	15608 0788E	15610 07E90	15612 07E92	15614 07E94	15616 07E96	15618 0789E		
15620 07EA0	15622 07EA2	15624 07EA4	15626 07EA6	15628 078AE	15630 07EB0	15632 07EB2	15634 07EB4	15636 07EB6	15638 078BE		
15640 07EC0	15642 07EC2	15644 07EC4	15646 07EC6	15648 078CE	15650 07ED0	15652 07ED2	15654 07ED4	15656 07ED6	15658 078DE		
15660 07EE0	15662 07EE2	15664 07EE4	15666 07EE6	15668 078EE	15670 07EF0	15672 07EF2	15674 07EF4	15676 07EF6	15678 078FE		
15680 07AE8	15682 07AEA	15684 07AEC	15686 07AEE	15688 07EE8	15690 07AF8	15692 07AFA	15694 07AFC	15696 07AFE	15698 07EF8		
15700 07F80	15702 07F82	15704 07F84	15706 07F86	15708 0798E	15710 07F90	15712 07F92	15714 07F94	15716 07F96	15718 0799E		
15720 07FA0	15722 07FA2	15724 07FA4	15726 07FA6	15728 079AE	15730 07FB0	15732 07FB2	15734 07FB4	15736 07FB6	15738 079BE		
15740 07FC0	15742 07FC2	15744 07FC4	15746 07FC6	15748 079CE	15750 07FD0	15752 07FD2	15754 07FD4	15756 07FD6	15758 079DE		
15760 07FE0	15762 07FE2	15764 07FE4	15766 07FE6	15768 079EE	15770 07FF0	15772 07FF2	15774 07FF4	15776 07FF6	15778 079FE		
15780 07BE8	15782 07BEA	15784 07BEC	15786 07BEE	15788 07FE8	15790 07BF8	15792 07BFA	15794 07BFC	15796 07BFE	15798 07FF8		
15800 07C88	15802 07C8A	15804 07C8C	15806 07C8E	15808 07E8A	15810 07C98	15812 07C9A	15814 07C9C	15816 07C9E	15818 07E9A		
15820 07CA8	15822 07CAA	15824 07CAC	15826 07CAE	15828 07EAA	15830 07CB8	15832 07CBA	15834 07CBC	15836 07CBE	15838 07EBA		
15840 07CC8	15842 07CCA	15844 07CCC	15846 07CCE	15848 07ECA	15850 07CD8	15852 07CDA	15854 07CDC	15856 07CDE	15858 07EDA		
15860 07CE8	15862 07CEA	15864 07CEC	15866 07CEE	15868 07EEA	15870 07CF8	15872 07CFA	15874 07CFC	15876 07CFE	15878 07EFA		
15880 07E8C	15882 07EAC	15884 07ECC	15886 07EEC	15888 07E8E	15890 07E9C	15892 07EBC	15894 07EDC	15896 07EFC	15898 07E9E		
15900 07D88	15902 07D8A	15904 07D8C	15906 07D8E	15908 07F8A	15910 07D98	15912 07D9A	15914 07D9C	15916 07D9E	15918 07F9A		
15920 07DA8	15922 07DAA	15924 07DAC	15926 07DAE	15928 07FAA	15930 07DB8	15932 07DBA	15934 07DBC	15936 07DBE	15938 07FBA		
15940 07DC8	15942 07DCA	15944 07DCC	15946 07DCE	15948 07FAA	15950 07DD8	15952 07DDA	15954 07DDC	15956 07DDE	15958 07FDA		
15960 07DE8	15962 07DEA	15964 07DEC	15966 07DEE	15968 07FEA	15970 07DF8	15972 07DFA	15974 07DFC	15976 07DFE	15978 07FFA		
15980 07F8C	15982 07FAC	15984 07FCC	15986 07FEC	15988 07F8E	15990 07F9C	15992 07FBC	15994 07FDC	15996 07FFC	15998 07F9E		

APPENDIX G: CALCULATION OF MODEL 30 STORAGE REQUIREMENTS

The total storage requirement of the Model 30 is the sum of the following:

1. Size of the user's DOS/360 supervisor
2. Size of the 1400 system to be simulated
3. Amount of storage reserved for partitions other than the one in which the Emulator Program is resident.
4. Amount of storage reserved for magnetic-tape I/O buffers (value assigned to the symbolic parameter BUFSIZE)
5. Size of the generated Emulator Program

Requirements (1) through (4) can be easily determined. The size of the generated Emulator Program, requirement (5), can be estimated by using the list of storage estimates in this appendix.

The storage estimates for parameters listed more than once should be included for each statement that is true. Parameters that do not appear in the list do not generate additional coding or have been included in the fixed overhead figure. Due to the vast number of possible ways to generate the Emulator Program, and since certain parameters share routines or constants with other parameters, the values obtained from the list should be used only as a guide. A "trial" generation is the only method of determining the exact amount of storage required. The following list contains the estimates of bytes required for the Emulator-Program generation:

<u>Parameter</u>	<u>Bytes</u>
Fixed Overhead	3400
CATALOG=YES	270
FETCH=YES	100
SYSIO=ipl (use Table 16)	

Example: If 1402 is to be simulated on a 2540 directly for card read and punch and the 1403 output to disk is to be simulated by assigning SYSLST to a 2311 extent, then SYSIO=003, or a storage requirement of 330 bytes as shown in Table 16.

Table 16. Model 30 SYSIO Storage Estimates

i p	l = 0	l = 1	l = 2	l = 3
00	0	260	490	330
01	260	520	750	600
02	550	800	1030	880
03	400	660	890	730
10	140	400	630	470
11	400	660	890	740
12	690	940	1170	1020
13	550	800	1030	880
20	300	520	720	600
21	530	780	1010	890
22	840	1090	1330	1170
23	700	950	1180	1030
30	180	440	670	520
31	450	700	930	780
32	730	990	1210	1060
33	580	840	1090	920

<u>Parameter (con't)</u>	<u>Bytes</u>
DISKDR=n (n≠0)	1770
DISKDR=130n	1770
DISKDR=1405	1405
DVOL=YES	700
SCAN=YES and SCAN360=NO	630
SCAN=YES and SCAN360=YES	880
TRACKOP=YES	300
TRACKOP=YES (1405) and OSINQRY≠YES	800
TRACKOP=YES (not 1405) and OSINQRY≠YES	2980-100n
(where n = no. of sectors)	
VERIFY=YES	300
SECTORS=n (not 1405)	124n
SECTORS=n (1405) and OSINQRY≠YES	200
TAPEDR=n (n≠0)	1150
TAPEMOD=MXEDPAR	600
TAPLDMD=YES	240
TAPERRS=LOG or LST	830
TAPERRS=LOGCHAR or LSTCHAR	700
RDR1400=1402	550
READRSS=YES	200

COLBINR=YES	1230
RDR 1400=1442	450
READRSS=YES	100
COLBINR=YES	1530
PCH1400=1402 and PCH360=2540	640
PUNCHSS=YES	100
COLBINP=YES	840
PCH1400=1402 and PCH360=2520 or 1442	500
PUNCHSS=YES	100
COLBINP=YES	740
PCH1400=1442 and PCH360=2540	660
PUNCHSS=YES	100
COLBINP=YES	480
PCH1400=1442 and PCH360=2520 or 1442	490
PUNCHSS=YES	50
COLBINP=YES	400
PCH1400=1444 and PCH360=2540	490
PUNCHSS=YES	50
COLBINP=YES	480
PCH1400=1444 and PCH360=2520 or 1442	350
PUNCHSS=YES	50
COLBINP=YES	380
PTR1400=1403	580
PTR1400=1404	1100
PTR1400=1443	450
CARRCTL=YES	510
PFR=YES or COM	270
COL51=YES	100
ERROPNG=YES and OSDUMP=NO	100
OSDUMP=YES and ERROPNG=NO	130
OSDUMP=YES and ERROPNG=YES	160
OSADDR=YES	50
OSALTER=YES	50
OSINQRY=YES	120
OSINQRY=YES and DISKDR=0	2980
OSINQRY=YES and DISKDR≠0 (not 1405) 2980-100n (where n = no. of sectors and is less than 30)	2980
OSINQRY=YES and DISKDR≠0(1405)	2980

If any of the following are true add only the value which is largest for any of the true statements. If none are true, add nothing.

OSDISK=YES	600
OSDUMP or ERROPNG=YES	570
OSTAPE=YES	570
OSINQRY≠NO	560
CATALOG=YES	400
OSENTER=YES	270
OSDSPLY≠NO	180
HALTS=YES	150
DVOL=YES	100
FETCH=YES	100
TIMER=YES	150

Sample Worksheet for Computing Model 30 Storage Requirements

1. DOS supervisor size _____
 2. Size of 1400 system being simulated (1000 bytes per K) _____
 3. Amount of storage reserved for partitions other than the one in which the Emulator Program is resident. _____
 4. Tape I/O area (same as BUFSIZE value) _____
 5. Emulator-Program size _____
- Total main storage required _____

APPENDIX H: CALCULATION OF MODEL 40 STORAGE REQUIREMENTS

The total storage requirement of the Model 40 is the sum of the following:

1. The constant 16,384 or the value assigned to RELOC times 1024, whichever is greater (beginning of 1400 memory)
2. Size of the 1400 system to be simulated
3. Amount of storage reserved for magnetic tape and disk I/O buffers (value of symbolic parameter BUFSIZE)
4. Amount of storage reserved for partitions above the partition for which this calculation is being done.
5. Size of the generated Emulator Program

Requirements (1) through (4) can easily be determined. The size of the generated Emulator Program, requirement (5), can be estimated by using the list of storage estimates in this appendix.

The storage estimates for parameters listed more than once in the list should be included for each statement that is true. Parameters that do not appear in the list do not generate additional coding or have been included in the fixed overhead figure. Due to the vast number of possible ways to generate the Emulator Program, and since certain parameters may share routines or constants with other parameters, the values obtained from the tables should be used only as a guide. A "trial" generation is the only method of determining the exact amount of storage required. The following list contains the estimates of bytes required for the Emulator-Program generation:

<u>Parameter</u>	<u>Bytes</u>
Fixed Overhead	6850
CATALOG=YES	790
FETCH=YES	200
EOJAADR=nnnnn	20
EOJBADR=nnnnn	20
HALTS=YES	600
TIMER=YES	150
SYSIO=ipl (use Table 17)	

Example: If 1402 is to be simulated on a 2540 directly for card read and punch and the 1403 output to disk is to be simulated by assigning SYSLST to a 2311 extent, then SYSIO=003, or a storage requirement of 330 bytes as shown in Table 17.

Table 17. Model 40 SYSIO Storage Estimates

i p	l = 0	l = 1	l = 2	l = 3
00	0	260	490	330
01	260	520	750	600
02	550	800	1030	880
03	400	660	890	730
10	140	400	630	470
11	400	660	890	740
12	690	940	1170	1020
13	550	800	1030	880
20	300	520	720	600
21	530	780	1010	890
22	840	1090	1330	1170
23	700	950	1180	1030
30	180	440	670	520
31	450	700	930	780
32	730	990	1210	1060
33	580	840	1090	920

<u>Parameters (con't)</u>	<u>Bytes</u>
DISKDR=n (n≠0)	2360
DISKDR=130n	2360
DISKDR=1405	1045
DVOL=YES (for 1311 support)	1100
DVOL=YES (for 1405 or 1301 support)	860
SCAN=YES and SCAN360=NO	685
SCAN=YES and SCAN360=YES	1200
TRACKOP=YES	350
TRACKOP=YES(1405) and OSINQRY≠YES	800
TRACKOP=YES (not 1405) and OSINQRY≠YES	2980-100n
	(where n = no. of sectors)
VERIFY=YES	455
SECTORS=n (not 1405)	148n
SECTORS=n (1405) and OSINQRY≠YES	200
TAPEDR=n (n≠0)	1830
TAPEMOD=MXEDPAR	920
TAPLDMD=YES	250
TAPERRS=LOG	940
TAPERRS=LST	990
TAPERRS=LOGCHAR	700

TAPERRS=LSTCHAR	725	OSDISK=YES and/or OSTAPE=YES	100
TAPEDR≠0 and/or DISKDR≠0	350	OSADDR=YES	645
		OSALTER=YES	35
RDR1400=1402	680	OSDSPLY=YES or nn	80
READRSS=YES	200	OSENTER=YES	125
COLBINR=YES	1160	OSINQRY=YES	935
RDR1400=1442	630	OSINQRY=1400	815
READRSS=YES	100	OSINQRY=YES and DISKDR=0	2980
COLBINR=YES	1440	OSINQRY=YES and DISKDR≠0 (not 1405) 2980-100n	
		(where n = no. of sectors	
		and is less than 30)	
PCH1400=1402 and PCH360=2540	700	OSINQRY=YES and DISKDR≠0 (1405)	2980
PUNCHSS=YES	100	OSENTER=YES and/or OSINQRY≠NO	505
COLBINP=YES	730	OSENTER=YES and/or OSALTER=YES and/or	515
PCH1400=1402 and PCH360=2520 or 1442	630	OSADDR=YES and/or OSDSPLY=YES	
PUNCHSS=YES	130	RELOC≠0	300
COLBINP=YES	630		
PCH1400=1442 and PCH360=2540	780		
PUNCHSS=YES	130		
COLBINP=YES	550		
PCH1400=1442 and PCH360=2520 or 1442	600		
PUNCHSS=YES	50		
COLBINP=YES	450		
PCH1400=1444 and PCH360=2540	630		
PUNCHSS=YES	70		
COLBINP=YES	550		
PCH1400=1444 and PCH360=2520 or 1442	480		
PUNCHSS=YES	50		
COLBINP=YES	420		
PTR1400=1403	580		
PTR1400=1443	480		
PTR1400=1404	1200		
CARRCTL=YES	550		
PFR=YES or COM	270		
COL51=YES	100		
OSDUMP=YES and ERROPNG=NO	1120		
OSDUMP=YES and ERROPNG=YES	1150		
ERROPNG=YES and OSDUMP=NO	1170		
OSDISK=YES	770		
OSTAPE=YES	665		

Sample Worksheet for Computing Model 40
Storage Requirements

1. Use the constant 16,384 or the value assigned to RELOC times 1024, whichever is greater _____
 2. Size of 1400 system being simulated (1024 bytes per K) _____
 3. Tape I/O area (same as BUFSIZE) value _____
 4. Size of partitions above the partition for which this calculation is being done _____
 5. Emulator-Program size _____
- Total main storage required _____

Two sample programs are provided with the 1401/1440/1460 Emulator Program for the Models 30 and 40. One sample program is used with an Emulator Program generated for either a 1401 or a 1460 program. The other sample program is used with an Emulator Program generated for a 1440 program. The name used to catalog the sample programs in the Source Statement Library is EU3SPRGM for the Model 30, and EU4SPRGM for the Model 40.

drive (the system residence volume), a card reader/punch, a printer, and a 1052 Printer-Keyboard. Optionally, the configuration may include a tape unit. The minimum storage capacity required for the sample program, using the Emulator Program generated as described in this section, is 24K for the Model 30, and 32K for the Model 40.

The sample programs are designed to:

- Read data from the card reader.
- Print the data on the printer.
- Punch the data into cards on the card punch.
- Read the punched cards on the card reader.
- Print the data from the punched cards on the printer.

If the System/360 configuration includes a tape unit, the sample program also reads and writes on tape.

The sample programs consist of 1400 object programs and the source statements as well as the necessary DOS and Emulator Program control cards for execution. Execution may be accomplished either with a user-generated Emulator Program that has been cataloged in the Core-Image Library, or with the Emulator Program generated and cataloged as described in this appendix. The sample programs require a minimum system configuration of at least one 2311 disk

GENERATING THE SAMPLE EMULATOR PROGRAM

The input required to generate the sample Emulator Program for use with either the 1401 or 1460 sample program is shown in Figure 10. In card 004, the user must specify EU30 for the Model 30, or EU40 for the Model 40. All underscored parameters in control cards 004 through 008 must be tailored to the user's System/360 configuration. Table 8 can be used to select model numbers for the punch, printer and reader in control cards 004 and 005. Control cards 006, 007, and 008 should be omitted if the system configuration does not include a tape drive. If the configuration includes a tape drive, "SYSnnn" in control cards 007 and 008 must specify valid DOS assigned programmer logical units. If other than standard assignments are desired, a // ASSGN control card must be provided for TAPE1. See paragraph on "Execution of Sample Program."

The input required to generate the sample Emulator Program for use with the 1440 sample program is shown in Figure 11. In card 004, the user must specify EU30 for the Model 30, or EU40 for the Model 40. All underscored parameters in control cards

```

// JOB    EUJOB1                                001
// OPTION LIST,DECK,XREF                        002
// EXEC   ASSEMBLY                              003
EUSAMPL  {EU30} PCH1400=1402,PCH360=nnnn, PTR1400=1403, PTR360=nnnn,    X  004
          {EU40} RDR1400=1402,RDR360=nnnn, SI Z1400=4, OSINQRY=1400,    X  005
          BLKSI Z1=0081,BUFSIZE=0081,HALTS=YES,                          X  006
          TAPEDR=1,TAPE1=SYSnnn,TAPE2=SYSnnn,TAPE3=SYSnnn,             X  007
          TAPE4=SYSnnn,TAPE5=SYSnnn,TAPE6=SYSnnn                        008
          END ACOMP01                                                  009
/*                                                                      010
/£                                                                      011

```

• Figure 10. Emulator Program Generation for 1401/1460 Sample Program

```

// JOB      EUJOB2                                001
// OPTION LIST,DECK,XREF                          002
// EXEC ASSEMBLY                                  003
EUSAMP2 {EU30} PCH1400=1442,PCH360=nnnn,PTR1400=1443,PTR360=nnnn, X 004
        {EU40} RDR1400=1442,RDR360=nnnn,SIZ1400=4,OSINQRY=1400, X 005
                BLKSIZ1=0081,BUFSIZE=0081,HALTS=YES, X 006
                TAPEDR=1,TAPE1=SYSnnn,TAPE2=SYSnnn,TAPE3=SYSnnn, X 007
                TAPE4=SYSnnn,TAPE5=SYSnnn,TAPE6=SYSnnn 008
        END ACOMP01                                009
/*                                                010
/£                                                011

```

•Figure 11. Emulator Program Generation for 1440 Sample Program

004 through 008 must be tailored to the user's System/360 configuration. Table 8 can be used to select model numbers for the punch, printer, and reader in control cards 004 and 005. Control cards 006, 007, and 008 should be omitted if the system configuration does not include a tape drive. If the configuration includes a tape drive, "SYSnnn" in control cards 007, and 008 must specify valid DOS assigned programmer logical units. If other than standard assignments are desired, a // ASSGN control card must be provided for TAPE1. See paragraph on "Execution of the Sample Program."

EXECUTION OF THE SAMPLE PROGRAM

Because the Emulator Program is executed using a 1400 object deck, it is necessary to retrieve the sample 1400 object programs and the DOS and Emulator Program control cards contained in the source statement library. Both an object deck and a source statement deck are punched out for both sample programs. Only that object deck for which the Emulator Program was generated should be retained (either the 1401/1460 object program or the 1440 object program). The following control cards are required to punch out and display the sample programs.

GENERATING A USER-WRITTEN EMULATOR PROGRAM

If the sample programs are to be executed with user-written Emulator Programs, several parameters must be included in the users' Emulator Program generation. For the 1401/1460 sample program, the parameters SIZ1400=4 (or larger) and OSINQRY=1400 or YES must be included. For the 1440 sample program, the parameters SIZ1400=4 (or larger), PCH1400=1442, RDR1400=1442, PTR1400=1443, and OSINQRY=1400 or YES must be included. Optionally, if tape support is desired, the necessary tape simulation parameters must be included.

```

// JOB PUNCH AND DISPLAY SAMPLE PROGRAMS
// EXEC SSERV
    DSPCH Z.EU3SPRGM (for Model 30)
        or
    DSPCH Z.EU4SPRGM (for Model 40)
/*
/£

```

After obtaining the punch card output of the sample programs, select the object deck and control cards to be used with the generated Emulator Program. The correct card deck for the 1401/1460 sample program is shown in Figure 12, while the correct card deck for the 1440 sample program is shown in Figure 13.

CATALOGING THE EMULATOR PROGRAM

The output of the Emulator-Program generation is a punched card deck which includes the necessary DOS control cards and System/360 emulator object module to catalog the Emulator Program in the Core-Image Library. The emulator object module, which is punched out following the /£ DOS control card, must be repositioned within the card deck. The proper position for the object module is marked by a punched card "***REPLACE WITH OBJECT MODULE***". Be sure to remove this card when repositioning the object deck. (Refer to Figure 2 for an example of the cards for the catalog run.)

The DOS control cards provided with the sample program are for use with either the sample Emulator Program or with a user-prepared Emulator Program. If the sample program is for use with the sample Emulator Program, perform the following operations.

- Discard the // ASSGN card if system configuration does not include tape, or if standard tape drive assignments were made during DOS system generation. If standard tape drive assignments were not made, complete the // ASSGN card as follows:

```
// ASSGN SYSnnn,X'cuu'
```

where "nnn" is the programmer logical unit assigned to the TAPE1=SYSnnn parameter during Emulator Program generation, and "cuu" is the device address of the tape drive.

- Discard the // UPSI card.
- Key punch the name of the sample Emulator Program, (EUSAMPL for the 1401/1460 program and EUSAMP2 for the 1440 program) in the operand field of the // EXEC card.

If the sample program is for use with a user-prepared Emulator Program, perform the following operations:

- Discard the // ASSGN card if the system configuration does not include tape, or if standard tape drive assignments were made during DOS generation. If standard tape drive assignments were not made, complete the // ASSGN card as follows:

```
// ASSGN SYSnnn,X'cuu'
```

where "nnn" is the programmer logical unit assigned to the TAPE1=SYSnnn pa-

rameter during Emulator Program generation, and "cuu" is the device address of the tape drive.

- Discard the // UPSI card if the system configuration does not include tape, or if the user's Emulator Program includes the parameter HALTS=YES.
- Key punch the user's Emulator Program name in the operand field of the // EXEC card.

Complete the preparations for executing the sample program by placing a /* card at the end of the sample program data cards. Do not include a /% card since the /* card only indicates the end of a data file and not the end of job. The sample program provides a /% card for end of job.

During execution, the operator must perform several operator service functions. A copy of SYSLOG, which includes operator responses to the operator service functions, is shown in Figure 14. A copy of the output data printed on SYSLST is shown in Figure 15.

```

*
*
// JOB SAMPLE PROGRAM FOR THE EMULATOR PROGRAM 1401/1460 0003
// ASSGN SYSNNN,X'CUU' SPECIFY 1400 TAPE 1 IF SYSTEM HAS TAPE 0004
// UPSI 01 0005
// EXEC INSERT NAME OF EMULATOR PROGRAM 0006
// 1400 S1401,1,1,,,1,,T,00730 0007
,008015,022026,030034,041,045,053L0721001026 /0991,001/001116IO 1 0008
L096116,105106,110110B101/I99,027A099029<027B001100 B026 0009
,008015,022029,036040L071131,1041081001/080,001V00600611M217159,004174M BOOT0010
L070162,116117,124131,136140,1471481001M218M003S224005AV108005KM007220 LOAD0011
L069192,156170,174181,189001,0010011001M219000<000A223159B193219 B124 LOAD0012
L071224,197205,212216,218219,221224B100S219B174220 M124170B15607< 0011 LOAD0013
33353 /332 / / ,001101 B680 M%T0913W M%T0996W .001001 B483B B437A 1 MO 000410014
3865580280 2 C/08/04 B378U M080W80 ,408 A/11410 <408 A/13/04 B378 MW80 001510015
44154180 4 ,438 A/11440 <438 A/13/06 C/04/06 B437/ B598 U%U1R B540A 1 M002610016
49555080280 2 M080813 M%U1734W B526L B488 U%U1B U%U1E B502 U%U1M U%U1R 003910017
55054 M%U1734R B572L B593K B581 U%U1B B550 M813180 4 B550 U%U1U M/1418 004910018
604550 M180179 M/16102 4 M/18102 4 M/14180 M180179 4 M%TO 22W .002002 B006010019
65951680 1 M080280 2 B709A B662 H708 F1 /280 M912307 FT 2 /307 / B000 F007110020
71024K /280 M/02224 2 .999999 B723 008610021
81401 | 009210022
81564 SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DO 009310023
87964S IF SYSTEM HAS A TAPE MOUNT SCR 009410024
94363ATCH ON TAPE UNIT 1, TURN ON SSW B AND RESPOND START | IF NO TAPE 009610025
0663, RESPOND START | PLACE CARDS THAT WERE PUNCHED IN READER AND RES 009810026
6950POND START | SAMPLE PROGRAM COMPLETE 00 00 20 080 01 _ /* _ /& 010010027
00608 /333080 011110028
001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0029
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0030
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0031
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0032
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0033
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0034
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0035
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0036
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0037
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0038
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0039
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0040
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0041
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0042
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0043
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0044
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0045
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0046
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0047
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0048
* 0049
* 0050
* USER MUST SUPPLY /* CARD 0051

```

Figure 12. Control Cards, 1400 Object Deck, and Data for 1401/1460 Sample Program

```

*
*
// JOB 1440 SAMPLE PROGRAM FOR THE EMULATOR PROGRAM
// ASSGN SYSNNN,X'CUU' SPECIFY 1400 TAPE 1 IF SYSTEM HAS TAPE
// UPSI 01
// EXEC INSERT NAME OF EMULATOR PROGRAM
// 1400 S1440,1,1,,1,1,,T,01222
,008015,022029,036058L070086,043087,050075,083054S058B075|M%G1001RB001 BOOT0061
<054050<058043L071231,231040B075 B131S226B181227 M131177B16307< 0011 LOAD0062
L072195,188181,177170,200204,212219B075M007227M226000<000A230166B200226_LOAD0063
L071162,155154,147143,139138,223225B075,004181MM225M003S231005AV100005K_LOAD0064
L070130,124120,112108,226226,228228B108V0060061/073M%G1001R,001M224166_LOAD0065
41301_|
00609_,333_B108 000410066
49401_| 000610067
00609_,414_B108 000610068
57501_| 000810069
00609_,495_B108 000810070
72101_| 001110072
72256 B/41 M%T0T24W M%T0U08W .001001 B892B B827A M%G1333R M412680 M%Y1 001210073
77855601W CV12V08 B754U M412W80 ,798 AV15800 <798 AV17V08 B754 B/72 M% 002010074
83356G1414G MW80493 M%G1414G ,840 AV15842 <840 AV17V10 CV08V10 B839/ B 003110075
88957 40 U%U1R B963A M%G1333R M412680 M%Y1601W M412574 M%U1495W B949L B004110076
94655897 U%U1B U%U1E B925 U%U1M U%U1R B/72 M%G1414G M%U1495R B 07L B 3 005010077
01555K B 16 U%U1B B985 M574493 M%G1414G B985 U%U1R B/72 MV19415 M%G14 006010078
565614G B/72 MV21415 M%G1414G B/72 M%G1414G M%T0U56W .002002 B/41 M%G 007010079
/12551333R M412680 M%Y1601W B/94A B/09 H/71 F1 MT23691 FT M%Y1601W /69 007910080
/67551 B000 H/93 MV22493 M493492 B000 FK /680 MU55624 M%Y1601W .999999 008910081
S2263 BS15 SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UN 009910082
S8564DER DOS IF SYSTEM HAS A TAPE, MOU 010210083
T4962NT SCRATCH ON TAPE UNIT 1, TURN ON SSW B AND RESPOND START | IF 010410084
U1162NO TAPE RESPOND START | SAMPLE PROGRAM COMPLETE PLACE CARDS JUST 010610085
U7350PCHED IN READER AND RESPOND START | 00 00 20 080 01 /* /& 010810086
00605 B722 011910087
001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0088
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0089
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0090
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0091
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0092
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0093
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0094
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0095
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0096
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0097
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0098
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0099
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0100
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0101
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0102
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0103
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0104
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0105
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0106
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM 0107
* 0108
* USER MUST SUPPLY /* CARD 0109

```

Figure 13. Control Cards, 1400 Object Deck, and Data for 1440 Sample Program

```

BG // JOB EUJOB1
BG // OPTION LIST,DECK,XREF
BG // EXEC ASSEMBLY
BG EOJ EUJOB1

```

(a) Generating the Emulator Program

```

BG // JOB CATALOG EUSAMPL
BF // OPTION CATAL
BG PHASE EUSAMPL,+16384
BG INCLUDE,(ACOMP00)
BG PHASE EUSAMPLX,+20480
BG INCLUDE,(ACOMP01)
BG PHASE $$BEU4M1
BG INCLUDE,($$BEU4M1)
BG PHASE $$BEU4M2
BG INCLUDE,($$BEU4M2)
BG INCLUDE
BG ENTRY EUENTRY
BG // EXEC LNKEDT
BG EOJ CATALOG

```

(b) Cataloging the Emulator Program

```

BG // JOB PUNCH AND DISPLAY SAMPLE PROGRAMS
BG // EXEC SSERV
BG EOJ PUNCH

```

(c) Retrieving the Sample Program

```

BG // JOB SAMPLE PROGRAM FOR THE EMULATOR PROGRAM 1401/1460
BG // EXEC EUSAMPL
BG // 1400 S1401,1,1,,,1,,T,00730
BG EC30I BEGIN S1401
BG IF SYSTEM HAS A TAPE MOUNT SCRATCH ON TAPE UNIT 1, TURN ON SSW B
AND RESPOND START
BG IF NO TAPE, RESPOND START
BG EC80I 1400 STATUS: I=00373; A=00001; B=00001 INSTN BLOCK=.001001B
BG EC82I HALT
BG EC40D TYPE IN FUNCTION
BG switch
BG EC46I S-SW ON =
BG EC45D TYPE S-SW
BG b
BG EC46I S-SW ON = B
BG EC40D TYPE IN FUNCTION
BG start
BG PLACE CARDS THAT WERE PUNCHED IN READER AND RESPOND START
BG EC80I 1400 STATUS: I=00658; A=00002; B=00002 INSTN BLOCK=.002002B
BG EC82I HALT
BG EC40D TYPE IN FUNCTION
BG start
BG EC31I EOJ S1401
BG EOJ SAMPLE

```

(d) Executing the Sample Program

Figure 14. SYSLOG Output for EU40 Sample Program Running in the Background

APPENDIX J: EMULATOR PROGRAM CONSIDERATIONS FOR MODEL 25

This appendix describes the programming restrictions and considerations applicable to Model 25 users utilizing the 1401/1440/1460 Emulator Program for Compatibility Support/30 to execute 1401, 1440, or 1460 object programs under control of the Disk Operating System (DOS). Unless otherwise noted in this appendix, discussions throughout this publication of the 1401/1440/1460 Emulator Program for the Model 30 apply to the Model 25.

- One 2311 Model 1 Disk Storage Drive for DOS System Residence.
- Whatever system configuration is required for operation of the user's Disk Operating System.

Note: One 2400- or 3400-Series Magnetic Tape Unit (7- or 9-track) may be substituted for this device. (If SYSIPT, SYSPCH, and/or SYSLST are assigned to 7-track tape units, the Data Conversion Feature is required.)

MINIMUM SYSTEM CONFIGURATION

The following features are required for a minimum Model 25 configuration for the 1401/1440/1460 Emulator Program under DOS:

- System/360 Model 25 with a 2025 Processing Unit containing at least 24,576 (24K) bytes of program storage.
- 1400 Series Compatibility Feature (#4440) and 1401/1440/1460 DOS Compatibility Feature (#4470).
- Storage Protection Feature (#7520) for Multiprogramming.
- One card reader (1442, 2501, 2520, or 2540) (see Note)
- One card punch (1442, 2520, 2540, or 2560 with 2540 Emulation or Control Feature) (see Note)
- One printer (1403, 1404, or 1443) (see Note)
- One 1052 Printer-Keyboard
- Integrated 2311 Attachment (#4598) for attaching up to four 2311 Model 1 Disk Storage Drives,... includes File Scan capability.

INPUT/OUTPUT DEVICES

The Emulator Program under DOS can request I/O operations on the following System/360 devices:

- 1442 Card Read Punch
- 2501 Card Reader
- 2520 or 2540 Card Read Punches
- 1403 Printer
- 1404 Printer (for continuous-forms or cut-card operations)
- 1443 Printer
- 1052 Printer Keyboard (for operator communications)
- 2311 Model 1 Disk Storage Drive
- 2401, 2415, or 3420 Magnetic Tape Units

The input/output device correspondence between a 1401, 1440, or 1460, and a System/360 Model 25 is as shown in Table 1 with the differences shown in Table 18.

Table 18. Differences in Input/Output Device Correspondence for Model 25

1401/1440/1460 I/O Device	System/360 I/O Device
IBM 729, 7330, or 7335 Magnetic Tape Unit	IBM 2401 or 3420 (Model 3 or 5) Magnetic Tape Unit, or 2415 Magnetic Tape Unit and Control
IBM 1311 Disk Storage Drive or 1405 Model 1 Disk Storage*	IBM 2311 Model 1 Disk Storage Drive
*IBM 1301 Disk Storages, and 1405 Model 2 Disk Storages are not supported	

Table 19. Input/Output Feature Correspondence for Model 25

1401/1440/1460 I/O Feature	Model 25 I/O Feature
IBM 1402 Punch Feed Read and Control Unit (#5890 and #5895)	IBM Punch Feed Read (#5890); and Punch Feed Read Control (#5895) on Integrated 2540 Attachment (#4595) on the 2025, or on the 2821 Control Unit
IBM Column Binary Feature (#1990), or IBM Binary Transfer Feature (#1468), or IBM Card Image Features (#1531 and #9035)	Standard for 2540 on Integrated 2540 Attachment (#4595) On Multiplexor Channel (#5248) or Selector Channel (#6960): IBM Column Binary Feature (#1990 on the 2821 Control Unit if 2540, or IBM Card Image Feature (#1531) if 2501 or 2520, or IBM Card Image Feature (#1532) if 1442
IBM 1402 51-Column Interchangeable Read Feed (#4150) and Feed Adapter (#1013)	IBM 2540 51-Column Interchangeable Read Feed (#4151)*
IBM 1403 Preferred Character Set (#5523) and Adapter (#5524) IBM 1416 Interchangeable Train Cartridge equipped with Preferred Character Set Print Chain	IBM 1403 Multiple Character Set Feature** (#5110) on Model 2, Model 25 Adapter (#9725), and Interchangeable Chain Cartridge Adapter (#4740) when attached via Integrated 1403 Attachment (#4590) with Multiple Character Set Adapter (#5100) on the 2025; or IBM 1403 Universal Character Set** for Model 2 (#8641) or Model N1 (#8640) with prerequisite Interchangeable Train Cartridge Adapter or Interchangeable Train Cartridge, and appropriate Universal Character Set Adapter for the 2821 Control Unit
IBM Scan Disk (#6396)	Standard for 2311 on Integrated 2311 Attachment (#4595)
*When this feature is installed, reading speed is permanently reduced from 1000 cpm to 800 cpm.	
**With this feature, printing speed is dependent upon the number of characters in the character set and whether unprintable characters are included in the print line.	

ADDITIONAL FEATURES SUPPORTED

Additional System/360 features supported by the Emulator Program under DOS are:

- Timer Feature
- Either Multiplexor Channel (#5248), or Selector Channel (#6960). The two are mutually exclusive.
- Tape Switching Unit (2816)
- Universal Character Set
- Multiple Character Set

The input/output feature correspondence between a 1401, 1440, or 1460 system and a System/360 Model 25 is given in Table 19.

The Model 30 Emulator Program under DOS when run on the Model 25 provides support for all 1401, 1440, and 1460 standard operations and instructions, plus the following special features (for those items followed by an asterisk, refer to the Input/Output Feature Correspondence List):

- Advanced Programming for the 1401
- Bit Test
- Column Binary*
- Expanded Print Edit
- 51-Column Interchangeable Read Feed*
- High-Low-Equal Compare
- Multiply-Divide
- Print Storage
- Additional Print Control
- Punch Feed Read
- Space Suppression
- Sense Switches

Scan Disk*
 Direct Seek for the 1311
 Track Record for the 1311
 Binary Transfer for the 1460*
 Indexing and Store Address Register for
 the 1460

RESTRICTIONS

In addition to those restrictions specified for the Model 30, the following programming restrictions must be considered:

1. IBM 1301 Disk Storages, and IBM 1405 Model 2 Disk Storages are not supported due to Model 25 machine limitations.
2. Floating Point Arithmetic, Sterling Arithmetic, and the Integrated Communications Attachment are mutually exclusive with the Emulator Program.
3. Long data fields in emulated 1400-program instructions impose the same restriction on the use of magnetic ink character (MICR) devices attached to the Model 25 as those attached to the Model 30. Examples of the delays involved with field lengths of various 1400 instructions are given in Table 20.

CONSIDERATIONS

In addition to those considerations specified for the Model 30, the user must take into account the following programming considerations:

1. The channel configuration is limited to either one multiplexor or one selector channel.
2. Disk operations are limited to four 2311 Disk Storages, and one of these must be reserved for DOS.
3. Column Binary and File Scan are standard features on the Model 25.
4. The allowable values for the SIZ360 parameter are 24, 32, and 48. This parameter always must be included in the Emulator Program generation for the Model 25 because the default value of 64 exceeds the maximum storage size of a Model 25.
5. The inverted print edit function is supported by the parameter EDITINV. The function and use of this parameter is identical to its use by the Model 40 Emulator Program. (Refer to the section on "Description of Printer

Table 20. Example of Field Lengths Affecting MICR Devices on Model 25

1400 Instructions	Delay	
	<1MSEC	<4MSEC
Load Characters (LCA)	La=147	Ia=322
Move Characters (MLC)	La=127	Ia=544
Move Record (MRCM)	La=85	La=362
Move & Binary Encode (MBC)	La=80	La=346
Move & Binary Decode (MBD)	La=80	La=346
Zero & Add/Subtract	La=68	La=290
Move Right Characters to Wordmark or Groupmark (MRCWG)	La=85	La=362
Add/Subtract	La=73	La=311
Compare	Lb=93	Lb=396
Multiply	La=3 Lb=7	La=7 Lb=15
Divide	La=3 Lb=7	La=9 Lb=19
Move Characters & Suppress Zeros (MCS)	Ls=12 La=97	Ls=22 La=493
Edit	La=20 Lb=25	La=104 Lb=109

Notes:
 1. La=Length of A-Field
 2. Lb=Length of B-Field
 3. Ls=Number of zeros to the left of the first significant digit.

Parameters" for a discussion of this parameter.)

Note: While this parameter is not required by the Model 30 Emulator Program, an Emulator Program generated for use on the Model 25 with this parameter, may be executed on the Model 30 without modification.

PERFORMANCE

The Model 30 Emulator Program, when executed on the Model 25 with System/360 input/output devices having speeds equivalent to 1400-series devices, performs approximately one to one with 1401 equipment.

The Emulator Programs under DOS for the Models 30 and 40 provide a comprehensive set of messages that inform the operator of the status of the 1400-series programs, the status of the Emulator Programs, and the occurrence of errors or other conditions that require the operator's attention. Each message is prefixed by a message code in the form "ECnnx" where:

- EC identifies the message as one issued by the Emulator Program.
- nn is the message number.
- x indicates the message type and is either a D or I, as follows:
- D indicates that the operator must make a decision among the actions specified.
- I designates a message issued for information or diagnostic purposes.

A number of the following messages indicate error conditions. In most cases, the error condition can be alleviated by following the proper corrective measure indicated by the "Operator Action" or "Programmer Action" associated with the message. If, after attempting all specified operator actions and programmer actions for the message, the problem still persists, the "problem determination action" should be performed. Upon completion of the "problem determination action", IBM can be called for assistance.

The Emulator program messages, their meaning, and the action required when they are issued follow. The operator should note that DOS also issues messages which should be dealt with according to current DOS System Reference Library publications.

The following group of messages, prefixed by the message code EC0nx, pertain to user-initiated procedures:

EC0ID ENTER DATA

Cause: The user has patched the invalid 1400 operation code wordmark R into the 1400 program being executed, and it has just been

encountered. This may be used as a branch indicator for 1400 programs.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator types a one-character, user-supplied code on the console. This response is placed into 1400 storage location 96. (Lower-case letters g, p, x and w are invalid responses). If there is a wordmark associated with the character, it must be preceded by an underscore ("_").

EC02I INTERIM STORAGE DUMP

Cause: A 1400 operation code of G with a wordmark has been encountered in the 1400 program and the user has specified ERROPNG=YES to request a 1400-style storage dump. If the user has specified an "S" for the test-mode option in the // 1400 control card, a System/360 main storage dump is also provided.

System Action: Storage is automatically dumped on SYS1ST. At the completion of the dump, processing continues.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC03D MOUNT 51 COL READ FEED

Cause: The program has encountered a // 51 control card, which conditions it to read 51-column cards.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action:

- (1) Clear the reader.
- (2) Mount the 51-column Interchangeable Read Feed device on the 2540 Card Read Punch.
- (3) Load 51-column cards and ready the reader.

(4) Reply START or EOB.

The following messages, prefixed by the message code ECinx, pertain to errors in operator responses:

EC10I INVALID RESPONSE

Cause: The format or content of the operator's reply to the previous message issued by the Emulator program is invalid.

Probable errors are:

- Misspelled or miskeyed response, or
- Incorrect sequence of responses, or
- An invalid response.

This is probably a user error.

System Action: Reissues previous message.

Programmer Action: Not applicable.

Operator Action: The operator must reply with a valid response to the reissued message.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

EC11I INVALID ADDRESS

Cause: An invalid address was entered for the ADDRESS, ALTER, DISPLAY, or ENTER operator service function.

Probable errors are:

- A non-decimal address, or
- The address exceeds the value specified in the SIZ1400 parameter of the emulator program, or
- The address exceeds five characters in length, or
- The operator reply is too long - the address field must begin

before position thirty of the reply.

This is probably a user error.

System Action: Message EC40D is reissued.

Programmer Action: The programmer should supply the operator with a valid 1400 address within the range specified by the SIZ1400 parameter of the emulator program.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the system log, printer output, and the job stream available.

Operator Action: The operator must reply with a valid 1400 decimal address.

EC12I INVALID DEVICE TYPE

Cause: If the previous message issued by the emulator program is:

1. EC43D - the operator attempted to assign a 1400 device to a programmer logical unit that is not a System/360 tape device.
2. EC44D - the operator attempted to assign a 1400 device to a programmer logical unit that is not a System/360 disk device.

Probable errors are:

- The programmer logical unit previously entered was the wrong unit (keying error on 1052), or
- Missing, misplaced, or incorrect ASSGN statements or cards in the job stream.

This is probably a user error.

System Action: Previous message is reissued.

Programmer Action: The programmer must be certain that the operator has the correct ASSGNs in the job stream and has the correct 1400 device-to-System/360 device assignments.

If the problem recurs, do the following to complete your problem determination action:

1. Have the Emulator assembly listing and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: The operator must reply with a programmer logical unit that is assigned to a compatible device type. After a valid response, an information message (type I) will be issued to confirm the assignment, followed by the message EC40D.

If the correct programmer logical unit is not known:

1. Cancel the job.
2. Press the attention key and enter PAUSE BG F2 F1 to halt job control at end-of-job.
3. When '1100A Ready For Communications' appears on SYSLOG, respond with LISTIO {PROG|F1|F2} if output is desired on SYSLOG, or //LISTIO {PROG|F1|F2} if output is desired on SYSLST.

Submit the LISTIO listing to the programmer and let him supply the correct assignments.

EC13I INVALID LOGICAL UNIT NUMBER

Cause: The operator's reply, assigning a programmer logical unit in response to the previous message issued by the Emulator program, is invalid. The assignment of programmer logical units must be within the range of the programmer logical units specified during system generation of the Disk Operating System.

This is probably a user error.

Programmer Action: Resubmit the job with correct device assignments.

System Action: Previous message is reissued.

Operator Action: Issue LISTIO to check the assignment; then reply with the valid programmer logical

unit. After a valid response, an information message (type I) is issued to confirm the assignment, followed by the message EC40D.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

EC14I CONFLICTING LOGICAL UNIT ASSIGNMENT

Cause: The operator's reply, assigning a 1400 device to a programmer logical unit in response to the previous message issued by the Emulator program, conflicts with a previous assignment. For example, an assignment of TAPE 2 to SYS011 cannot be made if TAPE 1 is currently assigned to SYS011. In the case of disk assignments, two 1400 disk drives cannot be assigned to the same part of quadrant of a System/360 direct access storage device. For example, SYS011, PART 1 cannot be specified for DISK 0 if SYS011, PART 1 is already specified for DISK 2.

This is probably a user error.

System Action: Previous message is reissued.

Programmer Action: Execute LISTIO and verify assignments. Correct assignments and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: The operator must reply with a non-conflicting assignment, or unassign the conflicting 1400 device using the "TAPE n" or "DISK n" operator service function. After a valid response, an information message (type I) is issued to confirm the assignment, followed by message EC40D.

EC15I LOGICAL UNIT NOT ASSIGNED

Cause: The operator's reply, to assign a 1400 device to a programmer logical unit in response to the previous message issued by the Emulator program, is invalid. The reply attempted to assign a 1400 device to a programmer logical unit that is not assigned to a System/360 device or DVOL checking was attempted on a system unit not assigned to a System/360 device.

This is probably a user error.

System Action: If the message is not the result of DVOL checking, the previous message is reissued, or

If the message is the result of DVOL checking, message EC40D is issued.

Programmer Action: Execute LISTVTOC and check assignments. Then resubmit the job with the correct assignments, or

Insure that the assignments are correct before checking DVOL.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: If this message is not the result of DVOL checking, respond to the associated reissued message, or

If the message is the result of DVOL checking, respond to the associated EC40D message.

EC19I DVOL SERIAL NUMBER NEEDED

Cause: The operator used the DVOL DISKn operator service function to verify the volume serial number of a disk drive for which no volume serial number has been supplied, either on a // DVOL control card or by the DVOL DISKn=xxxxxx operator service function.

This is probably a user error.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: Supply the DVOL DISK=xxxxxx operator service function to initiate serial number checking when the volume serial number has not been previously supplied.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

The following group of messages, prefixed by the message code EC2nx, pertains to errors detected during Emulator program initialization.

EC20I PARAMETER ERROR

Cause: The sum of the values specified for tape I/O buffers on all // TAPE control cards (parameter "nnnnn" exceeds the amount allocated by the BUFSIZE parameter at Emulator program generation.

This is probably a user error.

System Action: The value specified at program generation by the BLKSIZU parameter for each drive is assumed as a default and message EC29D is issued.

Programmer Action: Analyze the // TAPE control card(s) and the standard values (from the emulator program listing) and perform one of the following actions:

1. Provide a new // TAPE control card. The sum of this card's block size ('nnnnn') operand(s) plus the block size value(s) (either the standard value or a new value supplied by a previous // TAPE control card) of any 1400 tape drive not altered by this card must not exceed the amount allocated by the BUFSIZE parameter.
2. If multiple // TAPE control cards are used, place those cards decreasing tape buffer sizes before those increasing tape buffer sizes. The Emulator program compares the total

block size value against the BUFSIZE parameter as it completes each // TAPE control card, making it possible to exceed the BUFSIZE value if the cards are out of order.

3. Reassemble the Emulator program with the proper size parameters for BLKSIZU and BUFSIZE if they are not correct.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: Not applicable.

EC21I INITIALIZATION ERROR

Cause: This error has been caused by one of the following:

- An attempt to execute the Emulator program in a SPI environment has been initiated. SPI operation is not supported, or
- Parameter "a" of the // 1400 card has been specified as a D and the // FETCH card did not immediately follow the // 1400 control card, or the // TAPE, // DVOL, // CCTL control cards if included, or
- A /* card (END OF DATA) has been encountered before the // 1400 card.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: If the first cause applies, reassemble the DOS supervisor to support batched job processing, or

If the second cause applies, arrange the control cards so that the //FETCH card immediately follows the emulator control cards, or

If the third cause applies, place the /* card after the //1400 card.

Resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: Not applicable.

EC29D CONTROL CARD ERROR

Cause: The previous emulator JOB control card read is incorrectly formatted.

This is probably a user error.

System Action: The system waits for an operator response.

Programmer Action: Correct the card in error and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: The operator may respond with a corrected control card or with RETRY, START, END, or CANCEL. RETRY or START will cause the next card on SYSIPT to be read. When correcting a CCTL error, two control cards can be typed in via the console if the first is a valid CCTL1 control card.

The following group of messages, prefixed by the message code EC3nx, pertains to the interval timer:

EC30I BEGIN name AT hh.mm.ss

Cause: This message is issued just before 1400 program loading. "name" is the program name from the // 1400 control card. If the user has specified TIMER=YES at Emulator system generation, and the timer has been turned on by the operator at IPL time, the time of day ("hh" is the hour, "mm" is the minute, and "ss"

is the second) is printed as the second half of this message.

System Action: Processing begins.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC31I EOJ name AT hh.mm.ss

Cause: A normal 1400 end-of-job halt has been recognized (the user specified at Emulator system generation "EOJAADR=nnnnn" and/or "EOJBADR=nnnnn" or specified an EOJ I-address in the // 1400 control card). "name" is the program name from the // 1400 control card. If the user specified TIMER=YES at Emulator program generation, and the timer has been turned on by the operator at IPL time, the time of day ("hh" is the hour, "mm" is the minute, and "ss" is the second) is printed as the second half of this message.

System Action: Control is released automatically to DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC32I CANCEL name AT hh.mm.ss

Cause: An abnormal 1400 end-of-job has been recognized. "name" is the program name from the // 1400 control card. If the user specified TIMER=YES at Emulator program generation, and the timer has been turned on by the operator at IPL time, the time of day ("hh" is the hour, "mm" is the minute, and "ss" is the second) is printed as the second half of the message. If the user specified OSDUMP=YES at Emulator program generation, a 1400-style storage dump is provided on SYSLSST unless a nodump option (a "1") is specified in parameter "b" of the // 1400 control card. When a 1400-style dump is provided, a System/360 main storage dump is also provided if the testmode option in the // 1400 control card is specified as "S".

System Action: Following the storage dump, control is released to DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC33I END name AT hh.mm.ss

Cause: The operator has entered END to request an end-of-job termination of the 1400 program. "name" is the program name from the // 1400 control card. If the user specified TIMER=YES at Emulator program generation and the timer has been turned on by the operator, the time of day ("hh" is the hour, "mm" is the minute, and "ss" is the second) is printed as the second half of the message.

System Action: Job is terminated as if the job had gone to a normal end of job (no main storage dump); control is released automatically to DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

The following group of messages, prefixed by the message code EC4nx, pertains to the Operator Service Functions:

EC40D TYPE IN FUNCTION

Cause: This message is issued when Operator Service Functions have been requested.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator replies with one of the following:

ADDRESS
ALTER
CANCEL
DELETE
DISK
DISK n
DISPLAY
DSPLYV
DUMP
DVOL DISKn
DVOL DISKn=xxxxxx
END
ENTER
INQUIRY (or INQUIRY 1400)
INQUIRY phasename
NEWPAC
RESET
RETRY
START (or EOB)
STATUS

SWITCH
TAPE
TAPE n

See "Available Functions" in the "Operator Service Functions" section for a detailed description of response formats and the resulting functions.

EC41I HEX ADDRESS = xxxx

Cause: This message is displayed when the operator enters address "ADDRESS ddddd" (decimal) in response to message EC40D, where "dddd" is a valid 1400 address for the generated system in the range of 1 to 15999. The "xxxx" is the hexadecimal equivalent of the entered decimal address.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: See message EC40D.

EC42D TYPE DATA

Cause: This message is displayed if the operator types the response ENTER to message EC40D. This allows the operator to change the contents of 1400 storage beginning at the 1400 address specified in the ENTER response.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The data is entered, using the special character "_" to indicate that a wordmark is associated with the next character typed. The data must be typed as upper- or lower-case characters as required. Special characters must be entered as indicated by Table 11. For example, if the operator replies _NNNN, four characters in upper case are entered at the address specified in the ENTER reply, with a wordmark associated with the first character.

EC43D/I TAPES n ON SYSnnn, MAX BLK=xxxxx DR cuu, n TR, yyy BPI

EC43D/I TAPE n ON SYSnnn, MAX BLK=xxxxx SYSnnn NOT ASSIGNED

EC43D/I TAPE n UNASSIGNED, MAX BLK=xxxxx

Cause: This message is displayed if the operator types the response "TAPE" or "TAPE n" to message EC40D. The response "TAPE" produces a display of all 1400 tape assignments and associated buffer block sizes for each 1400 drive. The response "TAPE n" indicates that the operator wishes to display or alter a 1400 tape assignment as specified by "n" (where "n" is digit from 1 to 6) on a programmer logical unit identified by SYSnnn. Message EC43D is issued to display the present status of the 1400 tape drive and allow the operator to retain or change the current assignment. Tape density (yyy BPI) is displayed only for 7-track tapes. If the tape drive is unassigned, the device address (DR cuu), the designation for 7- or 9-track tapes (n TR) and tape density (yyy BPI) are not displayed.

System Action: Message EC40D is issued following message EC43I. If message EC43D is issued, the system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: Message EC43I requires no response. Message EC43D requires one of the following responses:

- START (or EOB) to retain the present assignment.
- "SYSnnn" to change an assignment, where "SYSnnn" is the programmer logical unit (SYS000-SYS221) to which the simulated 1400 tape drive is to be assigned.

Note: A programmer logical unit currently assigned to a 1400 tape drive must first be unassigned from that device before reassignment can be made, or message EC14I is issued.

- "UA" to unassign the simulated 1400 tape drive from a programmer logical unit.

EC44D/I DISK n ON SYSnnn, PART n DR cuu

EC44D/I DISK n ON SYSnnn, SYSnnn NOT ASSIGNED

EC44D/I DISK n UNASSIGNED

Cause: This message is displayed if the operator types the response "DISK" or "DISK n" to message EC40D. The response "DISK" to message EC40D

indicates that the operator wishes a display of all 1400 disk assignments and associated disk part for each 1400 drive. The response "DISK n" to message EC40D indicates that the operator wishes to display or alter a specific 1400 disk assignment as indicated by the digit 0, 2, 4, 6, or 8 typed after DISK. Message EC44D is issued to display the present status of the 1400 disk drive and allows the operator to retain or change the current assignment.

System Action: Message EC40D is issued following message EC44I. For message EC44D the system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: Message EC44I requires no response. Message EC44D requires that the operator reply with one of the following responses:

- "START (or EOB)" to retain the
- "SYSnnn,x" to change an assignment, where "SYSnnn" is the programmer logical unit (SYS000 - SYS221) to which the simulated 1400 disk drive is to be assigned, and "x" is a 0 or 1 to indicate which half of the new 2311 disk unit, or a 0, 1, 2, or 3 to indicate which quadrant of the new 2314 disk unit is to be used.

Note: A programmer logical unit currently assigned to a 1400 disk drive must first be unassigned from that device before reassignment can be made, or message EC14I is issued.

- "UA" to unassign the simulated 1400 disk drive from a programmer logical unit.

EC45D TYPE S-SW

Cause: The operator requested the SWITCH operator service function and HALTS=YES was specified at Emulator program generation. A display of the current sense switches, message EC46I, will precede this message. Note that sense switch A is not displayed or altered by this function.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator replies by typing in the desired switch or switches. If all sense switches are to be turned off, a blank (space bar) followed by EOB is entered. To retain present status of sense switches, the operator replies "START" (or EOB). Message EC46I is typed out following the user's response to confirm the sense-switch settings.

EC46I S-SW ON = xxxxxx

Cause: This message displays the current sense-switch status. The message text is followed by a listing ("xxxxxx") of the sense switches that are on. This message follows the reply SWITCH to message EC40D to inform the operator of the current sense-switch status, and then, is issued again to confirm the operator response to EC45D.

System Action: Message EC40D or EC45D is issued.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC47I 1400 ADDRESS LIMIT, FUNCTION ENDED

Cause: This message is displayed only following the use of the ENTER or DISPLAY operator service function. The message indicates that the maximum generated 1400 storage address has been exceeded during execution of the requested function.

System Action: The system will respond with the appropriate action as follows:

- If the message is in response to the ENTER function, the entered data is ignored and message EC40D is displayed.
- If the message is in response to the DISPLAY function, only those positions up to the maximum 1400 storage address are displayed, followed by message EC40D.

Programmer Action: The programmer must ensure that the ENTER or DISPLAY requests do not exceed the maximum 1400 address.

Operator Action: The operator should first verify the previous ENTER or DISPLAY request. If the response was incorrect, the correct command should be entered in response to message EC40D, or

If the request was correct, and is essential for satisfactory job completion, the job can be terminated by replying CANCEL or END to message EC40D, or

If the request was correct but unnecessary for successful job completion, the operator can respond START to message EC40D to resume emulator processing.

EC48I FUNCTION NOT GENERATED

Cause: This message indicates that the operator requested an operator service function which was not specified for this Emulator program generation.

This is probably a user error.

System Action: Message EC40D is issued.

Programmer Action: If the desired operator service function is not present in the Emulator program, reassemble the Emulator program to generate the desired function and catalog to the core image library, or

Correct any assembly errors, and reassemble and recatalog the Emulator program, or

If any new operator services do not function on a recently cataloged Emulator program, check the linkage editor diagnostics for errors which would have prevented the new program from being cataloged. The old Emulator program may have been used. Correct the diagnostics, reassemble and recatalog the Emulator program.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: The operator must reply with one of the supported operator service functions.

EC49D INVALID 1400 CHARACTER DETECTED ON
XXXXXXXXXX

Cause: This message is displayed when the Emulator program for the Model 40 encounters an invalid 1400 character. "XXXXXXXXXX" identifies the source of the error condition (DISK, TAPE, READER, or ENTERING).

If the error occurred while the operator was using the ENTER operator service function or during the execution of a Read Console Printer instruction, messages EC46I and EC42D are issued.

If the source of the error is disk, tape, or card reader, message EC49D is issued.

If the error occurred on the reader, the card in error is typed.

This is probably a user error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator may respond with CANCEL or END and terminate the job regardless of the source of the error. In addition, the following are valid operator responses:

- For disk -- Enter PROCESS to continue with record that contains the invalid character.
- For tape -- Enter BYPASS to skip the record with the invalid character.

Enter PROCESS to continue with the record that contains the invalid character.

Enter DISPLAY to display the record in error (if TAPERRS is not equal to NO).

- For Reader -- Enter PROCESS to continue with the record that contains the invalid character, or

Perform the RETRY operator service function.

- For ENTERING -- reenter data following message EC42D

The following group of messages, prefixed by the message code EC5nx, pertains to unit-record equipment and are displayed only during 2540 punch operations, or when stacker selection, or when simulating 1442

read punch updating on either a 2520 or 2540. The most common causes for these messages are:

- Card jams
- Double punching
- Multiple punches in rows 2 through 7

EC50D PUNCH ERROR

Cause: This message indicates that a 2540 or 2520 equipment check has occurred. The last card in the stacker is the card in error. This message is always preceded by a standard DOS operator intervention message.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: If error occurred on a 2520:

1. Remove last card from stacker one:
 - If performing punch-only operation, discard card.
 - If performing combined read and punch operation, reconstruct prepunching.
2. Remove cards from hopper.
3. Press NPRO key -- two cards enter stacker one.
4. Replace reconstructed card (if performing combined read and punch operation), two cards that were run out, and cards removed from the hopper in the hopper.
5. Ready the 2520.
6. Reply with START or EOB.

If error occurred on a 2540:

1. Remove cards from hopper.
2. Press and hold start key to clear punch feed.
3. Remove last four cards from stacker P1. Last two cards are blank; first two should be discarded.

4. Replace blank cards and cards removed from hopper in hopper.
5. Ready the punch.
6. Reply with START or EOB.

If the problem recurs, do the following to complete your problem determination action:

1. Execute the ROD command and retain the listing.
2. Execute EREP and retain the output.

EC51D PFR PUNCH ERROR

Cause: A punching error was detected during a PFR operation. The card in error is in stacker P1. The punch-check station may also contain an incorrectly punched card.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action:

1. Remove cards from punch hopper.
2. If the end-of-file light is on, press the stop key to reset the end-of-file circuits.
3. Press and hold the punch start key to clear the punch feed.
4. Remove the last four cards from stacker P1. The last two cards are correct; prepunching in the first two must be reconstructed.
5. Place the two reconstructed cards, the two correct cards, and the cards removed from the hopper, in that sequence, in the hopper.
6. Ready the punch.
7. Reply with START or EOB.

If the problem recurs, execute EREP and retain the listing to complete your problem determination action.

EC52D PFR READ ERROR

Cause: A reading error was detected during PFR operation. The card in error is at the punch station. The

punch-check station may also contain an incorrectly punched card.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action:

1. Remove cards from punch hopper.
2. If end-of-file light is on, press stop key to reset end-of-file circuits.
3. Press and hold punch start key to clear punch feed.
4. Remove last three cards from stacker P1.
5. The first of these three cards may have to be reconstructed because it has been read and punched but not punch checked.
6. The second card caused the validity check. Correct it as necessary.
7. Place these three cards, after any necessary corrections, in front of the cards removed from the hopper. Place this deck in the hopper.
8. Ready the punch.
9. Reply with START or EOB.

If the problem recurs, execute EREP and retain the listing to complete your problem determination action.

EC58D 1404 aaaaaaaaaa CCSW=yyxxxx SNS=xx

Cause: This message indicates that a 1404 printer error occurred. The type of error is identified by "aaaaaaaa", where "aaaaaaaa" is one of the following:

EQUIP CHK (equipment check)
INTERV REQ (intervention required)
BUSOUT CHK (busout check)
COMM REJCT (command reject)
DATA CHECK (data check)

The hexadecimal representation of the channel command word (CCW) command code is displayed by "yy" in the CCSW while the hexadecimal representation of the status bytes from the CCB is given by "xxxx". The sense bytes are displayed by SNS=xx.

System Action: The system waits for an operator response.

Programmer Action: The programmer must supply the operator with guidelines to handle each of the five types of error conditions.

Operator Action: The operator must type in one of the following replies:

- SKIP 1 -- which causes the printer to skip 1 and retry the operation.
- IGNORE -- the printer command causing the error is ignored and processing continues.
- RETRY -- the printer command is retried.
- SERVICE -- full operator services are made available, and message EC40D is issued.

If the problem recurs, execute EREP and retain the listing, and have the system log and printer output available to complete your problem determination action.

EC59D REPLY AGAIN TO 1404 MESSAGE

Cause: This message is displayed after the operator replied SERVICE or with an invalid response to message EC58D and additional corrective action is required.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The user must again reply SKIP 1, RETRY, IGNORE, or SERVICE.

If the problem recurs, execute EREP and retain the listing, and have the system log and printer output available to complete your problem determination action.

The following group of messages, prefixed by the message code EC6nx, pertains to magnetic-tape devices:

EC60I MESSAGE RESPONSES ARE B=BYPASS, P=PROCESS

Cause: This message is displayed to indicate that a tape error has occurred and that the 1400 Tape Error Recovery routine, as specified at Emulator program generation, has

been entered. This message is displayed only if TAPERRS=LST or LOG was specified during program generation.

System Action: Message EC62D is displayed.

Programmer Action: Not applicable.

Operator Action: One of the options (B=BYPASS or P=PROCESS) indicated in this message must be given in response to message EC62D.

EC61I MESSAGE RESPONSES ARE B=BYPASS, P=PROCESS, H=HEX-DISPLAY

Cause: This message is displayed to indicate that a tape error has occurred and that the 1400 Tape Error Recovery routine, as specified at Emulator Program generation, has been entered. This message is issued only if TAPERRS=LSTCHAR or LOGCHAR was specified during program generation.

System Action: Message EC62D is displayed.

Programmer Action: Not applicable.

Operator action: One of the options (B=BYPASS, H=HEX-DISPLAY, or P=PROCESS) indicated in this message must be given in response to message EC62D.

EC62D TAPE BLOCK IN ERROR

Cause: This message is displayed to indicate that a tape error has occurred, the operator has responded to the standard DOS-issued error message with IGNORE, and the Tape Error Recovery routine has been entered.

System Action: The tape block in error is printed on SYSLOG or SYSLST as specified by the TAPERRS parameter. Non-BCD characters appear as asterisks (*). If an invalid response is made, either message EC60I or EC61I is issued, followed by a reissued message EC62D. The system then waits for an operator response.

Programmer Action: Set up operator procedures to handle this error.

Operator Action: The available operator responses to this message are one-letter options (B, P, or H) indicated in messages EC60I and EC61I, one of which is issued just

prior to the display of this message. The functions of the one-letter options are:

B
The tape block in error is bypassed and is not given to the 1400 program. Processing continues with the next block. The 1400 program is not informed that a block has been bypassed.

P
The tape block in error is passed to the 1400 program as is.

H
The tape block in error is displayed in hexadecimal format exactly as it was read into System/360 main storage, except that parity has been corrected by the channel. After this response, the operator again has the option of bypassing or processing (B or P).

EC63I TAPE n BLOCK SIZE EXCEEDED

Cause: A record block, either read or written on 1400 tape unit "n" exceeds the maximum block size specified by the user during Emulator program generation ("BLKSIZEu=nnnnn"), as modified by the // TAPE control card. This message is always preceded by message EC80I (status of 1400 registers and current instruction). A 1400-style storage dump is provided on SYSLST unless a no-dump option (a "1") was specified in parameter "b" in the // 1400 control card. If the user has specified an "S" for the test-mode option in the // 1400 control card, a System/360 main storage dump also is provided.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Check the 1400 program for the maximum block size required for execution. If the total buffer size exceeds that specified in the BUFSIZE parameter, reassemble the Emulator program increasing the size of the BUFSIZE parameter, or

If the total buffer size does not exceed the size indicated by BUFSIZE, use a // TAPE card to redistribute the individual buffer space.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.
2. Have the system log, printer output, and job stream available.

Operator Action: Not applicable.

EC67I MOUNT NEW TAPE ON SYSIPT

Cause: An end-of-volume indication (tape mark) has been detected by the tape device assigned to SYSIPT before end of file (/*) was reached.

System Action: A standard DOS operator intervention message is issued.

Programmer Action: Not applicable.

Operator Action: Mount the next tape volume on SYSIPT and reply START or EOB.

EC68I MOUNT NEW TAPE ON SYSPCH

Cause: An end-of-volume indication has been detected by the tape drive assigned to SYSPCH.

System Action: A standard DOS operator intervention message is issued.

Programmer Action: Not applicable.

Operator Action: Mount a new tape volume on SYSPCH and reply START or EOB.

EC69I MOUNT NEW TAPE ON SYSLST

Cause: An end-of-volume indication has been detected by the tape drive assigned to SYSLST.

System Action: A standard DOS operator intervention message is issued.

Programmer Action: Not applicable.

Operator Action: Mount a new tape volume on SYSLST and reply START or EOB.

The following group of messages, prefixed by the message code EC7nx, pertains to disk devices:

EC70I DISK PACK NOT FORMATTED

Cause: This message indicates that the disk pack is not initialized to the proper 1400 format.

This is probably a user error.

System Action: The job is canceled.

Programmer Action: Initialize the disk pack using the DOS Initialize Disk utility program, then run the Clear Disk utility to format the tracks. The parameters of the clear disk utility depend on the device type being emulated.

If the problem recurs, do the following to complete your problem determination action:

1. Have the job stream, log sheet, and printer output available.
2. Have the control cards for the Initialize Disk and Clear Disk utility programs.

Operator Action: Check that the correct pack is mounted.

EC71D DISK ERROR DETECTED. SECTOR ADDRESS = dxxxxx. VALID DATA FOLLOWS:

Cause: This message indicates that an error has been detected during disk verification (optionally specified). The drive number and the beginning sector address is indicated. This is followed by one or more lines of 100 characters that represent the data that should have been recorded on disk. This data may be used in a subsequent operation to rebuild the record affected. The 1400 program is not informed of the disk error.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Reinitialize the disk pack or execute CLEAR DISK and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.

2. Have the system log, printer output, and job stream available.

Operator Action: The operator may type the response START to indicate that the record in error is to be accepted as is and that processing is to continue. The operator may also type the response END or CANCEL to cause the job to be terminated.

EC73I SYSLST EXTENT EXHAUSTED

Cause: The extent limit assigned to SYSLST (disk extent) has been exhausted.

This is probably a user error.

System Action: Message EC32I is issued and the job is canceled.

Programmer Action: Increase the extent for the required system unit and resubmit the job.

Operator Action: Not applicable.

EC74I SYSPCH EXTENT EXHAUSTED

Cause: The extent limit assigned to SYSPCH (disk extent) has been exhausted.

This is probably a user error.

System Action: Message EC32I is issued and the job is canceled.

Programmer Action: Increase the extent for the required system unit and resubmit the job.

Operator Action: Not applicable.

EC75I WRONG PACK, MOUNT xxxxxx DISK n ON DR cuu

Cause: This message is displayed if the Emulator program is accessing the wrong disk pack, where "xxxxxx"

is the volume serial number (EBCDIC characters) of the correct disk pack, "n" is the 1400 disk drive number (0, 2, 4, 6, or 8), and "cuu" is the hexadecimal channel and device address of the disk drive on which the disk pack is mounted. The volume serial number displayed is initially established by a // DVOL control card or by the operator using the DVOL DISKn=xxxxxx operator service function.

This is probably a user error.

System Action: Message EC40D is issued.

Programmer Action: Check that the assignments are correct and that the correct packs have been mounted.

Operator Action: This message indicates that the operator must either take corrective action or terminate the 1400 program. The operator can use the DSPLYV operator service function to display the volume serial number of the pack currently mounted on this device to assist in the evaluation of the corrective action. However, before further processing can be continued, the operator must perform one of the following corrective actions:

- Mount the correct disk pack on the specified drive and reply with the NEWPAC function, or
- Change the disk drive configuration using the DISK n function, or
- Change the volume serial number against which the pack is to be verified, with the DVOL DISKn=xxxxxx function, where "xxxxxx" is the volume serial number of the proper pack, or

- Discontinue volume serial number checking for this 1400 drive using the DELETE function. This function must be used with caution when performing write operations.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the log sheet, printer output, and job stream available.

EC76I DISK n ON cuu SERIAL NO.=xxxxxx

Cause: This message is displayed in response to the operator's selection of the DSPLYV operator service function following the display of message EC75I. "n" is the 1400 disk drive number (0, 2, 4, 6, or 8), "cuu" is the hexadecimal channel and device address of disk drive "n", and "xxxxxx" is the volume serial number (EBCDIC characters) of the disk pack.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: The operator must respond with one of the valid corrective actions described under message EC75I.

EC77D SCAN ERROR DETECTED

Cause: A 1400 disk scan was not successfully completed. An end of cylinder condition has not yet been detected.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: If the user wishes to retry the scan operation, he types in the word START. If the user does not wish to retry the operation, he may enter END or CANCEL to terminate the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the log sheet, printer output, and job stream available.
2. Obtain a 1400 dump and a 360 system dump before the job is canceled.
3. Issue the ROD command, execute EREP, and have the output available.

EC78D WRONG PACK, MOUNT xxxxxx DISK n ON DR cuu

EC78I 1301/1405 DRIVE xxx SERIAL NO.=xxxxxx

Cause: These messages are displayed if the Emulator program is accessing the wrong 1301 or 1405 disk pack, where message EC78I displays the volume serial number of the physical pack which is being accessed. Message EC78D always follows and identifies the volume serial number (MOUNT xxxxxx) which was requested on the // DVOL control card for this drive. DISK n indicates which part of the 1301 or 1405 drive is being simulated, while DR cuu indicates the hexadecimal channel and device address of the System/360 device being accessed.

This is probably a user error.

System Action: The system waits for an operator response.

Programmer Action: Correct the // DVOL card or supply the correct volumes and resubmit the job.

Operator Action: The operator must perform one of the following corrective actions:

- Mount the correct disk pack on the specified drive and reply with the NEWPAC functions.
- Abnormally terminate the job using the END or CANCEL operator service functions. The job can be resubmitted after correcting the volume serial number entries for the simulated 1301 or 1405 disk pack on the // DVOL control card.

The following group of messages, prefixed by the message code EC8nx or EC9nx, pertains to program messages:

EC80I 1400 STATUS I=nnnnn A=nnnnn B=nnnnn
INSTN_BLOCK=xxxxxxxxx

Cause: A 1400 halt or error has been encountered or the operator has requested the STATUS or ALTER operator service functions. This is a display of the 1400 storage address registers and eight characters from 1400 storage within an eight-byte range of where the I-STAR is pointing. Certain 1400 special characters (such as the record mark) are not printed on the model 30. When message EC80I is displayed after a 1400 program error, the A-STAR and B-STAR values may be invalid because of storage wraparound.

System Action: Variable, depending on program status as indicated in associated message.

Programmer Action: Not applicable.

Operator Action: Reply to associated message.

EC81I HALT

Cause: A 1400 halt other than end of job (as specified in "EOJAADR=nnnnn" and/or "EOJBADR=nnnnn" at Emulator program generation or as specified for an EOJ I-address in the // 1400 control card) has occurred and the user has not specified operator restart (a "1") in parameter "e" in the // 1400 control card. This message is preceded by the typing out of message EC80I (status of 1400 registers and current instruction). A 1400-style storage dump is provided on SYSLST unless a no/dump option (a "1") was specified in parameter "b" in the // 1400 control card. If the user has specified an "S" for the test-mode option in the // 1400 control card, a System/360 main storage dump is also provided.

System Action: Storage dump is provided and job is terminated unless operating in test mode. In test mode, message EC40D is issued.

Programmer Action: Resubmit the job with the // 1400 parameter "e" set to 1 to permit operator restart, or

Correct the problem causing the halt and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, printer output, and program listing available.

Operator Action: If message EC40D is issued in conjunction with this message, respond as indicated in the EC40D text.

EC82I HALT

Cause: A 1400 halt other than end of job (see message EC81I) has occurred, and the user has specified operator restart (a "1") in parameter "e" of the // 1400 control card. This message is preceded by the typing out of message EC80I.

System Action: Message EC40D is issued.

Programmer Action: Correct the problem causing the halt or give correct operating instructions to the operator and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.
2. Have the log sheet, printer output, and job stream available.

Operator Action: Not applicable.

EC83I 1400 PROGRAM ERROR

Cause: A 1400 program error has been detected. This message is always followed by message EC80I (status of 1400 registers and instruction block).

A 1400-style storage dump is provided on SYSLST if OSDUMP=YES was specified at Emulator Program generation and unless a no-dump option (a "1") was specified in parameter "b" in the // 1400 control card. If the user has specified an "s" for the test mode option (parameter "q") in the // 1400 control card, a main storage dump is also provided, followed by message EC40D. This message is also issued when the 1400 operation is valid, but emulator support for the function was not generated.

System Action: The job is terminated unless parameter "g" was specified on the // 1400 control card.

Programmer Action: Determine the operation being attempted from the 1400 program listing, the console log, and dumps. Verify that support for the operation was generated by checking the 1400 program listing. Reassemble the Emulator program with the required support.

Check the failing 1400 parameter for assembly errors and missing or incorrect object cards. If CS/30, examine MNOTES to determine if the Emulator program is overlaying simulated 1400 storage.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, printer output, and program listing available.

Operator Action: Not applicable.

EC84I TOO MANY PHASES TO CATALOG

Cause: The 1400 program or overlay section being cataloged consists of more than 27 internal phases.

System Action: The job is terminated.

Programmer Action: If the program does not have overlays, method 1 cataloging may be used. The "b" parameter on the // 1400 control card must be a "1". Method 1 cataloging will conserve space and improve retrieval time, or

If method 1 cannot be used, reorganize the program so that there are no more than 27 internal phases.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, printer output, and program listing available.

Operator Action: Not applicable.

EC90I INVALID OPERATION ON READER

Cause: (1) A 1400 read instruction has been incorrectly specified; or (2) a 1400 read instruction which is not supported by the Emulator program (e.g., column binary) has been specified.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: If the failing program specifies any of these reader instructions:

- Column binary.
- 51 column interchangeable read feed.
- Read stacker selection.

Then insure that the parameters to support the feature are specified in the Emulator assembly.

If the read instruction is for a feature not supported by the Emulator, a user-written simulation routine is required. Correct the error and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, printer output, and program listing available.

Operator Action: Not applicable.

EC91I INVALID OPERATION ON PUNCH

Cause: (1) A punch instruction for an unsupported operation has been specified in the 1400 program (e.g., punch-feed-read, column-binary); or (2) a punch-feed-read or column-binary instruction has been specified in the 1400 program when a magnetic device is being used to simulate the unit-record device.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: If the failing program specifies any of the following punch instructions:

- Column binary
- Punch-feed-read
- Punch stacker selection

Then insure that the parameter to support the feature is specified in the Emulator assembly. If the instruction is for a feature not supported by the 1400 Emulator program, then a user-written simulation routine is required. Correct the parameters and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, printer output, and program listing available.

Operator action: Not applicable.

EC92I INVALID OPERATION ON PRINTER

Cause: A 1404 print instruction has been specified but is not supported by this particular Emulator program generation.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Check all printer parameters specified in the emulator assembly and the print instructions issued by the failing program. If the 1400 program is issuing print instructions not supported by the emulator, a user simulation routine is required. Make the necessary corrections and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC93I CONTROL CARD NOT SUPPORTED // VVVV

Cause: The Emulator program has encountered a control card that is not supported. The first four characters of the unsupported control card are identified by "yyyy".

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Check that System/360 control cards do not follow the // 1400 card or that the flagged control card is supported by this assembly of the emulator program. If the 1400 control card is not supported, reassemble the emulator to provide support.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor map available.
2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC94I NO // LC DATA DELIMITER CARD

Cause: A // LC data delimiter card is required before the last data card, but is not present.

This is probably a user error.

System Action: Last card indicator (sense switch A) is turned on, and message EC40D is issued.

Programmer Action: Before the job is resubmitted, correct the control cards or give the operator instructions so that he can enter the address of your EOJ routine.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, and printer output available.

Operator Action: The operator must either enter the address of the user's end-of-job routine using the ALTER operator service function, or terminate the job.

EC95I STACKER 8/2 IGNORED

Cause: A 1402 stacker command has been specified for stacker 8/2 on either a magnetic device when punching, or a unit-record device other than a 2540. This message is displayed only for the first 8/2 stacker command issued.

System Action: 8/2 cards are stacked to normal stacker.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC96I CARRIAGE CONTROL CARD ERROR

Cause: The 1400 program specified a carriage-control channel punch which is not included in the carriage control card.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Correct the carriage control card and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC97I 1400 CONSOLE PRINTER NOT SUPPORTED

Cause: This message is issued if the OSINQRY parameter is not specified as "1400" or "YES", and a 1400 read or write console printer instruction has been encountered.

This is probably a user error.

System Action: Message EC80I is issued, followed by message EC40E.

Programmer Action: Check the emulator assembly listing for OSINQRY=1400 or YES. If these parameters are not present, and the function is desired, reassemble the emulator with one of these parameters specified.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.
2. Have the job stream, log sheet, and printer output available.

Operator Action: The parameter "B=nnnnn" in message EC80I is the address of the first storage position of the 1400 message area. The operator can use the DISPLAY operator service function to display the message. To continue processing, enter START or EOB.

INDEX

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IBM Technical Newsletter

File Number S360-35

Re: Form No. GC27-6940-4

This Newsletter No. GN33-7012

Date: April 15, 1971

Previous Newsletter Nos. None

IBM SYSTEM/360 DISK OPERATING SYSTEM

1401/1440/1460 EMULATOR PROGRAMS

COMPATIBILITY SUPPORT/30

COMPATIBILITY SUPPORT/40

PROGRAM NUMBER FOR CS/30: 360N-EU-484

PROGRAM NUMBER FOR CS/40: 360N-EU-485

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Cover, ii	29, 30	123-128
3-6	39, 40	131, 132, 132.1
11, 12	107, 108	135, 136
27, 28, 28.1		

A change to the text is indicated by a vertical line to the left of the change.

Summary of Amendments

This Technical Newsletter contains information on:

- the addition of the IBM 3420 Magnetic Tape Unit
- adding user routines by means of INCLUDE cards
- the removal of message EC72I

In addition, other minor changes have been made to the text.

Note: Please insert this page in your publication to provide a record of changes.

IBM France, Centre d'Etudes et Recherches, Programming Publications, Department 841, 06 La Gaude, France

File Number S360-35
Re: Form No. GC27-6940-4
This Newsletter No. GN33-7021
Date October 14, 1971
Previous Newsletter Nos. GN33-7012

IBM SYSTEM/360 DISK OPERATING SYSTEM

1401/1440/1460 EMULATOR PROGRAMS
COMPATIBILITY SUPPORT/30
COMPATIBILITY SUPPORT/40

PROGRAM NUMBER FOR CS/30: 360N-EU-484
PROGRAM NUMBER FOR CS/40: 360N-EU-485

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Cover, ii	39, 40, 40.1	61, 62
7-12	43, 44	97, 98
29, 30, 30.1	51, 52	

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Summary of Amendments

This Technical Newsletter describes minor changes to the Emulator Programs available with Release 26 of DOS.

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IBM System/360 Disk Operating System: 1401/1440/1460 Emulator Programs:
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GC27-6940-4

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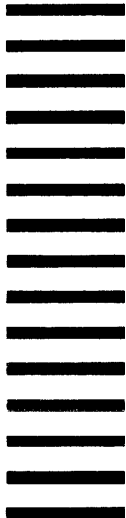
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