DOS

IBM

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.
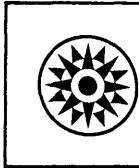
PREFACE

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.

The "Console Messages" section presents detailed descriptions of the comprehensive set of console messages issued by the Emulator Programs and the Tape Error Recovery routine provided as an option.

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.

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, Form C24-5030
IBM System/360 Disk Operating System: Data Management Concepts, Form C24-3427
IBM System/360 Disk Operating System: System Control and System Service Programs, Form C24-5036
IBM System/360 Disk Operating System: System Generation and Maintenance, Form C24-5033
IBM System/360 Disk Operating System: Operating Guide, Form C24-5022

Model 30 users should be familiar with the following publications:

IBM System/360 Model 30 Operator's Guide, Form A24-3373
IBM System/360 Model 30; 1401/1440/1460 Compatibility Feature, Form A24-3255

Model 40 users should be familiar with the following publications:

IBM System/360 Model 40 Operating Procedures, Form A22-6911
IBM System/360 Model 40 Functional Characteristics, Form A22-6881

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)

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 (#A004)

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 must be run as background programs. 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 typewriter.

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.

A storage protection check occurs during emulator initialization if the DOS supervisor is assembled with a standard allocation to a foreground partition(s) or the operator allocates storage to a foreground partition through the ALLOC command, unless the Emulator Program is assembled with a value given to the "MPGMBLK=nn" parameter. This is because, for the Model 30, 1400 main storage is simulated in the highest main storage address (less 256 on 65K machines) unless it is indicated that there will be a foreground partition(s) there. For the Model 40, 1400 main storage always starts at decimal 16,384 (hexadecimal 4000) and cannot be relocated. The Emulator Programs extend (with regard to addresses) from the end of the DOS supervisor to the beginning of the foreground partition indicated (or end of main storage, if none). The sum of the areas allocated to the foreground partitions cannot exceed the value specified in the "MPGMBLK=nn" parameter.

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)

- 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)

    Magnetic Tapes (#4467 for multiplexor and #4468 for selector channels)

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)

- Decimal Arithmetic Feature (#3237)

- 1311 Disk Compatability 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 Disk Operating System

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-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.

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 Card Read Punch

- 2540 Card Read Punch

- 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

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

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 or 2402 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

[1]If stacker selection of punch-feed-read cards 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 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 operations and instructions, plus the following special features (for those items followed by an asterisk, refer to Table 2).

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

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

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.

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.

- The CPU model designation (MODEL=30 or MODEL=40) must be specified in the CONFG macro instruction.

- If the Emulator Program operator service functions are to be requested by the external INTERRUPT key, 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.

In addition it should be noted that in a multiprogramming environment (MPS parameter in the SUPVR macro instruction specified as YES), if an assembled Emulator Program is loaded into the background partition of smaller size than required, the Emulator Program will be canceled due to a protection exception.

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 standard control cards in addition to those

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.
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.)

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
       END        ACOMP01
```

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

The output from the assembly run contains all of the cards needed to catalog the Emulator Program on the Core-Image Libraries (except ASSGN, DLBL, and EXTENT cards as required to define SYSLNK, SYS001, SYS002, and SYS003) for a DOS assembly, linkage-editing, and cataloging. The deck contains the assembler object module, which must be cataloged into the Core-Image Library, and the proper DOS control cards. The order in which the cards are punched is illustrated in Figure 1. The first 12 cards should be used to catalog the Emulator Program into the Core-Image Library (see Figure 2). 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(EU40) euparam1,...X
                     euparamn
          END    ACOMP01
/*
/&
```

End Statements

EU Macro Parameters

DOS Job Control Cards

DOS SYSRES

Assemble Tailored EU Program

Assembly Listing

EU Output Module

Consists of the output of EUJOB1:

```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
   PHASE euname,*
   INCLUDE ,(ACOMP00)
  [PHASE eunameX,ACOMP00+nnn](for Model 30)
  [PHASE eunameX,nnn        ](for Model 40)
   INCLUDE ,(ACOMP01)
   INCLUDE
*** REPLACE WITH OBJECT DECK
/*
   ENTRY EUENTRY
// EXEC LNKEDT
/&
(emulator object module)
```

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

Figure   1.   Assembly of User-Tailored Emulator Program Under DOS

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
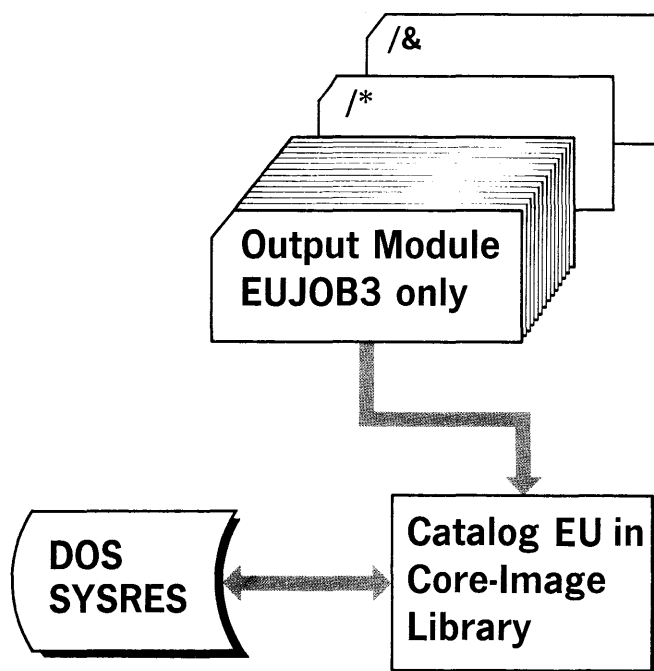
16

```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
   PHASE euname,*
   INCLUDE ,(ACOMPØØ)
   PHASE eunameX,ACOMPØØ+nnn
   INCLUDE ,(ACOMPØ1)
   INCLUDE
   (emulator object module)
/*
   ENTRY EUENTRY
// EXEC  LNKEDT
/&

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

Figure 2. Cataloging of an Emulator Program Into the Relocatable and Core-Image Libraries

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 by the first phase. The parameters may be inserted in any sequence, following the rules for the writing of macro statements of the keyword variety.

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") can be 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. It is desirable for the Emulator Program to have some method of determining 1400 EOJ. 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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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, this parameter must be omitted or specified as NO.

FETCH=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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 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=$\begin{Bmatrix} 82 \\ 195 \\ BOTH \\ \underline{NO} \end{Bmatrix}$

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 move occurs before programs are loaded from cards or 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=$\begin{Bmatrix} nn \\ \underline{0} \end{Bmatrix}$

This parameter is used 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 Model 30 Emulator Program allocates 1400 program storage "n" 2K blocks below the highest System/360 main storage location specified. The Model 30 Emulator Program allocates storage from the top of memory down, and from the end of the supervisor 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 Model 30 Emulator-Program generation time.

(d) The size of the Model 30 Emulator-Program depends on the parameters specified and is linkage-edited immediately above the System/360 supervisor.

(e) Tape I/O buffer areas are allocated above the Model 30 Emulator Program (value (d)), and the size of the area is indicated by the "BUFSIZE=nnnnn" parameter.

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

(a) 1400 storage location 0 is 16,384.

(b) The amount of 1400 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 the Model 40 Emulator Program depends on the parameters

specified and is linkage-edited immediately above 1400 storage.

(e) The foreground 2 starting location is found by determining the number of 2048-byte blocks of storage required for the Model 40 Emulator Program. The Emulator Program will calculate this for the user and will automatically add any space between the end of the Model 40 Emulator Program and the beginning of the foreground partition to the user's tape buffer pool. The address of the start of the first foreground partition is indicated by a macro note.

If this parameter is omitted, the assumed value for "nn" is zero.

Note: If the Model 40 Emulator Program is to be assembled with MPGMBLK not equal to zero, the DOS supervisor must be assembled with MPS=YES and SP=YES. The DOS supervisor size must be less than 16,384 bytes.

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, 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. If this parameter is omitted or NO is specified, the dumping facility is not included. If this parameter is specified, the facility for dumping 1400 simulated storage on SYSLST is provided through the Operator Service Functions. (See "Available Functions" in the section on "Operator Service Functions".) When specified, 1400 storage is dumped in standard 1400 format. 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, 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 ability 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.")

SEND=(0   )
     (nnnnn)

If specified, this parameter will force the assembler to assign Emulator Program storage addresses identical to those at object time. Thus, any System/360 storage dump of the Emulator Program can be directly related to the Emulator-Program listing. The value to be used is the decimal value

specified in the SEND macro instruction when the DOS supervisor was generated. The default value is zero.

SIZ1400=$\begin{Bmatrix} nn \\ \underline{16} \end{Bmatrix}$

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, the assumed value for "nn" is 16.

Note: 1400 programs that require more storage than has been specified for the SIZ1400 parameter may not execute properly.

SIZ360=$\begin{Bmatrix} nnn \\ \underline{64} \end{Bmatrix}$

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, and 64. Allowable values for "nnn" on the Model 40 are 32, 64, 128, and 256. If this parameter is omitted, the assumed value for "nnn" is 64.

SYSIO=$\begin{Bmatrix} ipl \\ \underline{000} \end{Bmatrix}$

This parameter must be specified if the user wishes to support device independence for 1400 unit-record devices. "i", "p", and "1", 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 "1" is specified as a 2 or 3, a 2311 or 2314 disk drive must be specified in the SYSFIL parameter of the FOPT macro during DOS Supervisor generation.

SYSROPT=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify whether or not the user wants the Emulator Program to change from card input on SYSRDR to tape or disk input from SYSIPT during the execution of a 1400 program. 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 which may be specified as either card reader, disk or tape.

TIMER=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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.

DESCRIPTION OF CARD READER AND PUNCH PARAMETERS

COLBINP=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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 <u>only</u>.

PCH1400=$\begin{Bmatrix} 1442 \\ 1444 \\ \underline{1402} \end{Bmatrix}$

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.

PCH360=$\begin{Bmatrix} 1442 \\ 2520 \\ \underline{2540} \end{Bmatrix}$

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=$\begin{Bmatrix} YES \\ COM \\ \underline{NO} \end{Bmatrix}$

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, and punch operations utilizing the Punch-Feed-Read feature of the 2540. When PFR=COM is specified, 1402 simulation of punch-feed-read and stacker select operations are supported also. If the 2540 Compatibility Attachment (#8065) is not installed on the 2821 Control Unit, PFR=YES should be specified. 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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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. If coded YES, the Emulator Programs have the ability to simulate punch stacker selection automatically for the 1444 but not automatically for the 1402. A parameter ("d") must be inserted in the // 1400 control card (see "The // 1400 Control Card" in the "Control Cards" section) for each 1401/1460 program in which 1402 punch stacker selection is to be simulated. Punch stacker selection is handled in this manner for 1402 simulation because, if it is to be simulated but the 1401/1460 program does not, in fact, issue Stacker Select instructions, all punch overlap is lost. Overlap is not affected for the 1444 because the Stacker Select instruction precedes the Punch instruction.

READRSS=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

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=$\begin{Bmatrix} 1442 \\ \underline{1402} \end{Bmatrix}$

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.

RDR360=$\begin{Bmatrix} 1442 \\ 2501 \\ 2520 \\ \underline{2540} \end{Bmatrix}$

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= $\left\{ \begin{array}{l} \text{ONE} \\ \underline{\text{MANY}} \end{array} \right\}$

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= $\left\{ \begin{array}{l} \text{nnnn} \\ \underline{0000} \end{array} \right\}$

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). "nnnn" 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=nnnn" parameters as he has 1400 drives to be simulated, although the user with abundant main storage may wish to include a "BLKSIZu=nnnn" for each drive that is accessed by 1400 programs. Load-mode operations do not depend on "BLKSIZu=nnnn" parameters. (See "BUFSIZE=nnnnn".)

BUFSIZE= $\left\{ \begin{array}{l} \text{nnnnn} \\ \underline{00000} \end{array} \right\}$

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=nnnn" 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=nnnn" 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.

OSTAPE= $\left\{ \begin{array}{l} \text{YES} \\ \underline{\text{NO}} \end{array} \right\}$

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= $\left\{ \begin{array}{l} \text{n} \\ \underline{0} \end{array} \right\}$

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.

$$TAPERRS= \begin{Bmatrix} LST \\ LOG \\ LSTCHAR \\ LOGCHAR \\ \underline{NO} \end{Bmatrix}$$

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=SYSnnn

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. The same tape unit cannot be assigned to more than one programmer logical unit; however,

several 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. The default values for unassigned values of "u" are:

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

$$TAPLDMD= \begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$$

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

$$DISKDR= \begin{Bmatrix} n \\ 130n \\ 1405 \\ \underline{0} \end{Bmatrix}$$

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. The meaning of each value of "u" is as follows:

"u"	1311	1405
1	Drive 0	Drive 0 (first 25,000 records for Models 1 & 2)
2	Drive 2	Drive 2 (second 25,000 records for Models 1 & 2)
3	Drive 4	Drive 4 (third 25,000 records for Model 2 only)
4	Drive 6	Drive 6 (fourth 25,000 records for Model 2 only)
5	Drive 8	--------

The assignments may be changed during program execution time if OSDISK=YES is specified. The default values for unassigned values of "u" are as follows:

"u"	Programmer Logical Unit
1	SYS001
2	SYS002
3	SYS003
4	SYS004
5	SYS005

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 verfication 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 preprinted forms. PTRASGN=SYSnnn must identify a printer and not a magnetic device. 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 = $\begin{cases} 1443 \\ 1404 \\ \underline{1403} \end{cases}$

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
EOJAADR PARAMETER INCORRECTLY SPECIFIED
EOJBADR PARAMETER INCORRECTLY SPECIFIED
ERROPNG PARAMETER INCORRECTLY SPECIFIED
FETCH PARAMETER INCORRECTLY SPECIFIED
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 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
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

STORAGE LAYOUT

The Emulator Program under DOS for the Model 30 is designed to reside in main storage immediately above the Disk Operating System (DOS) supervisor. 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. 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.

Storage allocation for a Model 30 Emulator Program with 4K of 1400 storage is illustrated in Figure 3. (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 Emulator Program under DOS for the Model 40 is designed to reside in main storage immediately above 1400 simulated storage. 1400 simulated storage always starts at hexadecimal 4000. The Emulator Program consists of an initialization phase and a main phase. The initialization phase is loaded immediately above the DOS super-
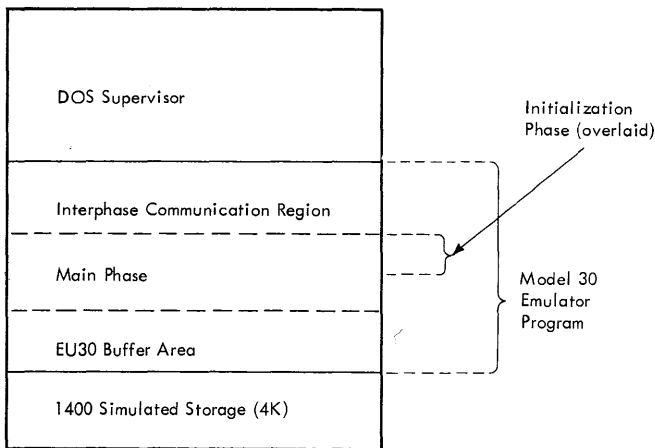
Figure 3. Typical Storage Map of Model 30 Emulator Program With 4K of 1400 Storage
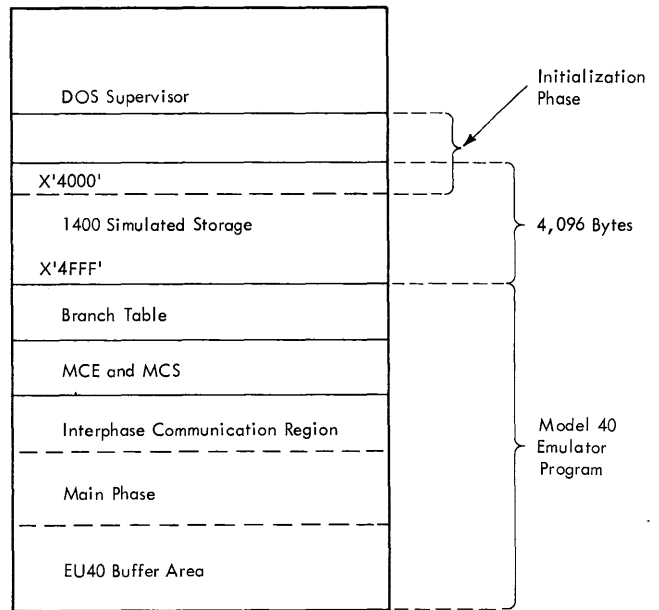
● Figure 4. Typical Storage Map of Model 40 Emulator Program With 4K of 1400 Storage

visor area, possibly extending into the 1400 simulated storage area. 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.

Storage allocation for a Model 40 Emulator Program with 4K of 1400 storage is illustrated in Figure 4. (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	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 & 15	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, & 10	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.
12 & 13	Temporary computations.
14 & 15	Subroutine linkage.

PROGRAMMING RESTRICTIONS AND CONSIDERATIONS

RESTRICTIONS

Before an installation utilizes the Model 30 or Model 40 Emulator Program 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.

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. Since this move occurs before the 1400 program is loaded, the user should remove the clear-storage cards from his 1400 object decks except for 1400 cataloging. The Emulator Programs clear the remaining portion of 1400 storage to blanks.

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 operation 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 C24-5032, 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 "n_1" and "n_2" in the FOPT macro are properly assigned at DOS system generation.

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 No MICR	Program edit 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

Under DOS	Original Computer	IBM 1401	IBM 1460
Model 30	Processing (1.5 microsecond 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.

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, files written under the stand-alone compatibility on the Model 30 are compatible with unstacked packs produced under the Model 30 Emulator Program. 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 C24-3465.

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.

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.

    Note: When OC=YES is specified for use with the Emulator Program, other programs that require the use of the INTERRUPT key, should not be run during Emulator Program operation.

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.

Table 8. Unit-Record Operation Correspondence

System/360 Unit / 1400 Unit and operation	2540	1442 Model N1	1442 Model N2	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
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 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
Read 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]The Emulator Program 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. The Emulator Program 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]Reading and 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]The Emulator Program executes one additional feed before punching begins to accommodate the devices with reading capability. Therefore, the first card will be a blank card.

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.

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 codes. The user's routine should test for those codes which are supported in his simulation routine. 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 16. 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:

- 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-, or seven-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.

With the exception of the operation code number which is in hexadecimal notation, the information placed into registers 0 and 1 by the compatibility feature has the same character representation as data in simulated 1400 storage and as shown in Table 15. When moving data between 1400 simu-

Table 9. Unassigned and Invalid Operation Codes

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

lated storage and the user's simulation routine, the user must use the special compatibility feature instructions given in Appendix D.

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
/*
/&
```

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
/*
/&
```

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

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 since the // LC card is ignored 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 RDR1400=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. A // PR 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. Since the data cards are not read ahead, the // LC card should precede 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 of punch-feed-read cards).

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 treated as No-Ops.

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 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 38 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 PTRLNG 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 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.

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 SYSLST. 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, parameter PTR1400 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 SYSLST. The Emulator Program checks for the type of device assigned to SYSLST at execution time and constructs proper I/O commands for that particular device. If SYSLST 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. Except when PTRLNG=100, the record length is equal to PTRLNG + 1. When PTRLNG=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 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).

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 SYSLST, 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 SYSLST 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 posi-

tions 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 SYSLST 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 SYSLST upon termination of the 1400 program; therefore, the operator must issue a standard CLOSE command to SYSLST 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 SYSLST 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 SYSLST 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 A24-3255.

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 <u>not</u> supported by the Emulator Program.

Magnetic-Tape Data Representation

<u>Nine-Track Tape Data</u>: 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 <u>even</u> 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 <u>on</u> (1). With <u>odd</u> 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 <u>off</u> (0).

Example:

Even parity: x1xxxxxx

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 <u>not</u> 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.

<u>Seven-Track Tape Data</u>: 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, <u>excludes</u> 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 <u>2311</u> are assumed:

1301 Sector Address	Programmer Logical Unit
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:

1301 Sector Address	Programmer Logical Unit
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 Initial-

ize 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. Write Console Printer instructions in Move mode only, having a data length exceeding 200 characters, can be executed by inserting a carrier-return line feed functional control character (]) in the 1400 program data field at intervals of 200 characters maximum. 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 (Ɩ). 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/

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
:	'
✓	"
>	=
ƀ	:
⧺	?
¤	<
△	¬
[	(
⧧	|
<	+
\	>
]	)
?	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	& +	0101 0000	&
11-8-5	]	0100 0000	blank
11-8-6	;	0100 0000	blank
11-8-7	△	0100 0000	blank
0-8-5	⌐	0100 0000	blank
0-8-6	\	0100 0000	blank
0-8-7	⧻	0100 0000	blank
8-2	ƀ	0100 0000	blank
8-5	:	0100 0000	blank
8-6	>	0100 0000	blank
8-7	✓	0100 0000	blank
12-0	?	0101 0000	&
11-0	!	0110 0000	-
0-8-2	⧺	0100 1110	+

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 alphabetics "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

System/360 EBCDIC graphic symbols for certain card codes differ from 1400-series system BCD graphic symbols. Some of these character codes are translated by the Emulator Programs into codes for which the graphic symbols correspond to 1400-series system symbols. Table 12 shows those codes transmitted to the printer which require translation or have graphic symbol differences.

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".

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 <u>not</u> 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,$f_0f_2f_4f_6f_8$,g,hhhhh

There can be only one // 1400 control card per job. 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.

For example:

// 1400

All operands have default values.

// 1400 PAYROL,,b,,,e

Operands "a", "c", "d", "$f_0 f_2 f_4 f_6 f_8$", "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 for the values of "a" are:

• 1 Specifies that the 1400 program is to be loaded from cards or 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.

• 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, 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. The proper values for the Model 30 are 1, 2, 3, or omitted. The proper values for the Model 40 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 (applicable to the Model 40 only), the same stacker select options are provided as when the parameter is omitted, or coded as a 1, 2, or 3, respectively. In addition, 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.

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 Emulator 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.

• When simulating a 1444 card punch, stacker selection is automatic if PUNCHSS=YES, and parameter "d" is ignored.

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.

$f_0 f_2 f_4 f_6 f_8$

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 simula-

tion 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. 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 u_1=nnnnn,y,u_2=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; continuation cards, however, 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 alphameric 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:

- // 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 operations, 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 tape or disk (SYSROPT=YES). Upon encountering the // IP control card, reading operations are transferred from SYSRDR to SYSIPT. Thus, when this card is used, SYSRDR and SYSIPT must be specified on separate programmer logical units and the SYSIO parameter must specify SYSIPT on either tape or disk (SYSIO 100). The // IP control card is placed in the card reader following the // 1400, // TAPE, // CCTL, and // DVOL emulator
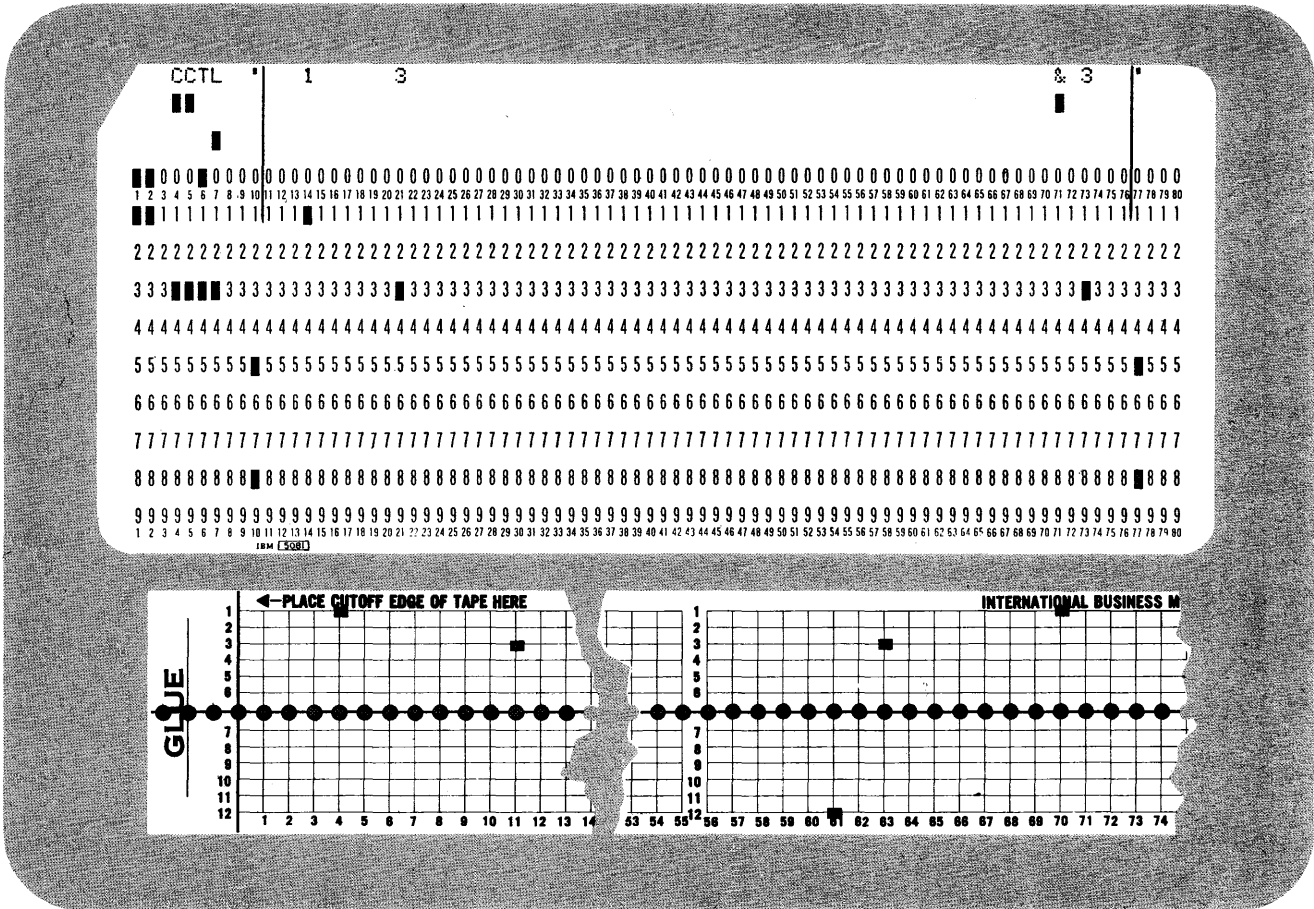
Figure 5. Carriage-Control Tape and // CCTL Control Card for 11-Inch Form
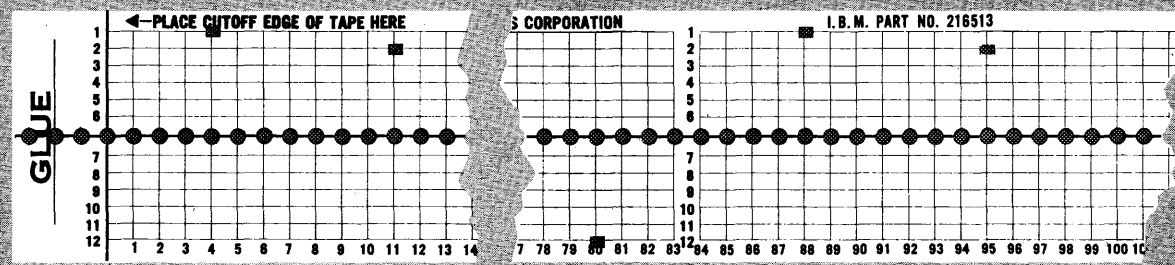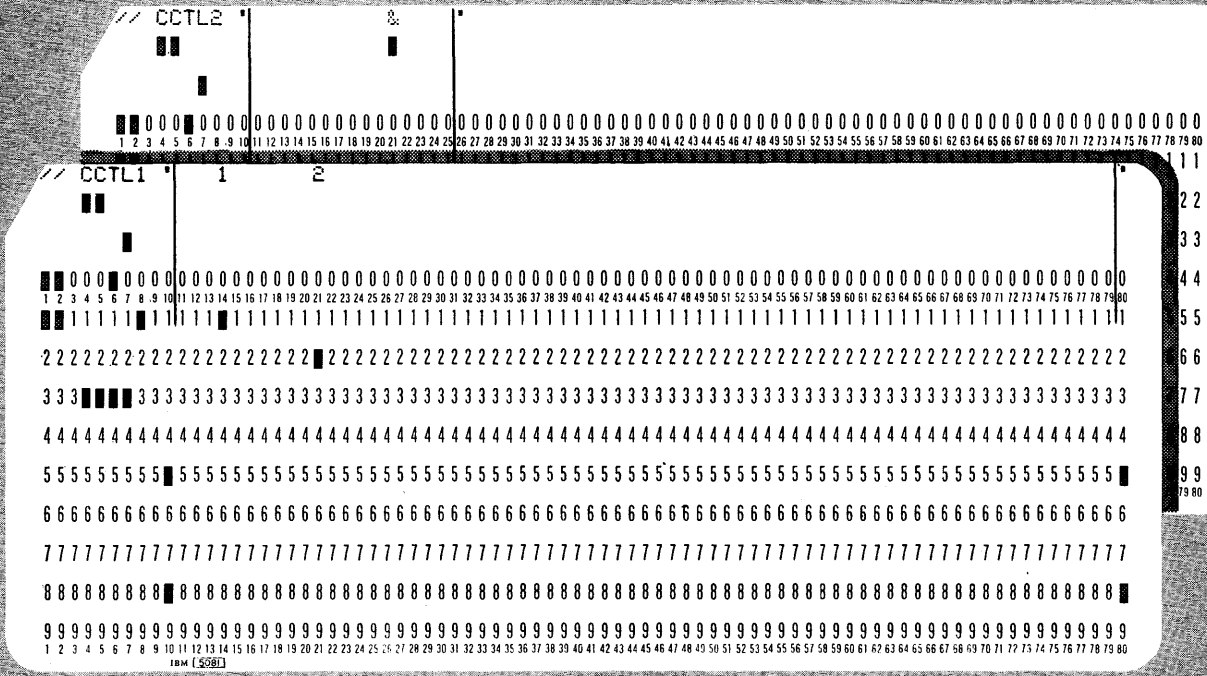
Figure 6. Carriage-Control Tape and // CCTL Control Cards for 14-Inch Form

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 pre-read 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. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

• // 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. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

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

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 word-mark 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-overlaying. Similarly, tape or disk AUTOCODER problems in which the user has not specifically programmed an overlay may also be considered non-overlaying.

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) 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.

An error message may occur during a 1400 catalog run (see the "Console Messages" section for the explanations and actions required for these messages):

    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.

/&

/*

End Card (1400 L/C)

Object Deck of Overlay Section

Program 2 (Overlay)

Clear Storage, Bootstrap, etc.

// 1400 prgnm2, C

// EXEC euname

/*

1400 XFR Card

1400 Object Deck of Overlaid Section

Program 1

1400 Clear Strg., Bootstrap, (& Loader if Disk Autocoder)

// 1400 prgnm1, C

// EXEC euname

// JOB jobname

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

Programming Considerations   55

instruction) 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 overlayed 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

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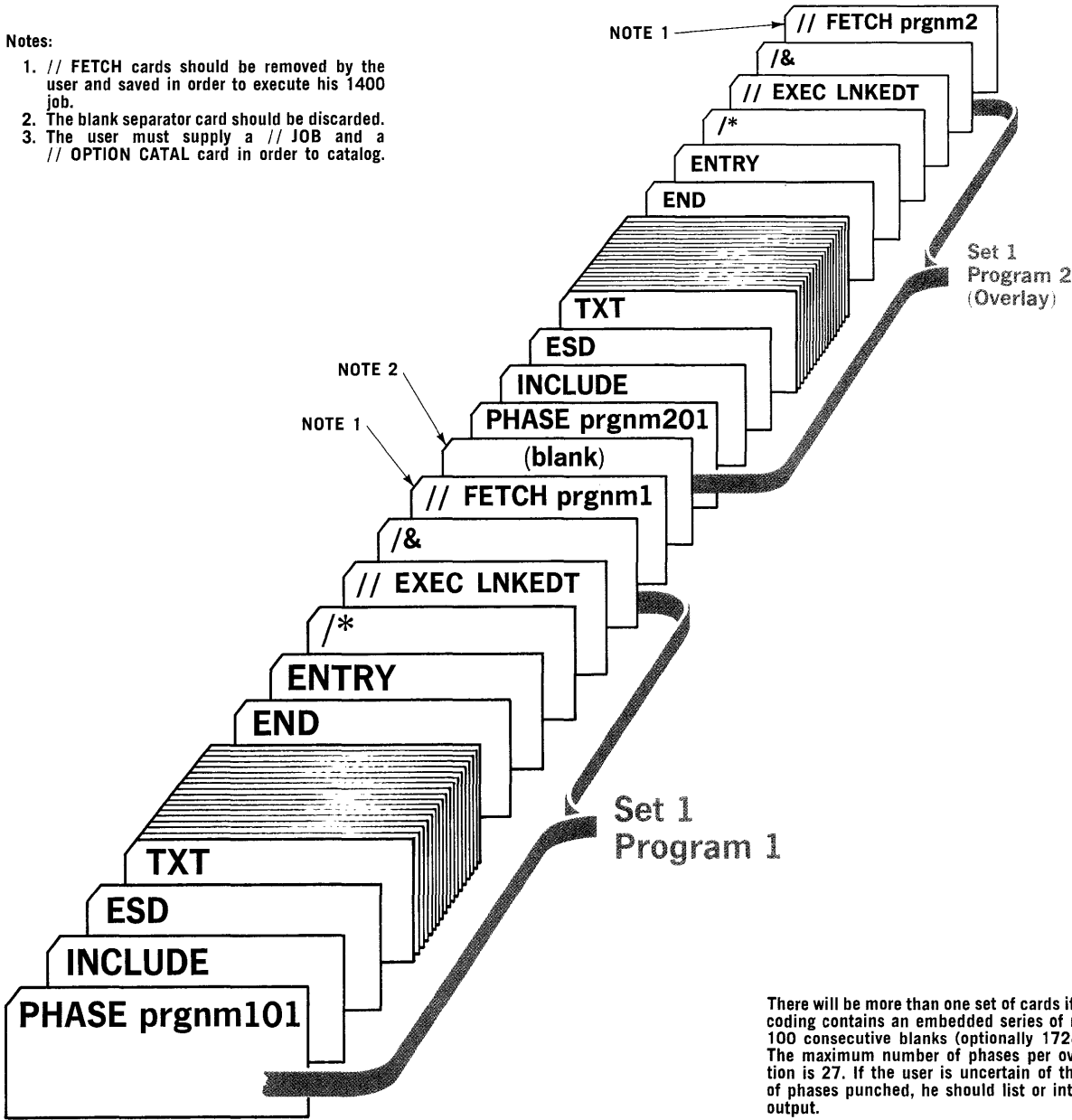
There will be more than one set of cards if the 1400 coding contains an embedded series of more than 100 consecutive blanks (optionally 1728 blanks). The maximum number of phases per overlay section is 27. If the user is uncertain of the number of phases punched, he should list or interpret the output.

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

is always some form of bootstrap card. 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 then 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.

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.)

/&

/*

Data Cards
(if required)

// FETCH prgnm2

Data Cards
(if required)

// FETCH prgnml

// 1400
anynam, D

// EXEC euname

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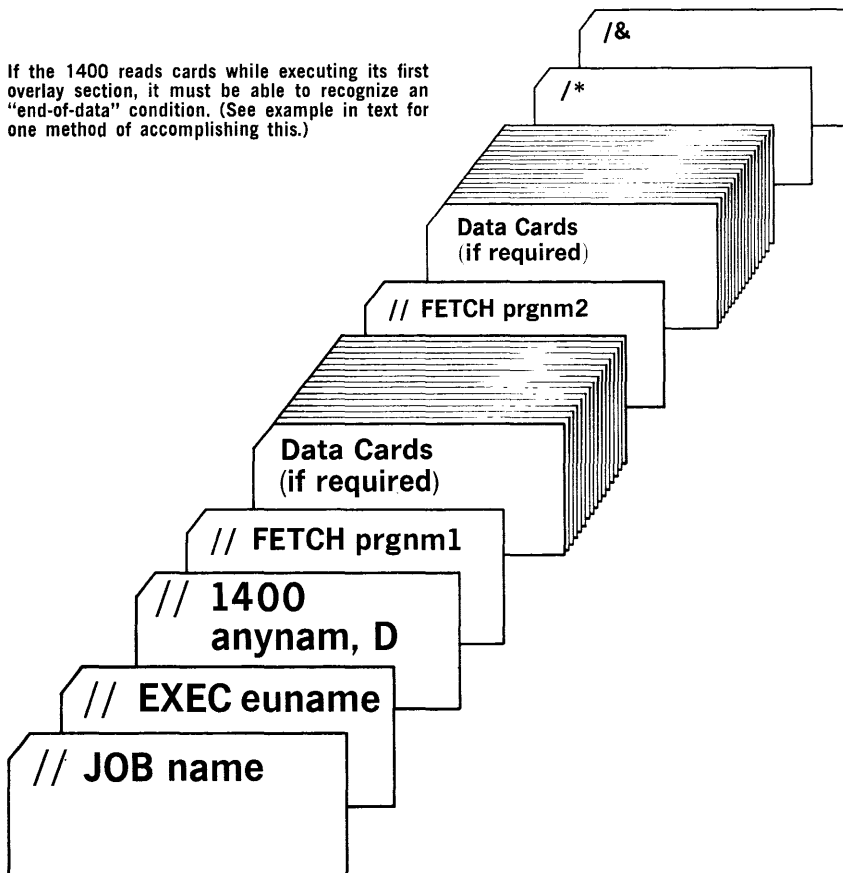
Figure 9. Executing a 1400 Program From the Core-Image Library

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 only if OC=YES is specified in the FOPT macro at DOS Supervisor generation. In addition, the Operator Service routine is entered through recognition of a 1400 halt when HALTS=YES has been specified, 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 function 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=xxxxxxxx

(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 SYSLST 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 reinitiated 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 OSDSPLY=YES or "OSDSPLY=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 word-marks. 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 alphameric 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 OSENTER=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.

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. One card is read and message EC40D is displayed again. The operator may then respond with START 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=xxxxx DR cuu, n TR,
                   yyy BPI
            EC43I TAPE 2 ON SYSxxx, MAX
                   BLK=xxxxx DR cuu, n TR,
                   yyy BPI
            EC43I TAPE 3 ON SYSxxx, MAX
                   BLK=xxxxx DR cuu, n TR,
                   yyy BPI
            EC43I TAPE 4 ON SYSxxx, MAX
                   BLK=xxxxx DR cuu, n TR,
                   yyy BPI
            EC43I TAPE 5 ON SYSxxx, MAX
                   BLK=xxxxx DR cuu, n TR,
                   yyy BPI
            EC43I TAPE 6 ON SYSxxx, MAX
                   BLK=xxxxx 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 <u>physical</u> unit. It should be noted that the maximum block size cannot be increased at this time.

<u>GENERAL COMMENTS</u>

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 <u>not</u> supported by the Emulator Programs under DOS.

OPERATOR MESSAGES

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.

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, pertains to user-initiated procedures:

EC01D ENTER DATA

Explanation: 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: None.

User Response: 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

Explanation: 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 SYSLST. At the completion of the dump, processing continues.

User Response: Not required.

EC03D MOUNT 51 COL READ FEED

Explanation: The program has encountered a // 51 control card, which conditions it to read 51-column cards.

System Action: None.

User Response: The operator must: (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 EC1nx, pertain to errors in operator responses:

EC10I INVALID RESPONSE

Explanation: The format or content of the operator's reply to the previous message issued by the Emulator Program is invalid.

System Action: Reissues previous message.

User Response: The operator must reply with a valid response to the reissued message.

EC11I INVALID ADDRESS

Explanation: Either a non-decimal address or a decimal address outside the range specified by the SIZ1400 parameter was entered for the ADDRESS, DISPLAY, ALTER, or ENTER operator services functions.

System Action: Message EC40D is issued.

User Response: The user must reply with a valid 1400 decimal address.

EC12I INVALID DEVICE TYPE

Explanation: The operator's reply, assigning 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 assigned to a noncompatible System/360 device. For example, a 1400 tape drive was specified for assignment to a programmer logical unit assigned to a System/360 disk device.

System Action: Previous message is reissued.

User Response: 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.

EC13I INVALID LOGICAL UNIT NUMBER

Explanation: 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.

System Action: Previous message is reissued.

User Response: The operator must rely with a valid programmer logical unit assignment. After a valid response, an information message (type I) is issued to confirm the assignment, followed by the message EC40D.

EC14I CONFLICTING LOGICAL UNIT ASSIGNMENT

Explanation: 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 or 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.

System Action: Previous message is reissued.

User Response: 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

Explanation: 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.

System Action: Previous message is reissued.

User Response: The operator must reply with one of the programmer logical units that were specified during system generation of the Disk Operating System, and which is not in the DOS unassigned or ignore status. After a valid response, an information message (type I) will be issued to confirm the assignment, followed by message EC40D.

EC19I DVOL SERIAL NUMBER NEEDED

Explanation: 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.

<u>System Action</u>: Message EC40D is issued.

<u>User Response</u>: The DVOL DISKn=xxxxxx operator service function is the only valid operator response to initiate volume serial number checking when the volume serial number has not been previously supplied.

The following group of messages, prefixed by the message code EC2nx, pertains to errors detected during Emulator Program initialization.

EC20I PARAMETER ERROR

<u>Explanation</u>: 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.

<u>System Action</u>: The value specified by the BLKSIZu parameter for each drive is assumed as a default and message EC29D is issued.

<u>User Response</u>: None.

EC29D CONTROL CARD ERROR

<u>Explanation</u>: The last control card read is incorrectly formatted.

<u>System Action</u>: None.

<u>User Response</u>: 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

<u>Explanation</u>: 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.

<u>System Action</u>: Processing begins.

<u>User Response</u>: Not required.

EC31I EOJ name AT hh.mm.ss

<u>Explanation</u>: 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 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.

<u>System Action</u>: Control is released automatically to DOS job control.

<u>User Response</u>: Not required.

EC32I CANCEL name AT hh.mm.ss

<u>Explanation</u>: 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 SYSLST unless a no-dump 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 test-mode option in the // 1400 control card is specified as "S".

<u>System Action</u>: Following the storage dump, control is released to DOS job control.

<u>User Response</u>: Not required.

EC33I END name AT hh.mm.ss

Explanation: 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, 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 has gone to a normal end of job (no main storage dump); control is released automatically to DOS job control.

User Response: Not required.

The following group of messages, prefixed by the message code EC4nx, pertains to the Operator Service Functions:

EC40D TYPE IN FUNCTION

Explanation: This message is issued when Operator Service Functions have been requested.

System Action: None.

User Response: The operator replies with one of the following:

    ADDRESS
    ALTER
    CANCEL
    DELETE
    DISK (or Disk n)
    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 (or 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

Explanation: This message is displayed when the operator enters "ADDRESS ddddd" (decimal) in response to message EC40D, where "ddddd" 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.

User Response: Not required.

EC42D TYPE DATA

Explanation: 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: None.

User Response: 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 in Table 10. 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 TAPE n ON SYSnnn, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
EC43D/I TAPE n UNASSIGNED,MAX BLK=xxxxx

Explanation: 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 a 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; no
system action is taken with message
EC43D.

User Response: 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 reassign-
  ment 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 UNASSIGNED,PART n DR cuu

Explanation: This message is dis-
played if the operator types the
response "DISK" or "DISK n" to mes-
sage 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; no
system action is taken with message
EC44D.

User Response: Message EC44I re-
quires no response. Message EC44D
requires that the operator reply with
one of the following responses:

- "START (or EOB)" to retain the
  present assignment.

- "SYSnnn,x" to change an assign-
  ment, where "SYSnnn" is the pro-
  grammer 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 reassign-
  ment 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

Explanation: The operator requested
the SWITCH operator service function
and HALTS=YES was specified at Emula-
tor 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: None.

User Response: 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 re-
tain 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

Explanation: 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 is issued.

User Response: Not required.

EC47I 1400 ADDRESS LIMIT, FUNCTION ENDED

Explanation: 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.

User Response: In response to the ENTER function, the operator may reenter the data if the original response was in error. No response is required following the DISPLAY function.

EC48I FUNCTION NOT GENERATED

Explanation: This message indicates that the operator requested an operator service function which was not specified for this Emulator Program generation.

System Response: Message EC40D is issued.

User Response: The operator must reply with one of the supported operator service functions.

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

EC49D/I INVALID 1400 CHARACTER DETECTED ON xxxxxxxx

Explanation: This message is displayed when the Emulator Program for the Model 40 encounters an invalid 1400 character. "xxxxxxxx" identifies the source of the error condition (DISK, TAPE, READER, or ENTERING).

System Action: If the error occurred while the operator was using the ENTER operator service function, the system issues message EC42D, or during the execution of a Read Console Printer instruction, message EC49I is issued and the source of the error is identified as ENTERING. Message EC49D is issued if the source of the error is disk, tape, or card reader. If the error occurred on the reader, the card in error is typed.

User Response: The user 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 -- PROCESS

- For TAPE -- BYPASS, PROCESS, or DISPLAY

- For READER -- PROCESS, RETRY

- For ENTERING -- reenter data after message EC42D

EC50D PUNCH ERROR

Explanation: 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.

System Action: None

User Response:

(1) Perform a non-process runout of the punch.

(2) Recreate both the error card and the following card (last two cards punched) if the cards contained prepunched data. On the 2520, recreate only the error card.

(3) Reload and ready the punch.

(4) Reply with START or EOB.

Note: The last two cards are repunched.

EC51D PFR PUNCH ERROR

Explanation: This message indicates that DOS error recovery did not correct the PFR punch error.

System Action: None.

User Response:

(1) Clear the punch.

(2) Recreate cards as necessary and place them in front of nonprocessed punched cards.

(3) Reload and ready the punch.

(4) Reply with START or EOB.

Note: The last two cards are repunched.

EC52D PFR READ ERROR

Explanation: This message indicates that DOS error recovery did not correct the PFR read error.

System Action: None.

User Response:

(1) Clear the punch.

(2) Recreate the first card cleared; check the second card for data checks and correct the card.

(3) Place the two corrected cards and the cleared cards in front of the nonprocessed cards.

(4) Reload and ready the punch.

(5) Reply with START or EOB.

EC58D 1404 aaaaaaaaaa CCSW=yyxxxx SNS=xx

Explanation: This message indicates that a 1404 printer error occurred. The type of error is identified by "aaaaaaaaaa", where "aaaaaaaaaa" 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 "xxx". The sense bytes are displayed by SNS=xx.

System Action: None.

User Response: 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.

EC59D REPLY AGAIN TO 1404 MESSAGE

Explanation: 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: None.

User Response: The user must again reply SKIP 1, RETRY, IGNORE, or SERVICE.

The following group of messages, prefixed by the message code EC6nx, pertains to magnetic-tape devices:

EC60I MESSAGE RESPONSES ARE B=BYPASS, P=PROCESS

Explanation: 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.

System Action: Message EC62D is displayed.

User Response: 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

Explanation: This message is dis-
played 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.

System Action: Message EC62D is
displayed.

User Response: 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

Explanation: This message is dis-
played to indicate that a tape error
has occurred, the operator has
responded to the standard DOS-issued
error message with IGNORE, and the
1400 Tape Error Recovery routine has
been specified at Emulator Program
generation.

System Action: The tape block in
error is printed on SYSLOG or SYSLST
as specified by the TAPERRS parame-
ter. Non-BCD characters appear as
asterisks (*). If an invalid re-
sponse is made, either message EC60I
or EC61I is issued, followed by a
reissued message EC62D.

User Response: The available opera-
tor responses to this message are
one-letter options (B, P, or H) indi-
cated 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 con-
    tinues 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 dis-
    played in hexadecimal format ex-
    actly 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

Explanation: 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 ("BLKSIZu=nnnn"),
as modified by the // TAPE control
card. This message is always pre-
ceded 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
also is provided.

System Action: The job is terminated.

User Response: Not required.

EC67I MOUNT NEW TAPE ON SYSIPT

Explanation: An end-of-volume indi-
cation has been detected by the tape
device assigned to SYSIPT before end
of file was reached.

System Action: A standard DOS opera-
tor intervention message is issued.

User Response: Mount the next tape
volume on SYSIPT and reply START or
EOB.

EC68I MOUNT NEW TAPE ON SYSPCH

Explanation: An end-of-volume indi-
cation has been detected by the tape
drive assigned to SYSPCH.

System Action: A standard DOS opera-
tor intervention message is issued.

User Response: Mount a new tape
volume on SYSPCH and reply START or
EOB.

EC69I MOUNT NEW TAPE ON SYSLST

Explanation: An end-of-volume indi-
cation has been detected by the tape
drive assigned to SYSLST.

System Action: A standard DOS opera-
tor intervention message is issued.

User Response: 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

Explanation: This message indicates that the disk pack is not initialized to the proper format. (See "Disk-Pack Initialization" in the section "Simulation of IBM 1401/1440/1460 Facilities.")

System Action: The job is canceled.

User Response: Not required.

EC71D DISK ERROR DETECTED. SECTOR ADDRESS = dxxxxx. VALID DATA FOLLOWS:

Explanation: This message indicates that an error has been detected during disk verification (optionally specified). 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.

System Action: None.

User Response: 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.

EC72I SYSIPT EXTENT EXHAUSTED

Explanation: The extent limit assigned to SYSIPT (disk extent) has been exhausted.

System Action: The job is canceled.

User Response: Not required.

EC73I SYSLST EXTENT EXHAUSTED

Explanation: The extent limit assigned to SYSLST (disk extent) has been exhausted.

System Action: The job is canceled.

User Response: Not required.

EC74I SYSPCH EXTENT EXHAUSTED

Explanation: The extent limit assigned to SYSPCH (disk extent) has been exhausted.

System Action: The job is canceled.

User Response: Not required.

EC75I WRONG PACK, MOUNT xxxxxx DISK n ON DR cuu

Explanation: 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.

System Action: Message EC40D is issued.

User Response: 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.

• Change the disk drive configuration using the DISK n function.

• 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.

• Discontinue volume serial number checking for this 1400 drive

using the DELETE function. This function must be used with caution when performing write operations.

EC76I DISK n ON cuu SERIAL NO.=xxxxxx

Explanation: 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.

User Response: The operator must respond with one of the valid corrective actions described under message EC75I.

EC77D SCAN ERROR DETECTED

Explanation: A 1400 disk scan was not successfully completed. An end of cylinder condition has not yet been detected.

System Action: None.

User Response: 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 END or CANCEL the job.

EC78D WRONG PACK, MOUNT xxxxxx DISK n ON DR cuu
EC78I 1301/1405 DRIVE xxx SERIAL NO.=xxxxxx

Explanation: 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.

System Action: None

User Response: 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.

- 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.

Note: The job may be immediately resubmitted if a non-process runout of the card reader transport is performed before performing the END or CANCEL function. After correcting the // DVOL control card, resubmit the job to the card reader beginning with the DOS // JOB control card.

The following group of messages, prefixed by the message code EC8nx, pertains to program messages:

EC80I 1400 STATUS: I=nnnnn;A=nnnnn;B=nnnnn. INSTN BLOCK=xxxxxxxx

Explanation: A 1400 halt or error has been encountered or the operator has requested the STATUS operator service function. This is a display of the 1400 storage address registers and eight characters from 1400 storage without wordmarks, beginning with the instruction that caused the halt or error condition. The eight characters normally include more than just the instruction that caused the halt or error, and certain 1400 special characters (such as the record mark) are not printed. When message EC80I is displayed after a 1400 program error, the AAR and BAR values may be invalid because of storage wraparound.

System Action: Variable, depending on program status as indicated in associated message.

User Response: Not required.

EC81I HALT

Explanation: 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.

User Response: Not required.

EC82I HALT

Explanation: 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 displayed.

User Response: One of the operator responses listed under "Available Functions" in the "Operator Service Functions" section must be given.

EC83I 1400 PROGRAM ERROR

Explanation: A 1400 program error has been detected. This message is always followed by the typing out of message EC80I (status of 1400 registers and current instruction). The Model 40 Emulator Program additionally issues a "NO.xxx" following the message indicating the branch table entry number. 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 in the // 1400 control card, a System/360 main storage dump is also provided.

System Action: The job is terminated.

User Response: Not required.

EC84I TOO MANY PHASES TO CATALOG

Explanation: The 1400 program or overlay section being cataloged consists of more than 27 internal phases.

System Action: The job is terminated.

User Response: Not required.

EC90I INVALID OPERATION ON READER

Explanation: (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.

System Action: The job is terminated.

User Response: Not required.

EC91I INVALID OPERATION ON PUNCH

Explanation: (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.

System Action: The job is terminated.

User Response: Not required.

EC92I INVALID OPERATION ON PRINTER

Explanation: A 1404 print instruction has been specified but is not supported by this particular Emulator Program generation.

System Action: The job is terminated.

User Response: Not required.

EC93I CONTROL CARD NOT SUPPORTED // yyyy

Explanation: 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".

System Action: The job is terminated.

User Response: Not required.

EC94I NO // LC DATA DELIMITER CARD

> Explanation: A // LC data delimiter card is required before the last data card.

> System Action: Last card indicator (Sense Switch A) is turned on, and message EC40D is issued.

> User Response: 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

> Explanation: 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.

> User Response: Not required.

EC96I CARRIAGE CONTROL CARD ERROR

> Explanation: The 1400 program specified a carriage-control channel punch which is not included in the carriage control card.

> System Action: The job is terminated.

> User Response: Not required.

EC97I 1400 CONSOLE PRINTER NOT SUPPORTED

> Explanation: This message is issued if the OSINQRY parameter is not specified as "1400" or "YES", and a 1400 Read Console Printer instruction has been encountered.

> System Action: Message EC80I is issued, followed by message EC40D.

> User Response: 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.

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 SYSLST 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.

Table 13.   Emulator-Program Parameters

Parameter	Required By	Remarks
BLKSIZu=$\begin{Bmatrix} nnnn \\ \underline{0000} \end{Bmatrix}$		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=$\begin{Bmatrix} nnnnn \\ \underline{00000} \end{Bmatrix}$	1400 magnetic tape	Indicates total storage area to be reserved by the Emulator Program for tape buffers. Default is 0000.
CARRCTL=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	Carriage-control pointer option	Indicates carriage-control tape pointer option. Default is NO.
CATALOG=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Indicates 1400 programs to be cataloged in the Core-Image Library. Default is cataloging not available.
COLBINP=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	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=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	51-column cards	Indicates 51-Column Interchangeable Read Feed feature support. Default is NO.
DVOL=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	1400 DASD	Indicates verification of volume serial number of disk pack accessed by the Emulator Program. Default is NO.
DISKDR=$\begin{Bmatrix} n \\ 130n \\ 1405 \\ \underline{0} \end{Bmatrix}$	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=$\begin{Bmatrix} 2314 \\ \underline{2311} \end{Bmatrix}$	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.

Table 13. Emulator-Program Parameters (continued)

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 G is detected. Default G 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 and variable by storage size for the Model 40 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.

Table 13. Emulator-Program Parameters (continued)

Parameter	Required By	Remarks
OSENTER={YES, NO}		Alters 1400 storage from console. Default is alteration of storage not performed.
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.
PTR1400={1443, 1404, 1403}	Other than 1403	Indicates type of 1400 printer. Default is 1403.
PTR360={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.
SCAN={YES, NO}	1400 Scan Disk	Indicates 1311 Scan Disk instructions in 1400 program. Default is Scan Disk not performed.

Table 13. Emulator-Program Parameters (continued)

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 to the assembler the decimal value of the DOS "SEND" parameter. Used to generate assembly listing addresses identical to those at object program execution time.
SIZ1400={nn / 16}	Other than 16K	Indicates 1400 main storage size, where "nn" is any even 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, 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 "l" 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. 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.
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.

Table 13. Emulator-Program Parameters (continued)

Parameter	Required By	Remarks
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.
TAPLDMD= {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.

Six specialized System/360 instructions are provided for use with the 1401/1440/ 1460 Basic Compatibility Feature. These are:

- Compatibility Feature Initialize Mode (CFIM)

- Compatibility Feature Mode Set (CFMS)

- Compatibility Feature Store Variables (CFSV)

- Compatibility Feature Load Variables (CFLV)

- Compatibility Feature Store Constants (CFSC)

- Compatibility Feature Load Constants (CFLC)

An attempt to use these instructions should not be made unless the Basic Compatibility Feature is installed on the system.

The System/360 Diagnose instructions (see the publication IBM System/360 Principles of Operations, Form A22-6821) provide a means to enable and disable these specialized instructions. Thus, operation-exception protection is assured when compatibility is not being used on the system. The Diagnose instruction as used for the Compatibility Feature has the following format:

SI

```
        ┌────┬─────────────────┬────┬─────────────┐
        │    │                 │ B₁ │     D₁      │
        │ 83 │       I₂        ├────┼─────────────┤
        │    │                 │ 0  │  3   C   C  │
        └────┴─────────────────┴────┴─────────────┘
        0   7 8              15 16 19 20         31
```
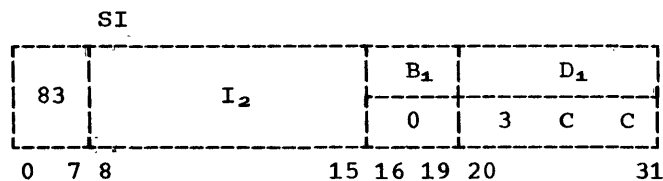
When the Diagnose instruction is used to enable or disable the special compatibility instructions, the displacement contains the hexadecimal address 3CC. Bits 16-19 (B_1) must be zero. When the I_2 byte of the Diagnose instruction is 80, special 1400 compatibility instructions are allowed to function. When the I_2 byte is 00, these special instructions are disabled and cause a program interruption if used. It should be noted that the Diagnose instruction is a privileged operation.

Condition Code:
    Unpredictable

Program Interruptions:
    Privileged operation
    Specification
    Addressing

Timing:
    19 microseconds

The six special System/360 instructions provided with the Basic Compatibility Feature have the SI format and are similar to the Diagnose instruction. The operation code for all instructions is the same (99). The six special compatibility instructions have the following format:

SI

```
        ┌────┬─────────────────┬────┬─────────────┐
        │    │       I₂        │    │             │
        │ 99 ├─────────┬───────┤ B₁ │     D₁      │
        │    │   W₁    │  W₂   │    │             │
        └────┴─────────┴───────┴────┴─────────────┘
        0   7 8       11 12   15 16 19 20         31
```
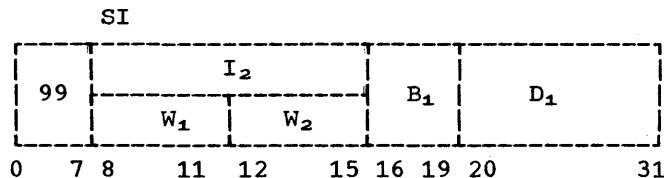
Bits 8-11 (W_1) are used to define the six special instructions. Mnemonics are not provided for these instructions in the assembler language. When the assembler language is used, these instructions must be coded as hexadecimal constants, using the DC assembler statement.

Condition Code:
    Remains unchanged

Program Interruptions:
    Addressing

Compatibility Feature Initialize Mode (CFIM)

This compatibility instruction is defined by W_1 being equal to zero. Bits 12-15 (W_2) are interpreted as follows:

W_2 Interpreted As

0   No initialization required

1   Initialize for 1402 card load

2   Initialize for 1401 tape load

9   Initialize for 1442 card load

This instruction loads auxiliary storage consecutively with 512 bytes, starting at the main storage address specified by the effective address ($B_1 + D_1$). 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 word-mark (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	0,1,2,9		

0   7 8   11 12   15 16 19 20   31
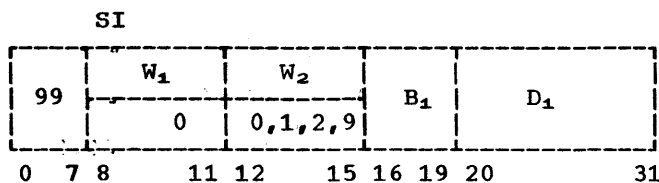
Condition Code:
   Unchanged

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 Interpreted As

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	0,1,2,9		

0   7 8   11 12   15 16 19 20   31
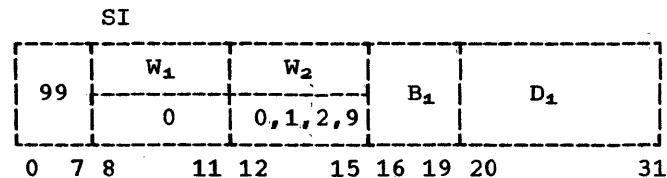
Condition Code:
   Unchanged

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 B_1 and D_1, to four contiguous 1400 auxiliary-storage locations specified by W_2 (see Table 14). For this instruction, W_1 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:

```
        SI
    r----T----T--------T--------T----T--------------------1
    |    |    |  W₁    |  W₂    |    |                    |
    | 99 |----+--------+--------+ B₁ |      D₁            |
    |    |    |   3    |        |    |                    |
    L----+----+--------+--------+----+--------------------J
    0   7 8       11 12      15 16 19 20                 31
```
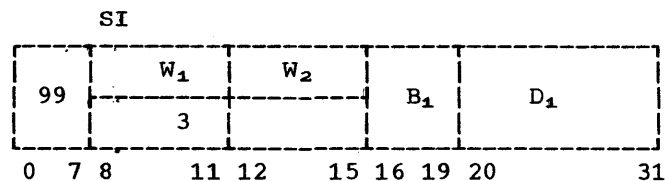
Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    44 microseconds

Table 14. 1400 Auxiliary Storage Bytes Defined by W_2

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 W_1 being equal to a hexadecimal value of 2. The CFLV instruction loads main storage, beginning with the effective address specified by B_1 and D_1, from the four contiguous bytes of 1400 auxiliary storage specified by W_2. The specifications of W_2 for this instruction are shown in Table 14.

The Compatibility Feature Load Variables instruction has the following format:

```
        SI
    r----T--------T--------T----T--------------------1
    |    |  W₁    |  W₂    |    |                    |
    | 99 +--------+--------+ B₁ |      D₁            |
    |    |   2    |        |    |                    |
    L----+--------+--------+----+--------------------J
    0   7 8     11 12    15 16 19 20                 31
```
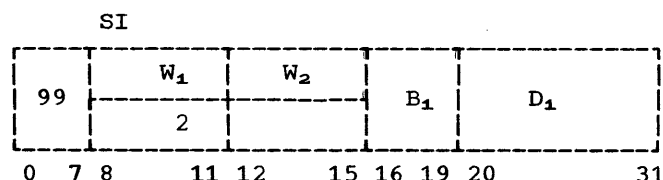
Condition Code:
    Unchanged

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 B_1 and D_1 to the 16 contiguous 1400 auxiliary-storage locations specified by W_1 and W_2. W_1 is used to define the instruction function and must contain the hexadecimal value 9 or D. If W_1 contains a 9, W_2 refers to a starting address in 1400 auxiliary storage A. If W_1 contains a D, W_2 refers to a starting address in 1400 auxiliary storage B. W_2 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 W_2 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 B_1 and D_1.

The Compatibility Feature Store Constants instruction has the following format:

```
        SI
 ┌─────┬──┬───────┬─────────┬──────┬───────────────┐
 │     │  │  W₁   │   W₂    │      │               │
 │ 99  ├──┴───────┼─────────┤  B₁  │     D₁        │
 │     │  9 or D  │         │      │               │
 └─────┴──────────┴─────────┴──────┴───────────────┘
 0   7 8        11 12     15 16  19 20            31
```
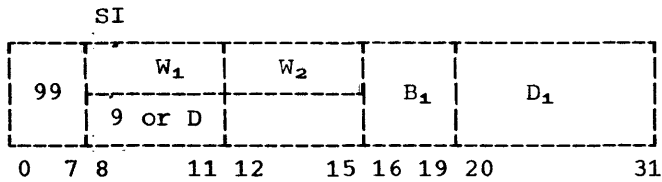
Condition Code:
    Unchanged

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 B_1 and D_1 from the 16
contiguous bytes of 1400 auxiliary storage
specified by W_1 and W_2. W_2 is used to
define the instruction function and must
contain the hexadecimal value 8 or C. If
W_1 contains an 8, data is fetched from 1400
auxiliary storage A. If W_1 contains a C,
data is fetched from 1400 auxiliary storage

B. W_2 provides the high-order hexadecimal
digit of the starting address in 1400
auxiliary storage. The low-order hexadeci-
mal digit of the starting address is always
zero. If W_2 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 B_1 and D_1.

   The Compatibility Feature Load Constants
instruction has the following format:
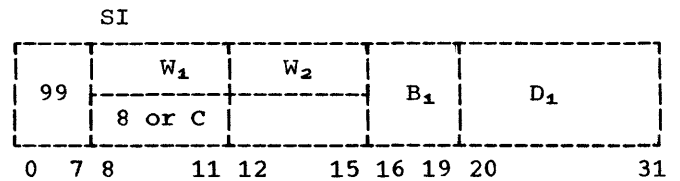
```
        SI
 ┌─────┬──┬───────┬─────────┬──────┬───────────────┐
 │     │  │  W₁   │   W₂    │      │               │
 │ 99  ├──┴───────┼─────────┤  B₁  │     D₁        │
 │     │  8 or C  │         │      │               │
 └─────┴──────────┴─────────┴──────┴───────────────┘
 0   7 8        11 12     15 16  19 20            31
```

Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    106 microseconds

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:

```
              RR
     r--------T--------T------1
     |  Op    |        |      |
     | Code   |  R₁    |  R₂  |
     L--------+--------+------J
     0      7 8      11 12  15
```
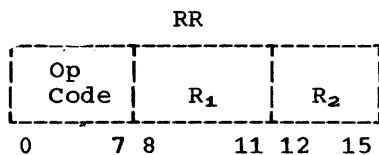
The general register specified by R_1 contains the destination address. The source address is specified by R_2.

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 R_2 is the source address in the 2030 storage area. The binary address specified by general register R_1 is the destination address in the 1400 main-storage area. The low-order 16 bits of the general register specified by $R_1 + 1$ 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:

```
              RR
     r--------T--------T------1
     |  0 E   |  R₁    |  R₂  |
     L--------+--------+------J
     0      7 8      11 12  15
```
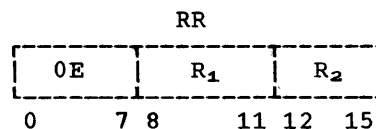
Condition Code:
  00 - Operation terminated by count zero
  01 - Operation terminated by a GMWM in 1400 storage

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:

```
            RR
  r--------T----------T--------1
  |  0F    |   R₁     |   R₂   |
  L--------┴----------┴--------J
  0       7 8        11 12   15
```
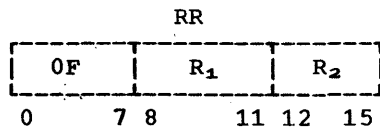
Condition Code:
      00 - Operation terminated by count zero
      01 - Operation terminated by a GMWM in 1400 storage

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 R_2 is the source address, and the binary address specified by general register R_1 is the destination address. The low-order 16 bits in general register

R_1 + 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:

```
            RR
  r--------T----------T--------1
  |  0C    |   R₁     |   R₂   |
  L--------┴----------┴--------J
  0       7 8        11 12   15
```
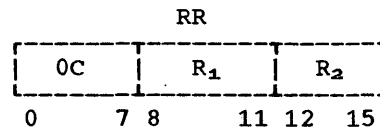
Condition Code:
      00 - Operation terminated by count zero
      01 - Operation terminated by a GMWM in 1400 storage

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:

```
            RR
r------T---------T------1
|  0D  |   R₁    |   R₂  |
L_____1_____1_____J
0      7 8      11 12   15
```
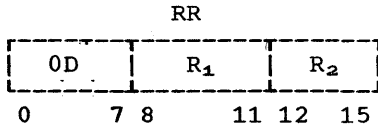
Condition Code:
    00 - Operation terminated by count zero
    01 - Operation terminated by GMWM in 1400 storage

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.

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 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 fol-
lowing 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 Fea-
  ture (hexadecimal 0741)

A description of each Diagnose instruc-
tion 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 recog-
nized. After each unequal compare of
search and table arguments, the table argu-
ment 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 bound-
ary. 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 15).

Scatter performs the following:

- Moves characters from contiguous
  Emulator-Program storage to noncontigu-
  ous 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, opera-
  tion 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 simu-
  lated 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 16. When this
data is scattered to 1400 storage, it
remaps into the representation as shown in
Table 15. 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:
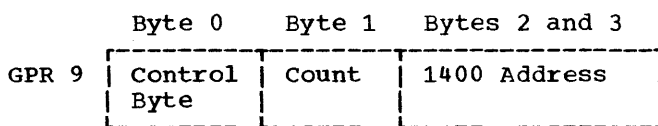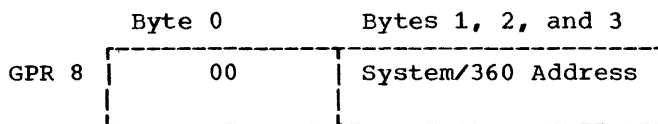
```
                Byte 0            Bytes 1, 2, and 3
        ┌─────────────────┬─────────────────────────┐
GPR 8   │       00        │   System/360 Address    │
        │                 │                         │
        └─────────────────┴─────────────────────────┘

                Byte 0      Byte 1    Bytes 2 and 3
        ┌─────────────┬───────────┬─────────────────┐
GPR 9   │  Control    │  Count    │  1400 Address   │
        │  Byte       │           │                 │
        └─────────────┴───────────┴─────────────────┘
```

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
 0   7                    Operation

 0   0   Gather characters in Load mode.
         The characters from simulated 1400
         internal code with word- marks are
         translated to BCDIC-8 with word-
         marks.

 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 char-
         acters with wordmarks are trans-
         lated to BCDIC-8 without word-
         marks.

 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 15). 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:

```
       Byte 0      Bytes 1, 2, and 3
     r--------------T---------------------1
GPR 8| Split        |System/360 Address   |
     | Operation    |                     |
     L_____i_____J
```

```
       Byte 0   Byte 1    Bytes 2 and 3
     r----------T--------T--------------------1
GPR 9| Control  |Count   |1400 Address        |
     | Byte     |        |                    |
     L_____i_____i_____J
```
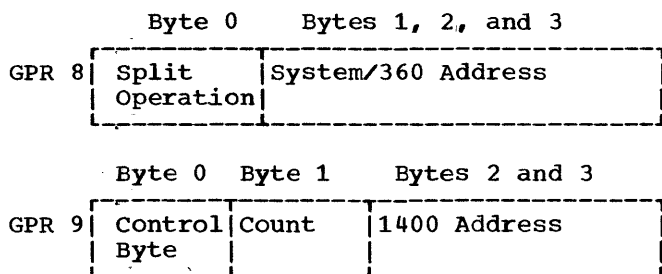
Split Operation: This byte (byte 0 of GPR 8) is used to indicate a split operation, where the last character read from Emulator-Program storage was a word separator. If bit 4 of byte 0 of GPR 8 is not a zero when Scatter Load Mode Tape is entered, a wordmark is placed at the first character in simulated 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.

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:

```
          Bytes 0 and 1      Bytes 2 and 3
        r----------------------T-----------------1
GPR 9   |                      |      hddd       |
        L----------------------1-----------------J
```

or

```
          Bytes 0 and 1      Bytes 2 and 3
        r----------------------T-----------------1
GPR 9   |         dd           |      dddd       |
        L----------------------1-----------------J
```
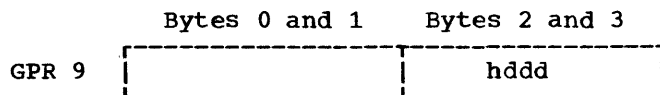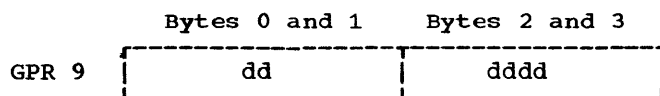
The count, if required, is in binary form in bytes 2 and 3 of GPR 8 and should be one less than the number desired to be incremented or decremented.

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
1010	dddddd	Decrement by one
1011	dddddd	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:

```
    Byte 0            Bytes 1, 2, and 3
  r--------T-------------------------------------1
  |        |         System/360 Address          |
  L--------1----------------------------------_--J
```
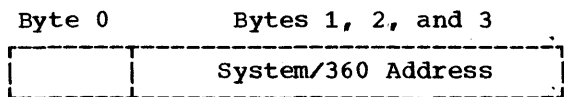
System/360 Address: This is the binary address of the lowest location of the binary data in Emulator-Program storage. After completion of the operation, this address will have been incremented by 160.

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:

```
          Bytes 0 and 1      Bytes 2 and 3
        r----------------------T-----------------1
GPR 8   |                      |      Count      |
        +----------------------+-----------------+
GPR 9   |                      |   1400 Address  |
        L----------------------1-----------------J
```
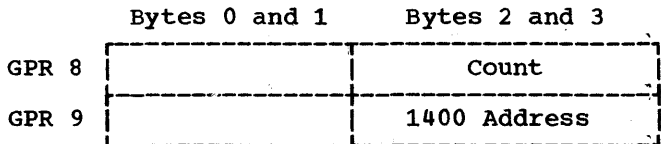
Count: This field specifies, in binary form, the number of positions to be scanned minus 1. This binary value should not

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.

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 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.

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

4567	WITHOUT WORDMARK 0123 ⟶								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	¤	*	%	@					¤	*	%	@				
1101	[	]	⌐	:					[	]	⌐	:				
1110	<	;	\	>					<	;	\	>				
1111	‡	Δ	#	✓					‡	Δ	#	✓				

Table 16.   Eight-Bit Representation of BCD Graphics in Simulated 1400 Storage for the Model 30, and Buffer Areas for Models 30 and 40

4567 \ 0123	WITH WORDMARK₁ 0000	0001	0010	0011	WITHOUT WORDMARK₂ 0100	0101	0110	0111	WITH WORDMARK₁ 1000	1001	1010	1011	WITHOUT WORDMARK₂ 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				ƀ				ƀ								
1011	.	$	,	#	.	$	,	#								
1100	⊓	*	%	∂	⊓	*	%	∂								
1101	[	]	⌐	:	[	]	⌐	:								
1110	<	;	\	>	<	;	\	>								
1111	‡	Δ	⧣	√	‡	Δ	⧣	√								

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

An area of Model 40 Emulator-Program main storage from hexadecimal 4000 to 7FFFF 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.

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	04108	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
1000 04080	1002 04082	1004 04084	1006 04086	1008 04088	1010 04090	1012 04092	1014 04094	1016 04096	1018 04098
1020 040A0	1022 040A2	1024 040A4	1026 040A6	1028 040A8	1030 040B0	1032 040B2	1034 040B4	1036 040B6	1038 040B8
1040 040C0	1042 040C2	1044 040C4	1046 040C6	1048 040C8	1050 040D0	1052 040D2	1054 040D4	1056 040D6	1058 040D8
1060 040E0	1062 040E2	1064 040E4	1066 040E6	1068 040E8	1070 040F0	1072 040F2	1074 040F4	1076 040F6	1078 040F8
1080 04288	1082 0428A	1084 0428C	1086 0428E	1088 04688	1090 04298	1092 0429A	1094 0429C	1096 0429E	1098 04698
1100 04180	1102 04182	1104 04184	1106 04186	1108 04188	1110 04190	1112 04192	1114 04194	1116 04196	1118 04198
1120 041A0	1122 041A2	1124 041A4	1126 041A6	1128 041A8	1130 041B0	1132 041B2	1134 041B4	1136 041B6	1138 041B8
1140 041C0	1142 041C2	1144 041C4	1146 041C6	1148 041C8	1150 041D0	1152 041D2	1154 041D4	1156 041D6	1158 041D8
1160 041E0	1162 041E2	1164 041E4	1166 041E6	1168 041E8	1170 041F0	1172 041F2	1174 041F4	1176 041F6	1178 041F8
1180 04388	1182 0438A	1184 0438C	1186 0438E	1188 04788	1190 04398	1192 0439A	1194 0439C	1196 0439E	1198 04798
1200 04280	1202 04282	1204 04284	1206 04286	1208 0408A	1210 04290	1212 04292	1214 04294	1216 04296	1218 0409A
1220 042A0	1222 042A2	1224 042A4	1226 042A6	1228 040AA	1230 042B0	1232 042B2	1234 042B4	1236 042B6	1238 040BA
1240 042C0	1242 042C2	1244 042C4	1246 042C6	1248 040CA	1250 042D0	1252 042D2	1254 042D4	1256 042D6	1258 040DA
1260 042E0	1262 042E2	1264 042E4	1266 042E6	1268 040EA	1270 042F0	1272 042F2	1274 042F4	1276 042F6	1278 040FA
1280 042A8	1282 042AA	1284 042AC	1286 042AE	1288 046A8	1290 042B8	1292 042BA	1294 042BC	1296 042BE	1298 046B8
1300 04380	1302 04382	1304 04384	1306 04386	1308 0418A	1310 04390	1312 04392	1314 04394	1316 04396	1318 0419A
1320 043A0	1322 043A2	1324 043A4	1326 043A6	1328 041AA	1330 043B0	1332 043B2	1334 043B4	1336 043B6	1338 041BA
1340 043C0	1342 043C2	1344 043C4	1346 043C6	1348 041CA	1350 043D0	1352 043D2	1354 043D4	1356 043D6	1358 041DA
1360 043E0	1362 043E2	1364 043E4	1366 043E6	1368 041EA	1370 043F0	1372 043F2	1374 043F4	1376 043F6	1378 041FA
1380 043A8	1382 043AA	1384 043AC	1386 043AE	1388 047A8	1390 043B8	1392 043BA	1394 043BC	1396 043BE	1398 047B8
1400 04480	1402 04482	1404 04484	1406 04486	1408 0408C	1410 04490	1412 04492	1414 04494	1416 04496	1418 0409C
1420 044A0	1422 044A2	1424 044A4	1426 044A6	1428 040AC	1430 044B0	1432 044B2	1434 044B4	1436 044B6	1438 040BC
1440 044C0	1442 044C2	1444 044C4	1446 044C6	1448 040CC	1450 044D0	1452 044D2	1454 044D4	1456 044D6	1458 040DC
1460 044E0	1462 044E2	1464 044E4	1466 044E6	1468 040EC	1470 044F0	1472 044F2	1474 044F4	1476 044F6	1478 040FC
1480 042C8	1482 042CA	1484 042CC	1486 042CE	1488 046C8	1490 042D8	1492 042DA	1494 042DC	1496 042DE	1498 046D8
1500 04580	1502 04582	1504 04584	1506 04586	1508 0418C	1510 04590	1512 04592	1514 04594	1516 04596	1518 0419C
1520 045A0	1522 045A2	1524 045A4	1526 045A6	1528 041AC	1530 045B0	1532 045B2	1534 045B4	1536 045B6	1538 041BC
1540 045C0	1542 045C2	1544 045C4	1546 045C6	1548 041CC	1550 045D0	1552 045D2	1554 045D4	1556 045D6	1558 041DC
1560 045E0	1562 045E2	1564 045E4	1566 045E6	1568 041EC	1570 045F0	1572 045F2	1574 045F4	1576 045F6	1578 041FC
1580 043C8	1582 043CA	1584 043CC	1586 043CE	1588 047C8	1590 043D8	1592 043DA	1594 043DC	1596 043DE	1598 047D8
1600 04680	1602 04682	1604 04684	1606 04686	1608 0408E	1610 04690	1612 04692	1614 04694	1616 04696	1618 0409E
1620 046A0	1622 046A2	1624 046A4	1626 046A6	1628 040AE	1630 046B0	1632 046B2	1634 046B4	1636 046B6	1638 040BE
1640 046C0	1642 046C2	1644 046C4	1646 046C6	1648 040CE	1650 046D0	1652 046D2	1654 046D4	1656 046D6	1658 040DE
1660 046E0	1662 046E2	1664 046E4	1666 046E6	1668 040EE	1670 046F0	1672 046F2	1674 046F4	1676 046F6	1678 040FE
1680 042E8	1682 042EA	1684 042EC	1686 042EE	1688 046E8	1690 042F8	1692 042FA	1694 042FC	1696 042FE	1698 046F8
1700 04780	1702 04782	1704 04784	1706 04786	1708 0418E	1710 04790	1712 04792	1714 04794	1716 04796	1718 0419E
1720 047A0	1722 047A2	1724 047A4	1726 047A6	1728 041AE	1730 047B0	1732 047B2	1734 047B4	1736 047B6	1738 041BE
1740 047C0	1742 047C2	1744 047C4	1746 047C6	1748 041CE	1750 047D0	1752 047D2	1754 047D4	1756 047D6	1758 041DE
1760 047E0	1762 047E2	1764 047E4	1766 047E6	1768 041EE	1770 047F0	1772 047F2	1774 047F4	1776 047F6	1778 041FE
1780 043E8	1782 043EA	1784 043EC	1786 043EE	1788 047E8	1790 043F8	1792 043FA	1794 043FC	1796 043FE	1798 047F8
1800 04488	1802 0448A	1804 0448C	1806 0448E	1808 0468A	1810 04498	1812 0449A	1814 0449C	1816 0449E	1818 0469A
1820 044A8	1822 044AA	1824 044AC	1826 044AE	1828 046AA	1830 044B8	1832 044BA	1834 044BC	1836 044BE	1838 046BA
1840 044C8	1842 044CA	1844 044CC	1846 044CE	1848 046CA	1850 044D8	1852 044DA	1854 044DC	1856 044DE	1858 046DA
1860 044E8	1862 044EA	1864 044EC	1866 044EE	1868 046EA	1870 044F8	1872 044FA	1874 044FC	1876 044FE	1878 046FA
1880 0468C	1882 046AC	1884 046CC	1886 046EC	1888 0468E	1890 0469C	1892 046BC	1894 046DC	1896 046FC	1898 0469E
1900 04588	1902 0458A	1904 0458C	1906 0458E	1908 0478A	1910 04598	1912 0459A	1914 0459C	1916 0459E	1918 0479A
1920 045A8	1922 045AA	1924 045AC	1926 045AE	1928 047AA	1930 045B8	1932 045BA	1934 045BC	1936 045BE	1938 047BA
1940 045C8	1942 045CA	1944 045CC	1946 045CE	1948 047CA	1950 045D8	1952 045DA	1954 045DC	1956 045DE	1958 047DA
1960 045E8	1962 045EA	1964 045EC	1966 045EE	1968 047EA	1970 045F8	1972 045FA	1974 045FC	1976 045FE	1978 047FA
1980 0478C	1982 047AC	1984 047CC	1986 047EC	1988 0478E	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
2000	04800	2002	04802	2004	04804	2006	04806	2008	04808	2010	04810	2012	04812	2014	04814	2016	04816	2018	04818
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
2500	04D00	2502	04D02	2504	04D04	2506	04D06	2508	0490C	2510	04D10	2512	04D12	2514	04D14	2516	04D16	2518	0491C
2520	04D20	2522	04D22	2524	04D24	2526	04D26	2528	0492C	2530	04D30	2532	04D32	2534	04D34	2536	04D36	2538	0493C
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
2800	04C08	2802	04C0A	2804	04C0C	2806	04C0E	2808	04E0A	2810	04C18	2812	04C1A	2814	04C1C	2816	04C1E	2818	04E1A
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
3000	04880	3002	04882	3004	04884	3006	04886	3008	04888	3010	04890	3012	04892	3014	04894	3016	04896	3018	04898
3020	048A0	3022	048A2	3024	048A4	3026	048A6	3028	048A8	3030	048B0	3032	048B2	3034	048B4	3036	048B6	3038	048B8
3040	048C0	3042	048C2	3044	048C4	3046	048C6	3048	048C8	3050	048D0	3052	048D2	3054	048D4	3056	048D6	3058	048D8
3060	048E0	3062	048E2	3064	048E4	3066	048E6	3068	048E8	3070	048F0	3072	048F2	3074	048F4	3076	048F6	3078	048F8
3080	04A88	3082	04A8A	3084	04A8C	3086	04A8E	3088	04E88	3090	04A98	3092	04A9A	3094	04A9C	3096	04A9E	3098	04E98
3100	04980	3102	04982	3104	04984	3106	04986	3108	04988	3110	04990	3112	04992	3114	04994	3116	04996	3118	04998
3120	049A0	3122	049A2	3124	049A4	3126	049A6	3128	049A8	3130	049B0	3132	049B2	3134	049B4	3136	049B6	3138	049B8
3140	049C0	3142	049C2	3144	049C4	3146	049C6	3148	049C8	3150	049D0	3152	049D2	3154	049D4	3156	049D6	3158	049D8
3160	049E0	3162	049E2	3164	049E4	3166	049E6	3168	049E8	3170	049F0	3172	049F2	3174	049F4	3176	049F6	3178	049F8
3180	04B88	3182	04B8A	3184	04B8C	3186	04B8E	3188	04F88	3190	04B98	3192	04B9A	3194	04B9C	3196	04B9E	3198	04F98
3200	04A80	3202	04A82	3204	04A84	3206	04A86	3208	0488A	3210	04A90	3212	04A92	3214	04A94	3216	04A96	3218	0489A
3220	04AA0	3222	04AA2	3224	04AA4	3226	04AA6	3228	048AA	3230	04AB0	3232	04AB2	3234	04AB4	3236	04AB6	3238	048BA
3240	04AC0	3242	04AC2	3244	04AC4	3246	04AC6	3248	048CA	3250	04AD0	3252	04AD2	3254	04AD4	3256	04AD6	3258	048DA
3260	04AE0	3262	04AE2	3264	04AE4	3266	04AE6	3268	048EA	3270	04AF0	3272	04AF2	3274	04AF4	3276	04AF6	3278	048FA
3280	04AA8	3282	04AAA	3284	04AAC	3286	04AAE	3288	04EA8	3290	04AB8	3292	04ABA	3294	04ABC	3296	04ABE	3298	04EB8
3300	04B80	3302	04B82	3304	04B84	3306	04B86	3308	0498A	3310	04B90	3312	04B92	3314	04B94	3316	04B96	3318	0499A
3320	04BA0	3322	04BA2	3324	04BA4	3326	04BA6	3328	049AA	3330	04BB0	3332	04BB2	3334	04BB4	3336	04BB6	3338	049BA
3340	04BC0	3342	04BC2	3344	04BC4	3346	04BC6	3348	049CA	3350	04BD0	3352	04BD2	3354	04BD4	3356	04BD6	3358	049DA
3360	04BE0	3362	04BE2	3364	04BE4	3366	04BE6	3368	049EA	3370	04BF0	3372	04BF2	3374	04BF4	3376	04BF6	3378	049FA
3380	04BA8	3382	04BAA	3384	04BAC	3386	04BAE	3388	04FA8	3390	04BB8	3392	04BBA	3394	04BBC	3396	04BBE	3398	04FB8
3400	04C80	3402	04C82	3404	04C84	3406	04C86	3408	0488C	3410	04C90	3412	04C92	3414	04C94	3416	04C96	3418	0489C
3420	04CA0	3422	04CA2	3424	04CA4	3426	04CA6	3428	048AC	3430	04CB0	3432	04CB2	3434	04CB4	3436	04CB6	3438	048BC
3440	04CC0	3442	04CC2	3444	04CC4	3446	04CC6	3448	048CC	3450	04CD0	3452	04CD2	3454	04CD4	3456	04CD6	3458	048DC
3460	04CE0	3462	04CE2	3464	04CE4	3466	04CE6	3468	048EC	3470	04CF0	3472	04CF2	3474	04CF4	3476	04CF6	3478	048FC
3480	04AC8	3482	04ACA	3484	04ACC	3486	04ACE	3488	04EC8	3490	04AD8	3492	04ADA	3494	04ADC	3496	04ADE	3498	04ED8
3500	04D80	3502	04D82	3504	04D84	3506	04D86	3508	0498C	3510	04D90	3512	04D92	3514	04D94	3516	04D96	3518	0499C
3520	04DA0	3522	04DA2	3524	04DA4	3526	04DA6	3528	049AC	3530	04DB0	3532	04DB2	3534	04DB4	3536	04DB6	3538	049BC
3540	04DC0	3542	04DC2	3544	04DC4	3546	04DC6	3548	049CC	3550	04DD0	3552	04DD2	3554	04DD4	3556	04DD6	3558	049DC
3560	04DE0	3562	04DE2	3564	04DE4	3566	04DE6	3568	049EC	3570	04DF0	3572	04DF2	3574	04DF4	3576	04DF6	3578	049FC
3580	04BC8	3582	04BCA	3584	04BCC	3586	04BCE	3588	04FC8	3590	04BD8	3592	04BDA	3594	04BDC	3596	04BDE	3598	04FD8
3600	04E80	3602	04E82	3604	04E84	3606	04E86	3608	0488E	3610	04E90	3612	04E92	3614	04E94	3616	04E96	3618	0489E
3620	04EA0	3622	04EA2	3624	04EA4	3626	04EA6	3628	048AE	3630	04EB0	3632	04EB2	3634	04EB4	3636	04EB6	3638	048BE
3640	04EC0	3642	04EC2	3644	04EC4	3646	04EC6	3648	048CE	3650	04ED0	3652	04ED2	3654	04ED4	3656	04ED6	3658	048DE
3660	04EE0	3662	04EE2	3664	04EE4	3666	04EE6	3668	048EE	3670	04EF0	3672	04EF2	3674	04EF4	3676	04EF6	3678	048FE
3680	04AE8	3682	04AEA	3684	04AEC	3686	04AEE	3688	04EE8	3690	04AF8	3692	04AFA	3694	04AFC	3696	04AFE	3698	04EF8
3700	04F80	3702	04F82	3704	04F84	3706	04F86	3708	0498E	3710	04F90	3712	04F92	3714	04F94	3716	04F96	3718	0499E
3720	04FA0	3722	04FA2	3724	04FA4	3726	04FA6	3728	049AE	3730	04FB0	3732	04FB2	3734	04FB4	3736	04FB6	3738	049BE
3740	04FC0	3742	04FC2	3744	04FC4	3746	04FC6	3748	049CE	3750	04FD0	3752	04FD2	3754	04FD4	3756	04FD6	3758	049DE
3760	04FE0	3762	04FE2	3764	04FE4	3766	04FE6	3768	049EE	3770	04FF0	3772	04FF2	3774	04FF4	3776	04FF6	3778	049FE
3780	04BE8	3782	04BEA	3784	04BEC	3786	04BEE	3788	04FE8	3790	04BF8	3792	04BFA	3794	04BFC	3796	04BFE	3798	04FF8
3800	04C88	3802	04C8A	3804	04C8C	3806	04C8E	3808	04E8A	3810	04C98	3812	04C9A	3814	04C9C	3816	04C9E	3818	04E9A
3820	04CA8	3822	04CAA	3824	04CAC	3826	04CAE	3828	04EAA	3830	04CB8	3832	04CBA	3834	04CBC	3836	04CBE	3838	04EBA
3840	04CC8	3842	04CCA	3844	04CCC	3846	04CCE	3848	04ECA	3850	04CD8	3852	04CDA	3854	04CDC	3856	04CDE	3858	04EDA
3860	04CE8	3862	04CEA	3864	04CEC	3866	04CEE	3868	04EEA	3870	04CF8	3872	04CFA	3874	04CFC	3876	04CFE	3878	04EFA
3880	04E8C	3882	04EAC	3884	04ECC	3886	04EEC	3888	04E8E	3890	04E9C	3892	04EBC	3894	04EDC	3896	04EFC	3898	04E9E
3900	04D88	3902	04D8A	3904	04D8C	3906	04D8E	3908	04F8A	3910	04D98	3912	04D9A	3914	04D9C	3916	04D9E	3918	04F9A
3920	04DA8	3922	04DAA	3924	04DAC	3926	04DAE	3928	04FAA	3930	04DB8	3932	04DBA	3934	04DBC	3936	04DBE	3938	04FBA
3940	04DC8	3942	04DCA	3944	04DCC	3946	04DCE	3948	04FCA	3950	04DD8	3952	04DDA	3954	04DDC	3956	04DDE	3958	04FDA
3960	04DE8	3962	04DEA	3964	04DEC	3966	04DEE	3968	04FEA	3970	04DF8	3972	04DFA	3974	04DFC	3976	04DFE	3978	04FFA
3980	04F8C	3982	04FAC	3984	04FCC	3986	04FEC	3988	04F8E	3990	04F9C	3992	04FBC	3994	04FDC	3996	04FFC	3998	04F9E

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
4000	05000	4002	05002	4004	05004	4006	05006	4008	05008	4010	05010	4012	05012	4014	05014	4016	05016	4018	05018
4020	05020	4022	05022	4024	05024	4026	05026	4028	05028	4030	05030	4032	05032	4034	05034	4036	05036	4038	05038
4040	05040	4042	05042	4044	05044	4046	05046	4048	05048	4050	05050	4052	05052	4054	05054	4056	05056	4058	05058
4060	05060	4062	05062	4064	05064	4066	05066	4068	05068	4070	05070	4072	05072	4074	05074	4076	05076	4078	05078
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
4400	05400	4402	05402	4404	05404	4406	05406	4408	0500C	4410	05410	4412	05412	4414	05414	4416	05416	4418	0501C
4420	05420	4422	05422	4424	05424	4426	05426	4428	0502C	4430	05430	4432	05432	4434	05434	4436	05436	4438	0503C
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
4520	05520	4522	05522	4524	05524	4526	05526	4528	0512C	4530	05530	4532	05532	4534	05534	4536	05536	4538	0513C
4540	05540	4542	05542	4544	05544	4546	05546	4548	0514C	4550	05550	4552	05552	4554	05554	4556	05556	4558	0515C
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
4600	05600	4602	05602	4604	05604	4606	05606	4608	0500E	4610	05610	4612	05612	4614	05614	4616	05616	4618	0501E
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
4660	05660	4662	05662	4664	05664	4666	05666	4668	0506E	4670	05670	4672	05672	4674	05674	4676	05676	4678	0507E
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
4900	05508	4902	0550A	4904	0550C	4906	0550E	4908	0570A	4910	05518	4912	0551A	4914	0551C	4916	0551E	4918	0571A
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
5000	05080	5002	05082	5004	05084	5006	05086	5008	05088	5010	05090	5012	05092	5014	05094	5016	05096	5018	05098
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
5080	05288	5082	0528A	5084	0528C	5086	0528E	5088	05688	5090	05298	5092	0529A	5094	0529C	5096	0529E	5098	05698
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
5200	05280	5202	05282	5204	05284	5206	05286	5208	0508A	5210	05290	5212	05292	5214	05294	5216	05296	5218	0509A
5220	052A0	5222	052A2	5224	052A4	5226	052A6	5228	050AA	5230	052B0	5232	052B2	5234	052B4	5236	052B6	5238	050BA
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
5280	052A8	5282	052AA	5284	052AC	5286	052AE	5288	056A8	5290	052B8	5292	052BA	5294	052BC	5296	052BE	5298	056B8
5300	05380	5302	05382	5304	05384	5306	05386	5308	0518A	5310	05390	5312	05392	5314	05394	5316	05396	5318	0519A
5320	053A0	5322	053A2	5324	053A4	5326	053A6	5328	051AA	5330	053B0	5332	053B2	5334	053B4	5336	053B6	5338	051BA
5340	053C0	5342	053C2	5344	053C4	5346	053C6	5348	051CA	5350	053D0	5352	053D2	5354	053D4	5356	053D6	5358	051DA
5360	053E0	5362	053E2	5364	053E4	5366	053E6	5368	051EA	5370	053F0	5372	053F2	5374	053F4	5376	053F6	5378	051FA
5380	053A8	5382	053AA	5384	053AC	5386	053AE	5388	057A8	5390	053B8	5392	053BA	5394	053BC	5396	053BE	5398	057B8
5400	05480	5402	05482	5404	05484	5406	05486	5408	0508C	5410	05490	5412	05492	5414	05494	5416	05496	5418	0509C
5420	054A0	5422	054A2	5424	054A4	5426	054A6	5428	050AC	5430	054B0	5432	054B2	5434	054B4	5436	054B6	5438	050BC
5440	054C0	5442	054C2	5444	054C4	5446	054C6	5448	050CC	5450	054D0	5452	054D2	5454	054D4	5456	054D6	5458	050DC
5460	054E0	5462	054E2	5464	054E4	5466	054E6	5468	050EC	5470	054F0	5472	054F2	5474	054F4	5476	054F6	5478	050FC
5480	052C8	5482	052CA	5484	052CC	5486	052CE	5488	056C8	5490	052D8	5492	052DA	5494	052DC	5496	052DE	5498	056D8
5500	05580	5502	05582	5504	05584	5506	05586	5508	0518C	5510	05590	5512	05592	5514	05594	5516	05596	5518	0519C
5520	055A0	5522	055A2	5524	055A4	5526	055A6	5528	051AC	5530	055B0	5532	055B2	5534	055B4	5536	055B6	5538	051BC
5540	055C0	5542	055C2	5544	055C4	5546	055C6	5548	051CC	5550	055D0	5552	055D2	5554	055D4	5556	055D6	5558	051DC
5560	055E0	5562	055E2	5564	055E4	5566	055E6	5568	051EC	5570	055F0	5572	055F2	5574	055F4	5576	055F6	5578	051FC
5580	053C8	5582	053CA	5584	053CC	5586	053CE	5588	057C8	5590	053D8	5592	053DA	5594	053DC	5596	053DE	5598	057D8
5600	05680	5602	05682	5604	05684	5606	05686	5608	0508E	5610	05690	5612	05692	5614	05694	5616	05696	5618	0509E
5620	056A0	5622	056A2	5624	056A4	5626	056A6	5628	050AE	5630	056B0	5632	056B2	5634	056B4	5636	056B6	5638	050BE
5640	056C0	5642	056C2	5644	056C4	5646	056C6	5648	050CE	5650	056D0	5652	056D2	6554	056D4	5656	056D6	5658	050DE
5660	056E0	5662	056E2	5664	056E4	5666	056E6	5668	050EE	5670	056F0	5672	056F2	5674	056F4	5676	056F6	5678	050FE
5680	052E8	5682	052EA	5684	052EC	5686	052EE	5688	056E8	5690	052F8	5692	052FA	5694	052FC	5696	052FE	5698	056F8
5700	05780	5702	05782	5704	05784	5706	05786	5708	0518E	5710	05790	5712	05792	5714	05794	5716	05796	5718	0519E
5720	057A0	5722	057A2	5724	057A4	5726	057A6	5728	051AE	5730	057B0	5732	057B2	5734	057B4	5736	057B6	5738	051BE
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
5780	053E8	5782	053EA	5784	053EC	5786	053EE	5788	057E8	5790	053F8	5792	053FA	5794	053FC	5796	053FE	5798	057F8
5800	05488	5802	0548A	5804	0548C	5806	0548E	5808	0568A	5810	05498	5812	0549A	5814	0549C	5816	0549E	5818	0569A
5820	054A8	5822	054AA	5824	054AC	5826	054AE	5828	056AA	5830	054B8	5832	054BA	5834	054BC	5836	054BE	5838	056BA
5840	054C8	5842	054CA	5844	054CC	5846	054CE	5848	056CA	5850	054D8	5852	054DA	5854	054DC	5856	054DE	5858	056DA
5860	054E8	5862	054EA	5864	054EC	5866	054EE	5868	056EA	5870	054F8	5872	054FA	5874	054FC	5876	054FE	5878	056FA
5880	0568C	5882	056AC	5884	056CC	5886	056EC	5888	0568E	5890	0569C	5892	056BC	5894	056DC	5896	056FC	5898	0569E
5900	05588	5902	0558A	5904	0558C	5906	0558E	5908	0578A	5910	05598	5912	0559A	5914	0559C	5916	0559E	5918	0579A
5920	055A8	5922	055AA	5924	055AC	5926	055AE	5928	057AA	5930	055B8	5932	055BA	5934	055BC	5936	055BE	5938	057BA
5940	055C8	5942	055CA	5944	055CC	5946	055CE	5948	057CA	5950	055D8	5952	055DA	5954	055DC	5956	055DE	5958	057DA
5960	055E8	5962	055EA	5964	055EC	5966	055EE	5968	057EA	5970	055F8	5972	055FA	5974	055FC	5976	055FE	5978	057FA
5980	0578C	5982	057AC	5984	057CC	5986	057EC	5988	0578E	5990	0579C	5992	057BC	5994	057DC	5996	057FC	5998	0579E

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
6000	05800	6002	05802	6004	05804	6006	05806	6008	05808	6010	05810	6012	05812	6014	05814	6016	05816	6018	05818
6020	05820	6022	05822	6024	05824	6026	05826	6028	05828	6030	05830	6032	05832	6034	05834	6036	05836	6038	05838
6040	05840	6042	05842	6044	05844	6046	05846	6048	05848	6050	05850	6052	05852	6054	05854	6056	05856	6058	05858
6060	05860	6062	05862	6064	05864	6066	05866	6068	05868	6070	05870	6072	05872	6074	05874	6076	05876	6078	05878
6080	05A08	6082	05A0A	6084	05A0C	6086	05A0E	6088	05E08	6090	05A18	6092	05A1A	6094	05A1C	6096	05A1E	6098	05E18
6100	05900	6102	05902	6104	05904	6106	05906	6108	05908	6110	05910	6112	05912	6114	05914	6116	05916	6118	05918
6120	05920	6122	05922	6124	05924	6126	05926	6128	05928	6130	05930	6132	05932	6134	05934	6136	05936	6138	05938
6140	05940	6142	05942	6144	05944	6146	05946	6148	05948	6150	05950	6152	05952	6154	05954	6156	05956	6158	05958
6160	05960	6162	05962	6164	05964	6166	05966	6168	05968	6170	05970	6172	05972	6174	05974	6176	05976	6178	05978
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
6300	05B00	6302	05B02	6304	05B04	6306	05B06	6308	0590A	6310	05B10	6312	05B12	6314	05B14	6316	05B16	6318	0591A
6320	05B20	6322	05B22	6324	05B24	6326	05B26	6328	0592A	6330	05B30	6332	05B32	6334	05B34	6336	05B36	6338	0593A
6340	05B40	6342	05B42	6344	05B44	6346	05B46	6348	0594A	6350	05B50	6352	05B52	6354	05B54	6356	05B56	6358	0595A
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
6400	05C00	6402	05C02	6404	05C04	6406	05C06	6408	0580C	6410	05C10	6412	05C12	6414	05C14	6416	05C16	6418	0581C
6420	05C20	6422	05C22	6424	05C24	6426	05C26	6428	0582C	6430	05C30	6432	05C32	6434	05C34	6436	05C36	6438	0583C
6440	05C40	6442	05C42	6444	05C44	6446	05C46	6448	0584C	6450	05C50	6452	05C52	6454	05C54	6456	05C56	6458	0585C
6460	05C60	6462	05C62	6464	05C64	6466	05C66	6468	0586C	6470	05C70	6472	05C72	6474	05C74	6476	05C76	6478	0587C
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
6520	05D20	6522	05D22	6524	05D24	6526	05D26	6528	0592C	6530	05D30	6532	05D32	6534	05D34	6536	05D36	6538	0593C
6540	05D40	6542	05D42	6544	05D44	6546	05D46	6548	0594C	6550	05D50	6552	05D52	6554	05D54	6556	05D56	6558	0595C
6560	05D60	6562	05D62	6564	05D64	6566	05D66	6568	0596C	6570	05D70	6572	05D72	6574	05D74	6576	05D76	6578	0597C
6580	05B48	6582	05B4A	6584	05B4C	6586	05B4E	6588	05F48	6590	05B58	6592	05B5A	6594	05B5C	6596	05B5E	6598	05F58
6600	05E00	6602	05E02	6604	05E04	6606	05E06	6608	0580E	6610	05E10	6612	05E12	6614	05E14	6616	05E16	6618	0581E
6620	05E20	6622	05E22	6624	05E24	6626	05E26	6628	0582E	6630	05E30	6632	05E32	6634	05E34	6636	05E36	6638	0583E
6640	05E40	6642	05E42	6644	05E44	6646	05E46	6648	0584E	6650	05E50	6652	05E52	6654	05E54	6656	05E56	6658	0585E
6660	05E60	6662	05E62	6664	05E64	6666	05E66	6668	0586E	6670	05E70	6672	05E72	6674	05E74	6676	05E76	6678	0587E
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
6840	05C48	6842	05C4A	6844	05C4C	6846	05C4E	6848	05E4A	6850	05C58	6852	05C5A	6854	05C5C	6856	05C5E	6858	05E5A
6860	05C68	6862	05C6A	6864	05C6C	6866	05C6E	6868	05E6A	6870	05C78	6872	05C7A	6874	05C7C	6876	05C7E	6878	05E7A
6880	05E0C	6882	05E2C	6884	05E4C	6886	05E6C	6888	05E0E	6890	05E1C	6892	05E3C	6894	05E5C	6896	05E7C	6898	05E1E
6900	05D08	6902	05D0A	6904	05D0C	6906	05D0E	6908	05F0A	6910	05D18	6912	05D1A	6914	05D1C	6916	05D1E	6918	05F1A
6920	05D28	6922	05D2A	6924	05D2C	6926	05D2E	6928	05F2A	6930	05D38	6932	05D3A	6934	05D3C	6936	05D3E	6938	05F3A
6940	05D48	6942	05D4A	6944	05D4C	6946	05D4E	6948	05F4A	6950	05D58	6952	05D5A	6954	05D5C	6956	05D5E	6958	05F5A
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
7000	05880	7002	05882	7004	05884	7006	05886	7008	05888	7010	05890	7012	05892	7014	05894	7016	05896	7018	05898
7020	058A0	7022	058A2	7024	058A4	7026	058A6	7028	058A8	7030	058B0	7032	058B2	7034	058B4	7036	058B6	7038	058B8
7040	058C0	7042	058C2	7044	058C4	7046	058C6	7048	058C8	7050	058D0	7052	058D2	7054	058D6	7056	058D6	7058	058D8
7060	058E0	7062	058E2	7064	058E4	7066	058E6	7068	058E8	7070	058F0	7072	058F2	7074	058F4	7076	058F6	7078	058F8
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	7112	05992	7114	05994	7116	05996	7118	05998
7120	059A0	7122	059A2	7124	059A4	7126	059A6	7128	059A8	7130	059B0	7132	059B2	7134	059B4	7136	059B6	7138	059B8
7140	059C0	7142	059C2	7144	059C4	7146	059C6	7148	059C8	7150	059D0	7152	059D2	7154	059D4	7156	059D6	7158	059D8
7160	059E0	7162	059E2	7164	059E4	7166	059E6	7168	059E8	7170	059F0	7172	059F2	7174	059F4	7176	059F6	7178	059F8
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	7212	05A92	7214	05A94	7216	05A96	7218	0589A
7220	05AA0	7222	05AA2	7224	05AA4	7226	05AA6	7228	058AA	7230	05AB0	7232	05AB2	7234	05AB4	7236	05AB6	7238	058BA
7240	05AC0	7242	05AC2	7244	05AC4	7246	05AC6	7248	058CA	7250	05AD0	7252	05AD2	7254	05AD4	7256	05AD6	7258	058DA
7260	05AE0	7262	05AE2	7264	05AE4	7266	05AE6	7268	058EA	7270	05AF0	7272	05AF2	7274	05AF4	7276	05AF6	7278	058FA
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	7312	05B92	7314	05B94	7316	05B96	7318	0599A
7320	05BA0	7322	05BA2	7324	05BA4	7326	05BA6	7328	059AA	7330	05BB0	7332	05BB2	7334	05BB4	7336	05BB6	7338	059BA
7340	05BC0	7342	05BC2	7344	05BC4	7346	05BC6	7348	059CA	7350	05BD0	7352	05BD2	7354	05BD4	7356	05BD6	7358	059DA
7360	05BE0	7362	05BE2	7364	05BE4	7366	05BE6	7368	059EA	7370	05BF0	7372	05BF2	7374	05BF4	7376	05BF6	7378	059FA
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	7412	05C92	7414	05C94	7416	05C96	7418	0589C
7420	05CA0	7422	05CA2	7424	05CA4	7426	05CA6	7428	058AC	7430	05CB0	7432	05CB2	7434	05CB4	7436	05CB6	7438	058BC
7440	05CC0	7442	05CC2	7444	05CC4	7446	05CC6	7448	058CC	7450	05CD0	7452	05CD2	7454	05CD4	7456	05CD6	7458	058DC
7460	05CE0	7462	05CE2	7464	05CE4	7466	05CE6	7468	058EC	7470	05CF0	7472	05CF2	7474	05CF4	7476	05CF6	7478	058FC
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	7512	05D92	7514	05D94	7516	05D96	7518	0599C
7520	05DA0	7522	05DA2	7524	05DA4	7526	05DA6	7528	059AC	7530	05DB0	7532	05DB2	7534	05DB4	7536	05DB6	7538	059BC
7540	05DC0	7542	05DC2	7544	05DC4	7546	05DC6	7548	059CC	7550	05DD0	7552	05DD2	7554	05DD4	7556	05DD6	7558	059DC
7560	05DE0	7562	05DE2	7564	05DE4	7566	05DE6	7568	059EC	7570	05DF0	7572	05DF2	7574	05DF4	7576	05DF6	7578	059FC
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	7612	05E92	7614	05E94	7616	05E96	7618	0589E
7620	05EA0	7622	05EA2	7624	05EA4	7626	05EA6	7628	058AE	7630	05EB0	7632	05EB2	7634	05EB4	7636	05EB6	7638	058BE
7640	05EC0	7642	05EC2	7644	05EC4	7646	05EC6	7648	058CE	7650	05ED0	7652	05ED2	7654	05ED4	7656	05ED6	7658	058DE
7660	05EE0	7662	05EE2	7664	05EE4	7666	05EE6	7668	058EE	7670	05EF0	7672	05EF2	7674	05EF4	7676	05EF6	7678	058FE
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	7712	05F92	7714	05F94	7716	05F96	7718	0599E
7720	05FA0	7722	05FA2	7724	05FA4	7726	05FA6	7728	059AE	7730	05FB0	7732	05FB2	7734	05FB4	7736	05FB6	7738	059BE
7740	05FC0	7742	05FC2	7744	05FC4	7746	05FC6	7748	059CE	7750	05FD0	7752	05FD2	7754	05FD4	7756	05FD6	7758	059DE
7760	05FE0	7762	05FE2	7764	05FE4	7766	05FE6	7768	059EE	7770	05FF0	7772	05FF2	7774	05FF4	7776	05FF6	7778	059FE
7780	05BE8	7782	05BEA	7784	05BEC	7786	05BEE	7788	05FE8	7790	05BF8	7792	05BFA	7794	05BFC	7796	05BFE	7798	05FF8
7800	05C88	7802	05C8A	7804	05C8C	7806	05C8E	7808	05E8A	7810	05C98	7812	05C9A	7814	05C9C	7816	05C9E	7818	05E9A
7820	05CA8	7822	05CAA	7824	05CAC	7826	05CAE	7828	05EAA	7830	05CB8	7832	05CBA	7834	05CBC	7836	05CBE	7838	05EBA
7840	05CC8	7842	05CCA	7844	05CCC	7846	05CCE	7848	05ECA	7850	05CD8	7852	05CDA	7854	05CDC	7856	05CDE	7858	05EDA
7860	05CE8	7862	05CEA	7864	05CEC	7866	05CEE	7868	05EEA	7870	05CF8	7872	05CFA	7874	05CFC	7876	05CFE	7878	05EFA
7880	05E8C	7882	05EAC	7884	05ECC	7886	05EEC	7888	05E8E	7890	05E9C	7892	05EBC	7894	05EDC	7896	05EFC	7898	05E9E
7900	05D88	7902	05D8A	7904	05D8C	7906	05D8E	7908	05F8A	7910	05D98	7912	05D9A	7914	05D9C	7916	05D9E	7918	05F9A
7920	05DA8	7922	05DAA	7924	05DAC	7926	05DAE	7928	05FAA	7930	05DB8	7932	05DBA	7934	05DBC	7936	05DBE	7938	05FBA
7940	05DC8	7942	05DCA	7944	05DCC	7946	05DCE	7948	05FCA	7950	05DD8	7952	05DDA	7954	05DDC	7956	05DDE	7958	05FDA
7960	05DE8	7962	05DEA	7964	05DEC	7966	05DEE	7968	05FEA	7970	05DF8	7972	05DFA	7974	05DFC	7976	05DFE	7978	05FFA
7980	05F8C	7982	05FAC	7984	05FCC	7986	05FEC	7988	05F8E	7990	05F9C	7992	05FBC	7994	05FDC	7996	05FFC	7998	05F9E

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
8000	06000	8002	06002	8004	06004	8006	06006	8008	06008	8010	06010	8012	06012	8014	06014	8016	06016	8018	06018
8020	06020	8022	06022	8024	06024	8026	06026	8028	06028	8030	06030	8032	06032	8034	06034	8036	06036	8038	06038
8040	06040	8042	06042	8044	06044	8046	06046	8048	06048	8050	06050	8052	06052	8054	06054	8056	06056	8058	06058
8060	06060	8062	06062	8064	06064	8066	06066	8068	06068	8070	06070	8072	06072	8074	06074	8076	06076	8078	06078
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
8220	06220	8222	06222	8224	06224	8226	06226	8228	0602A	8230	06230	8232	06232	8234	06234	8236	06236	8238	0603A
8240	06240	8242	06242	8244	06244	8246	06246	8248	0604A	8250	06250	8252	06252	8254	06254	8256	06256	8258	0605A
8260	06260	8262	06262	8264	06264	8266	06266	8268	0606A	8270	06270	8272	06272	8274	06274	8276	06276	8278	0607A
8280	06228	8282	0622A	8284	0622C	8286	0622E	8288	06628	8290	06238	8292	0623A	8294	0623C	8296	0623E	8298	06638
8300	06300	8302	06302	8304	06304	8306	06306	8308	0610A	8310	06310	8312	06312	8314	06314	8316	06316	8318	0611A
8320	06320	8322	06322	8324	06324	8326	06326	8328	0612A	8330	06330	8332	06332	8334	06334	8336	06336	8338	0613A
8340	06340	8342	06342	8344	06304	8346	06346	8348	0614A	8350	06350	8352	06352	8354	06354	8356	06356	8358	0615A
8360	06360	8362	06362	8364	06364	8366	06366	8368	0616A	8370	06370	8372	06372	8374	06374	8376	06376	8378	0617A
8380	06328	8382	0632A	8384	0632C	8386	0632E	8388	06728	8390	06338	8392	0633A	8394	0633C	8396	0633E	8398	06738
8400	06400	8402	06402	8404	06404	8406	06406	8408	0600C	8410	06410	8412	06412	8414	06414	8416	06416	8418	0601C
8420	06420	8422	06422	8424	06424	8426	06426	8428	0602C	8430	06430	8432	06432	8434	06434	8436	06436	8438	0603C
8440	06440	8442	06442	8444	06444	8446	06446	8448	0604C	8450	06450	8452	06452	8454	06454	8456	06456	8458	0605C
8460	06460	8462	06462	8464	06464	8466	06466	8468	0606C	8470	06470	8472	06472	8474	06474	8476	06476	8478	0607C
8480	06248	8482	0624A	8484	0624C	8486	0624E	8488	06648	8490	06258	8492	0625A	8494	0625C	8496	0625E	8498	06658
8500	06500	8502	06502	8504	06504	8506	06506	8508	0610C	8510	06510	8512	06512	8514	06514	8516	06516	8518	0611C
8520	06520	8522	06522	8524	06524	6526	06526	8528	0612C	8530	06530	8532	06532	8534	06534	8536	06536	8538	0613C
8540	06540	8542	06542	8544	06544	8546	06546	8548	0614C	8550	06550	8552	06552	8554	06554	8556	06556	8558	0615C
8560	06560	8562	06562	8564	06564	8566	06566	8568	0616C	8570	06570	8572	06575	8574	06574	8576	06576	8578	0617C
8580	06348	8582	0634A	8584	0634C	8586	0634E	8588	06748	8590	06358	8592	0635A	8594	0635C	8596	0635E	8598	06758
8600	06600	8602	06602	8604	06604	8606	06606	8608	0600E	8610	06610	8612	06612	8614	06614	8616	06616	8618	0601E
8620	06620	8622	06622	8624	06624	8626	06626	8628	0602E	8630	06630	8632	06632	8634	06634	8636	06636	8638	0603E
8640	06640	8642	06642	8644	06644	8646	06646	8648	0604E	8650	06650	8652	06652	8654	06654	8656	06656	8658	0605E
8660	06660	8662	06662	8664	06664	8666	06666	8668	0606E	8670	06670	8672	06672	8674	06674	8676	06676	8678	0607E
8680	06268	8682	0626A	8684	0626C	8686	0626E	8688	06668	8690	06278	8692	0627A	8694	0627C	8696	0627E	8698	06678
8700	06700	8702	06702	8704	06704	8706	06706	8708	0610E	8710	06710	8712	06712	8714	06714	8716	06716	8718	0611E
8720	06720	8722	06722	8724	06724	8726	06726	8728	0612E	8730	06730	8732	06732	8734	06734	8736	06736	8738	0613E
8740	06740	8742	06742	8744	06744	8746	06746	8748	0614E	8750	06750	8752	06752	8754	06754	8756	06756	8758	0615E
8760	06760	8762	06762	8764	06764	8766	06766	8768	0616E	8770	06770	8772	06772	8774	06774	8776	06776	8778	0617E
8780	06368	8782	0636A	8784	0636C	8786	0636E	8788	06768	8790	06378	8792	0637A	8794	0637C	8796	0637E	8798	06778
8800	06408	8802	0640A	8804	0640C	8806	0640E	8808	0660A	8810	06418	8812	0641A	8814	0641C	8816	0641E	8818	0661A
8820	06428	8822	0642A	8824	0642C	8826	0642E	8828	0662A	8830	06438	8832	0643A	8834	0643C	8836	0643E	8838	0663A
8840	06448	8842	0644A	8844	0644C	8846	0644E	8848	0664A	8850	06458	8852	0645A	8854	0645C	8856	0645E	8858	0665A
8860	06468	8862	0646A	8864	0646C	8866	0646E	8868	0666A	8870	06478	8872	0647A	8874	0647C	8876	0647E	8878	0667A
8880	0660C	8882	0662C	8884	0664C	8886	0666C	8888	0660E	8890	0661C	8892	0663C	8894	0665C	8896	0667C	8898	0661E
8900	06508	8902	0650A	8904	0650C	8906	0650E	8908	0670A	8910	06518	8912	0651A	8914	0651C	8916	0651E	8918	0671A
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
9000	06080	9002	06082	9004	06084	9006	06086	9008	06088	9010	06090	9012	06092	9014	06094	9016	06096	9018	06098
9020	060A0	9022	060A2	9024	060A4	9026	060A6	9028	060A8	9030	060B0	9032	060B2	9034	060B4	9036	060B6	9038	060B8
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
9080	06288	9082	0628A	9084	0628C	9086	0628E	9088	06688	9090	06298	9092	0629A	9094	0629C	9096	0629E	9098	06698
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	9359	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
9500	06580	9502	06582	9504	06584	9506	06586	9508	0618C	9510	06590	9512	06592	9514	06594	9516	06596	9518	0619C
9520	065A0	9522	065A2	9524	065A4	9526	065A6	9528	061AC	9530	065B0	9532	065B2	9534	065B4	9536	065B6	9538	061BC
9540	065C0	9542	065C2	9544	065C4	9546	065C6	9548	061CC	9550	065D0	9552	065D2	9554	065D4	9556	065D6	9558	061DC
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
9600	06680	9602	06682	9604	06684	9606	06686	9608	0608E	9610	06690	9612	06692	9614	06694	9616	06696	9618	0609E
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
9700	06780	9702	06782	9704	06784	9706	06786	9708	0618E	9710	06790	9712	06792	9714	06794	9716	06796	9718	0619E
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
9800	06488	9802	0648A	9804	0648C	9806	0648E	9808	0668A	9810	06498	9812	0649A	9814	0649C	9816	0649E	9818	0669A
9820	064A8	9822	064AA	9824	064AC	9826	064AE	9828	066AA	9830	064B8	9832	064BA	9834	064BC	9836	064BE	9838	066BA
9840	064C8	9842	064CA	9844	064CC	9846	064CE	9848	066CA	9850	064D8	9852	064DA	9854	064DC	9856	064DE	9858	066DA
9860	064E8	9862	064EA	9864	064EC	8966	064EE	9868	066EA	9870	064F8	9872	064FA	9874	064FC	9876	064FE	9878	066FA
9880	0668C	9882	066AC	9884	066CC	9886	066EC	9888	0668E	9890	0669C	9892	066BC	9894	066DC	9896	066FC	9898	0669E
9900	06588	9902	0658A	9904	0658C	9906	0658E	9908	0678A	9910	06598	9912	0659A	9914	0659C	9916	0659E	9918	0679A
9920	065A8	9922	065AA	9924	065AC	9926	065AE	9928	067AA	9930	065B8	9932	065BA	9934	065BC	9936	065BE	9938	067BA
9940	065C8	9942	065CA	9944	065CC	9946	065CE	9948	067CA	9950	065D8	9952	065DA	9954	065DC	9956	065DE	9958	067DA
9960	065E8	9962	065EA	9964	065EC	9966	065EE	9968	067EA	9970	065F8	9972	065FA	9974	065FC	9976	065FE	9978	067FA
9980	0678C	9982	067AC	9984	067CC	9986	067EC	9988	0678E	9990	0679C	9992	067BC	9994	067DC	9996	067FC	9998	0679E

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
10000	06800	10002	06802	10004	06804	10006	06806	10008	06808	10010	06810	10012	06812	10014	06814	10016	06816	10018	06818
10020	06820	10022	06822	10024	06824	10026	06826	10028	06828	10030	06830	10032	06832	10034	06834	10036	06836	10038	06838
10040	06840	10042	06842	10044	06844	10046	06846	10048	06848	10050	06850	10052	06852	10054	06854	10056	06856	10058	06858
10060	06860	10062	06862	10064	06864	10066	06866	10068	06868	10070	06870	10072	06872	10074	06874	10076	06876	10078	06878
10080	06A08	10082	06A0A	10084	06A0C	10086	06A0E	10088	06E08	10090	06A18	10092	06A1A	10094	06A1C	10096	06A1E	10098	06E18
10100	06900	10102	06902	10104	06904	10106	06906	10108	06908	10110	06910	10112	06912	10114	06914	10116	06916	10118	06918
10120	06920	10122	06922	10124	06924	10126	06926	10128	06928	10130	06930	10132	06932	10134	06934	10136	06936	10138	06938
10140	06940	10142	06942	10144	06944	10146	06946	10148	06948	10150	06950	10152	06952	10154	06954	10156	06956	10158	06958
10160	06960	10162	06962	10164	06964	10166	06966	10168	06968	10170	06970	10172	06972	10174	06974	10176	06976	10178	06978
10180	06B08	10182	06B0A	10184	06B0C	10186	06B0E	10188	06F08	10190	06B18	10192	06B1A	10194	06B1C	10196	06B1E	10198	06F18
10200	06A00	10202	06A02	10204	06A04	10206	06A06	10208	0680A	10210	06A10	10212	06A12	10214	06A14	10216	06A16	10218	0681A
10220	06A20	10222	06A22	10224	06A24	10226	06A26	10228	0682A	10230	06A30	10232	06A32	10234	06A34	10236	06A36	10238	0683A
10240	06A40	10242	06A42	10244	06A44	10246	06A46	10248	0684A	10250	06A50	10252	06A52	10254	06A54	10256	06A56	10258	0685A
10260	06A60	10262	06A62	10264	06A64	10266	06A66	10268	0686A	10270	06A70	10272	06A72	10274	06A74	10276	06A76	10278	0687A
10280	06A28	10282	06A2A	10284	06A2C	10286	06A2E	10288	06E28	10290	06A38	10292	06A3A	10294	06A3C	10296	06A3E	10298	06E38
10300	06B00	10302	06B02	10304	06B04	10306	06B06	10308	0690A	10310	06B10	10312	06B12	10314	06B14	10316	06B16	10318	0691A
10320	06B20	10322	06B22	10324	06B24	10326	06B26	10328	0692A	10330	06B30	10332	06B32	10334	06B34	10336	06B36	10338	0693A
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
10400	06C00	10402	06C02	10404	06C04	10406	06C06	10408	0680C	10410	06C10	10412	06C12	10414	06C14	10416	06C16	10418	0681C
10420	06C20	10422	06C22	10424	06C24	10426	06C26	10428	0682C	10430	06C30	10432	06C32	10434	06C34	10436	06C36	10438	0683C
10440	06C40	10442	06C42	10444	06C44	10446	06C46	10448	0684C	10450	06C50	10452	06C52	10454	06C54	10456	06C56	10458	0685C
10460	06C60	10462	06C62	10464	06C64	10466	06C66	10468	0686C	10470	06C70	10472	06C72	10474	06C74	10476	06C76	10478	0687C
10480	06A48	10482	06A4A	10484	06A4C	10486	06A4E	10488	06E48	10490	06A58	10492	06A5A	10494	06A5C	10496	06A5E	10498	06E58
10500	06D00	10502	06D02	10504	06D04	10506	06D06	10508	0690C	10510	06D10	10512	06D12	10514	06D14	10516	06D16	10518	0691C
10520	06D20	10522	06D22	10524	06D24	10526	06D26	10528	0692C	10530	06D30	10532	06D32	10534	06D34	10536	06D36	10538	0693C
10540	06D40	10542	06D42	10544	06D44	10546	06D46	10548	0694C	10550	06D50	10552	06D52	10554	06D54	10556	06D56	10558	0695C
10560	06D60	10562	06D62	10564	06D64	10566	06D66	10568	0696C	10570	06D70	10572	06D72	10574	06D74	10576	06D76	10578	0697C
10580	06B48	10582	06B4A	10584	06B4C	10586	06B4E	10588	06F48	10590	06B58	10592	06B5A	10594	06B5C	10596	06B5E	10598	06F58
10600	06E00	10602	06E02	10604	06E04	10606	06E06	10608	0680E	10610	06E10	10612	06E12	10614	06E14	10616	06E16	10618	0681E
10620	06E20	10622	06E22	10624	06E24	10626	06E26	10628	0682E	10630	06E30	10632	06E32	10634	06E34	10636	06E36	10638	0683E
10640	06E40	10642	06E42	10644	06E44	10646	06E46	10648	0684E	10650	06E50	10652	06E52	10654	06E54	10656	06E56	10658	0685E
10660	06E60	10662	06E62	10664	06E64	10666	06E66	10668	0686E	10670	06E70	10672	06E72	10674	06E74	10676	06E76	10678	0687E
10680	06A68	10682	06A6A	10684	06A6C	10686	06A6E	10688	06E68	10690	06A78	10692	06A7A	10694	06A7C	10696	06A7E	10698	06E78
10700	06F00	10702	06F02	10704	06F04	10706	06F06	10708	0690E	10710	06F10	10712	06F12	10714	06F14	10716	06F16	10718	0691E
10720	06F20	10722	06F22	10724	06F24	10726	06F26	10728	0692E	10730	06F30	10732	06F32	10734	06F34	10736	06F36	10738	0693E
10740	06F40	10742	06F42	10744	06F44	10746	06F46	10748	0694E	10750	06F50	10752	06F52	10754	06F54	10756	06F56	10758	0695E
10760	06F60	10762	06F62	10764	06F64	10766	06F66	10768	0696E	10770	06F70	10772	06F72	10774	06F74	10776	06F76	10778	0697E
10780	06B68	10782	06B6A	10784	06B6C	10786	06B6E	10788	06F68	10790	06B78	10792	06B7A	10794	06B7C	10796	06B7E	10798	06F78
10800	06C08	10802	06C0A	10804	06C0C	10806	06C0E	10808	06E0A	10810	06C18	10812	06C1A	10814	06C1C	10816	06C1E	10818	06E1A
10820	06C28	10822	06C2A	10824	06C2C	10826	06C2E	10828	06E2A	10830	06C38	10832	06C3A	10834	06C3C	10836	06C3E	10838	06E3A
10840	06C48	10842	06C4A	10844	06C4C	10846	06C4E	10848	06E4A	10850	06C58	10852	06C5A	10854	06C5C	10856	06C5E	10858	06E5A
10860	06C68	10862	06C6A	10864	06C6C	10866	06C6E	10868	06E6A	10870	06C78	10872	06C7A	10874	06C7C	10876	06C7E	10878	06E7A
10880	06E0C	10882	06E2C	10884	06E4C	10886	06E6C	10888	06E0E	10890	06E1C	10892	06E3C	10894	06E5C	10896	06E7C	10898	06E1E
10900	06D08	10902	06D0A	10904	06D0C	10906	06D0E	10908	06F0A	10910	06D18	10912	06D1A	10914	06D1C	10916	06D1E	10918	06F1A
10920	06D28	10922	06D2A	10924	06D2C	10926	06D2E	10928	06F2A	10930	06D38	10932	06D3A	10934	06D3C	10936	06D3E	10938	06F3A
10940	06D48	10942	06D4A	10944	06D4C	10946	06D4E	10948	06F4A	10950	06D58	10952	06D5A	10954	06D5C	10956	06D5E	10958	06F5A
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

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
11000	06880	11002	06882	11004	06884	11006	06886	11008	06888	11010	06890	11012	06892	11014	06894	11016	06896	11018	06898
11020	068A0	11022	068A2	11024	068A4	11026	068A6	11028	068A8	11030	068B0	11032	068B2	11034	068B4	11036	068B6	11038	068B8
11040	068C0	11042	068C2	11044	068C4	11046	068C6	11048	068C8	11050	068D0	11052	068D2	11054	068D4	11056	068D6	11058	068D8
11060	068E0	11062	068E2	11064	068E4	11066	068E6	11068	068E8	11070	068F0	11072	068F2	11074	068F4	11076	068F6	11078	068F8
11080	06A88	11082	06A8A	11084	06A8C	11086	06A8E	11088	06E88	11090	06A98	11092	06A9A	11094	06A9C	11096	06A9E	11098	06E98
11100	06980	11102	06982	11104	06984	11106	06986	11108	06988	11110	06990	11112	06992	11114	06994	11116	06996	11118	06998
11120	069A0	11122	069A2	11124	069A4	11126	069A6	11128	069A8	11130	069B0	11132	069B2	11134	069B4	11136	069B6	11138	069B8
11140	069C0	11142	069C2	11144	069C4	11146	069C6	11148	069C8	11150	069D0	11152	069D2	11154	069D4	11156	069D6	11158	069D8
11160	069E0	11162	069E2	11164	069E4	11166	069E6	11168	069E8	11170	069F0	11172	069F2	11174	069F4	11176	069F6	11178	069F8
11180	06B88	11182	06B8A	11184	06B8C	11186	06B8E	11188	06F88	11190	06B98	11192	06B9A	11194	06B9C	11196	06B9E	11198	06F98
11200	06A80	11202	06A82	11204	06A84	11206	06A86	11208	0688A	11210	06A90	11212	06A92	11214	06A94	11216	06A96	11218	0689A
11220	06AA0	11222	06AA2	11224	06AA4	11226	06AA6	11228	068AA	11230	06AB0	11232	06AB2	11234	06AB4	11236	06AB6	11238	068BA
11240	06AC0	11242	06AC2	11244	06AC4	11246	06AC6	11248	068CA	11250	06AD0	11252	06AD2	11254	06AD4	11256	06AD6	11258	068DA
11260	06AE0	11262	06AE2	11264	06AE4	11266	06AE6	11268	068EA	11270	06AF0	11272	06AF2	11274	06AF4	11276	06AF6	11278	068FA
11280	06AA8	11282	06AAA	11284	06AAC	11286	06AAE	11288	06EA8	11290	06AB8	11292	06ABA	11294	06ABC	11296	06ABE	11298	06EB8
11300	06B80	11302	06B82	11304	06B84	11306	06B86	11308	0698A	11310	06B90	11312	06B92	11314	06B94	11316	06B96	11318	0699A
11320	06BA0	11322	06BA2	11324	06BA4	11326	06BA6	11328	069AA	11330	06BB0	11332	06BB2	11334	06BB4	11336	06BB6	11338	069BA
11340	06BC0	11342	06BC2	11344	06BC4	11346	06BC6	11348	069CA	11350	06BD0	11352	06BD2	11354	06BD4	11356	06BD6	11358	069DA
11360	06BE0	11362	06BE2	11364	06BE4	11366	06BE6	11368	069EA	11370	06BF0	11372	06BF2	11374	06BF4	11376	06BF6	11378	069FA
11380	06BA8	11382	06BAA	11384	06BAC	11386	06BAE	11388	06FA8	11390	06BB8	11392	06BBA	11394	06BBC	11396	06BBE	11398	06FB8
11400	06C80	11402	06C82	11404	06C84	11406	06C86	11408	0688C	11410	06C90	11412	06C92	11414	06C94	11416	06C96	11418	0689C
11420	06CA0	11422	06CA2	11424	06CA4	11426	06CA6	11428	068AC	11430	06CB0	11432	06CB2	11434	06CB4	11436	06CB6	11438	068BC
11440	06CC0	11442	06CC2	11444	06CC4	11446	06CC6	11448	068CC	11450	06CD0	11452	06CD2	11454	06CD4	11456	06CD6	11458	068DC
11460	06CE0	11462	06CE2	11464	06CE4	11466	06CE6	11468	068EC	11470	06CF0	11472	06CF2	11474	06CF4	11476	06CF6	11478	068FC
11480	06AC8	11482	06ACA	11484	06ACC	11486	06ACE	11488	06EC8	11490	06AD8	11492	06ADA	11494	06ADC	11496	06ADE	11498	06ED8
11500	06D80	11502	06D82	11504	06D84	11506	06D86	11508	0698C	11510	06D90	11512	06D92	11514	06D94	11516	06D96	11518	0699C
11520	06DA0	11522	06DA2	11524	06DA4	11526	06DA6	11528	069AC	11530	06DB0	11532	06DB2	11534	06DB4	11536	06DB6	11538	069BC
11540	06DC0	11542	06DC2	11544	06DC4	11546	06DC6	11548	069CC	11550	06DD0	11552	06DD2	11554	06DD4	11556	06DD6	11558	069DC
11560	06DE0	11562	06DE2	11564	06DE4	11566	06DE6	11568	069EC	11570	06DF0	11572	06DF2	11574	06DF4	11576	06DF6	11578	069FC
11580	06BC8	11582	06BCA	11584	06BCC	11586	06BCE	11588	06FC8	11590	06BD8	11592	06BDA	11594	06BDC	11596	06BDE	11598	06FD8
11600	06E80	11602	06E82	11604	06E84	11606	06E86	11608	0688E	11610	06E90	11612	06E92	11614	06E94	11616	06E96	11618	0689E
11620	06EA0	11622	06EA2	11624	06EA4	11626	06EA6	11628	068AE	11630	06EB0	11632	06EB2	11634	06EB4	11636	06EB6	11638	068BE
11640	06EC0	11642	06EC2	11644	06EC4	11646	06EC6	11648	068CE	11650	06ED0	11652	06ED2	11654	06ED4	11656	06ED6	11658	068DE
11660	06EE0	11662	06EE2	11664	06EE4	11666	06EE6	11668	068EE	11670	06EF0	11672	06EF2	11674	06EF4	11676	06EF6	11678	068FE
11680	06AE8	11682	06AEA	11684	06AEC	11686	06AEE	11688	06EE8	11690	06AF8	11692	06AFA	11694	06AFC	11696	06AFE	11698	06EF8
11700	06F80	11702	06F82	11704	06F84	11706	06F86	11708	0698E	11710	06F90	11712	06F92	11714	06F94	11716	06F96	11718	0699E
11720	06FA0	11722	06FA2	11724	06FA4	11726	06FA6	11728	069AE	11730	06FB0	11732	06FB2	11734	06FB4	11736	06FB6	11738	069BE
11740	06FC0	11742	06FC2	11744	06FC4	11746	06FC6	11748	069CE	11750	06FD0	11752	06FD2	11754	06FD4	11756	06FD6	11758	069DE
11760	06FE0	11762	06FE2	11764	06FE4	11766	06FE6	11768	069EE	11770	06FF0	11772	06FF2	11774	06FF4	11776	06FF6	11778	069FE
11780	06BE8	11782	06BEA	11784	06BEC	11786	06BEE	11788	06FE8	11790	06BF8	11792	06BFA	11794	06BFC	11796	06BFE	11798	06FF8
11800	06C88	11802	06C8A	11804	06C8C	11806	06C8E	11808	06E8A	11810	06C98	11812	06C9A	11814	06C9C	11816	06C9E	11818	06E9A
11820	06CA8	11822	06CAA	11824	06CAC	11826	06CAE	11828	06EAA	11830	06CB8	11832	06CBA	11834	06CBC	11836	06CBE	11838	06EBA
11840	06CC8	11842	06CCA	11844	06CCC	11846	06CCE	11848	06ECA	11850	06CD8	11852	06CDA	11854	06CDC	11856	06CDE	11858	06EDA
11860	06CE8	11862	06CEA	11864	06CEC	11866	06CEE	11868	06EEA	11870	06CF8	11872	06CFA	11874	06CFC	11876	06CFE	11878	06EFA
11880	06E8C	11882	06EAC	11884	06ECC	11886	06EEC	11888	06E8E	11890	06E9C	11892	06EBC	11894	06EDC	11896	06EFC	11898	06E9E
11900	06D88	11902	06D8A	11904	06D8C	11906	06D8E	11908	06F8A	11910	06D98	11912	06D9A	11914	06D9C	11916	06D9E	11918	06F9A
11920	06DA8	11922	06DAA	11924	06DAC	11926	06DAE	11928	06FAA	11930	06DB8	11932	06DBA	11934	06DBC	11936	06DBE	11938	06FBA
11940	06DC8	11942	06DCA	11944	06DCC	11946	06DCE	11948	06FCA	11950	06DD8	11952	06DDA	11954	06DDC	11956	06DDE	11958	06FDA
11960	06DE8	11962	06DEA	11964	06DEC	11966	06DEE	11968	06FEA	11970	06DF8	11972	06DFA	11974	06DFC	11976	06DFE	11978	06FFA
11980	06F8C	11982	06FAC	11984	06FCC	11986	06FEC	11988	06F8E	11990	06F9C	11992	06FBC	11994	06FDC	11996	06FFC	11998	06F9E

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
12000	07000	12002	07002	12004	07004	12006	07006	12008	07008	12010	07010	12012	07012	12014	07014	12016	07016	12018	07018
12020	07020	12022	07022	12024	07024	12026	07026	12028	07028	12030	07030	12032	07032	12034	07034	12036	07036	12038	07038
12040	07040	12042	07042	12044	07044	12046	07046	12048	07048	12050	07050	12052	07052	12054	07054	12056	07056	12058	07058
12060	07060	12062	07062	12064	07064	12066	07066	12068	07068	12070	07070	12072	07072	12074	07074	12076	07076	12078	07078
12080	07208	12082	0720A	12084	0720C	12086	0720E	12088	07608	12090	07218	12092	0721A	12094	0721C	12096	0721E	12098	07618
12100	07100	12102	07102	12104	07104	12106	07106	12108	07108	12110	07110	12112	07112	12114	07114	12116	07116	12118	07118
12120	07120	12122	07122	12124	07124	12126	07126	12128	07128	12130	07130	12132	07132	12134	07134	12136	07136	12138	07138
12140	07140	12142	07142	12144	07144	12146	07146	12148	07148	12150	07150	12152	07152	12154	07154	12156	07156	12158	07158
12160	07160	12162	07162	12164	07164	12166	07166	12168	07168	12170	07170	12172	07172	12174	07174	12176	07176	12178	07178
12180	07308	12182	0730A	12184	0730C	12186	0730E	12188	07708	12190	07318	12192	0731A	12194	0731C	12196	0731E	12198	07718
12200	07200	12202	07202	12204	07204	12206	07206	12208	0700A	12210	07210	12212	07212	12214	07214	12216	07216	12218	0701A
12220	07220	12222	07222	12224	07224	12226	07226	12228	0702A	12230	07230	12232	07232	12234	07234	12236	07236	12238	0703A
12240	07240	12242	07242	12244	07244	12246	07246	12248	0704A	12250	07250	12252	07252	12254	07254	12256	07256	12258	0705A
12260	07260	12262	07262	12264	07264	12266	07266	12268	0706A	12270	07270	12272	07272	12274	07274	12276	07276	12278	0707A
12280	07228	12282	0722A	12284	0722C	12286	0722E	12288	07628	12290	07238	12292	0723A	12294	0723C	12296	0723E	12298	07638
12300	07300	12302	07302	12304	07304	12306	07306	12308	0710A	12310	07310	12312	07312	12314	07314	12316	07316	12318	0711A
12320	07320	12322	07322	12324	07324	12326	07326	12328	0712A	12330	07330	12332	07332	12334	07334	12336	07336	12338	0713A
12340	07340	12342	07342	12344	07344	12346	07346	12348	0714A	12350	07350	12352	07352	12354	07354	12356	07356	12358	0715A
12360	07360	12362	07362	12364	07364	12366	07366	12368	0716A	12370	07370	12372	07372	12374	07374	12376	07376	12378	0717A
12380	07328	12382	0732A	12384	0732C	12386	0732E	12388	07728	12390	07338	12392	0733A	12394	0733C	12396	0733E	12398	07738
12400	07400	12402	07402	12404	07404	12406	07406	12408	0700C	12410	07410	12412	07412	12414	07414	12416	07416	12418	0701C
12420	07420	12422	07422	12424	07424	12426	07426	12428	0702C	12430	07430	12432	07432	12434	07434	12436	07436	12438	0703C
12440	07440	12442	07442	12444	07444	12446	07446	12448	0704C	12450	07450	12452	07452	12454	07454	12456	07456	12458	0705C
12460	07460	12462	07462	12464	07464	12466	07466	12468	0706C	12470	07470	12472	07472	12474	07474	12476	07476	12478	0707C
12480	07248	12482	0724A	12484	0724C	12486	0724E	12488	07648	12490	07258	12492	0725A	12494	0725C	12496	0725E	12498	07658
12500	07500	12502	07502	12504	07504	12506	07506	12508	0710C	12510	07510	12512	07512	12514	07514	12516	07516	12518	0711C
12520	07520	12522	07522	12524	07524	12526	07526	12528	0712C	12530	07530	12532	07532	12534	07534	12536	07536	12538	0713C
12540	07540	12542	07542	12544	07544	12546	07546	12548	0714C	12550	07550	12552	07552	12554	07554	12556	07556	12558	0715C
12560	07560	12562	07562	12564	07564	12566	07566	12568	0716C	12570	07570	12572	07572	12574	07574	12576	07576	12578	0717C
12580	07348	12582	0734A	12584	0734C	12586	0734E	12588	07748	12590	07358	12592	0735A	12594	0735C	12596	0735E	12598	07758
12600	07600	12602	07602	12604	07604	12606	07606	12608	0700E	12610	07610	12612	07612	12614	07614	12616	07616	12618	0701E
12620	07620	12622	07622	12624	07624	12626	07626	12628	0702E	12630	07630	12632	07632	12634	07634	12636	07636	12638	0703E
12640	07640	12642	07642	12644	07644	12646	07646	12648	0704E	12650	07650	12652	07652	12654	07654	12656	07656	12658	0705E
12660	07660	12662	07662	12664	07664	12666	07666	12668	0706E	12670	07670	12672	07672	12674	07674	12676	07676	12678	0707E
12680	07268	12682	0726A	12684	0726C	12686	0726E	12688	07668	12690	07278	12692	0727A	12694	0727C	12696	0727E	12698	07678
12700	07700	12702	07702	12704	07704	12706	07706	12708	0710E	12710	07710	12712	07712	12714	07714	12716	07716	12718	0711E
12720	07720	12722	07722	12724	07724	12726	07726	12728	0712E	12730	07730	12732	07732	12734	07734	12736	07736	12738	0713E
12740	07740	12742	07742	12744	07744	12746	07746	12748	0714E	12750	07750	12752	07752	12754	07754	12756	07756	12758	0715E
12760	07760	12762	07762	12764	07764	12766	07766	12768	0716E	12770	07770	12772	07772	12774	07774	12776	07776	12778	0717E
12780	07368	12782	0736A	12784	0736C	12786	0736E	12788	07768	12790	07378	12792	0737A	12794	0737C	12796	0737E	12798	07778
12800	07408	12802	0740A	12804	0740C	12806	0740E	12808	0760A	12810	07418	12812	0741A	12814	0741C	12816	0741E	12818	0761A
12820	07428	12822	0742A	12824	0742C	12826	0742E	12828	0762A	12830	07438	12832	0743A	12834	0743C	12836	0743E	12838	0763A
12840	07448	12842	0744A	12844	0744C	12846	0744E	12848	0764A	12850	07458	12852	0745A	12854	0745C	12856	0745E	12858	0765A
12860	07468	12862	0746A	12864	0746C	12866	0746E	12868	0766A	12870	07478	12872	0747A	12874	0747C	12876	0747E	12878	0767A
12880	0760C	12882	0762C	12884	0764C	12886	0766C	12888	0760E	12890	0761C	12892	0763C	12894	0765C	12896	0767C	12898	0761E
12900	07508	12902	0750A	12904	0750C	12906	0750E	12908	0770A	12910	07518	12912	0751A	12914	0751C	12916	0751E	12918	0771A
12920	07528	12922	0752A	12924	0752C	12926	0752E	12928	0772A	12930	07538	12932	0753A	12934	0753C	12936	0753E	12938	0773A
12940	07548	12942	0754A	12944	0754C	12946	0754E	12948	0774A	12950	07558	12952	0755A	12954	0755C	12956	0755E	12958	0775A
12960	07568	12962	0756A	12964	0756C	12966	0756E	12968	0776A	12970	07578	12972	0757A	12974	0757C	12976	0757E	12978	0777A
12980	0770C	12982	0772C	12984	0774C	12986	0776C	12988	0770E	12990	0771C	12992	0773C	12994	0775C	12996	0777C	12998	0771E

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
13000 07080	13002 07082	13004 07084	13006 07086	13008 07088	13010 07090	13012 07092	13014 07094	13016 07096	13018 07098
13020 070A0	13022 070A2	13024 070A4	13026 070A6	13028 070A8	13030 070B0	13032 070B2	13034 070B4	13036 070B6	13038 070B8
13040 070C0	13042 070C2	13044 070C4	13046 070C6	13048 070C8	13050 070D0	13052 070D2	13054 070D4	13056 070D6	13058 070D8
13060 070E0	13062 070E2	13064 070E4	13066 070E6	13068 070E8	13070 070F0	13072 070F2	13074 070F4	13076 070F6	13078 070F8
13080 07288	13082 0728A	13084 0728C	13086 0728E	13088 07688	13090 07298	13092 0729A	13094 0729C	13096 0729E	13098 07698
13100 07180	13102 07182	13104 07184	13106 07186	13108 07188	13110 07190	13112 07192	13114 07194	13116 07196	13118 07198
13120 071A0	13122 071A2	13124 071A4	13126 071A6	13128 071A8	13130 071B0	13132 071B2	13134 071B4	13136 071B6	13138 071B8
13140 071C0	13142 071C2	13144 071C4	13146 071C6	13148 071C8	13150 071D0	13152 071D2	13154 071D4	13156 071D6	13158 071D8
13160 071E0	13162 071E2	13164 071E4	13166 071E6	13168 071E8	13170 071F0	13172 071F2	13174 071F4	13176 071F6	13178 071F8
13180 07388	13182 0738A	13184 0738C	13186 0738E	13188 07788	13190 07398	13192 0739A	13194 0739C	13196 0739E	13198 07798
13200 07280	13202 07282	13204 07284	13206 07286	13208 0708A	13210 07290	13212 07292	13214 07294	13216 07296	13218 0709A
13220 072A0	13222 072A2	13224 072A4	13226 072A6	13228 070AA	13230 072B0	13232 072B2	13234 072B4	13236 072B6	13238 070BA
13240 072C0	13242 072C2	13244 072C4	13246 072C6	13248 070CA	13250 072D0	13252 072D2	13254 072D4	13256 072D6	13258 070DA
13260 072E0	13262 072E2	13264 072E4	13266 072E6	13268 070EA	13270 072F0	13272 072F2	13274 072F4	13276 072F6	13278 070FA
13280 072A8	13282 072AA	13284 072AC	13286 072AE	13288 076A8	13290 072B8	13292 072BA	13294 072BC	13296 072BE	13298 076B8
13300 07380	13302 07382	13304 07384	13306 07386	13308 0718A	13310 07390	13312 07392	13314 07394	13316 07396	13318 0719A
13320 073A0	13322 073A2	13324 073A4	13326 073A6	13328 071AA	13330 073B0	13332 073B2	13334 073B4	13336 073B6	13338 071BA
13340 073C0	13342 073C2	13344 073C4	13346 073C6	13348 071CA	13350 073D0	13352 073D2	13354 073D4	13356 073D6	13358 071DA
13360 073E0	13362 073E2	13364 073E4	13366 073E6	13368 071EA	13370 073F0	13372 073F2	13374 073F4	13376 073F6	13378 071FA
13380 073A8	13382 073AA	13384 073AC	13386 073AE	13388 077A8	13390 073B8	13392 073BA	13394 073BC	13396 073BE	13398 077B8
13400 07480	13402 07482	13404 07484	13406 07486	13408 0708C	13410 07490	13412 07492	13414 07494	13416 07496	13418 0709C
13420 074A0	13422 074A2	13424 074A4	13426 074A6	13428 070AC	13430 074B0	13432 074B2	13434 074B4	13436 074B6	13438 070BC
13440 074C0	13442 074C2	13444 074C4	13446 074C6	13448 070CC	13450 074D0	13452 074D2	13454 074D4	13456 074D6	13458 070DC
13460 074E0	13462 074E2	13464 074E4	13466 074E6	13468 070EC	13470 074F0	13472 074F2	13474 074F4	13476 074F6	13478 070FC
13480 072C8	13482 072CA	13484 072CC	13486 072CE	13488 076C8	13490 072D8	13492 072DA	13494 072DC	13496 072DE	13498 076D8
13500 07580	13502 07582	13504 07584	13506 07586	13508 0718C	13510 07590	13512 07592	13514 07594	13516 07596	13518 0719C
13520 075A0	13522 075A2	13524 075A4	13526 075A6	13528 071AC	13530 075B0	13532 075B2	13534 075B4	13536 075B6	13538 071BC
13540 075C0	13542 075C2	13544 075C4	13546 075C6	13548 071CC	13550 075D0	13552 075D2	13554 075D4	13556 075D6	13558 071DC
13560 075E0	13562 075E2	13564 075E4	13566 075E6	13568 071EC	13570 075F0	13572 075F2	13574 075F4	13576 075F6	13578 071FC
13580 073C8	13582 073CA	13584 073CC	13586 073CE	13588 077C8	13590 073D8	13592 073DA	13594 073DC	13596 073DE	13598 077D8
13600 07680	13602 07682	13604 07684	13606 07686	13608 0708E	13610 07690	13612 07692	13614 07694	13616 07696	13618 0709E
13620 076A0	13622 076A2	13624 076A4	13626 076A6	13628 070AE	13630 076B0	13632 076B2	13634 076B4	13636 076B6	13638 070BE
13640 076C0	13642 076C2	13644 076C4	13646 076C6	13648 070CE	13650 076D0	13652 076D2	13654 076D4	13656 076D6	13658 070DE
13660 076E0	13662 076E2	13664 076E4	13666 076E6	13668 070EE	13670 076F0	13672 076F2	13674 076F4	13676 076F6	13678 070FE
13680 072E8	13682 072EA	13684 072EC	13686 072EE	13688 076E8	13690 072F8	13692 072FA	13694 072FC	13696 072FE	13698 076F8
13700 07780	13702 07782	13704 07784	13706 07786	13708 0718E	13710 07790	13712 07792	13714 07794	13716 07796	13718 0719E
13720 077A0	13722 077A2	13724 077A4	13726 077A6	13728 071AE	13730 077B0	13732 077B2	13734 077B4	13736 077B6	13738 071BE
13740 077C0	13742 077C2	13744 077C4	13746 077C6	13748 071CE	13750 077D0	13752 077D2	13754 077D4	13756 077D6	13758 071DE
13760 077E0	13762 077E2	13764 077E4	13766 077E6	13768 071EE	13770 077F0	13772 077F2	13774 077F4	13776 077F6	13778 071FE
13780 073E8	13782 073EA	13784 073EC	13786 073EE	13788 077E8	13790 073F8	13792 073FA	13794 073FC	13796 073FE	13798 077F8
13800 07488	13802 0748A	13804 0748C	13806 0748E	13808 0768A	13810 07498	13812 0749A	13814 0749C	13816 0749E	13818 0769A
13820 074A8	13822 074AA	13824 074AC	13826 074AE	13828 076AA	13830 074B8	13832 074BA	13834 074BC	13836 074BE	13838 076BA
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
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	14841	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
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	15156	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	07AAA	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	07FCA	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

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 multi-programming (value assigned to the symbolic parameter MPGMBLK times 2048)

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:

Parameter	Bytes
Fixed Overhead	3550
CATALOG=YES	770
FETCH=YES	305
EOJAADR	20
EOJBADR	20
HALTS=YES	310
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.

DISKDR=n (n≠0)	1650
DISKDR=130n	1650

DISKDR=1405	620
DVOL=YES (for 1311 support)	1045
DVOL=YES (for 1405 or 1301 support)	805
SCAN=YES and SCAN360=NO	610
SCAN=YES and SCAN360=YES	860
TRACKOP=YES (not 1405)	280
TRACKOP=YES (1405)	390
VERIFY=YES (not 1405)	325
VERIFY=YES (1405)	280
SECTORS=n	124n
TAPEDR=n (n≠0)	1155
TAPEMOD=MXEDPAR	1185
TAPLDMD=YES	240
TAPERRS=LOG	920
TAPERRS=LST	910
TAPERRS=LOGCHAR	695
TAPERRS=LSTCHAR	685
TAPEDR≠0 and/or DISKDR≠0	350
RDR1400=1402	550
READRSS=YES	200
COLBINR=YES	1230
RDR1400=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	550
PFR=YES or COM	270
COL51=YES	100
OSDUMP=YES and ERROPNG=NO	810
OSDUMP=YES and ERROPNG=YES	840
ERROPNG=YES and OSDUMP=NO	860
OSDISK=YES	780
OSTAPE=YES	660
OSDISK=YES and/or OSTAPE=YES	100
OSADDR=YES	80
OSALTER=YES	50
OSDSPLY=YES or nn	75

Table 17. Model 30 SYSIO Storage Estimates

i p	1 = 0	1 = 1	1 = 2	1 = 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

OSENTER=YES	70
OSINQRY=YES	480
OSINQRY=1400	360
OSINQRY=YES and DISKDR=0	2980
OSINQRY=YES and DISKDR$\neq$0	2980-100n

(where n=no. of sectors and is less than 30)

OSINQRY$\neq$NO and/or OSENTER=YES	280
OSINQRY$\neq$NO and/or OSDSPLY$\neq$NO	250
OSDSPLY$\neq$NO and/or OSENTER=YES	70
OSENTER=YES and/or OSALTER=YES and/or OSADDR=YES and/or OSDSPLY=YES	165
OSDUMP=YES and/or OSDSPLY=YES and/or OSALTER=YES and/or OSENTER=YES and/or OSADDR=YES and/or OSTAPE=YES and/or OSINQRY=YES and/or OSISK=YES	295

Sample Worksheet for Computing Model 30 Storage Requirements

1. DOS supervisor size _____

2. Size of 1400 system being simulated (1000 bytes per K) _____

3. Size of foreground area (MPGBLK*2048) _____

4. Tape I/O area (same as BUFSIZE value) _____

5. Emulator-Program size _____

Total main storage required _____

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

1. The constant 16,384 (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 multi-programming (value assigned to the symbolic parameter MPGMBLK times 2048)

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:

Parameter	Bytes
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 18)	

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 18.

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 (not 1405) 350+(2980-100n) (where n=sectors)	
TRACKOP=YES (1405)	1360
VERIFY=YES (not 1405)	455
VERIFY=YES (1405)	455
SECTORS=n	148n
TAPEDR=n (n≠0)	1830
TAPEMOD=MXEDPAR	920
TAPLDMD=YES	250
TAPERRS=LOG	940
TAPERRS=LST	990
TAPERRS=LOGCHAR	700
TAPERRS=LSTCHAR	725
TAPEDR≠0 and/or DISKDR≠0	350
RDR1400=1402	680
READRSS=YES	200
COLBINR=YES	1160
RDR1400=1442	630
READRSS=YES	100
COLBINR=YES	1440
PCH1400=1402 and PCH360=2540	700
PUNCHSS=YES	100
COLBINP=YES	730
PCH1400=1402 and PCH360=2520 or 1442	630
PUNCHSS=YES	130
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
OSDISK=YES and/or OSTAPE=YES	100

Table 18. Model 40 SYSIO Storage Estimates

i p	1 = 0	1 = 1	1 = 2	1 = 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

OSADDR=YES	645
OSALTER=YES	35
OSDSPLY=YES or nn	80
OSENTER=YES	125
OSINQRY=YES	935
OSINQRY=1400	815
OSINQRY=YES and DISKDR=0	2980
OSINQRY=YES and DISKDR$\neq$0	2980-100n

(where n = no. of
sectors and is less than 30)

OSENTER=YES and/or OSINQRY$\neq$NO	505
OSENTER=YES and/or OSALTER=YES and/or OSADDR=YES and/or OSDSPLY=YES	515

Sample Worksheet for Computing Model 40 Storage Requirements

1. Use the constant 16,384 for the beginning of 1400 memory   _____

2. Size of 1400 system being simulated (1024 bytes per K)   _____

3. Tape I/O area (same as BUFSIZE) value   _____

4. Size of foreground area (MPGMBLK*2048)   _____

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.

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 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.

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 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 assign-

```
// 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,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 10.   Emulator Program Generation for 1401/1460 Sample Program

```
// JOB    EUJOB2                                                          001
// OPTION LIST,DECK,XREF                                                  002
// EXEC   ASSEMBLY                                                        003
EUSAMP   [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

ments are desired, a // ASSGN control card must be provided for TAPE1. See paragraph on "Execution of the Sample Program."

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.

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. The arrangement of the cards for the catalog run is as follows:

```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
   PHASE euname,*
   INCLUDE ,(ACOMP00)
   PHASE eunameX,ACOMP00+nnn (for Model 30)
      or
   PHASE eunameX,nnn (for Model 40)
   INCLUDE ,(ACOMP01)
   INCLUDE
   (Place emulator object module here)
/*
   ENTRY EUENTRY
// EXEC LNKEDT
/&
```

where "euname" is the name of the generated Emulator Program (i.e., EUSAMPL or EUSAMP), and "nnn" is the size of the emulator communications region (variable).

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.

```
// 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.

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:

120

```
// 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 EUSAMP 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 parameter 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.

```
*                                                                          0001
*                                                                          0002
// 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           /0991,001/001116I0 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_M0 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%T0_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

```
*                                                                          0052
*                                                                          0053
// JOB 1440 SAMPLE PROGRAM FOR THE EMULATOR PROGRAM                        0054
// ASSGN SYSNNN,X'CUU'        SPECIFY 1400 TAPE 1 IF SYSTEM HAS TAPE       0055
// UPSI 01                                                                 0056
// EXEC              INSERT NAME OF EMULATOR PROGRAM                        0057
// 1400 S1440,1,1,,1,1,,T,01222                                           0058
,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_|                                                                 000410066
00609_,333_B108                                                         000610067
49401_|                                                                 000610068
00609_,414_B108                                                         000810069
57501_|                                                                 000810070
00609_,495_B108                                                         000810071
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 TO CORE IMAGE LIBRARY
BF // OPTION CATAL
BG     PHASE EUSAMPL,*
BG       INCLUDE ,(ACOMP00)
BG     PHASE EUSAMPLX,ACOMP00+456
BG       INCLUDE ,(ACOMP01)
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 Sample Program

```
         SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DOS


  001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
```

```
         SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DOS


  001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM
  020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789  1401/1440/1460  SAMPLE  PROGRAM


  SAMPLE PROGRAM COMPLETE
```

Figure 15. SYSLST Output for Sample Program

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.

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 (#A004).

* Storage Protection Feature (#7520) for Multiprogramming.

* One card reader (1442, 2520, or 2540) (see Note)

* One card punch (1443, 2520, or 2540) (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.

* 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-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.)

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 Card Read Punch

* 2540 Card Read Punch

* 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 or 2415 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 19.

• Table 19. 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 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 20. 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 20.

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 speci-
fied for the Model 30, the following pro-
gramming restrictions must be considered:

1. IBM 1301 Disk Storages, and IBM 1405
    Model 2 Disk Storages are not sup-
    ported due to Model 25 machine
    limitiations.

2. Floating Point Arithmetic, Sterling
    Arithmetic, and the Integrated Com-
    munications 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
    21.

CONSIDERATIONS

In addition to those considerations spe-
cified 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 se-
    lector 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 stan-
    dard 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 21.   Example of Field Lengths Affect-
              ing MICR Devices on Model 25

		Delay	
1400 Instructions		<1MSEC	<4MSEC
Load Characters (LCA)		La=147	La=322
Move Characters (MLC)		La=127	La=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 Group-mark (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 Zeroes (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 equiva-
lent to 1400-series devices, performs
approximately one to one with 1401
equipment.

Where more than one page reference is given, the first page number indicates the major reference.

READER'S COMMENT FORM

IBM System/360 Disk Operating System: 1401/1440/1460 Emulator Programs:
Compatibility Support/30, Compatibility Support/40

C27-6940-2

Please check or fill in the items below, adding explanations and other comments
in the space provided.

Which of the following terms best describes your job?
       ⊠ Programmer   ⊠ Systems Analyst   ⊠ Customer Engineer
       ⊠ Manager   ⊠ Engineer   ⊠ Systems Engineer
       ⊠ Operator   ⊠ Mathematician   ⊠ Sales Representative
       ⊠ Instructor   ⊠ Student/Trainee   ⊠ Other (explain) _____

Does your installation subscribe to the SRL Revision Service?   ⊠ Yes   ⊠ No

How did you use this publication?
       ⊠ As an introduction
       ⊠ As a reference manual
       ⊠ As a text (student)
       ⊠ As a text (instructor)
       ⊠ For another purpose (explain) _____

Did you find the material easy to read and understand?   ⊠ Yes   ⊠ No (explain below)

Did you find the material organized for convenient use?   ⊠ Yes   ⊠ No (explain below)

Specific criticisms (explain below)

       Clarifications on pages _____

       Additions on pages _____

       Deletions on pages _____

       Errors on pages _____

Explanations and other comments:

Thank you for your cooperation. No postage necessary if mailed in the U.S.A.

YOUR COMMENTS PLEASE . . .

This manual is one of a series which serves as reference sources for systems analysts, programmers and operators of IBM systems. Your answers to the questions on the back of this form, together with your comments, will help us produce better publications for your use. Each reply will be carefully reviewed by the persons responsible for writing and publishing this material. All comments and suggestions become the property of IBM.

Please note: Requests for copies of publications and for assistance in utilizing your IBM system should be directed to your IBM representative or to the IBM 'sales office serving your locality.
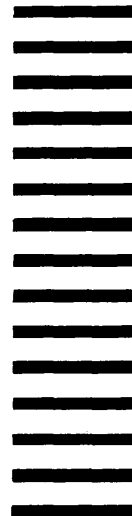
FOLD   FOLD

FIRST CLASS
PERMIT NO. 116
KINGSTON, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

POSTAGE WILL BE PAID BY

IBM CORPORATION

NEIGHBORHOOD ROAD

KINGSTON, N. Y. 12401

ATTN: PROGRAMMING PUBLICATIONS

DEPARTMENT 637

FOLD   FOLD

IBM
®

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, N.Y. 10601
[USA Only]

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
[International]

IBM