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**IBM System/360 Conversion Aids:
The 1620 Simulator
for IBM System/360**

Program Number 360C-SI-752

This document provides information on the IBM System/360 Simulator for the IBM 1620 Model 1 and Model 2, and is directed to the user who is replacing his IBM 1620 Model 1 or Model 2 Data Processing System with an IBM System/360 Model 30, 40, 50, 65, or 75. Simulation is a technique which uses System/360 instruction sequences to perform the functions of 1620 Model 1 or Model 2 instructions, thus permitting the user to execute object programs written for the 1620 Model 1 or Model 2.



PREFACE

This document contains information on the preparation and operation of the IBM System/360 Simulator for the IBM 1620 Model 1 and Model 2. The program simulates the operation of the IBM 1620 Model 1 and Model 2 Data Processing Systems, and permits the user to execute 1620 Model 1 and 1620 Model 2 programs on his System/360 Model 30, 40, 50, 65, or 75.

To simplify the presentation, the 1620 Model 1 and Model 2 systems are referred to in this document as the 1620 unless a particular system is being described. In the latter case, it is made clear which system is being considered.

The reader should be familiar with the contents of the following publications:

IBM System/360 System Summary, Form A22-6810

IBM System/360 Principles of Operation, Form A22-6821

IBM 1620 Central Processing Unit, Model 1, Form A26-5706

or

IBM 1620 Central Processing Unit, Model 2, Form A26-5781

IBM System/360 Model 30 Operator's Guide, Form A24-3373

IBM System/360 Model 40 Operating Techniques, Form C20-1635

IBM System/360 Model 50 Operating Procedures, Form A22-6908

IBM System/360 Model 65 Functional Characteristics, Form A22-6884

IBM System/360 Model 75 Functional Characteristics, Form A22-6889

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Significant changes or additions to the specifications contained in this publication will be reported in subsequent revisions or Technical Newsletters.

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THE SIMULATOR

The IBM System/360 Simulator for IBM 1620 Models 1 and 2 is a completely independent program which causes the System/360 to function logically as a 1620. The program contains all the routines required to simulate 1620 instructions and reserves an area of System/360 main storage to simulate the 1620 core storage. System/360 I/O devices perform the corresponding functions of the 1620 I/O devices.

The purpose of the Simulator is to aid a user during the period of transition from a 1620 installation to a System/360 installation. By enabling him to run existing 1620 programs on the System/360, it eliminates the need for immediate rewriting of all his 1620 programs. Data processing can thus continue normally while reprogramming is taking place.

Rewriting existing programs is desirable, since they do not make maximum use of the System/360 capabilities. The cost of rewriting infrequently used programs may be unwarranted and can be avoided by running them under control of the Simulator.

The Simulator system, distributed by IBM on tape (7-track or 9-track) or on cards, contains four separate programs, plus a sample program which demonstrates the use of the Simulator. The four programs are:

- SIM20, the simulation program
- EDITOR, used to adapt SIM20 to the particular 1620 system to be simulated, and to create an absolute, self-loading version of SIM20
- DSKINT, a disk initialization program used for those installations with 1311 Disk Storage Drives
- UPDT20, used to maintain the Simulator

All the Simulator programs are distributed on the same magnetic tape. For those System/360 installations which have no magnetic tape units, a punched-card version of the Simulator will be distributed.

The utility programs are in binary form, SIM20 and DSKINT are in symbolic form, and the sample program is in BCD.

After having been edited, SIM20 and DSKINT must be assembled; this should be

done using one of the assemblers described in the following publications:

- IBM System/360 Basic Operating System Assembler With Input/Output Macros (8K Disk), Form C24-3361
- IBM System/360 Basic Programming Support Assembler With Input/Output Macros (Tape), Form C24-3355
- IBM System/360 Disk and Tape Operating Systems, Assembler Specifications, Form C24-3414

When using the Basic Programming Support and Disk and Tape Operating System assemblers, the AOPTN card will not be recognized, and an error message will be issued. This message should be ignored.

The Disk and Tape Operating System assembler may issue other messages during the assembly. If SIM20 has been successfully assembled, these messages can be ignored.

PROGRAMS ACCEPTED

SIM20 accepts any 1620 program which is not subject to one or more of the restrictions given in the section "Restrictions and Limitations." However, only 1620 programs that are known to be working properly should be run under SIM20 control.

Before a 1620 program is run under control of SIM20, it should be examined to ensure that the programming methods used follow established procedures as outlined in the IBM 1620 reference publications:

- IBM 1620 Central Processing Unit Model 1, Form A26-5706
- IBM 1620 Central Processing Unit Model 2, Form A26-5781

Programs that are dependent upon the timing of the 1620 or its associated devices may produce incorrect results.

DATA FORMATS

Most data formats accepted and produced by the 1620 will be accepted and produced by SIM20. In the case of the 1311 Disk Storage Drive, the format must be changed; the method is described in the section "1311 Disk Storage Drive, Models 2 and 3."

EDITING

SIM20 as distributed by IBM contains all the routines necessary to simulate the 1620 Model 1 and Model 2. The user must first adapt it to his particular 1620 system, using EDITOR.

The edited version of SIM20 must be assembled to obtain a binary, self-loading version. This avoids re-editing SIM20 before each run.

CONTROL INFORMATION

Control information is required to edit SIM20; it defines the System/360 I/O configuration and indicates to EDITOR the characteristics of the 1620 system to be simulated. This information takes the form of punched cards, or of commands entered on the 1052 Printer-Keyboard.

OPERATOR INTERVENTION

Operator intervention takes the form of commands to the Simulator. These commands are entered via the keys and switches on the System/360 system control panel and via the 1052 Printer-Keyboard.

Requests for operator intervention appear as messages from the Simulator, printed on the 1052 Printer-Keyboard.

Two types of operator intervention are accepted by the Simulator. The first closely parallels that which would have been required on the 1620. The second is necessary for the operation of the Simulator itself.

SUPPLEMENTARY INFORMATION

The appendixes contain supplementary information about the Simulator:

- Appendix A contains a description of the functions and use of DSKINT.
- Appendix B contains a description of the functions and use of UPDT20.
- Appendix C contains SIM20 performance information.
- Appendix D contains a description of the sample program delivered with the Simulator.
- Appendix E contains a complete list of Simulator messages, plus the action to be taken in response to each message.

EDITOR/SIM20 MACHINE REQUIREMENTS

A System/360 with the following minimum characteristics is required to run EDITOR or SIM20.

- Main storage as shown in Table 1 (regardless of the 1620 system being simulated, EDITOR requires only 32,768 bytes of main storage)
- Standard instruction set
- One System/360 I/O device for each 1620 I/O device to be simulated
- System/360 I/O devices for EDITOR support functions

Complete information on the devices required by EDITOR/SIM20 is given later in this section.

1620 CONFIGURATIONS SIMULATED

1620 Model 1 and Model 2 systems with the following characteristics are simulated.

- Core storage as shown in Table 1
- Standard instruction set, plus the following special features:

Additional Instructions (Model 1)
 Indirect Addressing (Model 1)
 Automatic Divide (Model 1)
 Automatic Floating Point Arithmetic (Models 1 and 2)
 Index Registers (Model 2)

- 1621 Paper Tape Reader
- 1621 Paper Tape Punch
- 1622 Card Read Punch
- 1311 Disk Storage Drive
- 1443 Printer
- 1443 Printer with the 24 additional character special feature

Table 1. Main Storage Requirements

1620 CORE STORAGE (in positions)	SYSTEM/360 MAIN STORAGE (in bytes)
20,000	32,768
40,000	65,536
60,000	131,072

If the user wishes to simulate a 20,000-position 1620 system with disk storage drives on a 32,768-byte System/360, the I/O simulation routines may have to be resident on disk.

In order to determine whether a particular simulated 1620 system must use the "disk residence" feature (see "FEATURE Card" in the section "Control Information"), the amount of main storage required to simulate 1620 features and devices is shown below. In the case of simulated devices, the amount of storage required is independent of the number of each type of device simulated.

Feature or Device	Bytes
Simulated 1620 core storage	20,000
Standard instruction set (Model 1)	7,900
Additional Instructions	200
Indirect Addressing	50
Automatic Divide	450
Standard instruction set (Model 2)	8,600
Automatic Floating Point Arithmetic	1,200
Index Registers	550
Console typewriter	400
Card reader/card punch	350
Printer	950
Paper tape reader	150
Paper tape punch	550
Disk storage drive	1,950

Example

Given a 1620 Model 1 disk configuration with the Additional Instructions, Indirect Addressing, and Automatic Divide features, and a console typewriter, a card reader, a card punch, and a printer, the amount of main storage required is:

$$20,000 + 7,900 + 200 + 50 + 450 + 400 + 350 + 950 + 1,950 = 32,250$$

This configuration can be simulated on a 32,768-byte System/360 without the "disk residence" feature.

However, if the Automatic Floating Point Arithmetic feature is added, the amount of storage necessary is:

$$32,250 + 1200 = 33,450$$

The simulation of this configuration requires the "disk residence" feature.

CORRESPONDENCE OF 1620 AND SYSTEM/360 DEVICES

Table 2 shows the System/360 I/O devices which may be used to simulate 1620 I/O devices.

One 1442 Card Read Punch, Model N1, or one 2520 Card Read Punch, Model B1, may not be used to simulate simultaneously the reading and punching functions of the 1622 Card Read Punch.

EDITOR SUPPORT DEVICES

System/360 I/O devices may be required for certain EDITOR support functions. Each function is given a symbolic name. The symbolic names and their definitions are shown in Table 3.

Table 3 also shows the various System/360 devices that can be assigned to each symbolic name.

RESTRICTIONS AND LIMITATIONS

Before a 1620 program is run under control of SIM20, the following restrictions and limitations must be considered.

1. Features and functions not simulated:

- Binary Capabilities for the 1620 Model 2
- 1627 Plotter and 1626 Plotter Control
- 1710 Control System
- Magnetic Tape Units
- 1620 Instant Stop Key (It is possible, however, to stop SIM20 immediately and to enter the 1620 manual mode by pressing the request key on the 1052 Printer-Keyboard.)

The Stop/SIE key is simulated, but SIM20 does not allow step by step processing.

- Synchro check of the 1443 Printer

Table 2. Device Correspondence

1620 DEVICE	SYSTEM/360 DEVICE
✓ 1620 Console Typewriter	1052 Printer-Keyboard (with 1051 Control Unit for Model 30)
1621 Paper Tape Reader	2671 Paper Tape Reader with 2822 Paper Tape Control Unit 2540 Card Read Punch with 2821 Control Unit 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2501 Card Reader, Model B1 or B2
1621 Paper Tape Punch	2540 Card Read Punch with 2821 Control Unit 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 1442 Card Punch, Model N2 2520 Card Punch, Model B2 or B3
✓ 1622 Card Read Punch	2540 Card Read Punch with 2821 Control Unit 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 A combination of ✓ 2501 Card Reader, Model B1 or B2 ✓ 1442 Card Punch, Model N2 2520 Card Punch, Model B2 or B3
✓ 1311 Disk Storage Drive	2311 Disk Storage Drive with 2841 Control Unit
✓ 1443 Printer	1403 Printer, Models 2, 3, or N1, with 2821 Control Unit ✓ 1443 Printer, Model N1
1443 Printer, with 24 additional character special feature	1443 Printer, Model N1 with 24 additional character special feature

2. The 1620 Release and Reset keys are each simulated in two different ways (see the section "Operating Instructions").

3. Undefined cases are detected, cause an

Table 3. EDITOR Support Devices

SYMBOLIC NAME	SYSTEM/360 DEVICE	DEFINITION
✓ SIM2SYS	2540 Card Read Punch 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2501 Card Reader, Model B1 or B2 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (7-track or 9-track)	The device used to load the EDITOR into System/360 main storage ¹
✓ SIM2IN	2540 Card Read Punch 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2501 Card Reader, Model B1 or B2 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (7-track or 9-track)	The device used for EDITOR input (the unedited symbolic version of SIM20) ¹
✓ SIM2OUT	2540 Card Read Punch 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2520 Card Punch, Model B2 or B3 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (9-track)	The device used for EDITOR output (the edited symbolic version of SIM20)
✓ SIM2INF	2540 Card Read Punch 1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2501 Card Reader, Model B1 or B2 1052 Printer-Keyboard	The device used to enter EDITOR control information
✓ SIM2COM	1052 Printer-Keyboard	The device used to transmit commands from the operator to EDITOR
✓ SIM2MES	1403 Printer 1443 Printer	The device used to transmit messages from EDITOR to the operator
✓ SIM2PRNT (optional)	1403 Printer 1443 Printer	The device used to list the edited version of SIM20

¹When SIM20 is edited directly from the system tape, the same device must be assigned to the two functions SIM2SYS and SIM2IN.

error message to be printed on the 1052 Printer-Keyboard, and cause SIM20 to stop and enter the 1620 manual mode. Such cases may be:

Illegal operation code
Non-decimal character in address
Wrong I/O code (non-existent device)
Branch to odd location
Even address in alphameric I/O operations

4. Results may be unpredictable when invalid codes are used in arithmetic and floating-point operations, and when the mantissas of the two operands are of different lengths.

5. The difference in internal timing of the 1620 and the System/360 may cause programs which rely on 1620 internal timing to overlap I/O and CPU operations to produce incorrect results when run under SIM20 control.

6. The use of the "core storage wrap-around" capability is limited to:

- CPU operations

Transmit Field and Transmit Field Immediate
Transmit Record and Transmit Record No Record Mark
Transfer Numerical Strip
Transfer Numerical Fill

Transmit Floating
Branch and Transmit Address and
Branch and Transmit Address
Immediate
Load Dividend and Load Dividend
Immediate

- I/O operations (except disk)

Read Numerically
Read Alphamerically
Write Numerically
Write Alphamerically

- Dump Numerically (on cards), to fill the last card

7. For instructions which do not fit in at the end of simulated 1620 core storage, no wraparound is possible.
8. The 1620 Model 2 correction key is not directly simulated; however, its function can be performed by a 1052 cancel operation.
9. A parity check in CPU operations causes a system halt in the wait and disabled states.
10. Testing the Memory Buffer Register parity indicators (MBR-E or MBR-O) results in a negative (off) response.
11. The "Quotient plus Remainder" and "Product" area is limited to 100 positions (from 1620 address 00000 through 00099).
12. All digits in the Add and Multiply tables must be decimal.
13. Special characters in the Q field are processed as they are in the 1620. In arithmetic operations, SIM20 processes special characters in the P field as it processes them in the Q field.

However, special characters in the P field are not checked.

14. Simulation of the Stop key does not allow step-by-step execution of 1620 instructions.
15. For certain 20,000-position 1620 systems with disk storage drives, simulated on a 32,768-byte System/360, the I/O simulation routines are resident on disk. No extra disk unit is needed, since simulation of the 1311 Disk Storage Drive requires only half of the capacity of the 2311 Disk Storage Drive.
16. One 2311 disk pack must be used to simulate each 1311 disk pack.
17. On printers attached to the System/360, detecting a punched hole in channel 1 of the printer carriage control tape does not turn off the channel 9 and channel 12 indicators. A special procedure is used to turn off these indicators (see "Punching of the Carriage Control Tape" under "1443 Printer, Model 2").
18. When simulating the 1622 Card Read Punch (Models 1 and 2) by one 1442 Card Read Punch, Model N1, or one 2520 Card Read Punch, Model B1, reading and punching cannot be performed simultaneously. When only one unit is used for both functions, it will be the user's responsibility to perform the necessary card merging and sorting operations.
19. The 1052 Printer-Keyboard does not print flags. Flagged numbers are printed as corresponding special and alphabetic characters as shown in Table 4.

Data formats not described in the publications IBM 1620 Central Processing Unit Model 1, Form A26-5706, and IBM 1620 Central Processing Unit Model 2, Form A26-5781, are not accepted by SIM20.

1620 CONSOLE TYPEWRITER

Input Format: Any line format which can be typed on the 1620 Console Typewriter is accepted by SIM20. Space, tabulate, carriage return, backspace, and index operations are directly simulated. All valid 1620 characters are accepted and checked for validity. The alphabetic characters A through Z must be entered in upper case.

Output Format: Except for the characters shown in Table 4, the output format is the same as that on the 1620 Console Typewriter.

Table 4 gives the character correspondence for flagged numerics and for some special characters.

1622 CARD READ PUNCH, MODELS 1 AND 2

Card Format: Any card format which can be read or punched by the 1622 is accepted or produced by SIM20. All valid 1620 character codes are accepted and checked for validity. In a given column, only one of the rows 1 to 7 can be punched.

1620 Last Card Indicator (EOF)

All 1620 programs testing the Last Card indicator require the following operations on System/360 card readers.

Place a card containing a 7-8 punch in column 1 in the card deck, just before the last card of the deck.

Table 4. Graphic Correspondence

1620 CONSOLE	1052 PRINTER-KEYBOARD
0 1 2 3 4 5 6 7 8 9	- J K L M N O P Q R
Record Mark	#
Flagged Record Mark	!
Group Mark	?
Flagged Group Mark	

This card is read by SIM20, but is ignored by the 1620 program. The card allows SIM20 to set the Last Card indicator on when the last card is read.

The Last Card indicator can then be checked by the 1620 program.

1443 PRINTER, MODEL 2

Line Format: Any line format which can be printed by the 1443 is reproduced by SIM20. There are no differences in graphics, apart from the record mark, which is printed as a number symbol (#).

Punching of the Carriage Control Tape: The channel 9 and channel 12 indicators 33 and 34 are not reset by detecting a channel 1 punch in the carriage control tape. To reset the indicator, the carriage control tape must be punched as shown in Figure 1.

1621 PAPER TAPE READER

Input Format (Paper Tape): Any paper tape record format that can be read by the 1621 is accepted by SIM20. All valid 1620 paper tape characters are accepted and checked for validity.

Input Format (Cards): Any paper tape record format punched by SIM20 using a card punch to simulate the 1621 Paper Tape Punch is accepted by SIM20.

The selection of paper tape or card input is made using a switch on the System/360 system control panel. The use of this switch is described in the section "Operating Instructions."

1621 PAPER TAPE PUNCH

The 1621 Paper Tape Punch is simulated by a card punch or a card read-punch, as shown in Table 2.

Output Format: Any paper tape record format that can be punched by the 1621 is punched by SIM20. Since the 1621 punches variable-length records, a variable number of cards are punched for each record, depending on its length. The data on the cards punched by SIM20 are images of the data in main storage, in SIM20 internal code (EBCDIC).

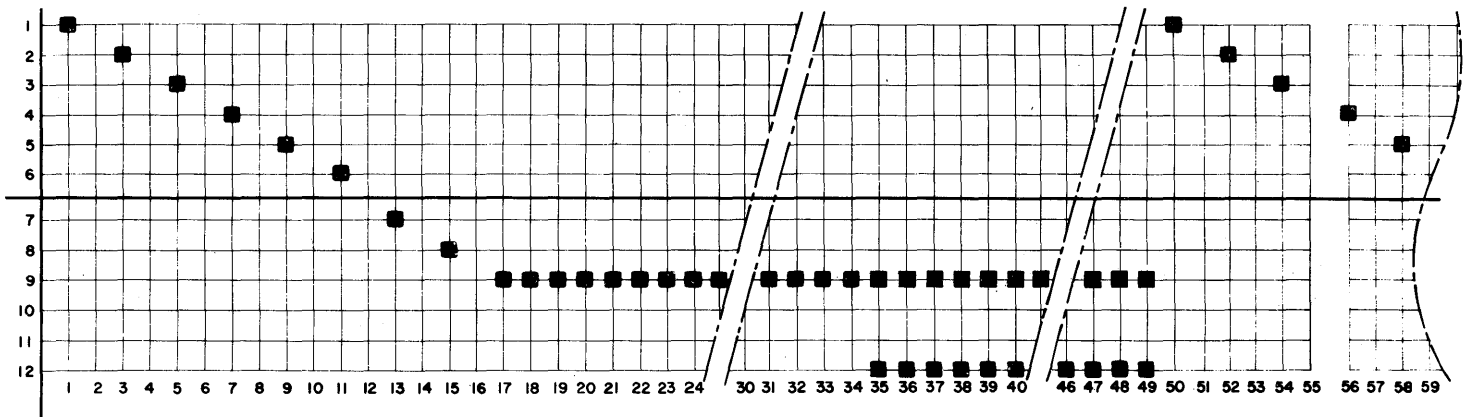


Figure 1. Punching the 1443 Carriage Control Tape

1311 DISK STORAGE DRIVE, MODELS 2 AND 3

The 1316 disk pack is used with both the IBM 1311 and 2311 Disk Storage Drives. However, a disk pack written on a 1311 cannot be read by a 2311, owing to the increased track and bit densities of the latter and to the special format used to obtain maximum SIM20 performance. This format is not compatible with every System/360 operating system. More detailed operating procedures are given in Appendix A (DSKINT).

Disk File Formats: Transfer of 1311 address and data formats to the 2311 Disk Storage Drive is performed by mapping 1311 data, cylinder by cylinder, onto cylinders 03 to 102 of the 2311 Disk Storage Drive. (The nth 1311 cylinder is mapped onto the nth+3 2311 cylinder.) 2311 cylinders 00, 01, and 02 are reserved for SIM20. The format of the 2311 track is shown in Figure 2.

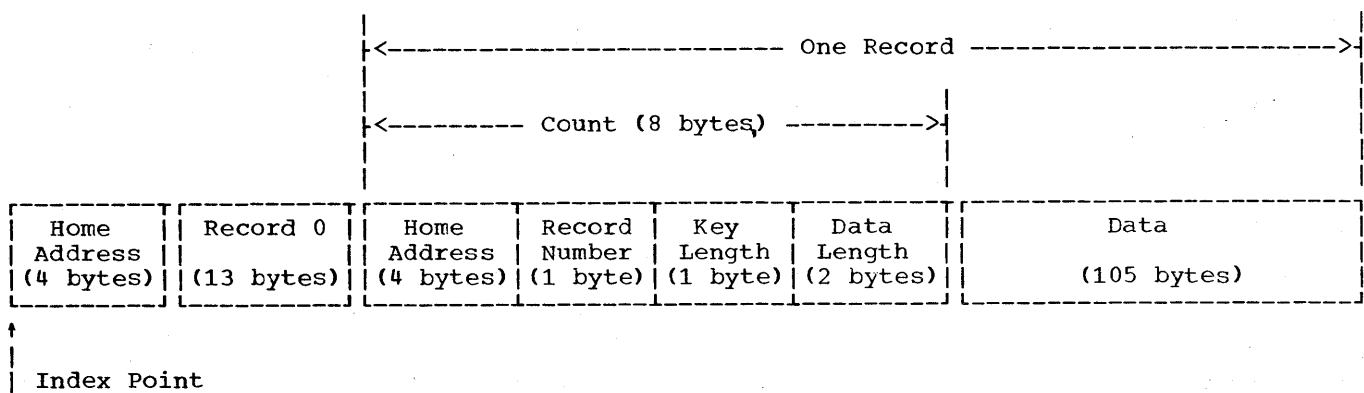
Disk Record Format: The first 20 records of each track have 105 bytes each (5 bytes for the sector address; 100 bytes for data). The 21st record, of 100 bytes, contains the addresses of the 20 preceding records (20x5 bytes=100 bytes) and is used by SIM20 to check sector addresses.

Note: The disk records are of the "count data" type; that is, the key length is zero.

Format Conversion: The 1316 disk pack may be dumped onto cards using a 1620 system with one of the following programs: Disk Utility Program, Monitor 1, or Disk Utility Program, Monitor 2.

To transfer the data from cards to the 2311 disk pack, use one of the following programs under Simulator control.

- Disk Utility Program, Monitor 1
- Disk Utility Program, Monitor 2



Note: The key-length byte always contains zero; the data-length bytes always contain 105.

Figure 2. Record Format for 2311 Disk Storage Drives

Control information is required to define:

- The I/O configuration and the CPU of the System/360 on which EDITOR is to be run
- The assignment of the I/O devices used in support of EDITOR
- The characteristics and configuration of the 1620 system to be simulated

This information can be supplied by the programmer (using control cards), by the operator (using commands on the 1052), or by both, and is entered via SIM2INF. Its format is described in the section "Control Card Formats." For the sake of simplicity, control information is referred to as "control cards," though it may be in punched-card or operator-command form. The procedure used to enter control information via the 1052 Printer-Keyboard is described in the section "Operating Procedures."

CONTROL CARD FORMATS

All control cards must conform to the following format rules:

Identifier One slash (/) in column 1 identifies the card as a control card. One blank must immediately follow the slash.

Operation This field describes the type of control card. It consists of a string of up to eight alphanumeric characters.

One blank must immediately follow the last character of the operation field.

Operand This field may contain one or more entries, called terms. The terms are separated by commas, and, in certain cases, by the character =.

The last term must be followed by a blank.

The last character of the operand field must not extend beyond column 71. If column 72 does not contain a blank, EDITOR forces a blank into this position.

Control cards are punched using an IBM 029 Card Punch. All positions between the end of the operand field and column 72 must be blank. Columns 73 to 80 can be used for identifying comments.

The valid operation fields are presented in Table 5.

DEV360 CARD

DEV360 cards define the System/360 I/O configuration on which EDITOR is to be run. One card is required for each device defined, but the user need define only those I/O devices of his installation which he wishes to make available to EDITOR.

If two DEV360 cards define the same System/360 device, EDITOR retains only the second definition.

The DEV360 control card has the following format:

/ DEV360 ADDR=X'aaa',type,feature

All terms except "feature" must be present. ADDR must be the first term in the operand field. "X'aaa'" must be the second term. "type" and "feature" may be in either order.

Table 5. Operation Fields

OPERATION FIELD	FUNCTION
DEV360	Defines a System/360 I/O device
DEVSUP	Assigns an EDITOR support device
CALL	Gives control to EDITOR
CPU1	Defines the 1620 Model and its core storage capacity
CPU2	Defines the System/360 model and its main storage capacity
FEATURE	Defines any optional features
DEVICE	Assigns a 1620 I/O device
START	Denotes the end of control information input

aaa denotes three hexadecimal characters giving the System/360 address of the device.

type denotes the device type and must be one of those shown in Table 6.

feature denotes any special feature associated with the device, and takes one of the values shown in Table 6.

Examples

```
/ DEV360 ADDR=X'009',1052
/ DEV360 ADDR=X'20E',1403
/ DEV360 ADDR=X'00E',1443,144BAR
```

The first of these examples describes the 1052 Printer-Keyboard at System/360 address 009; the second, the 1403 Printer (with 100 print positions) at System/360 address 20E; and the third, the 1443 Printer (with 144 print positions) at System/360 address 00E.

DEVSUP CARD

DEVSUP cards are required to assign System/360 I/O devices to EDITOR support functions.

If two DEVSUP cards define the same support device, EDITOR retains only the second definition.

The DEVSUP control card has the following format:

```
/ DEVSUP function=X'aaa',type,mode,density
```

Table 6. Device Types and Special Features

TYPE	FEATURE	MEANING
1442 2501 2520 2540 1052	(Blank)	No special features
1403	132BAR (Blank)	132 print positions 100 print positions
1443	144BAR (Blank)	144 print positions 120 print positions
2400	7TRACK 9TRACK	The unit is used for 7-track tapes The unit is used for 9-track tapes

All terms except "density" must be present "function" must be the first term in the operand field. "X'aaa'" must be the second term. "type" and "mode" may be in either order.

function

denotes the EDITOR support function performed by the device, and takes one of the values shown in Table 7.

aaa

denotes three hexadecimal characters giving the System/360 address of the device.

type

denotes the device type, and must be one of those shown in Table 7.

mode

denotes input or output mode (where I = input and O = output) and must follow the correspondence shown in Table 7.

density

is required only if "type" has the value 2400, and if this tape unit is used for 7-track tapes in Data Converter "off", Translator "on" mode. "density" takes one of the following values:

- 800
- 556
- 200

If this term is absent when "type" has the value 2400, it is assumed that the tape unit is for 9-track tapes, or for 7-track tapes in Data Converter "on", Translator "off" mode.

Note: The DEVSUP card used to assign a 7-track 2400-series unit to SIM2SYS must not contain the term "density".

Examples

```
/ DEVSUP SIM2INF=X'00C',1442,I
/ DEVSUP SIM2OUT=X'00D',2520,O
/ DEVSUP SIM2IN=X'283',2400,I
```

The first of these examples assigns the 1442 Card Read Punch at System/360 address 00C to read control information (SIM2INF), the second assigns the 2520 Card Read Punch at System/360 address 00D to punch the edited version of SIM20 (SIM2OUT), and the third assigns the 2400-Series tape unit at System/360 address 283 to read the unedited version of SIM20 (SIM2IN).

Table 7. EDITOR Support Device Function, Type, and Mode

FUNCTION	TYPE	MODE
SIM2SYS	1442	I
	2501 ✓	
	2520	
	2540	
	2400	
SIM2IN	1442	I
	2501 ✓	
	2520	
	2540	
	2400	
SIM2OUT	1442 ✓	O
	2520	
	2540	
	2400	
SIM2INF	1442	I
	2501 ✓	
	2520	
	2540	
	1052	
SIM2COM	1052 ✓	I
SIM2MES	1403 ✓	O
	1443	
SIM2PRNT (optional)	1443 ✓	O
	1403	

CALL CARD

A CALL card is required to indicate the end of System/360 control information and to give control to EDITOR.

The CALL control card has one of the following formats:

- / CALL EDITOR
- / CALL EDITOR,PUNCH
- / CALL EDITOR,LIST
- / CALL EDITOR,PUNCH,LIST ✓

The term PUNCH is required when the edited version of SIM20 is to be punched into cards; the term LIST is required when a printer is assigned to the symbolic name SIM2PRNT.

The first of the above formats is used when the edited version of SIM20 is written on magnetic tape; the second is used when the edited version is punched into cards; the third is used when the edited version is written on magnetic tape, and a printer is assigned to the symbolic name SIM2PRNT; the last one is used when the edited version is punched into cards, and a printer is assigned to SIM2PRNT.

CPU1 CARD

A CPU1 card is required to define the 1620 model used and the core storage capacity to be simulated. If there are several CPU1 cards, only the last one encountered is considered.

The CPU1 control card has the following format:

/ CPU1 1620/x,yyK

All terms must be present in the above order. The terms must be punched in columns 1 to 17.

x denotes the 1620 model to be simulated and takes one of the following two values:

- 1 for 1620 Model 1
- 2 for 1620 Model 2

yy denotes the 1620 core storage capacity in thousands of positions, and takes one of the values:

- 20
- 40
- 60

Examples

- / CPU1 1620/1,20K
- / CPU1 1620/2,60K

The first of these examples describes a 1620 Model 1 with a core storage capacity of 20,000 positions; the second describes a 1620 Model 2 with a core storage capacity of 60,000 positions.

CPU2 CARD

A CPU2 card is required to define the System/360 model used to run SIM20 and its main storage capacity. If there are several CPU2 cards, only the last one encountered is considered.

The CPU2 control card has the following format:

- / CPU2 360/xx,yyK
- or
- / CPU2 360/xx,yyyK

All terms must be present in the above order. The terms must be punched in columns 1 to 17 or columns 1 to 18.

xx denotes the System/360 model used and takes one of the two values:

30 to indicate Model 30
40 to indicate Model 40, 50, 65, or 75

yy denotes the System/360 main storage capacity, in thousands of bytes, and takes one of the two values:

32
64

yyy denotes a System/360 main storage capacity of 131,072 bytes and above and, regardless of the capacity, takes the value:

128

Examples

/ CPU2 360/30,32K
/ CPU2 360/40,128K

The first of these examples describes a System/360 Model 30 with a main storage capacity of 32,768 bytes; the second describes a System/360 Model 40, 50, 65, or 75 with a main storage capacity of 131,072, 262,144, or 524,288 bytes.

FEATURE CARD

A FEATURE card is required for each of the 1620 optional features to be simulated.

The FEATURE control card has the following format:

/ FEATURE xxxxx

The terms must be punched in columns 1 to 15.

xxxxx denotes an optional feature and takes one of the values:

INDEX for 1620 Model 2 Index Registers
INDAD for 1620 Model 1 Indirect Addressing
FLOAT for Automatic Floating-Point Arithmetic
TRANS for Model 1 Additional Instructions
DIVID for Model 1 Automatic Divide (when FLOAT is not used)
144LN for a 1443 Printer with the 24 additional character special feature
DISKV for disk-resident I/O program (To determine whether this fea-

ture is necessary, see "1620 Configurations Simulated" in the section "Machine Considerations.")

DEVICE CARD

A DEVICE card is required for each 1620 device.

The DEVICE control card has the following format:

/ DEVICE xxxxx,yyyyy,c,X'aaa'

All terms must be present in the above order. The terms must be punched in columns 1 to 29.

xxxxx denotes the 1620 device to be simulated; the last "x" denotes the function of the device, and takes one of the values:

R for read
P for punch
W for write (print)
C for type

yyyyy denotes the System/360 device used to simulate the 1620 device; the last "y" denotes the function of the device, and takes one of the values:

R for read
P for punch
W for write (print)
T for type

c denotes the number of the System/360 channel to which the device is attached.

aaa denotes three hexadecimal characters giving the System/360 address of the device. The first of these characters must correspond to the value of "c".

The DEVICE control card must be punched in one of the following ways:

1622 CARD READER

/ DEVICE 1622R,1442R,c,X'aaa'
simulated by the 1442 Card Read Punch

/ DEVICE 1622R,2540R,c,X'aaa'
simulated by the 2540 Card Read Punch

/ DEVICE 1622R,2520R,c,X'aaa'
simulated by the 2520 Card Read Punch

/ DEVICE 1622R,2501R,c,X'aaa'
 simulated by the 2501 Card Reader

1622 CARD PUNCH

/ DEVICE 1622P,1442P,c,X'aaa'
 simulated by the 1442 Card Read Punch

/ DEVICE 1622P,2540P,c,X'aaa'
 simulated by the 2540 Card Read Punch

/ DEVICE 1622P,2520P,c,X'aaa'
 simulated by the 2520 Card Read Punch or
 2520 Card Punch

1443 PRINTER

/ DEVICE 1443W,1443W,c,X'aaa'
 simulated by the 1443 Printer

/ DEVICE 1443W,1403W,c,X'aaa'
 simulated by the 1403 Printer

1621 PAPER TAPE READER

/ DEVICE 1621R,2671R,c,X'aaa'
 simulated by the 2671 Paper Tape Reader

1621 PAPER TAPE PUNCH

/ DEVICE 1621P,1442P,c,X'aaa'
 simulated by the 1442 Card Read Punch

/ DEVICE 1621P,2540P,c,X'aaa'
 simulated by the 2540 Card Read Punch

/ DEVICE 1621P,2520P,c,X'aaa'
 simulated by the 2520 Card Read Punch or
 2520 Card Punch

1620 CONSOLE TYPEWRITER

/ DEVICE 1620C,1052T,c,X'aaa'
 simulated by the 1052 Printer-Keyboard

1311 DISK STORAGE DRIVE

/ DEVICE 1311n,2311p,c,X'aaa'
 simulated by the 2311 Disk Storage Drive

n
 denotes the module number.

p
 denotes the serial number.

The module numbers and their corresponding serial numbers are given in Table 8.

c
 denotes the number of the System/360 channel to which the device is attached and takes one of the values:

- 0 for channel 0
- 1 for channel 1
- 2 for channel 2
- .
- .
- .
- 6 for channel 6

Table 8. Disk Module Numbers and Serial Numbers

n = Module Number	p = Serial Number
0	A
1	B
2	C
3	D

aaa
 denotes three hexadecimal characters giving the System/360 device address. The first of these characters must correspond to the value of "c".

START CARD

A START card is always required and is the last one in the control card deck. It has the format

/ START

and the characters must be punched in columns 1 to 7.

CONTROL CARD SEQUENCE

Control card decks must be arranged as follows:

1. All DEV360 cards, in any order
2. All DEVSUP cards, in any order
3. The CALL card
4. The CPU1 card
5. The CPU2 card

6. The FEATURE cards, if any, in any order
7. The DEVICE cards, in any order, and
8. The START card

An example of control card sequence is given in Appendix D, in conjunction with the sample program.

This section is divided into five parts, one for each of the System/360 Models 30, 40, 50, 65, and 75. This division is necessary because the system control panels of the models are different. As elements of these system control panels are used to simulate 1620 keys and switches, the operating procedures are different.

The function of a particular 1620 Console key or switch is simulated by setting switches on the System/360 system control panel to the appropriate value, and then entering this value into System/360 main storage. The values to which the switches are set to simulate the functions of the different 1620 keys and switches are given in Tables 9 (keys) and 10 (switches). How these values are entered into main storage is described in the following sections.

SYSTEM/360 MODEL 30

SIMULATION OF 1620 KEYS AND SWITCHES

All 1620 keys and switches except the 1620 Release key are directly simulated by

setting the two rightmost rotary data switches on the 2030 system control panel to the appropriate value (see Tables 9 and 10), and then entering this value into main storage.

In order to enter the values into main storage, the following steps must be performed:

1. Set the display storage select switch to MS (Main Storage).
2. Set the four storage address switches to:
 - 0000 to simulate 1620 keys
 - 0001 to simulate 1620 switches
 - 0002 to set the "paper tape switch"
3. Press the stop key.
4. Set the rotary data switches to the appropriate value.
5. Press the store and start keys.

Table 9. System Control Panel Switch Settings for 1620 Keys

1620 KEY	2030 CONTROL PANEL	2040 CONTROL PANEL 2050 CONTROL PANEL 2065 CONTROL PANEL 2075 CONTROL PANEL	
	ROTARY DATA SWITCH SETTING	STORAGE DATA SWITCH	SETTING
Start	00	a ³	up
Stop	80	a	down
Save	C0	b	down
Check Reset	A0	c	down
Reset	90	d	down
Insert	88	e	down
Modify ¹	84	f	down
Automatic Card Load ²	82	g	down

¹Simulation of the Modify key (used to set 1620 Model 2 core storage to zero) is included in all versions of SIM20, and is used to set simulated core storage to zero (Model 1 and Model 2).

²The Automatic Card Load key, located on the 1622 Card Read Punch, is simulated on the system control panel.

³For the correspondence of 1620 keys and "storage data" switches, see Figures 3, 4, 5, and 6.

Table 10. System Control Panel Switch Settings for 1620 Switches

1620 SWITCH	2030 CONTROL PANEL	2040 CONTROL PANEL 2050 CONTROL PANEL 2065 CONTROL PANEL 2075 CONTROL PANEL	
	ROTARY DATA SWITCH SETTING	STORAGE DATA SWITCH	SETTING
Program Switch 1			
ON	80	i ¹	down
OFF	00	i	up
Program Switch 2			
ON	40	j	down
OFF	00	j	up
Program Switch 3			
ON	20	k	down
OFF	00	k	up
Program Switch 4			
ON	10	l	down
OFF	00	l	up
Disk Check Switch			
on PROGRAM	08	m	down
on STOP	00	m	up
Write Address Switch			
ON	04	n	down
OFF	00	n	up
I/O Check Switch			
on PROGRAM	02	o	down
on STOP	00	o	up
Overflow Switch			
on PROGRAM	01	p	down
on STOP	00	p	up
Paper Tape Switch			
Input on cards	20	q	down
Input on paper tape	20	q	up

¹For the correspondence of 1620 switches and "storage data" switches, see Figures 3, 4, 5, and 6.

disk check, I/O CK, O/FLOW SWITCHES - PROGRAM (DOWN) 08 + 02401 = 11 = 08

As 1620 keys are spring loaded, they automatically return to the neutral position after being pressed. In SIM20, to return the simulated keys to the neutral position, the value 00 must be entered into main storage. The values entered by System/360 switches to simulate 1620 switches must be retained in main storage as long as they are used by the 1620 program.

Any combination of 1620 switches can be obtained by using the rotary data switches of the 2030 system control panel. The two rotary switches must be set to the sum of the settings of all the 1620 switches.

Example: The 1620 program to be simulated requires setting the following 1620 switches:

	Position	Individual Setting
Program Switch 1	on	80
Program Switch 2	on	40
Program Switch 3	on	20
Program Switch 4	off	00
Overflow Switch	program	01
All other switches	stop	00

To obtain this combination of switch settings, the two rotary data switches must

be set to the sum of the settings of all the switches; that is, to E1.

1620 Release Key

The 1620 Release key is simulated in two ways, as follows:

1. After an Insert Operation: Hold down the alternate coding key on the 1052 Printer-Keyboard and press the numeric 5 key, then perform a simulated 1620 Start operation. (The 1620 Release and Start key of the 1620 console typewriter is simulated by the same operation.)
2. After a Programmed Read Operation on the Typewriter: Hold down the alternate coding key on the 1052 Printer-Keyboard and press the numeric 5 key.

In order to terminate an I/O operation (example: a Dump Numerically operation) on all I/O devices except the 1052 Printer-Keyboard, press the System/360 stop key; as soon as the current operation on the I/O device has terminated, press the request key on the 1052 and re-start the System/360. This operation releases I/O devices in the course of operation and places SIM20 in the 1620 manual mode.

Note: When the operator does not intend to initiate an I/O operation requested by the 1620 program (for example, a "Reader No Feed" indication following a "Last Card" or a "Low Tape" indication), he must press the request key on the 1052 in order to ignore this request.

1620 Reset Key

The simulated Reset key restores simulated status and check indicators to their initial status. It does not reset SIM20 I/O functions; this must be performed using the simulated Release key.

Examples of Key Manipulation

To simulate the manipulation of 1620 Console keys:

1. Set the display storage select switch to MS.
2. Set the four storage address switches to 0000.
3. Press the stop key.
4. Perform the operations described under the appropriate heading below.

1620 Insert Operation:

- Set the rotary data switches to 88.

- Press the store and start keys. (This will turn on the read light of the 1052 Printer-Keyboard.)

- Type the appropriate information on the 1052.

- Hold down the alternate coding key on the 1052, and press the numeric 5 key. (In this particular case, the 1620 release operation must not be performed by pressing the 1052 request key.)

A maximum of 100 characters can be entered by an Insert operation.

Note: When a read operation on the simulated 1620 console typewriter (Read Numerically, Read Alphamerically) is pending, and the operator wishes to reset the simulated 1620 in order to perform an Insert operation, he must:

- Set the rotary data switches to 80.
- Press the store and start keys.
- Hold down the alternate coding key on the 1052, and press the numeric 5 key.
- Perform a Reset and Insert operation.

1620 Modify Operation:

- Set the rotary data switches to 84.
- Press the store and start keys.

This key is standard on Model 2, but may be used when simulating either model.

1620 Dump

- Set the rotary data switches to 88.
- Press the store and start keys.
- Type the Dump Numerically instruction (operation code 35) on the 1052 when the 1052 read light is turned on.
- Hold down the alternate coding key on the 1052, and press the numeric 5 key. (This terminates the input operation.)
- Press the stop key.
- Set the rotary data switches to 00. *START*
- Press the store and start keys.

Paper Tape Switch

When the 1621 Paper Tape Reader is simulated by a card reader, the "paper tape switch" must be set on. This is done in the following way:

1. Set the display storage select switch to MS.
2. Set the four storage address switches to 0002.
3. Press the stop key.
4. If no bit is present in main storage at this address, set the rotary data switches to 20. If any other bits are present, perform the logical OR of these bits with the setting 20.
5. Press the store and start keys.

Note: The value 00 must be entered into System/360 main storage if, later, the 2671 Paper Tape Reader is to be used to simulate the 1621 Paper Tape Reader.

SYSTEM/360 MODEL 40

SIMULATION OF 1620 KEYS AND SWITCHES

All simulated 1620 Console keys and switches except the Release key are directly simulated by setting the "storage data" switches on the 2040 system control panel to the appropriate value (see Tables 9 and 10), and then entering this value into main storage. The two leftmost switches of this panel are not used. Figure 3 shows the

storage data switches and their corresponding 1620 keys and switches.

In order to enter the values into main storage, the following steps must be performed:

1. Set the display storage select switch to MS (Main Storage).
2. Set the storage address switches:
All "up" to simulate 1620 keys and switches
All "up", except the second one in from the right to set the "paper tape switch"
3. Press the stop key.
4. Set the storage data switches to the appropriate position.
5. Press the store and start keys.

Since 1620 keys are spring loaded, they automatically return to the neutral position after being pressed. In SIM20, to return the simulated keys to the neutral position, the storage data switches must all be set "up", and the value entered into main storage. Since the Start and Stop keys are simulated by the same switch, they do not have a neutral position.

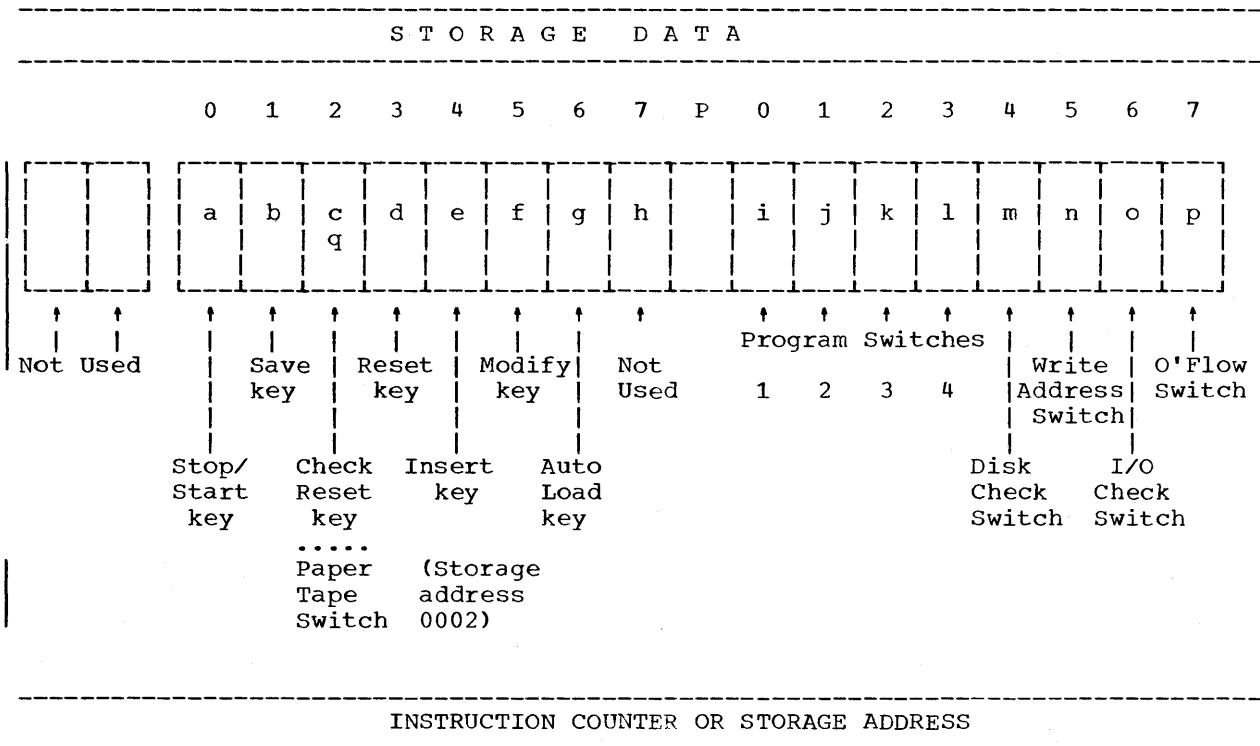


Figure 3. Storage Data Switches on the 2040 Control Panel

1620 Release Key

The 1620 Release key is simulated in two ways, as follows:

1. After an Insert Operation: Hold down the alternate coding key on the 1052 Printer-Keyboard and press the numeric 5 key, then perform a simulated 1620 Start operation. (The 1620 Release and Start key of the 1620 console typewriter is simulated by the same operation.)
2. After a Programmed Read Operation on the Typewriter: Hold down the alternate coding key on the 1052 Printer-Keyboard and press the numeric 5 key.

In order to terminate an I/O operation (example: a Dump Numerically operation) on all I/O devices except the 1052 Printer-Keyboard on input, press the System/360 stop key; as soon as the current operation on the I/O device has terminated, press the request key on the 1052 and re-start the System/360. This operation releases I/O devices in the course of operation and places SIM20 in the 1620 manual mode.

Note: When the operator does not intend to initiate an I/O operation requested by the 1620 program (for example, a "Reader No Feed" indication following a "Last Card" or a "Low Tape" indication), he must press the request key on the 1052 in order to ignore this request.

1620 Reset Key

The simulated Reset key restores simulated status and check indicators to their initial status. It does not reset SIM20 I/O functions; this must be performed using the simulated Release key.

Examples of Key Manipulation

To simulate the manipulation of 1620 Console keys:

1. Set the display storage select switch to MS.
2. Set all the main storage address switches "up".
3. Press the stop key.
4. Perform the operations described under the appropriate heading below.

1620 Insert Operation:

- Set storage data switch (a) and storage data switch (e) "down".
- Press the store and start keys. (This

will turn on the read light of the 1052 Printer-Keyboard).

- Type the the appropriate information on the 1052.
- Hold down the alternate coding key on the 1052, and press the numeric 5 key. In this particular case, the 1620 release operation must not be performed by pressing the 1052 request key).

A maximum of 100 characters can be entered by an Insert operation.

Note: When a read operation on the simulated 1620 console typewriter (Read Numerically, Read Alphamerically) is pending, and the operator wishes to reset the simulated 1620 in order to perform an Insert operation, he must:

- Set storage data switch (a) "up".
- Press the store and start keys.
- Hold down the alternate coding key on the 1052, and press the numeric 5 key.
- Perform a Reset and Insert operation.

1620 Modify Operation:

- Set storage data switch (a) and storage data switch (e) "down".
- Press the store and start keys.

This key is standard on Model 2, but may be used when simulating either model.

1620 Dump

1. Set all the storage address switches "up".
2. Press the stop key.
3. Set storage data switch (a) and storage data switch (e) "down".
4. Press the store and start keys.
5. Type the Dump Numerically instruction (operation code 35) on the 1052 when the 1052 read light is turned on.
6. Hold down the alternate coding key on the 1052, and press the numeric 5 key. (This terminates the input operation.)
7. Press the stop key.
8. Set storage data switches (a) and (e) "up".
9. Press the store and start keys.

Paper Tape Switch

When the 1621 Paper Tape Reader is simulated by a card reader, the "paper tape switch" must be set on. This is done in the following way:

1. Set the display storage select switch to MS.
2. Set the storage address switches to 0002 (all "up", except the last on the right but one).
3. Press the stop key.
4. If no bit is present in main storage at this address, set storage data switch (q) "down". If any other bits are present, perform the logical OR of these bits with storage data switch (q).
5. Press the store and start keys.

Note: Storage data switch (q) must be set "down", and this value entered into System/360 main storage if, later, the 2671 Paper Tape Reader is to be used to simulate the 1621 Paper Tape Reader.

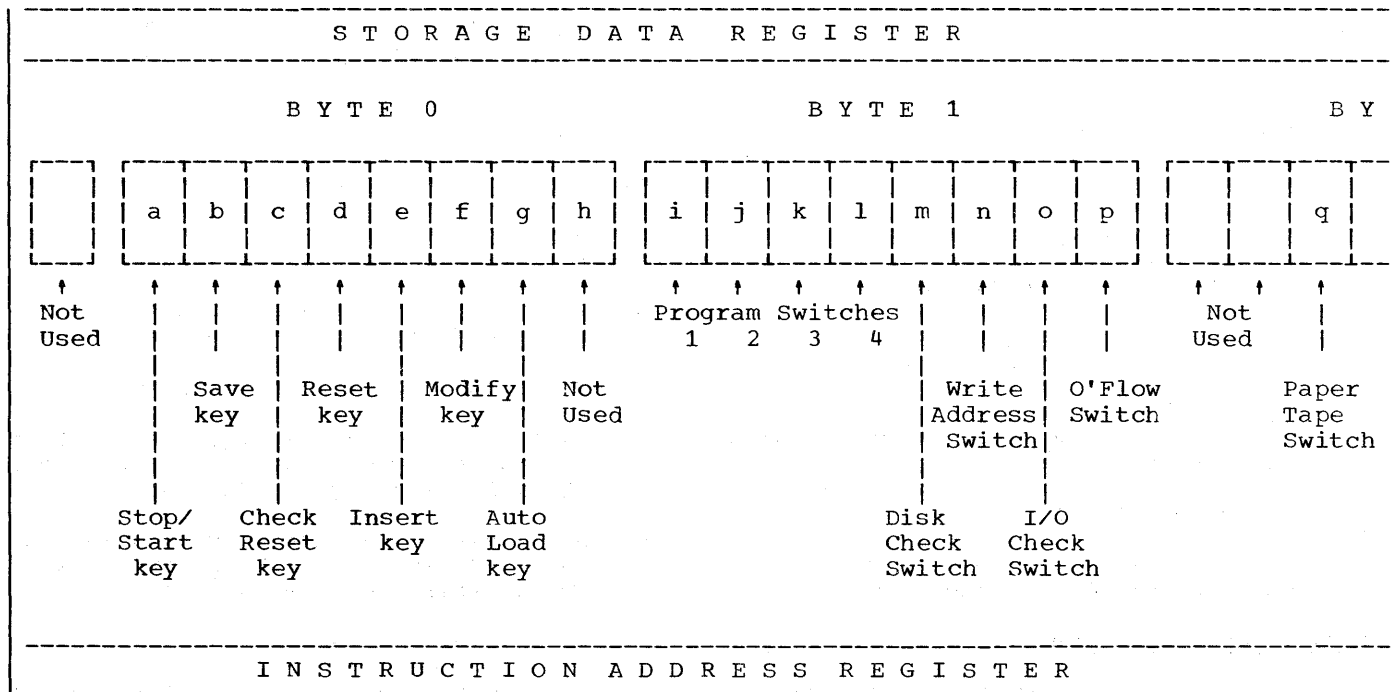
SYSTEM/360 MODEL 50

SIMULATION OF 1620 KEYS AND SWITCHES

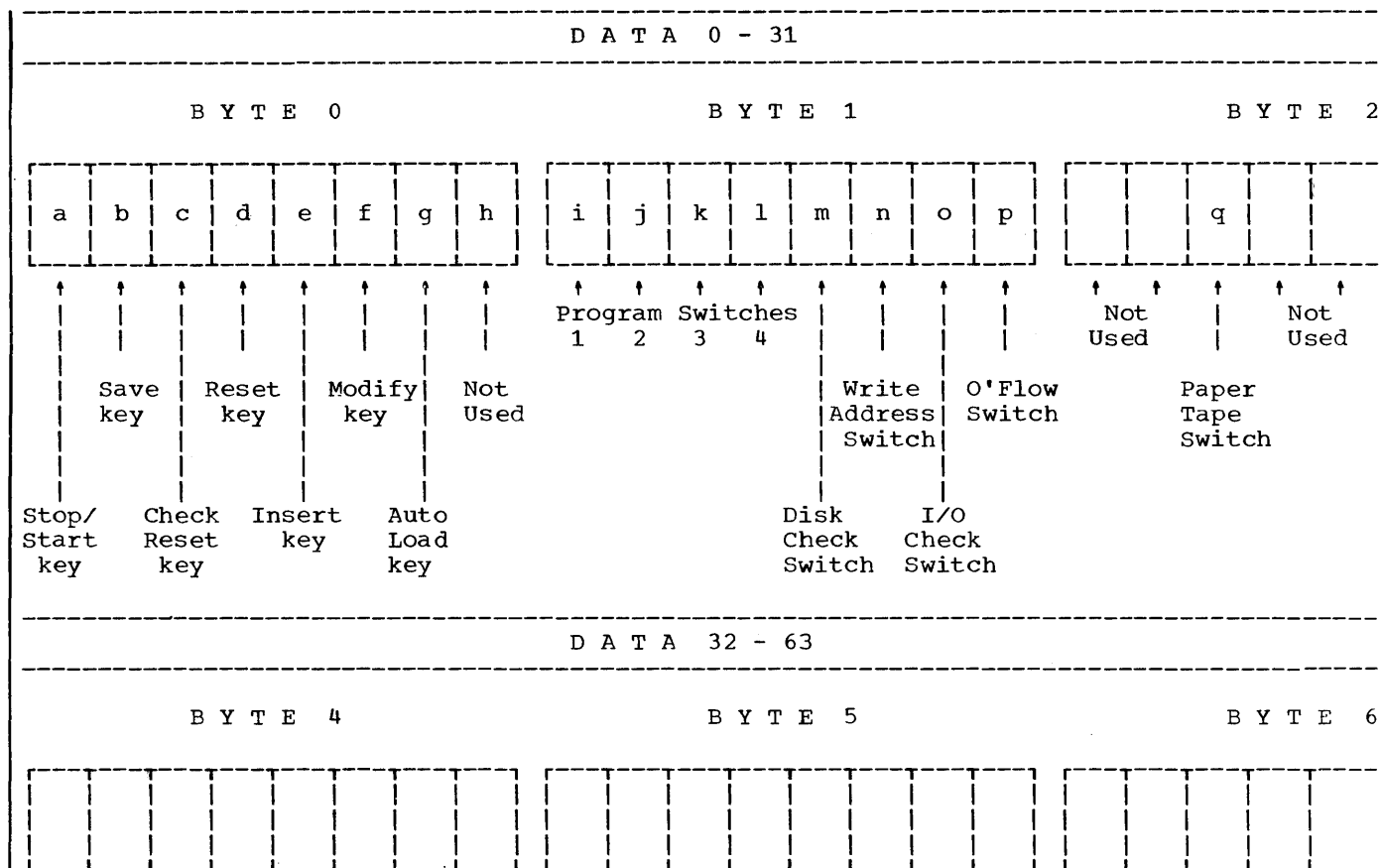
All simulated 1620 Console keys and switches except the Release key are directly simulated by setting the "storage data" switches on the 2050 system control panel to the appropriate value (see Tables 9 and 10), and then entering this value into main storage. The leftmost switch of this panel is not used. Figure 4 shows the storage data switches and their corresponding 1620 keys and switches.

In order to enter the values into main storage, the following steps must be performed:

1. Set the display storage select switch to MAIN (Main Storage).
2. Set all the storage address switches "up".
3. Press the stop key.
4. If no bits are present in bytes 2 and 3, set the storage data switches to the appropriate position. If any other bits are present, perform the logical OR of these bits with storage data switch (q).
5. Press the store and start keys.



•Figure 4. Storage Data Switches on the 2050 Control Panel



•Figure 5. Storage Data Switches on the 2065 Control Panel

Since 1620 keys are spring loaded, they automatically return to the neutral position after being pressed. In SIM20, to return the simulated keys to the neutral position, the storage data switches must all be set "up", and the value entered into main storage. Since the Start and Stop keys are simulated by the same switch, they do not have a neutral position.

The simulation of the 1620 Release and Reset keys, and the manipulation of 1620 Console keys are identical to the procedure on the Model 40.

SYSTEM/360 MODEL 65

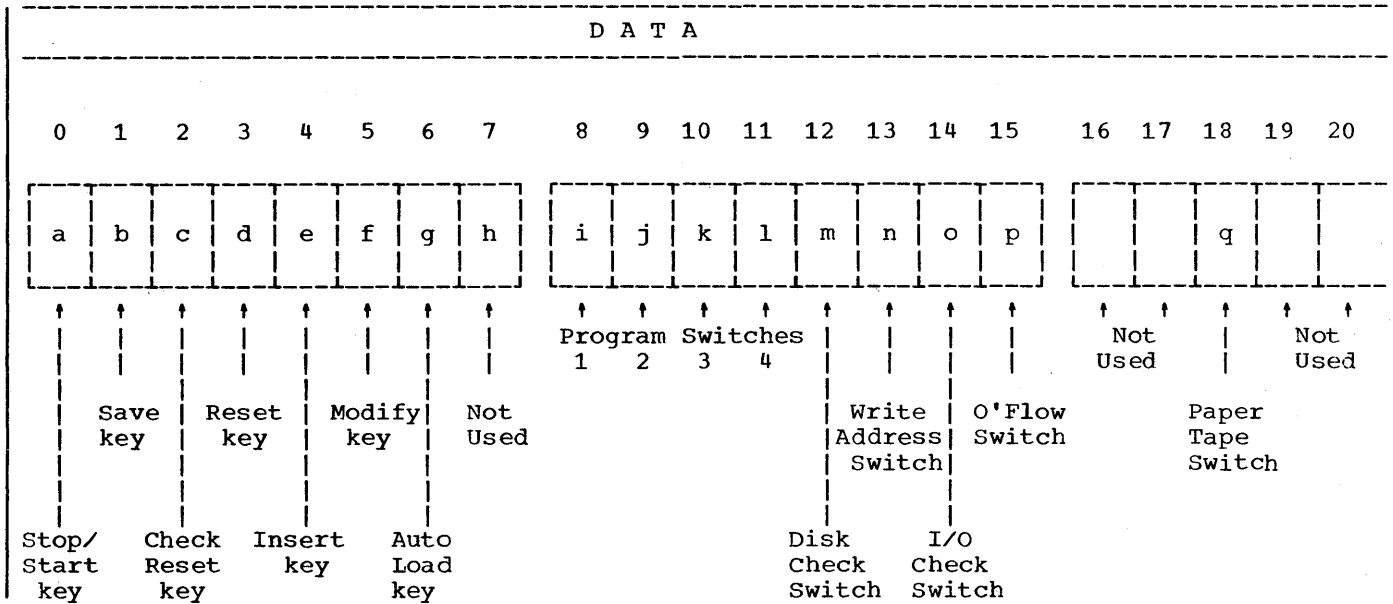
SIMULATION OF 1620 KEYS AND SWITCHES

All simulated 1620 Console keys and switches except the Release key are directly simulated by setting the "storage data" switches on the 2065 system control panel to the appropriate value (see Tables 9 and 10), and then entering this value into main storage. Figure 5 shows the storage data switches and their corresponding 1620 keys and switches.

In order to enter the values into main storage, the following steps must be performed:

1. Set the display storage select switch to MAIN (Main Storage).
2. Set all the storage address switches "up".
3. Press the stop key.
4. If no bits are present in bytes 2 through 7, set the storage data switches to the appropriate position. If any other bits are present, perform the logical OR of these bits with storage data switch (q). The data in main storage at the address corresponding to the storage data switches is displayed in the ST and AB registers (see IBM System/360 Model 65 Functional Characteristics, Form A22-6884).
5. Press the store and start keys.

Since 1620 keys are spring loaded, they automatically return to the neutral posi-



•Figure 6. Storage Data Switches on the 2075 Control Panel

tion after being pressed. In SIM20, to return the simulated keys to the neutral position, the storage data switches must all be set "up", and the value entered into main storage. Since the Start and Stop keys are simulated by the same switch, they do not have a neutral position.

The simulation of the 1620 Release and Reset keys, and the manipulation of 1620 Console keys are identical to the procedure on the Model 40.

SYSTEM/360 MODEL 75

SIMULATION OF 1620 KEYS AND SWITCHES

All simulated 1620 Console keys and switches except the Release key are directly simulated by setting the "storage data" switches on the 2075 system control panel to the appropriate value (see Tables 9 and 10), and then entering this value into main storage. Figure 6 shows the storage data switches and their corresponding 1620 keys and switches.

In order to enter the values into main storage, the following steps must be performed:

1. Set the display storage select switch to MAIN (Main Storage).

2. Set all the storage address switches "up".
3. Press the stop key.
4. If none of the bits 16 through 63 are set to one, set the storage data switches to the appropriate position. If any bits are set to one, perform the logical OR of these bits with storage data switch (q). The data in main storage at the address corresponding to the storage data switches is displayed in the J register (see IBM System/360 Model 75 Functional Characteristics, Form A22-6889).
5. Press the store and start keys.

Since 1620 keys are spring loaded, they automatically return to the neutral position after being pressed. In SIM20, to return the simulated keys to the neutral position, the storage data switches must all be set "up", and the value entered into main storage. Since the Start and Stop keys are simulated by the same switch, they do not have a neutral position.

The simulation of the 1620 Release and Reset keys, and the manipulation of 1620 Console keys are identical to the procedure on the Model 40.

EDITOR/SIM20 OPERATING PROCEDURES

The operating procedure varies according to whether an editing or a simulation run is to be executed (that for an updating run is given in Appendix B). In addition, the procedure to be followed when loading a 1620 program differs with the System/360 model used. The procedure for each type of run is described in the following sections.

EDITING RUN

As the unedited version of SIM20 contains all the routines necessary to simulate the 1620 Model 1 and Model 2, the user must adapt it to his particular 1620 system.

The operating procedure for creating an edited version of SIM20 differs according to whether the Simulator is on cards or on tape. In all cases, the support devices must be those defined in DEV360 and DEVSUP cards.

Editing the Simulator on Cards

Before the user can edit the card version of SIM20, he must prepare all the necessary control cards and place them in the proper place in the card deck. The following description of the card version of the Simulator as distributed by IBM will aid the user in placing the control cards in their proper places.

The Simulator Card Deck: All cards in the deck distributed by IBM have identification numbers in columns 73 through 80 of each card. The first five sets of cards in the deck have the identification A21B, A22B, A23B, A24B, and A25B, respectively, in columns 73 through 76 of each card, followed by a sequence number. These five sets of cards should always be the first cards in the deck.

The next set of cards has the identification A2UB in columns 73 through 76 of each card, followed by a sequence number. This set of cards contains the UPDT20 program.

The next set of cards has the identification A2EB in columns 73 through 76 of each card, followed by a sequence number. This set of cards contains the EDITOR program.

EDITOR is followed by a card with the identification A2ZB0001 in columns 73 through 80. This card must always be used.

The next set of cards has the identification A2S in columns 73 through 75 of each card, followed by a sequence number. This

set of cards contains the SIM20 program and, for those installations with disks, the DSKINT program.

SIM20 is immediately followed by a set of cards, of which the first one contains the identification A2P0000 in columns 73 through 80. This set of cards contains the sample program for SIM20.

If there are any end-of-file cards (7-8) punches in column 1) ^{MARK} in the deck, these ^{FILE} cards should be removed and thrown away.

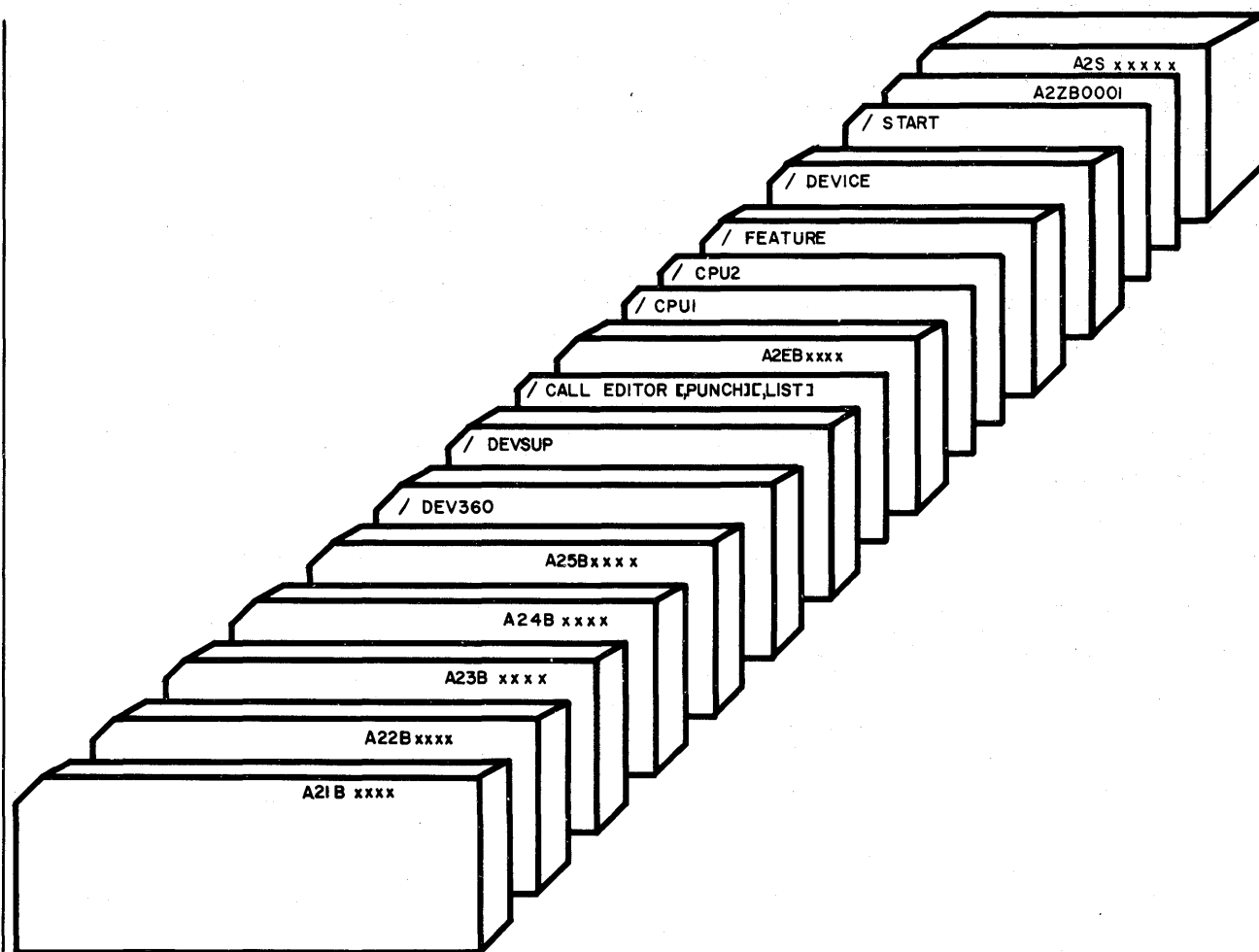
Sequence of Cards for Editing Run: In order to edit the card version of SIM20, the card deck should be arranged in the following sequence:

1. The five sets of cards with the identification A21B, A22B, A23B, A24B, and A25B in columns 73 through 76
2. The DEV360 control cards
3. The DEVSUP control cards
4. The CALL control card (with the term PUNCH if the edited version of SIM20 is to be produced on a card punch)
5. The set of cards with the identification A2EB in columns 73 through 76 (EDITOR)
6. The CPU1, CPU2, FEATURE, DEVICE, and START control cards
7. The card with the identification A2ZB0001 in columns 73 through 80
8. The set of cards with the identification A2S in columns 73 through 75 (SIM20)

The sequence of cards in the deck is shown in Figure 7.

Editing Procedure (Cards): The operating procedure for creating an edited version of SIM20 from cards is described below. In this description, it is assumed that the user's installation has no tape units and only one card reader (used as SIM2SYS, SIM2IN, and SIM2INF). This procedure is also recommended for those installations with more than one card reader. (One 1442 Card Read Punch, Model N1, or one 2520 Card Read Punch, Model B1, may not be used for both the card reading and punching functions.)

1. Prepare all control cards and set up the card deck as shown in Figure 7.
2. Place the card deck thus prepared in the card read hopper of the card reader assigned to SIM2SYS.



•Figure 7. Sequence of Cards for Editing Run

3. Ready the devices assigned to SIM2COM, SIM2MES, SIM2OUT, and (optionally) SIM2PRNT.
4. Go to step 4 under "Editing the Simulator on Tape."

Editing the Simulator on Tape

The operating procedure for creating an edited version of SIM20 from tape is described below.

1. Mount the Simulator system tape distributed by IBM on the 2400-Series unit assigned to SIM2SYS.
2. Ready the device assigned to SIM2OUT. (The edited symbolic version of SIM20 will be written on this device.)
3. Ready the devices assigned to SIM2INF,

SIM2COM, SIM2MES, and (optionally) SIM2PRNT.

4. Set the load-unit switches on the system control panel to the address of the device assigned to SIM2SYS.
5. Press the load key on the system control panel. Part of EDITOR is read into System/360 main storage, and the wait state is entered.
6. Press the request key on the 1052 Printer-Key-board. The message
A200A ASSIGN CONTROL CARD INPUT DEVICE
is printed, and the wait state is re-entered.
7. Press the request key on the 1052 and enter the following command:

type,X'aaa'

where:

type

denotes the type of input device, and must be one of: 1442, 2501, 2520, 2540, 1052.

aaa

denotes three hexadecimal characters giving the System/360 address of the device assigned to SIM2INF.

8. Hold down the alternate coding key on the 1052, and press the numeric 5 key.

a. If the control information is entered via a card reader, all the control cards up to and including the CALL card are read from SIM2INF, processed, and listed on the 1052. The rest of EDITOR is read into main storage, and the remaining control cards up to and including the START card are read from SIM2INF, processed, and listed on the 1052.

b. If the control information is entered via the 1052 Printer-Keyboard, the read light on the 1052 is turned on, and the operator may enter the control information one card image at a time. Before entering each image, the operator must press the request key on the 1052; after entering it, he must hold down the alternate coding key on the 1052, and press the numeric 5 key. After the CALL card is entered, the rest of EDITOR is read into main storage, and the read light on the 1052 is again turned on. The operator may then enter the remaining control information up to and including the START control card.

9. From the information in the control cards, EDITOR selects the routines necessary to simulate the required 1620 system, and they are written on SIM2OUT.

10. The message

A241I END OF EDITING

followed by the message

A242W WAIT STATE

is printed on the 1052 Printer-Keyboard, and the System/360 enters the wait state.

11. The edited version of SIM20 written on

the device assigned to SIM2OUT is in symbolic form (cards or card images) and must be assembled before use. This can be done using a System/360 assembler program; the output must be on punched cards. When SIM20 is assembled using a disk assembler, 54 cylinders are required. The output from the assembly run contains, in addition to SIM20, DSKINT (for 1620 disk configurations).

Possible Error Conditions

If, at step 7, the message A200A is not printed in response to the depression of the request key on the 1052 Printer-Keyboard, and the wait light stays on, a loading error has occurred. The operator must rewind SIM2SYS (or, when the Simulator is on cards, re-place the cards in the hopper of the card reader assigned to SIM2SYS) and restart from step 5.

The other errors which may occur during the initialization procedure, together with the action required to correct them, are described in Appendix E ("Messages").

SIMULATION RUN

The operation procedure to be followed when running a 1620 program under control of SIM20 is:

1. Remove from the card deck of the assembled version of SIM20, the cards preceding the card identified by IPL in columns 69, 70, and 71; at the end of the deck, place a Load Terminate card (12-2-9 punches in column 1, and LDT in columns 2, 3, and 4), and place the deck on any card reader.
2. Set the load-unit switches of the system control panel to the address of this device. 190
3. Press the load key on the system control panel. The edited version of SIM20 is read into System/360 main storage.

If the version of SIM20 to be run simulates a 1620 system without disk storage drives, go to step 4 below.

If the version of SIM20 to be run simulates a 1620 system with disk storage drives, go to step 1 in the section "Execution of the Program" in Appendix A (DSKINT).

4. The message

A250A SIM20 READY

is printed on the 1052 Printer-Keyboard, and SIM20 enters the 1620 manual mode.

5. Ready all the System/360 devices required for the first 1620 program to be executed.
6. Load the 1620 program.

On a 1620, self-loading programs generally stop after a printout; this indicates the end of loading. A 1620 Console start

operation would normally be necessary to start execution of the program. The corresponding start operation on the system control panel is performed as follows:

1. Press the stop key.
2. Ensure that the stop bit light is set on by the self-loading program.
3. Set storage data switch (a) "up", or set the rotary data switches to 00.
4. Press the store and start keys.

Before data can be written on a 2311 disk pack, certain initial information must be placed on each track of cylinders 00 to 102 of the 2311. DSKINT is used for this purpose.

In addition, as 2311 disk packs cannot be directly loaded with the contents of the 1311 disk packs, the 1311 disk data must be converted to a special format. This conversion may be performed by one of the methods given in the section "Data Formats."

When an editing run is made to produce a version of SIM20 for a 1620 system with 1311 Disk Storage Drives, the SIM20 version produced automatically contains DSKINT.

DSKINT MACHINE REQUIREMENTS

DSKINT requires the same System/360 configuration as that described in the section "EDITOR/SIM20 Machine Requirements."

DSKINT SUPPORT DEVICES

The following support devices are required to run DSKINT:

- From one to four 2311 Disk Storage Drives with 2841 Control Unit
- One program input device
- One 1052 Printer-Keyboard (same as that for SIM20)

OPERATING INSTRUCTIONS

PROGRAM LOADING

The assembled version of SIM20 and DSKINT is loaded in the following way:

1. Ready the 2311 Disk Storage Drives.
2. Ready the device for program input.
3. Place the program on the input device.
4. Dial the address of the input device on the load-unit switches of the System/360 system control panel.
5. Press the load key on the system control panel.

SIM20 and DSKINT are loaded into System/360 main storage, and control is given to DSKINT.

EXECUTION OF THE PROGRAM

1. When the program has been loaded into System/360 main storage, the message

A260D DISK ADDRESS(ES)?

is printed on the 1052 Printer-Keyboard. In response to this message, the operator enters the addresses of the 2311 Disk Storage Drives to be used. These addresses must have the format

nnnn

where "nnnn" represents four hexadecimal characters (example: 02C0). Alphabetic characters must be typed in upper case.

Up to four addresses may be typed, each separated from the others by commas. A separator other than a comma causes the program to ignore the following address.

If an incorrect address is entered in response to the message A260D, the message

A265A INVALID DISK ADDRESS

is printed on the 1052. The operator must then enter the correct address.

2. The program then causes the message

A261D FORMAT NEEDED?

to be written on the 1052. In response to this message, the operator must enter one of the following commands:

YES causes the necessary format of the 2311 Disk Storage Drive to be prepared.

The message

A262I END OF FORMAT

is then written on the 1052, and the program proceeds with step 3.

NO causes the program to go immediately to step 3.

END causes the program to stop and the System/360 to enter the wait state.

Any other command is ignored and causes the program to return to the beginning of step 2 (FORMAT).

3. The message

A263D SIMULATOR LOADING NEEDED?

is written on the 1052. In response to this message, the operator must enter one of the following commands:

YES causes the following to be loaded on each device whose address was specified in step 1.

- A self-loading main storage image of SIM20 (without DSKINT, which is no longer needed) on cylinder 00
- I/O device simulation routines (other than those for disks) on cylinder 01
- Disk simulation routines on cylinder 02

(Loading I/O simulation routines from disk is an optional feature for 1620 disk configurations to

be simulated on a System/360 Model 40E or 30E. This feature is described in the section "Control Information.")

The message:

A264I END OF LOADING

is written on the 1052, and control is then returned to step 1 (DISK ADDRESS).

NO causes the program to stop and the System/360 to enter the wait state.

END also causes the program to stop and the System/360 to enter the wait state.

Any other command is ignored and causes the program to return to step 3.

Following any command END, the message

A266W WAIT STATE

is written on the 1052. The System/360 enters the wait state and the operator must press the load key of the system control panel to ready SIM20.

For error messages see Appendix E "Messages."

Whenever IBM modifies the Simulator, the user receives either a deck of correction cards or a magnetic tape containing the corrections. He must incorporate these corrections into the current Simulator system to create a corrected version of the system. This process is referred to as updating.

Corrections to EDITOR and UPDT20 are distributed in binary form, and those to SIM20 and DSKINT, in symbolic form.

INITIALIZATION

Before using UPDT20 to incorporate corrections into the Simulator system, the user must "initialize" it. Initialization consists in defining the System/360 I/O devices to be used and, in some cases, the functions which they are to perform. UPDT20 may be initialized at the same time the updating run is executed, or it may be initialized separately, prior to the updating run.

The initialization process will create an absolute, self-loading version of UPDT20, which may be written on magnetic tape or cards to avoid re-initializing the program each time it is used.

SYSTEM/360 MACHINE REQUIREMENTS

The devices required to use UPDT20 depend upon whether the run is an initialization run or an updating run. However, all the devices (for the initialization run and the updating run) must be defined by DEV360 and, in certain cases, DEVSUP cards at the time of initialization.

SYSTEM/360 CONFIGURATION FOR UPDT20 INITIALIZATION

A System/360 with the following characteristics is required to initialize UPDT20.

- 32,768 bytes of main storage
- Standard instruction set
- System/360 I/O devices as shown in Tables 11 and 13

Table 11. System/360 Devices Required to Initialize UPDT20

SYMBOLIC NAME	FUNCTION
SIM2SYS	The device used to load the Simulator, as distributed by IBM, into System/360 main storage
None	The device used to enter control information
None	The device used to send messages to the operator, and commands to UPDT20
UPDTPROG (optional)	The device on which the absolute, self-loading version of UPDT20 is written

Table 12. System/360 Devices Required to Execute UPDT20

SYMBOLIC NAME	FUNCTION
SIM2SYS	The device used to load the Simulator as distributed by IBM into System/360 main storage
None	The device used to enter control information
None	The device used to send messages to the operator, and commands to UPDT20
UPDTCORR	The device used to enter the corrections distributed by IBM
UPDTNEW	The device on which the corrected version of the Simulator is written
UPDTOLD	The device from which the version of the Simulator to be corrected is read

SYSTEM/360 CONFIGURATION FOR UPDT20 EXECUTION

A System/360 with the following minimum characteristics is required to run UPDT20.

- 16,384 bytes of main storage
- Standard instruction set
- System/360 I/O devices as shown in Tables 12 and 13

The procedure for running UPDT20 is given in a later section of this appendix, entitled "Operating Instructions."

Table 13. System/360 Devices for UPDT20 Functions

SYMBOLIC NAME	SYSTEM/360 DEVICE
SIM2SYS	1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3
No symbolic name-device for control information	1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 1052 Printer-Keybaord
No symbolic name-device for messages and commands	1052 Printer-Keybaord
UPDTCORR	1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3
UPDTNEW	1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2520 Card Punch, Model B2 or B3 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3

(continued)

Table 13. System/360 Devices for UPDT20 Functions (continued)

SYMBOLIC NAME	SYSTEM/360 DEVICE
UPDTOLD	2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch
UPDTPROG (optional)	1442 Card Read Punch, Model N1 2520 Card Read Punch, Model B1 2520 Card Punch, Model B2 or B3 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3

A device is also required to load the initialized version of UPDT20 into System/360 main storage. The device must correspond to the one used as UPDTPROG.

CONTROL CARDS

The following control cards are required to initialize UPDT20. The general format of these cards is described in the section "Control Information."

DEV360 Cards

DEV360 control cards are required to define the System/360 devices used to initialize UPDT20 (see Table 11). In addition, DEV360 control cards are required to define the devices of the System/360 on which the initialized version of UPDT20 is to be processed (see Table 12).

DEVSUP Cards

One DEVSUP card is required for each symbolic name given in Table 13. While not all the devices described in Tables 11, 12, and 13 are used during initialization, they must all be defined by DEV360 and DEVSUP cards at this time.

Note: The DEVSUP card used to assign a 7-track 2400-Series unit to UPDTPROG must not contain the term "density".

CALL Card

One CALL card is required to indicate the end of control information and to load UPDT20.

The CALL card has one of the following formats:

1. / CALL UPDT20
2. / CALL UPDT20,PUNCH
3. / CALL UPDT20,INIT=UPDTPROG
4. / CALL UPDT20,PUNCH,INIT=UPDTPROG

The first of these formats is used when a 2400-Series Magnetic Tape Unit is assigned to UPDTNEW, and the symbolic name UPDTPROG has not been defined.

The second format is used when a card punch is assigned to UPDTNEW, and the symbolic name UPDTPROG has not been defined.

The third format is used when 2400-Series units are assigned both to UPDTNEW and to UPDTPROG.

The fourth format is used in the following cases:

- A 2400-Series unit is assigned to UPDTNEW, and a card punch is assigned to UPDTPROG
- A card punch is assigned to UPDTNEW, and a 2400-Series unit is assigned to UPDTPROG
- Card punches are assigned both to UPDTNEW and to UPDTPROG

Using any of the four formats, UPDT20 will be loaded into System/360 main storage. However, if the term INIT=UPDTPROG is present in the CALL card, the initialized version of UPDT20 will be written on the device assigned to UPDTPROG.

Sample Control Cards

```
/ DEV360 ADDR=X'185',2400,9TRACK
/ DEV360 ADDR=X'209',1052
/ DEV360 ADDR=X'00C',2540
/ DEV360 ADDR=X'280',2400,9TRACK

/ DEVSUP SIM2SYS=X'185',2400,I
/ DEVSUP UPDTCORR=X'00C',2540,I
/ DEVSUP UPDTOLD=X'185',2400,I
/ DEVSUP UPDTNEW=X'280',2400,O

/ CALL UPDT20
```

UPDT20 OPERATING INSTRUCTIONS

The operating procedure for using UPDT20 depends upon whether the Simulator is distributed on cards or on tape. If the Simulator is distributed on cards, the updated version must be on cards; if the Simulator is distributed on tape, the updated version must be on tape.

In either case, three types of run may be executed:

- Initialization only
- Initialization and updating
- Updating only

The operating procedure is given for each of these three types of run.

UPDATING THE SIMULATOR ON CARDS

If the user's installation has no tape units and only one card reader, the user must insert corrections by hand. In order to do so, he must know where to insert his corrections. A description of the arrangement of the cards in the deck distributed by IBM is given under "Editing the Simulator on Cards" in the section "EDITOR/SIM20 Operating Procedures."

If the user's installation has no tape units, but at least two card readers and one card punch, he may insert corrections using UPDT20. (One 1442 Card Read Punch, Model N1, or one 2520 Card Read Punch, Model B1, may not be used for both the card reading and punching functions.) However, before using UPDT20 to insert corrections, he must initialize it.

Initialization Only (Cards)

1. Prepare all the necessary control cards, and arrange the Simulator card deck as follows:
 - a. The five sets of cards with the identification A21B, A22B, A23B, A24B, and A25B in columns 73 through 76
 - b. The DEV360 control cards
 - c. The DEVSUP control cards
 - d. The CALL control card with the term PUNCH
 - e. The set of cards with the identification A2UB in columns 73 through 76 (UPDT20)

f. The card with the identification A2ZB0001 in columns 73 through 80

2. Place the resulting card deck in the card read hopper of the card reader assigned to SIM2SYS.
3. Ready the device assigned to UPDTPROG. (The absolute, self-loading version of UPDT20 will be written on this device.)
4. Go to step 4 under "Initialization Only (Tape)."

Initialization and Updating (Cards)

When initializing and updating during the same run, the same device may be assigned to SIM2SYS and UPDTOLD.

1. Prepare all the necessary control cards, and arrange the Simulator card deck as described under "Initializing UPDT20 on Cards," with the following modification:

Remove the card with the identification A2ZB0001 in columns 73 through 80.

Place the complete Simulator card deck as distributed by IBM after the last card with the identification A2UB in columns 73 through 76.

2. Place the resulting card deck in the card read hopper of the card reader assigned to SIM2SYS and UPDTOLD.
3. Place the correction cards in the card read hopper of the card reader assigned to UPDTCORR.
4. Go to step 4 under "Initialization Only (Tape)."

Updating Only (Cards)

When an updating run is executed separately, the same device may be assigned to SIM2SYS and UPDTOLD.

1. Place the card deck of the initialized version of UPDT20, followed by the Simulator card deck distributed by IBM, in the card read hopper of the card reader assigned to UPDTOLD.
2. Place the correction cards in the card read hopper of the card reader assigned to UPDTCORR.
3. Go to step 4 under "Updating Only (Tape)."

UPDATING THE SIMULATOR ON TAPE

The operating procedure depends upon whether the run is an initialization run, an updating run, or both.

Initialization Only (Tape)

1. Mount the Simulator system tape on the 2400-Series Magnetic Tape Unit assigned to SIM2SYS.
2. Ready the device assigned to UPDTPROG. (The absolute, self-loading version of UPDT20 will be written on this device.)
3. Ready the control information input device.
4. Set the load-unit switches on the system control panel to the address of the device assigned to SIM2SYS.
5. Press the load key on the system control panel. Part of the Simulator is read into System/360 main storage, and the wait state is entered.
6. Press the request key on the 1052 Printer-Keyboard. The message
A200A ASSIGN CONTROL CARD INPUT DEVICE
is printed, and the wait state is re-entered.
7. Press the request key on the 1052 and enter the following command:

type,X'aaa'

where:

type

denotes the type of the input device, and must be one of: 1442, 2501, 2520, 2540, 1052.

aaa

denotes three hexadecimal characters giving the System/360 address of the device from which control cards will be read.

8. Hold down the alternate coding key on the 1052, and press the numeric 5 key to send an end-of-block signal to UPDT20. Control cards, up to and including the CALL control card, are read, processed, and listed on the 1052 Printer-Keyboard. UPDT20 is read into main storage; then:
 - a. If this is an "initialization only" run, the absolute self-loading version of UPDT20 is

written on the device assigned to UPDTPROG.

The message

A212A END OF INITIALIZATION

is printed on the 1052 Printer-Keyboard, and the System/360 enters the wait state, ready for the next job.

- b. If this is an "initialization and updating" run, the message

A212A END OF INITIALIZATION

is not printed, and the updating run is executed immediately.

The corrections are incorporated into the existing version of the Simulator, and the updated version is written on the device assigned to UPDTNEW.

After the corrections have been incorporated into the Simulator, UPDT20 (if corrected) must again be initialized and SIM20 must be re-edited.

Possible Error Conditions: If, at step 7, the message A200A is not printed in response to the depression of the request key on the 1052 Printer-Keyboard, and the wait light stays on, a loading error has occurred. The operator must rewind SIM2SYS (or, when the Simulator is on cards, replace the cards in the hopper of the card reader assigned to SIM2SYS) and restart from step 6 (IPL).

Other errors which may occur during initialization, together with the action required to correct them, are described in Appendix E ("Messages").

Initialization and Updating (Tape)

When initializing and updating during the same run, the same device must be assigned to SIM2SYS and UPDTOLD.

1. Mount the system tape distributed by IBM on the 2400-Series tape unit assigned to SIM2SYS and UPDTOLD.

2. Ready the control information input device.

3. Place the corrections on the device assigned to UPDTCORR.

4. Go to step 4 under "Initialization Only (Tape)."

Updating Only (Tape)

When an updating run is executed separately, the operating procedure is:

1. Place the initialized version of UPDT20 on any 2400-Series tape unit.
2. Mount the existing version of the Simulator on the 2400-Series unit assigned to UPDTOLD.
3. Place the corrections on the device assigned to UPDTCORR.
4. Ready the device assigned to UPDTNEW. (The corrected version of the Simulator will be written on this device.)
5. Set the load-unit switches on the system control panel to the address of the device used to load UPDT20 (or of the device assigned to SIM2SYS, if initializing UPDT20).
6. Press the load key on the system control panel. UPDT20 is read into main storage; then the corrections are incorporated into the existing version of the Simulator, and the updated version is written on the device assigned to UPDTNEW.

After the corrections have been incorporated into the Simulator, UPDT20 (if corrected) must again be initialized and SIM20 must be re-edited.

Possible Error Conditions: If, at step 6, the load light on the system control panel does not go out, a loading error has occurred. The operator must re-ready the device used to load UPDT20, and retry step 6 (IPL).

APPENDIX C. PERFORMANCE

For a given 1620 program, the performance of SIM20 is represented by the performance ratio, defined as the ratio of the total execution time on the 1620 to the total execution time on the System/360.

The performance ratio for a given program depends mainly on the relative amounts of CPU and I/O activity, the amount of overlapped CPU and I/O activity, the CPU instruction mix, and the I/O devices used. Programs in which most of the total processing activity is CPU activity (overlapped and non-overlapped) will have a relatively low performance ratio, and those in which most of the total processing activity is non-overlapped I/O activity will have a relatively high performance ratio.

A number of programs were run on the 1620 Model 1, on the 1620 Model 2, and on

different models of the System/360 under control of SIM20. A selection of the timed programs, together with their performance ratios, is shown in Table 14. Table 15 summarizes the performance ratios of all the 1620 programs timed on the System/360 Models 30 and 40. The correspondence between the devices simulated and those used for their simulation is given in Table 16. This table also gives the performance of each device ("cpm" represents "cards per minute," and "chps" represents "characters per second").

The timed programs are not necessarily representative of all customer programs, and therefore, the performance ratio of a given program may not fall within the range shown in Table 15.

Table 14. Performance of Timed Programs

1620 MODEL 1			
PROGRAM NUMBER	PROGRAM NAME	PERFORMANCE RATIO	
		SYSTEM/360 MODEL 30	SYSTEM/360 MODEL 40
SP-035C	SPS III Printer: Assembly (with SIM20 sample program)	0.19	0.57
MP-21X	Contouring by Triangulation	0.37	0.88
SP-021	SPS II Paper Tape: Assembly Execution	----	1.12 1.00
MP-34X	Economic Evaluation of Petroleum Project	0.57	1.05
SP-020C	SPS II Card: Assembly	0.87	1.35
MP-03X	Least Square Curve Fitting	1.07	1.61
EO-05X	Lens Design	0.69	1.76
1620 MODEL 2			
SP-035	SPS III Printer: Assembly	0.11	0.27
SP-020C	SPS II Card: Assembly Execution	0.17 0.09	0.35 0.20

Table 15. SIM20 Performance Ratios

1620	I/O DEVICES	PERFORMANCE RATIO	
		SYSTEM/360 MODEL 30	SYSTEM/360 MODEL 40
Model 1	Cards	0.20 to 1.08	0.55 to 1.90
	Paper Tape	0.20 to 2.85	0.55 to 2.85
Model 2	Cards	0.06 to 0.54	0.15 to 1.90
	Paper Tape	0.06 to 2.85	0.15 to 2.85

Table 16. Speeds of Devices Used for Performance Data

1620 DEVICE	PERFORMANCE		SYSTEM/360 DEVICE	PERFORMANCE	
	MODEL 1	MODEL 2		MODEL 30	MODEL 40
1622 Card Reader	250 cpm	250 cpm	2540 Card Read Punch	1000 cpm	1000 cpm
1622 Card Punch	125 cpm	125 cpm	2540 Card Read Punch	300 cpm	300 cpm
1621 Paper Tape Reader	150 chps	150 chps	2671 Paper Tape Reader	1000 chps	1000 chps
1621 Paper Tape Punch	15 chps	15 chps	2540 Card Read Punch	300 cpm	300 cpm

APPENDIX D. SAMPLE PROGRAM

The sample program demonstrates the use of EDITOR, SIM20, and DSKINT. This description follows the preparation and execution of a SIM20 run, from receipt of the Simulator to the output from SIM20.

SIMULATOR SYSTEM TAPE

The Simulator system tape distributed by IBM contains EDITOR and UPDT20, in binary form, followed by SIM20 and DSKINT, in symbolic form and the sample program in BCD. After it has been edited, SIM20 must be assembled before being used to execute a 1620 program.

EDITING RUN

The first step to be performed is the editing of SIM20. The sample program assumes a minimum 1620 configuration simulated on a minimum System/360 configuration, but it may be run on a larger simulated 1620 system.

1620 System Simulated

The assumed 1620 configuration is:

- 20,000-position core storage (Model 1)
- Automatic divide feature
- 1620 console typewriter
- 1622 Card Read Punch
- 1443 Printer (optional)
- 1311 Disk Storage Drive (optional)

System/360 Configuration

The assumed 1620 configuration described above requires the following minimum System/360 configuration:

- 32,768 bytes of main storage (Model 30, 40, 50, 65, or 75)
- Standard instruction set
- 1052 Printer-Keyboard
- 2540 Card Read Punch
- 1403 Printer (optional)
- 2311 Disk Storage Drive (optional)

(The specific devices may have to be

changed to conform to the user's System/360 configuration.)

Control Cards

The following control cards are necessary to edit SIM20 for the simulation of the 1620 configuration described above. The sequence of the control cards is shown in Figure 8.

1. Simulator distributed on tape:

```
/ DEV360 ADDR=X'183',2400,9TRACK
/ DEV360 ADDR=X'283',2400,9TRACK
/ DEV360 ADDR=X'009',1052
/ DEV360 ADDR=X'00C',2540

/ DEVSUP SIM2SYS=X'183',2400,I
/ DEVSUP SIM2OUT=X'283',2400,O
/ DEVSUP SIM2IN=X'183',2400,I
/ DEVSUP SIM2COM=X'009',1052,I
/ DEVSUP SIM2INF=X'00C',2540,I
```

/ CALL EDITOR

```
/ CPU1 1620/1,20K
/ CPU2 360/30,32K
/ FEATURE DIVID
/ DEVICE 1622R,2540R,0,X'00C'
/ DEVICE 1622P,2540P,0,X'00D'
/ DEVICE 1443W,1403W,0,X'00E'
/ DEVICE 13110,2311A,1,X'190'
/ DEVICE 1620C,1052T,0,X'009'
/ START
```

2. Simulator distributed on cards:

```
/ DEV360 ADDR=X'009',1052
/ DEV360 ADDR=X'00C',2540
/ DEV360 ADDR=X'00D',2540

/ DEVSUP SIM2SYS=X'00C',2540,I
/ DEVSUP SIM2OUT=X'00D',2540,O
/ DEVSUP SIM2IN=X'00C',2540,I
/ DEVSUP SIM2COM=X'009',1052,I
/ DEVSUP SIM2INF=X'00C',2540,I
```

/ CALL EDITOR,PUNCH

```
/ CPU1 1620/1,20K
/ CPU2 360/30,32K
/ FEATURE DIVID
/ DEVICE 1622R,2540R,0,X'00C'
/ DEVICE 1622P,2540P,0,X'00D'
/ DEVICE 1443W,1403W,0,X'00E'
/ DEVICE 13110,2311A,1,X'190'
/ DEVICE 1620C,1052T,0,X'009'
/ START
```

(The user may have to change the device assignments to conform to his System/360 I/O configuration.)

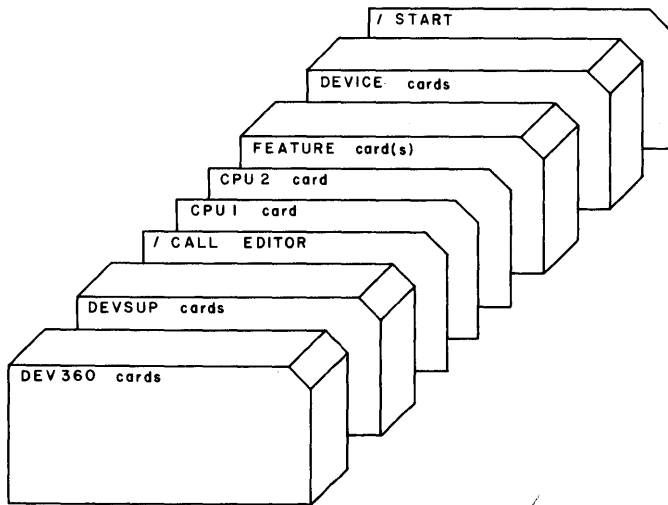


Figure 8. Control Card Sequence

Operating Procedure (Tape)

1. Mount the system tape on the 2400-Series tape unit assigned to SIM2SYS (System/360 address 183).
2. Place the control cards in the read hopper of the 2540 Card Read Punch assigned to SIM2INF (System/360 address 00C).
3. Ready the 2400-Series unit assigned to SIM2OUT (System/360 address 283). The edited version of SIM20 will be written on this tape.
4. Set the load-unit switches on the system control panel to 183.
5. Press the load key on the system control panel. Part of EDITOR is loaded into main storage, and the System/360 enters the wait state.
6. Press the request key on the 1052 Printer-Keybaord. The message
A200A ASSIGN CONTROL CARD INPUT DEVICE
is printed, and the System/360 again enters the wait state.
7. Press the request key on the 1052 and enter the following command:
2540,X'00C'
8. Send an end-of-block signal to EDITOR (hold down the alternate coding key and press the numeric 5 key).

All the control cards up to and including the CALL card are read from SIM2INF, processed, and listed on the 1052. The

rest of EDITOR is read into main storage, and the remaining control cards up to and including the START card are read from SIM2INF, processed, and listed on the 1052.

From the information in the control cards, EDITOR selects the routines necessary to simulate the 1620 system described above, and they are written on SIM2OUT.

The message

A241I END OF EDITING

followed by the message

A242W WAIT STATE

is printed on the 1052 ^{Printer}Printer-Keybaord, and the System/360 enters the wait state.

The edited version of SIM20 written on the device assigned to SIM2OUT is in symbolic form (cards or card images) and must be assembled before use. This can be done using the System/360 Basic Assembler program. The output contains in addition to SIM20, DSKINT if the disk DEVICE card was used.

Operating Procedure (Cards)

1. Prepare the control cards and arrange the Simulator card deck as described in the section "Editing the Simulator on Cards."
2. Place the resulting card deck in the card read hopper of the 2540 Card Read Punch assigned to SIM2SYS, SIM2INF, and SIM2IN (System/360 address 00C).
3. Ready the 2540 Card Read Punch assigned to SIM2OUT (System/360 address 00D).
4. Set the load-unit switches on the system control panel to 00C.
5. Go to step 5 under "Operating Procedure (Tape)."

UPDATING RUN

UPDT20 is used to extract the sample program from the system tape and to transfer it to punched cards. (This can be done by hand when the Simulator is distributed on cards.)

Control Cards

The following control cards are necessary to transfer the sample program from the system tape onto punched cards.

```

/ DEV360 ADDR=X'183',2400,9TRACK
/ DEV360 ADDR=X'00D',2540
/ DEV360 ADDR=X'009',1052
/ DEV360 ADDR=X'00C',2540

/ DEVSUP SIM2SYS=X'183',2400,I
/ DEVSUP UPDTOLD=X'183',2400,I
/ DEVSUP UPDTNEW=X'00D',2540,O
/ DEVSUP UPDTCORR=X'00C',2540,I

```

A special CALL card and a / UPDATE card (which must be placed on the device with symbolic name UPDTCORR) are used to extract the sample program from the system tape and to transfer it to punched cards.

```

/ CALL UPDT20,PUNCH
/ UPDATE A2P (The term A2P must be punched
in columns 15, 16, and 17.)

```

(The user may have to change the device assignments to conform to his System/360 I/O configuration.)

Operating Instructions

1. Mount the system tape on the 2400-Series unit assigned to SIM2SYS (System/360 address 183).
2. Ready the devices assigned to UPDTCORR and UPDTNEW. (The control cards are placed in the card reader assigned to UPDTCORR.)
3. Set the load-unit switches on the system control panel to the address 183.
4. Press the load key on the system control panel. Part of the system tape is read into main storage, and the System/360 enters the wait state.
5. Press the request key on the 1052. The message
A200A ASSIGN CONTROL CARD INPUT DEVICE
is printed, and the System/360 again enters the wait state.
6. Press the request key on the 1052 and enter the following command:
2540,X'00C'
7. Send an end-of-block signal to UPDT20 (hold down the alternate coding key and press the numeric 5 key).

The control cards, up to and including the CALL card, are read, processed, and listed on the 1052. The rest of UPDT20 is read into main storage, the / UPDATE card is read and processed, and the sample program is punched from the card read-punch

assigned to UPDTNEW (System/360 address 00D). The first card (identification card) and the last two cards (end-of-file cards) must be removed from the card deck before loading the sample program.

LOADING THE SAMPLE PROGRAM

The procedure to be followed when loading the sample program depends on whether the DEVICE card for the 1311 Disk Storage Drive is present.

No Disk Simulation

1. Remove from the card deck of the assembled version of SIM20, the cards preceding the card identified by IPL in columns 69, 70, and 71; add an LDT card to the end of the deck, and place the resulting deck in the card read hopper of the 2540 at address 00C.
2. Press the start and end-of-file keys of the 2540.
3. Set the load-unit switches of the system control panel to the address 00C.
4. Press the load key on the system control panel. The edited version of SIM20 is read into System/360 main storage.
5. The message
A250A SIM20 READY
is printed on the 1052 Printer-Keyboard, and SIM20 enters the 1620 manual mode.
6. Place the sample program in the 2540 Card Read Punch at address 00C and ready the 1403 Printer (if the appropriate DEVICE card was used).
7. Perform a simulated automatic load operation.

The sample program is read into main storage and is executed immediately. The execution of the program is described in the section "Executing the Sample Program."

With Disk Simulation ✓

1. Remove from the card deck of the assembled version of SIM20 and DSKINT, the cards preceding the card identified by IPL in columns 69, 70, and 71; add an LDT card to the end of the deck, and place the resulting deck on the 2540 at address 00C.

2. Press the start and end-of-file keys of the 2540.
3. Set the load-unit switches on the system control panel to 00C. ✓
4. Press the load key on the system control panel. The edited version of SIM20 and DSKINT are read into System/360 main storage.

The message

A260D DISK ADDRESS(ES)?
is printed on the 1052.

5. Enter the command

0190

and send an end-of-block signal to DSKINT.

The message

A261D FORMAT NEEDED?
is printed on the 1052.

6. Enter the command

YES

and send an end-of-block signal to DSKINT. DSKINT sets up the format of the 2311 Disk Storage Drive.

The message

A262I END OF FORMAT
followed by the message

A263D SIMULATOR LOADING NEEDED?
is printed on the 1052.

7. Enter the command

YES

and send an end-of-block signal to DSKINT.

FROM CORE STORAGE
SIM20 is loaded onto cylinder 00 of the 2311, the I/O simulation routines (other than those for disks) are loaded onto cylinder 01, and the disk simulation routines are loaded onto cylinder 02.

The message

A264I END OF LOADING
followed by the message

A260D DISK ADDRESS(ES)?

is printed on the 1052.

8. Enter the command

END

and send an end-of-block signal to DSKINT.

The message

A266W WAIT STATE
is printed on the 1052, and the System/360 enters the wait state.

9. Set the load-unit switches on the system control panel to 190, and press the load key.

SIM20 is loaded from cylinder 00 of the 2311 into System/360 main storage, and the message

A250A SIM20 READY

is printed on the 1052.

10. Go to step 6 in the section "No Disk Simulation."

EXECUTING THE SAMPLE PROGRAM

The sample program consists of two self-loading phases.

Phase 1

The first phase sets simulated 1620 core storage and indicators to zero, using the simulated Modify and Reset keys.

Phase 2

The second phase:

- Verifies that simulated 1620 core storage has been set to zero
- Tests the status of the program switches
- Tests the input of numeric and alpha-meric characters on the simulated 1620 console typewriter and on the simulated 1622 Card Reader, and tests the output of numeric and alpha-meric characters on the simulated 1622 Card Punch
- Tests the simulated 1620 CPU (fixed-point addition, subtraction, multiplication, and optionally, division)

Note: For these tests, the final results are printed, but the program

executes and verifies other alphanumeric operations which do not appear on the output. It is to these internal operations that the following error messages apply:

ERROR ON ADDITION OR SUBTRACTION

ERROR ON MULTIPLICATION

ERROR ON DIVISION

- Tests the printer routine with a standard ripple test
- Tests disk operations:
 1. Ten seek operations on 1620/1311 cylinders 00 through 99

2. Manual entry of a control word
3. Execution of a numeric read (RDN)
4. Execution of a numeric write (WDN)
5. Execution of a numeric control (CDN)

- Tests for the end of the program and, if so indicated by a switch setting, branches to the beginning of Phase 2

The following is the output of the sample program. The operator need only perform the operations indicated in the messages. Those messages preceded by an asterisk (*) are information messages; those preceded by a vertical line (|) are messages indicating errors which may occur.

** 1620 SAMPLE PROGRAM **

* PHASE I.SET ALL ADDRESS AND DATA SWITCHES TO ZERO.START

HALT,01188

KEY IN SIZE.1,3 OR 5 FOR 20K,40K OR 60K.

THEN EOB.IF @RD CHK@ MESSAGE,@START@AND VERIFY NUMERIC POSITION OF TYPEWRITER,SIZE = 3

| DUMP MEMORY,ADDRESS 19959

0J234567890J234567890J234567890J234567890

| CLEAR MEMORY WITH @MODIFY@ KEY (84).AFTER LOADING,START.

HALT,01512

*PHASE II.LOADING TERMINATED.

VERIFY THAT MEMORY HAS BEEN CLEARED BY MODIFY.

EXECUTE @SAVE@ OPERATION,THEN @INSERT@,KEY IN

34000000010235X99600010042,EOB.@START@.X=1,3 OR 5

HALT,04834

34000000010235399600010042

00

SET ALL PROGRAM SWITCHES ON,@START@

| POSITION OF SWITCHES IS INCORRECT.

| SET ALL PROGRAM SWITCHES ON,@START@

HALT,04918

SET ALL PROGRAM SWITCHES OFF,@START@.

| POSITION OF SWITCHES IS INCORRECT.

| SET ALL PROGRAM SWITCHES OFF,@START@.

HALT,05026

*TEST OF SWITCHES IS CORRECT.

TO TEST CARD READ-PUNCH,SET SWITCH 3 ON.

HALT,05194

KEY IN 80 ALPHA CHARACTERS TO GENERATE CARD DECK.IF @RD CHK@ MESSAGE TYPED,DO @START@.

WYTISFJWIRHQUORIRO

READY THE CARD PUNCH.@START@.

HALT,05386

010 CARDS PUNCHED. LOAD CARDS INTO READER.

HALT,05506

| ERROR,PUNCHED DATA ARE DIFFERENT FROM TYPED DATA.SW1 ON TO RETRY.

| HALT,05968

| KEEP THE LAST CARD,LOAD THE OTHERS INTO READER

| AFTER @LAST CARD RDR NO FEED@ MESSAGES,LOAD THE LAST ONE.@START@.

| HALT,05740

| LAST CARD

| RDR NO FEED

| INCORRECT DECK,7/8 CARD MISSING. SW1 ON TO RETRY

KEY IN 80 NUMERIC CHARACTERS TO GENERATE CARDS.

IF @RD CHK@ MESSAGE TYPED,DO @START@.

01234567890123456789012JKLMNOPQR

READY THE CARD PUNCH. @START@.

HALT,05950
010 CARDS PUNCHED. LOAD CARDS INTO READER.

HALT,06364

| LAST CARD
| RDR NO FEED
| LOADING OF DATA CARDS INCORRECT. SW1 ON TO RETRY.

| HALT,06520
| ERROR, PUNCHED DATA ARE DIFFERENT FROM TYPED DATA. SW1 ON TO RETRY.

| HALT,06298

*TEST OF CARD READ-PUNCH IS OK.

SET SWITCH 4 ON TO RETRY CARD TESTING.
HALT,06382

TESTS FOR CPU. IF AUTOMATIC DIVIDE, SET SWITCH 2 ON

HALT,06466
ENTER TWO NUMBERS OF 5 FIGURES WITH FLAGS. EOB.
A = P5467
B = R098Q

A + B = -4479

| ERROR ON ADDITION OR SUBTRACTION.

TEST FOR ADDITION AND SUBTRACTION COMPLETED

A * B = N357251390

| ERROR ON MULTIPLICATION.

TEST FOR MULTIPLICATION COMPLETED.

A / B = -0001.00

| ERROR ON DIVISION.

TEST FOR DIVISION COMPLETED.

*CPU TEST COMPLETED.

SET SWITCH 4 ON TO RETRY CPU TESTING.
HALT,07786

IF PRINTER IS PRESENT, SET SWITCH 3 ON.

HALT,07858

* PRINTER TEST COMPLETED.

IF DISKS ARE PRESENT, SET SWITCH 4 ON.
HALT,08146

TURN ON THE @DISK SWITCH@.

HALT,08206
KEY IN 1 DIGIT DRIVE CODE 1

KEY IN 5 DIGIT SECTOR ADDRESS 00000

|ERROR ON DISK

* DISK TEST COMPLETED.

SET SWITCH 1 ON TO LOOP ON PROGRAM.
HALT,08542

* 1620 SAMPLE PROGRAM FINISHED.

HALT,08626

The following is a sample of the output of the ripple test for the 1403 Printer.

ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI JKLMNO
6ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI JKLMN
56ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI JKLM
456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI JKL
3456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI JK
23456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI J
123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI
0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGHI
0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFGH
) 0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEFG
') 0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDEF
,') 0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCDE
,') 0123456ABCDEFGHI JKLMNOPQR STUVWXYZ .(+\$*-/,') 0123456789 RIPPLE TEST PRINTER ABCD

The following messages may be printed on the 1052 Printer-Keyboard during a Simulator run. If an action is to be performed in response to the message, it is described immediately after the message text.

The code which precedes each message has the general form

A2nnc

where:

A2 denotes that the message which follows the code has been printed by the 1620 Simulator.

nn denotes the serial number of the message, where:

00 through 29 indicates that the message can appear during an editing or updating run.

30 through 49 indicates that the message can appear only during an editing run.

50 through 59 indicates that the message can appear only during a simulation run.

60 through 69 indicates that the message can appear only during a disk initialization run.

90 through 99 indicates that the message can appear only during an updating run.

c denotes the action code, and takes one of the values:

A indicates that operator action is required.

D indicates that an operator decision is awaited.

I indicates that the message merely gives information.

W indicates that the message refers to an unrecoverable error, and the System/360 enters the wait state pending operator intervention.

COMMON MESSAGES

The following messages can appear during an editing or an updating run.

A200A ASSIGN CONTROL CARD INPUT DEVICE

Explanation: EDITOR or UPDT20 needs to be informed of the address and type of the device to be used to read control information.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: Enter the required data on the 1052 Printer-Keyboard, in the following format:

type,X'aaa'

type denotes the type of the input device, and must be one of: 1442, 2540, 2501, 2520, 1052.

aaa denotes three hexadecimal characters giving the System/360 address of the device.

A201W COMMAND ERROR,CANNOT CONTINUE

Explanation: There is an error in the command entered in response to message A200A.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Rewind SIM2SYS.
2. Restart the editing or updating procedure from the beginning (IPL).

A202W CONTROL CARD ERROR,INVALID CARD,CANNOT CONTINUE

Explanation: One of the following errors has been detected.

1. The identification /blank is not present in columns 1 and 2 of the control card.

2. The operation field is not one of the following: DEV360, DEVSUP, CALL.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Correct the control card.
2. Rewind SIM2SYS.
3. Restart the editing or updating procedure from the beginning (IPL).

A203I CONTROL CARD ERROR,TERMS ABSENT,CARD IGNORED

Explanation: One or more terms of the control card are absent.

System Response: The control card is ignored, and the editing or updating procedure continues.

Required Action: None.

A204I CONTROL CARD ERROR,INVALID TERMS,CARD IGNORED

Explanation: One or more terms in the control card are invalid. The following errors cause this message to be printed.

1. The operand field contains terms with more than eight characters.
2. The System/360 address of a device specifies a channel number greater than 6.
3. A hexadecimal or decimal operand is incorrect; for example, ADDR=F'...' instead of ADDR=X'...', or X'00H', or F'1A00'.

System Response: The control card is ignored, and the editing or updating procedure continues.

Required Action: None.

A205W CONTROL CARD ERROR,nnnnnnnn NOT ASSIGNED,CANNOT CONTINUE

Explanation: "nnnnnnnn" takes one of the values: 1052PK, SIM2SYS, SIM2PRNT. This message is printed in the following cases:

1. There is no DEV360 card defining the 1052 Printer-Keyboards.

2. One or both of the DEVSUP cards used to define the devices SIM2SYS and SIM2PRNT are absent.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Correct the control card.
2. Rewind SIM2SYS.
3. Restart the editing or updating procedure from the beginning (IPL).

A206W CONTROL CARD ERROR,TOO MANY DEVSUP SYMBOLS,CANNOT CONTINUE

Explanation: EDITOR or UPDT20 can accept only ten different symbolic device names. The DEVSUP control cards have specified more than ten.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Remove the invalid DEVSUP cards.
2. Rewind SIM2SYS.
3. Restart the editing or updating procedure from the beginning (IPL).

A207I CONTROL CARD ERROR,nnnnnnnn INCORRECTLY DEFINED,CARD IGNORED

Explanation: "nnnnnnnn" denotes a symbolic device name. This message is printed in the following cases:

1. The System/360 address of the device with symbolic name "nnnnnnnn" has not been defined in a DEV360 control card.
2. The values of the parameters "type" and "mode" are not consistent with the symbolic name "nnnnnnnn".

System Response: The control card is ignored, and the editing or updating procedure continues.

Required Action: None.

A208W CONTROL CARD ERROR,pppppp INVALID, CANNOT CONTINUE

Explanation: The symbolic program name "pppppp" in the CALL control card is not one of EDITOR, TAPDK, UPDT20.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Correct the control card.
2. Rewind SIM2SYS.
3. Restart the editing or updating procedure from the beginning (IPL).

A209W PROGRAM ERROR,CANNOT CONTINUE,DUMP

Explanation: An error has been detected in the program.

System Response: A program interruption occurs, and the System/360 enters the wait state.

Required Action: Dump all of System/360 main storage for analysis.

A210D INCORRECT CARDS - EITHER START NEW RUN OR PUSH INTERRUPT KEY

Explanation: One or more of the messages A203I, A204I, A207I have been printed on the 1052 Printer-Keyboard.

System Response: The editing or updating procedure is interrupted, and the System/360 enters the wait state.

Required Action: The operator can either correct the erroneous cards and start a new run; or he can push the interrupt key to ignore the incorrect cards and continue processing.

A211W LOADING ERROR,CANNOT CONTINUE

Explanation: An error condition has been detected during the loading of

the program specified by the CALL control card.

System Response: Loading is interrupted and the System/360 enters the wait state.

Required Action: Restart the loading procedure from the beginning.

A212A END OF INITIALIZATION

Explanation: The initialization procedure has terminated without error, and the initialized version of the program has been written on the appropriate device.

System Response: The System/360 enters the wait state.

Required Action: Go on to the next job.

A213A INITIALIZATION ERROR,CANNOT CONTINUE

Explanation: An I/O error has been detected while writing the initialized version of the program on cards or tape.

System Response: Initialization is interrupted, and the System/360 enters the wait state.

Required Action: Restart the initialization procedure from the beginning.

A214A EQUIPMENT CHECK - TRY AGAIN

Explanation: An equipment check has been detected on the 1052 Printer-Keyboard during the typing of a command.

System Response: The read light on the 1052 Printer-Keyboard is turned on.

Required Action: Re-enter the command.

The following messages can appear when a System/360 device defined by a DEVSUP card is used to perform an I/O operation. The I/O messages have the general form

A2nnc X'aaa' bbbbbb,cccc

where:

aaa

denotes three hexadecimal characters giving the System/360 address of the corresponding device.

bbbbbb
denotes the message.

cccccc
denotes the required action, if any.

A220W X'aaa' PROGRAM ERROR,LOAD DUMP

Explanation: A program check or a command reject condition has been encountered during an I/O operation.

System Response: The System/360 enters the wait state.

Required Action: The operator must load a System/360 dump program.

A221W X'aaa' UNRECOVERABLE ERROR

Explanation: This message is printed in all cases of failure defined by IBM Standards. (Example: device not operational after a Start I/O instruction).

System Response: The System/360 enters the wait state.

Required Action: The operator must load the SEREP program.

A222I X'aaa' END OF FILE

Explanation: This message is printed when a tape mark has been encountered on a magnetic tape, or when the last card has been read.

System Response: Execution of the program continues.

Required Action: None.

A223I X'aaa' END OF TAPE

Explanation: This message is printed when an end-of-tape indication has been detected during a tape write operation.

System Response: Execution of the program continues.

Required Action: None.

A224A X'aaa' INTERVENTION REQUIRED

Explanation: This message can be supplemented by a further message, printed on the next line, which defines the action to be taken. Depending on the device, three supplementary messages are possible:

TYPE START OR STOP
(example: 2400-Series Magnetic Tape Units)

UNLOAD HOPPER,RELOAD LAST n CARD(S)
AND TYPE START OR STOP
(example: card readers)

RUN OUT - SCRAP LAST n CARD(S) AND
TYPE START OR STOP
(example: card punches)

System Response: The System/360 enters the wait state.

Required Action: As indicated in the message. When the message is not followed by a supplementary request, the operator must press the Start key of the device.

A225A X'aaa' DATA CHECK

A226A X'aaa' EQUIPMENT CHECK

A227A X'aaa' BUS OUT CHECK

A228A X'aaa' OVERRUN

A229A X'aaa' CHAINING CHECK

Explanation: These messages can be supplemented by a further message, printed on the next line, which defines the action to be taken. Depending on the device, three supplementary messages are possible:

TYPE START OR STOP
(example: 2400-Series Magnetic Tape Units)

UNLOAD HOPPER,RELOAD LAST n CARD(S)
AND TYPE START OR STOP
(example: card readers)

RUN OUT - SCRAP LAST n CARD(S) AND
TYPE START OR STOP
(example: card punches)

System Response: The System/360 enters the wait state

Required Action: As indicated in the supplementary message. When the message is not followed by a supplementary request, the operator must press the Start key of the device.

EDITING MESSAGES

The following messages can appear only during an editing run.

A230I DUPLICATION OF CONTROL INFORMATION

Explanation: Two or more DEVICE control cards have been read, defining the same device.

System Response: The first of each of these control cards is ignored, and the editing process continues.

Required Action: None.

A231I NO INDEX ON THIS MODEL

Explanation: The CPU1 control card has defined a 1620 Model 1, and the FEATURE control card has requested the simulation of index registers.

System Response: The FEATURE card containing the term INDEX is ignored, and the editing process continues.

Required Action: None.

A232I END OF SIM20

Explanation: During an editing run of several versions of SIM20, this message indicates the end of each version.

System Response: The message A233D is printed.

Required Action: None.

A233D DO YOU WANT ANOTHER FILE

Explanation: This message is printed following the message A232I, as EDITOR must know whether another version of SIM20 is to be created.

System Response: The device SIM2COM is ready to read further information.

Required Action: Enter one of the following commands and send an end-of-block signal to the System/360.

1. YES, to indicate that another version of SIM20 is to be created.
2. NO, to indicate that there are no further versions to be created. (In this case, the message A241I is printed.)

A234I INVALID CONTROL INFORMATION
CANNOT CONTINUE

Explanation: Some of the information in the CPU1, CPU2, DEVICE, or FEATURE control cards were not found in the dictionary in EDITOR.

System Response: The card or cards containing the invalid terms are ignored, and the message A242W is printed.

Required Action: None.

A235A CPU1 AND CPU2 ARE INCOMPATIBLE

Explanation: The 1620 core storage capacity given in the CPU1 control card is too large for the System/360 main storage capacity given in the CPU2 control card.

System Response: The read light on the SIM2COM is lighted.

Required Action: All control information must be re-entered, and an end-of-block signal sent to the System/360.

A236A SIM2OUT DEVICE NOT DEFINED

Explanation: No DEVSUP control card has defined the device assigned to SIM2OUT.

System Response: The System/360 enters the wait state.

Required Action: Prepare a DEVSUP card for the device, and re-start the editing run.

A237A SIM2IN DEVICE NOT DEFINED

Explanation: No DEVSUP control card has defined the device assigned to SIM2IN.

System Response: The System/360 enters the wait state.

Required Action: Prepare a DEVSUP card for the device, and re-start the editing run.

A238A SIM2COM DEVICE NOT DEFINED

Explanation: No DEVSUP control card has defined the device assigned to SIM2COM.

System Response: The System/360 enters the wait state.

Required Action: Prepare a DEVSUP card for the device, and re-start the editing run.

A239A SIM2INF DEVICE NOT DEFINED

Explanation: No DEVSUP control card has defined the device assigned to SIM2INF.

System Response: The System/360 enters the wait state.

Required Action: Prepare a DEVSUP card for the device, and re-start the editing run.

A240I END OF TAPE ON SIM2OUT

Explanation: An end-of-tape mark has been written on the device assigned to SIM2OUT.

System Response: The editing procedure continues.

Required Action: None.

A241I END OF EDITING

Explanation: This message is printed at the end of the editing run and indicates that the editing procedure has terminated.

System Response: The message A242W is printed.

Required Action: None.

A242W WAIT STATE

Explanation: This message indicates the end of the editing run.

System Response: The System/360 enters the wait state.

Required Action: Go on to the next job.

A243A DISK FEATURE NEEDED

Explanation: The amount of System/360 main storage necessary to simulate the defined 1620 configuration exceeds 32,768 bytes. The "disk residence" feature is required to simulate this configuration.

System Response: The read light on the SIM2COM is lighted.

Required Action: All control information must be re-entered, and an end-of-block signal sent to the System/360.

SIM20 MESSAGES

The following messages can appear only during a simulation run.

There are two types of simulation messages, those which refer to simulated 1620 lights and indicators and those which refer to the operation of SIM20 itself. The first type of message is not preceded by a code.

MESSAGES SIMULATING 1620 LIGHTS AND INDICATORS

The following messages display the state of the 1620 lights and indicators, and put SIM20 in 1620 manual mode. The text of each message corresponds to the name of the indicator on the 1620 Console.

RDR NO FEED¹

Required Action: The following operations must be performed.

1. Place the required deck in the card read hopper.
2. Ready the card reader.
3. Perform the simulated start operation on the system control panel.

P/D INTLK²

Required Action: The following operations must be performed.

1. Ready the paper tape punch, card punch, or disk storage drive.
2. Perform the simulated start operation on the system control panel.

ARITH CHK

Required Action: That which would have been necessary on a 1620.

EXP CHK

Required Action: That which would have been necessary on a 1620.

MAR CHK

Explanation: This message is issued when SIM20 detects an invalid operation code, an invalid address, or an invalid I/O device.

Required Action: Perform a 1620 Dump Numerically operation.

RD CHK

Required Action: That which would have been necessary on a 1620.

¹Also printed when the message READ INTER-LOCK (Model 2) should appear.

²Also printed when the message WRITE INTER-LOCK (Model 2) should appear.

Note: The locking of the 1622 Card Reader is not simulated. If the 1620 program is run under Monitor I system control, the operator must perform the following actions:

1. Unload the hopper.
2. Re-place the erroneous card, and all the cards that follow it, in the hopper.
3. Perform the simulated start operation on the system control panel.

WR CHK

Required Action: That which would have been necessary on a 1620.

DISK CHECK 4

Explanation: This message simulates the Disk Address Check indicator.

Required Action: That which would have been necessary on a 1620.

DISK CHECK 2

Explanation: This message simulates the Disk Wrong-Length-Record/Read-Back-Check indicator.

Required Action: That which would have been necessary on a 1620.

DISK CHECK 1

Explanation: This message simulates the Disk Cylinder Overflow indicator.

Required Action: That which would have been necessary on a 1620.

INT.REQ.ON xxxx

Explanation: The printer with name xxxx is not ready.

Required Action: The following operations must be performed:

1. Ready the printer.
2. Perform the simulated start operation on the system control panel.

HALT,nnnnn

Explanation: This message simulates the 1620 Halt instruction, where "nnnnn" denotes the 1620 address of the Halt instruction.

System Response: SIM20 stops and enters the 1620 manual mode.

Required Action: When this message appears, the operator must perform the operations required by the 1620 program.

PR CHK

Required Action: That which would have been necessary on a 1620.

LAST CARD

Explanation: This message is issued when the 1620 program has tried to read a card and no card was fed into the card reader.

System Response: SIM20 enters the 1620 manual mode.

Required Action: Place the last card in the card read hopper and perform the 1620 start operation, or press the request key on the 1052 Printer-Keyboard if the card reading operation has terminated (see "1620 Release Key").

SIMULATION MESSAGES

A250A SIM20 READY

Explanation: SIM20 has been loaded into core storage.

System Response: SIM20 enters the 1620 manual mode.

Required Action: Begin the simulation run.

A251A DAMAGE ON xxxx

Explanation: This message is printed in the following cases:

1. The device "xxxx" is not operational (for example, switch disable on the 2311).
2. The device is not assigned.
3. A persistent error has occurred during a read or write operation.

System Response: SIM20 enters the 1620 manual mode.

Required Action: Depending on the cause of the message, one of the following actions is required:

1. If the device is not operational, correct the error condition and press the start key.
2. If the device is not assigned, prepare the necessary control information and make a new EDITOR run, or
3. If a persistent error has occurred during a read or write operation, dump System/360 main storage for analysis.³

A252A 2311 EQUIP CHECK

Explanation: An equipment-check condition has been detected on the 2311.

System Response: SIM20 enters the 1620 manual mode.

Required Action: Dump System/360 main storage for analysis.³

A253A UC

Explanation: A unit-check condition has been detected on the printer.

System Response: SIM20 enters the 1620 manual mode.

Required Action: Press the start key to retry the print operation. If the unit-check condition is persistent, reload the universal character buffer using the UT-48 utility program, and restart the run.³

A254W PROGRAM ERROR

Explanation: An error has been detected in SIM20.

System Response: A program interruption occurs, and the System/360 enters the wait state.

Required Action: Dump all of System/360 main storage for analysis.

DISK INITIALIZATION MESSAGES

The following messages can appear during a disk initialization run.

A260D DISK ADDRESS(ES)?

Explanation: The program must be informed of the address of the 2311

³Any 1620 program which does not use the failed device may be run after this one.

Disk Storage Drive or Drives to be used.

System Response: The disk initialization run is interrupted, the 1052 read light is turned on, and operator action is awaited.

Required Action: Enter the required information, which must have the format "nnnn".

nnnn
denotes four hexadecimal characters (example: 0C1A).

Up to four addresses may be entered, each separated from the others by a comma.

A261D FORMAT NEEDED?

Explanation: The program must be told whether or not disk formatting is required.

System Response: The 1052 read light is turned on and operator action is awaited.

Required Action: Enter one of the commands:

- YES
- NO
- END

A262I END OF FORMAT

Explanation: This message is written after the command YES has been entered in response to the message A261D.

System Response: The program prints message A263D.

Required Action: None.

A263D SIMULATOR LOADING NEEDED?

Explanation: The program must be told whether or not SIM20 routines are to be loaded from disk storage.

System Response: The 1052 read light is turned on and operator action is awaited.

Required Action: Enter one of the commands:

- YES
- NO
- END

A264I END OF LOADING

Explanation: This message is written at the end of the disk initialization run and indicates that the loading procedure has terminated.

System Response: The program goes on to write message A260D.

Required Action: None.

A265A INVALID DISK ADDRESS

Explanation: This message is written when the operator types a device address which is not recognized by the program.

System Response: The 1052 read light is turned on and operator action is awaited.

Required Action: Enter the correct address.

A266W WAIT STATE

Explanation: This message is written in response to the command END.

System Response: The System/360 enters the wait state.

Required Action: Press the load key on the system control panel to perform the IPL operation.

A267A INTERVENTION REQUIRED

Explanation: The disk storage drive for which an I/O operation has been requested is not ready.

System Response: The program waits for approximately three minutes, then reprints the message if the disk storage drive is still not ready. When the device is ready, processing re-starts immediately.

Required Action: Ready the disk storage drive.

A268A TYPE AGAIN

Explanation: An invalid character has been detected in the command just entered.

System Response: The read light on the 1052 Printer-KeyBoard is turned on.

Required Action: Re-enter the command.

A269W DAMAGE ON 2311

Explanation: This message is printed in the following cases:

1. The device "xxxx" is not operational (for example, switch disable on the 2311).
2. The device is not assigned.
3. A persistent error has occurred during a read or write operation.

System Response: The System/360 enters the wait state.

Required Action: Depending on the cause of the message, one of the following actions is required:

1. If the device is not operational, correct the error condition and press the start key.
2. If the device is not assigned, prepare the necessary control information and make a new EDITOR run.
3. If a persistent error has occurred during a read or write operation, dump System/360 main storage for analysis.

UPDT20 MESSAGES

The following messages can appear only during an updating run.

A290A END OF UPDATING

Explanation: The updating run has terminated without error.

System Response: The System/360 enters the wait state.

Required Action: Go on to the next job.

A291W CONTROL CARD ERROR,nnnnnnnn NOT ASSIGNED,CANNOT CONTINUE

Explanation: The device with symbolic name "nnnnnnnn" (where "nnnnnnnn" takes one of the values: UPDTOLD, UPDTCORR, UPDTNEW) has not been defined by a DEV360 or a DEVSUP control card at initialization.

System Response: The updating run is interrupted, and the System/360 enters the wait state.

Required Action: When this message appears, the following operations must be performed.

1. Prepare the necessary control cards.
2. Re-initialize UPDT20.
3. Restart the updating run with the re-initialized version of UPDT20.

A292W UPDATING ERROR,CANNOT CONTINUE

Explanation: A condition has been detected which prevents UPDT20 from terminating the run.

System Response: The updating run is interrupted, and the System/360 enters the wait state.

Required Action: Dump all of System/360 main storage for analysis.

A293W POSSIBLE UPDATING ERROR(S) DETECTED

Explanation: One or more irregularities have been detected during an updating run.

System Response: The updating run is terminated, and the System/360 enters the wait state.

Required Action: Define SIM2PRNT and re-execute the run using a CALL control card with the format:

/ CALL UPDT20,LIST

A listing of the module to be updated will be printed on SIM2PRNT with the modifications and the control cards. The possible errors are flagged.

Check the modifications, ignoring re-numbering errors (flagged N).

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

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BASIC PROGRAM MATERIAL LIST
 For
 IBM System/360
 1620 Simulator Program (360C-SI-752)
 Version 1, Modification Level 2

Write-up	Ident. Key	Description			Quantity
		BW01-02	Basic Program Material List		
Cards	Ident. Key	Description			Quantity
		BC01-02	1620 Simulator Object Programs : - COMMON PROGRAMS - UPDT20 - EDITOR - SYSINEND - SIMULATOR - SAMPLE PROGRAM		
Magnetic Tape	Ident. Key	Description of Reel	Tape Contents (No. of Recs-Mode-Density) with / for TM	No. of TMs	Max. blk length in chrs.
		BT01-02	1620 Simulator Object Programs : - COMMON PROGRAMS - UPDT20 - EDITOR - SYSINEND - SIMULATOR - SAMPLE PROGRAM	9 Track Tape 339 EBCDIC 800/ 128 EBCDIC 800/ 101 EBCDIC 800/ 1 EBCDIC 800/ 10863 EBCDIC 800/ 202 EBCDIC 800//	7
	OR				

	Ident. Key	Description of Reel	Tape Contents (No. of Recs-Mode-Density) with / for TM	No. of TMs	Max. blk length in chrs
Magnetic Tape	BT02-02 *	1620 Simulator Object Programs : - COMMON PROGRAMS - UPDT20 - EDITOR - SYSINEND - SIMULATOR - SAMPLE PROGRAM	7 Track Tape 339 EBCDIC 800/ 128 EBCDIC 800/ 101 EBCDIC 800/ 1 EBCDIC 800/ 10863 EBCDIC 800/ 202 EBCDIC 800//	7	80

The following publications are considered Basic Program Material and are automatically supplied by DPPID in answer to an original request for the program package.

	Form Number	Title	Source
Publications	C28-6529-2	IBM System/360 Conversion Aids : The 1620 Simulator for IBM System/360	Additional copies available through IBM Branch Offices

* If a 7 track tape is received, the Data Conversion feature is required.

The Sample Program Operating Procedures are found in the 1620 Simulator for IBM System/360 (Form No. C28-6529-2) - Appendix D.

The above list constitutes the complete list of Basic Program Material. Only those items requested are enclosed.

All Program Material which has an Identification Key beginning with B and all listed Basic Publications are considered Basic Program Material and automatically supplied in answer to a request for this program package.

OPTIONAL PROGRAM MATERIAL LIST
 For
 IBM System/360
 1620 Simulator Program (360C-SI-752)
 Version 1, Modification 2

Write-up	Ident. Key	Description		Quantity	
	XW01-02	Optional Program Material List		1 Page	
XW02-00	Optional Tape Assembly Procedure		3 Pages		

Magnetic Tape	Ident. Key	Description by Reel	Tape Contents (No. of Recs- Mode-Density) with / for TM	No. of TM	Max. blk length in chrs.
	XT01-02	1620 Simulator Source Program	9 Track 686 EBCDIC 800//	2	1600
OR					
XT02-02 *	1620 Simulator Source Program	7 Track 686 EBCDIC 800//	2	1600	

* If a 7 track DTR is received the **Data Conversion** feature is required.

Prior to using the above tape it **must either** be punched out onto cards or deblocked into 80 character records. The **punch operation** may be performed using the System/360 Tape to Card Program (360P-UT-053). The **deblock operation** may be performed using the System/360 Tape to Tape **Program** (360P-UT-054).

The above list constitutes the **complete list** of Optional Program Material. Only those items requested are enclosed.

All Program Material which has an **Identification Key** beginning with X is Optional Program Material and must be **individually** requested if desired.

XW01-02

OPTIONAL TAPE ASSEMBLY PROCEDURE
For
IBM System/360
1620 Simulator Program, 360C-SI-752
Version 1, Modification Level 0

To create a new Simulator System Tape, the procedures listed below should be followed:

1. Assembly may be done using the BOS 8K disk assembler. Assemble the 7 modules of the Simulator Source Tape.
2. Remove any blank cards which may be produced between modules in the punched output form assembly.
3. Perform any updating with adequate DEV360 and DEVSUP control cards. Mount the basic tape on the unit whose assignment is UPDTOLD.
4. Create the following card deck:

Columns	1	8	15	41	44	59	67	73
---------	---	---	----	----	----	----	----	----

/UPDATE			A21B					
ØRIS		A21B		R	C	1	1	

Absolute Loader card deck obtained from assembly (remove the first two cards).

ØRIS		A22B		R	C	1	1	
------	--	------	--	---	---	---	---	--

Control Program Card Deck

ØRIS		A23B		R	C	1	1	
------	--	------	--	---	---	---	---	--

I/O Package Card Deck

ØRIS		A24B		R	C	1	1	
------	--	------	--	---	---	---	---	--

Initializer Card Deck

ØRIS		A25B		R	C	1	1	
------	--	------	--	---	---	---	---	--

Relocating Loader Card Deck

ØLDT								A25B0020
/UPDATE			A2UB					
ØRIS		A2UB		R	C	1	1	
/bPROGRAMbUPDT20, TBSIZ=F'500'								A2UB0000

Columns	1	8	15	41	44	59	67	73
---------	---	---	----	----	----	----	----	----

Update Card Deck

⊖LDT								A2UB0020
/UPDATE		A2EB						
⊖RIS	A2EB		R	C	1	1		
/bPROGRAMbEDITOR, TBSIZ=F'500'								A2EB0001

Editor Card Deck

⊖LDT								A2EB0020
/UPDATE		A2ZB						
/UPDATE		A2S						
/UPDATE		A2P						
/UPDATE		TEM						

⊖ = 12/2/9 Punches in the same column

The magnetic tape unit on which the basic system tape is mounted must be referred to as UPDTCORR.

The magnetic tape unit on which the new basic system tape will be written must be referred to as UPDTNEW. The console printer keyboard must be referred to as SIM2COM.

Operating Instructions

1. Perform an IPL operation on SIM2SYS.
2. When the System/360 enters the wait state, depress the Request Key on the 1052. A message is printed, requesting the assignment of the control card input device.
3. Depress the Request Key again, then key in the requested definition, as specified in the SRL (example: Type - 2540, X'00C').

4. The control cards are read and listed on the 1052, then the Object card deck is read and written on UPDTNEW. When the program has found the SIM20 file, it performs a tape copy on UPDTNEW, and stops.

Upon completion of the operation, UPDTNEW becomes the new basic system tape.