

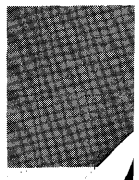
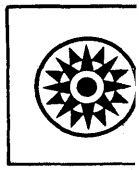
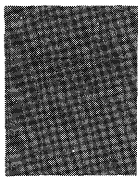
## Systems Reference Library

### IBM System/360 Disk Operating System Operating Guide

This reference publication describes the procedures to be followed by system operators when executing jobs in a multiprogramming environment using the Disk Operating System. Topics discussed include: multiprogramming, batched job processing, IPL procedure, device assignments, initiating and terminating processing, and operator communication to the system. A section of general operating techniques is included.

Messages from the system, previously included in the DOS Operating Guide, are now contained in a separate publication, IBM System/360 Disk Operating System Operator Communications, Form C24-5074-0. The communications manual also contains other reference information of interest to the system operator.

For a list of associated publications, refer to the IBM System/360 Bibliography, Form A22-6822.



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Ninth Edition (November 1969)

This edition applies to Release 21 of IBM System/360 Disk Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest System/360 SRL Newsletter, Form N20-0360, for the editions that are applicable and current.

This edition, C24-5022-8, is a major revision of C24-5022-7.

Summary of Amendments

Significant changes in this edition include:

- Removal of the system-to-operator messages and the appendixes. These sections are now included in IBM System/360 Disk Operating System Operator Communications, Form C24-5074-0.
- Reorganization of the sequence of the material in the publication.
- Addition of a General Operating Techniques section.

Changes are indicated by a vertical line to the left of the affected text and to the left of affected parts of figures. A dot (•) next to a figure title or page number indicates that the entire figure or page should be reviewed.

Requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

A form for readers' comments is provided at the back of this publication. If the form has been removed, comments may be addressed to IBM Corporation, Programming Publications, P.O. Box 6, Endicott, New York 13760.

## Preface

This publication tells the system operator how to execute jobs, in a multiprogramming environment, using the Disk Operating System. This publication should be used together with IBM System/360 Disk Operating System Operator Communications, Form C24-5074-0.

Prerequisite publications are: IBM System/360 Disk and Tape Operating Systems, Concepts and Facilities, Form C24-5030 and IBM System/360 Model 30 Operator's Guide, Form A24-3373 (or a corresponding publication).

The publication is divided into three major sections following the Introduction. The first section, System Operation, describes how to IPL (initial program load) the system and how to start, run, and stop jobs in the various system partitions. The second section, Communications, describes the operator commands and how they are used to communicate with the system. The third section, General Operating Techniques, contains techniques for using the system with several System/360 models, permanent main storage assignments, and general operating hints.



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The Disk Operating System consists of an IBM control program and one or more processing programs. The processing programs may be written by the user's programmers or they may be supplied by IBM. The system is disk resident, using IBM 2311 or IBM 2314 disk storage for on-line storage of all programs. Depending upon the requirements of the particular application, the system can be expanded to include all processing programs used to perform the various jobs of a particular installation, or it can be tailored to a minimum system to control a single program.

The control program is that part of the Disk Operating System that prepares and controls the execution of all other programs in the system. It includes the following components:

1. Supervisor. The Supervisor handles all input/output operations, interruption conditions, and other functions for all problem programs. Part of the Supervisor resides in main storage at all times. Processing time is divided between the Supervisor and the program(s) being executed. This is true for the user's programs as well as other IBM-supplied components of the system. Certain functions of the Supervisor are provided by transient routines that remain in disk storage until needed and which are then loaded into main storage for execution.
2. Job Control. Job Control runs between job steps and prepares the system for execution of all other programs in a batched-job environment. Job Control is loaded by the Supervisor from disk storage whenever needed. For foreground programs operating in other than batched-job environment, Job Control type functions are performed by the single program initiator.
3. Initial Program Loader (IPL). The IPL routine loads the Supervisor into main storage when system operation is initiated. IPL is loaded from disk storage simply by selecting the address of the disk drive in the load-unit switches on the system console and pressing the load key. IPL also processes certain control statements.

The control program supervises all input/output functions. Required control program input/output units are:

1. System Residence (SYSRES): system residence unit
2. System Reader (SYSRDR): unit used for Job Control statements
3. System Input (SYSIPT): system input unit
4. System Punch (SYSPCH): system output unit
5. System List (SYSLSLST): system printer unit
6. System Communication (SYSLOG): medium for operator communication.

These required control program input/output units are used by programs operating in either the background or batched foreground partitions.

## Batched-Job Processing

Batch processing capabilities, within the following limitations, are available to all three programming partitions (BG, F1, and F2) in a multiprogramming system, provided this option is specified at the time the system is generated.

The two limitations that must be satisfied before batch processing can be undertaken in two or more programming partitions are:

1. Separate input/output files for each partition.
2. At least 10K bytes of storage for each partition.

Batch processing capabilities are discussed in greater detail in the Multiprogramming section.

Because the control program resides on disk, it must be read into main storage by an IPL (Initial Program Loading) procedure before the first job can be processed. A job may consist of either the execution of a single program in the system or the execution of more than one program. Each execution is called a job step. Thus, a job consists of a series of one or more job steps.

In preparing to execute a job, the operator must be sure that:

1. Input for the control program is on the correct device. This can be a card reader, magnetic tape unit, or disk.
2. Input for the processing program is on the correct device. This can be a card reader, magnetic tape unit, or disk.
3. Any I/O devices referenced by the processing program have been readied.

After the operator has checked the preceding items, his primary function is to monitor messages that may appear on the 1052 printer-keyboard, and to service, as required, card readers and punches, printers, magnetic tapes, disk units, etc.

## Multiprogramming

For those systems with main storage equal to or greater than 24K, the Disk Operating System offers multiprogramming support. This support is referred to as Fixed Partitioned Multiprogramming, because the number and size of the partitions is fixed, or defined, during system generation. The size of the partitions may be redefined by the operator for a specific program after system generation.

### Background vs Foreground Programs

Two types of problem programs exist in multiprogramming: background and foreground. Foreground programs may operate in either the batched-job mode or in the single-program mode. Background programs and batched-job foreground programs are initiated by Job Control from the batched-job input streams. Single-program foreground programs are initiated by the operator from the 1052 printer-keyboard. When one program completes, the operator must explicitly initiate the next program.

A multiprogramming environment is capable of concurrently operating one background program and one or two foreground programs. Priority for CPU processing is controlled by the Supervisor, with foreground programs having priority over background programs. All programs operate with interruptions enabled. When an interruption occurs, the Supervisor gains control, processes the interruption, and gives control to the highest priority program that is in a ready state. Control is taken away from a high priority program when that program encounters a condition

that prevents continuation of processing until a specified event has occurred. For example, this condition would occur when a WRITE operation is issued to a tape unit. Control is taken away from a lower priority program when an event on which a higher priority program was waiting has been completed. In the previous example, control would return to the high priority program when the WRITE I/O operation has been executed. When all programs in the system are simultaneously waiting (i.e., no program can process), the system is placed in the wait state enabled for interruptions. Interruptions are received and processed by the Supervisor. When an interruption satisfies a program's wait condition, that program becomes active and competes with other programs for CPU processing time. During a fetch operation, all programming is halted unless Supervisor option PTO=YES (physical transient overlap) is specified. Thus, programs requiring frequent fetches can adversely affect system throughput.

In addition to at least 24K positions of main storage, multiprogramming support requires the storage protection feature.

If the batch-job foreground option is selected when the system is generated, many types of programs may be run in the foreground partitions. (Specifying the option causes the generation of individual communication regions for each partition.) However, the Linkage Editor and the maintenance functions of the Librarian are restricted to the background partition. (Refer to the Disk and Tape Operating Systems Concepts and Facilities publication, listed in the Preface, for the IBM-supplied programs that may be run in the foreground partitions.)

Figure 1 illustrates how storage is organized for various size machines. This figure shows that multiprogramming requires at least 24K of storage. Since the background partition can never be less than 10K (refer to ALLOC command), a machine with 24K of storage can have one foreground area of 6K or two foreground areas of 4K and 2K respectively. SPI (single program initiated) programs can be run in these foreground areas within the limitations imposed by the remaining storage available. For a machine with at least 32K of storage, it is possible to have at most two batch processing areas--one in the background and the other in a foreground area. An SPI program can be run in the remaining foreground area, if it does not require more than 4K of storage. There is another possibility for a 32K machine that is not illustrated in Figure 1. The background area can be 14K (required for the assembler with disk work file variants). In this



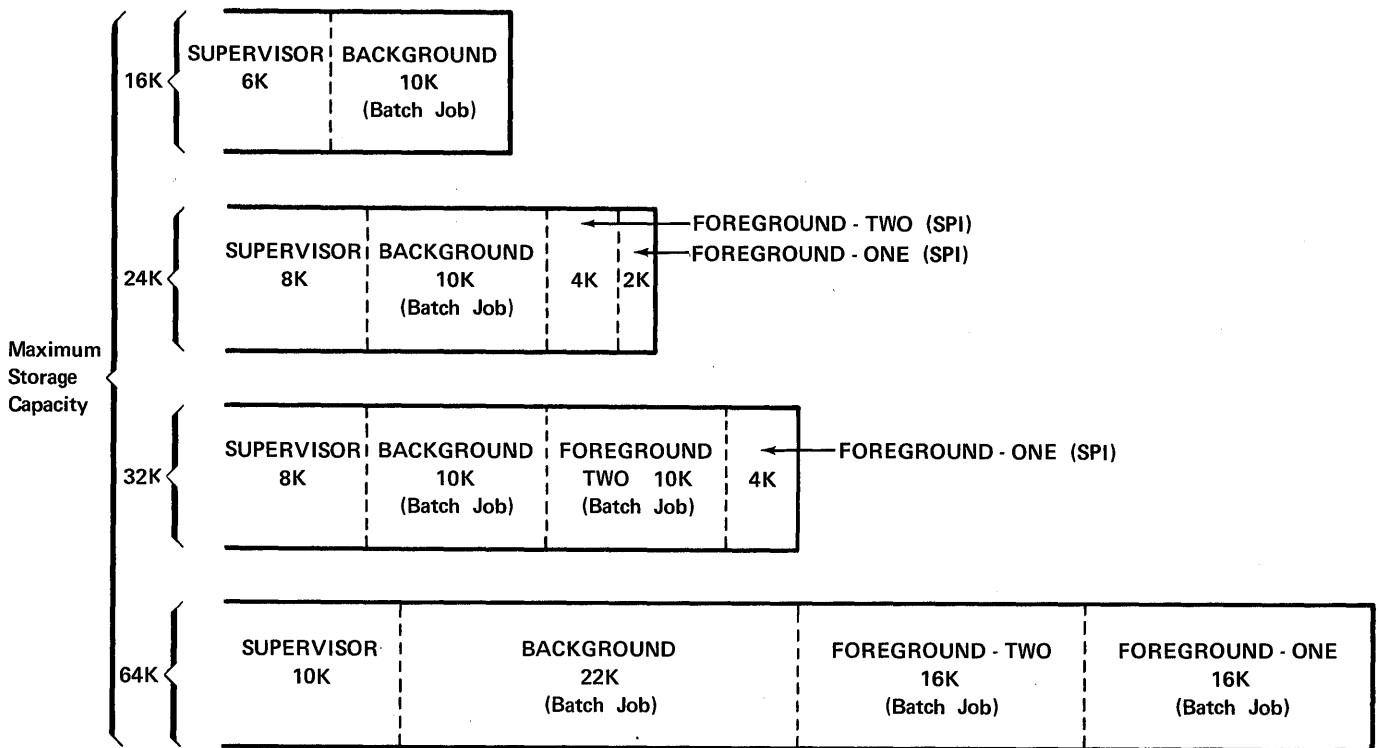


Figure 1. Possible Storage Allocation for System/360 with Various Storage Capacities

case, there is insufficient storage remaining to support a second batch processing area. The remaining 8K of storage could, however, be used for SPI programs in one or two foreground areas. In machines with at least 48K of storage, it is possible to have all three programming areas operating in a batch processing environment.

A job may consist of either the execution of a single program in the system or the execution of more than one program. Each execution is called a job step. Thus, a job consists of a series of one or more job steps.

## Batch Processing

The execution of all batch processing programs in either background or foreground areas is under the supervision of a control program.

The main function of the control program is to transfer control from one job step to the next. Job Control is called by:

1. The Initial Program Loader, to process the first batch job after an IPL procedure.
2. The Supervisor, at the normal or abnormal end-of-job for all batch programs.

## Control Program Input

The Job Control program requires certain input statements to exercise its control function. These statements, referred to as job-control statements, describe each job step that is to be executed in the program.

Each job normally contains a JOB, one or more EXEC's, and a /& control statement. The other statements are optional, depending upon the job requirements. For example, if disk files are used DLBL and EXTENT statements may also be required. The name of each statement and its function are as follows:

<u>Statement</u>	<u>Function</u>		
// ASSGN	Used to assign symbolic names to physical input/output devices.	// RSTRT	Provides identification and location of checkpoint records for restarting a job, and starts the execution of the job.
// DATE	Provides a date for the job being executed.	// TLBL	Provides magnetic tape file label information.
// CLOSE	Close either a system or programmer logical unit.	// TPLAB	
// DLBL	Provides DASD (direct access storage device) file label information.	// UPSI	Sets user program switch indicators used by the individual program.
// DLAB		// VOL	Provides volume label information.
// EXEC	Always the last statement read before a program is executed. It initiates the execution of a job step and can provide the name of the program to be executed.	// EXTENT	Indicates the limits of a file on a DASD unit.
// JOB	Always the first job statement. It provides the job name.	// XTENT	
// LBLTYP	Defines the amount of storage to be reserved at linkage edit time for processing tape and nonsequential disk file labels.	/*	Indicates end-of-data file input for a job step.
// LISTIO	Prints I/O assignment listings.	/*	Always the last statement in every job. Indicates end-of-job.
// LOG	Causes job control statement to be logged on SYSIST.	*	Used for programmer-to-operator comments.
// MTC	Initiates magnetic tape control operations.		
// NOLOG	Suppresses logging of job control statements on SYSLST.		
// OPTION	Establishes program options.		
// PAUSE	Causes the system to suspend the processing program input for operator intervention.		
// RESET	Resets I/O device assignments to the standard established at		

system generation time or modified by the operator.

## Processing Program Input

A processing program can be any of the following: a language translator (such as Assembler), a utility program, a sort program, or a user's compiled program.

The programmer is responsible for preparing both the job control statements and the necessary coding to perform the desired program function. For example, he may prepare a set of source statements to be assembled or compiled, or a set of statements describing an input file for a utility program.

# System Operation

## Starting the System (IPL Procedure)

This section describes the IPL procedure used to start the system or to load a new Supervisor after placing a new SYSRES pack on the system. Figures 2 and 3 provide a summary of this information.

Step	Procedure	Comments
1	Mount the system pack on a 2311 or 2314 disk drive. Ready this device.	
2	Place job control statements in SYSRDR. Ready this device.	
3	Dial the load-unit switches on the system control panel to the address (channel and unit) of the 2311 or 2314.	
4	Press LOAD.	IPL and the Supervisor are loaded into main storage. The system enters the wait state.
5	Press REQUEST.	This message prints: 0110A GIVE IPL CONTROL STATEMENTS
6	If desired, enter ADD and DEL commands. Otherwise, omit this step.	Devices can be added to, or deleted from the PUB table.
7	Enter SET command.	The date is required. The time of day is required if the interval timer is present. No other SET command operands are acceptable. This message prints: 0120I DOS IPL COMPLETE Control is given to the control program.

Figure 2. IPL Procedure Using an IBM 1052 Printer-Keybaord

If a new SYSRES pack is placed on the system and no IPL is performed, the supervisor on the new pack will not be loaded. The supervisor previously loaded into core will be used in all future jobs.

Step	Procedures	Comments
1	Mount the system pack on a 2311, 2314 disk drive. Ready this device.	
2	Place control statements in a card reader. Do not ready this device if it is to be assigned during this IPL.	These statements are: ADD (optional, but if used, DEL must be ahead of SET) SET (required) job control statements.
3	Dial the load-unit switches on the system control panel to the address (channel and unit) of the 2311,2314	
4	Press LOAD.	IPL and the supervisor are loaded into main storage. The system enters the wait state.
5	Press INTERRUPT, if the card reader is assigned to SYSRDR,  or Press START on card reader if it is not yet assigned to SYSRDR.	Control statements are read. Control is then given to the control program.  When the reader becomes ready, it is automatically assigned to SYSRDR. Control statements are read and message 0120I DOS IPL COMPLETE is issued when IPL is complete and control is given to the control program.

Figure 3. IPL Procedure Using a Card Reader for Control Statements

Any jobs run that require the label cylinder may cause portions of the SYSRES pack to be destroyed as a result. To prevent this, the IPL procedure should always be performed after a new SYSRES pack is mounted.

The system pack must first be placed on a disk unit. The address of the disk unit is then selected from the load-unit switches on the console, and the load key is pressed. This causes IPL and the supervisor portion of the control program to be read into low main storage. When IPL and the supervisor portion of the control program have been read successfully, the wait state is entered (with all interruptions enabled). This part of the IPL procedure is the same whether a printer-keyboard or a card reader is used for operator communication.

When the wait state is entered, the operator communication device for IPL must be given to the system. If it is to be a 1052, the request key on the printer-keyboard is pressed. The message:

```
0I10A GIVE IPL CONTROL COMMANDS
```

is printed on the printer-keyboard.

If a card reader is used to perform the IPL procedure, there are two alternatives.

1. If the card reader is not yet assigned to SYSRDR, the start key on the reader is pressed. (Feeding the first card automatically assigns the card reader to SYSRDR.) If the wrong device is readied, a low-core wait-state message will be given. No printed messages occur after the system enters the wait state. Instead, the first four characters of any message (0I10-0I21) are placed in bytes 0-3. For example, message 07Wcuu is given if the device type is invalid for IPL communication. If the device accepts the command, message 0I11A is given.
2. If the card reader is already assigned to SYSRDR, press the interrupt key on the console. Control statements can now be read from the communication device.

The operator has the option of changing the PUB table (which indicates I/O device configuration) by adding or deleting devices. When a device is deleted (via the DEL command), all references to the device are removed. A device may be added (via the ADD command) only if sufficient space is already available in the PUB table. If a tape is to be added to the PUB table and tape-error statistics were specified during system generation, there must also be enough space for the associated tape-error block. If space is insufficient, an error message is issued. The ADD and DEL commands are described in Operator Command Formats.

The SET command must be entered at the operator communication device. The date is required and, if the timer is supported by the Supervisor, the time of day is also required. The SET command is described in Operator Command Formats. No other information is acceptable at this time. The SET command must follow any ADD or DEL commands. When the communication device is a 1052 printer-keyboard, the end-of-block character (Ⓟ) must be given immediately after the SET command. The message 0I20I DOS IPL COMPLETE, followed by 1I00A READY FOR COMMUNICATIONS, is printed on the printer-keyboard. Control statements can now be entered via the 1052 printer-

keyboard. Ⓟ end-of-communications must be given to read control statements from SYSRDR, assigned to the background partition. Three situations are possible:

1. If a permanent assignment exists for SYSRDR and it is assigned to an operative device, control statements are read from this device.
2. If a permanent assignment exists for SYSRDR and it is assigned to an inoperative device, a message is printed on the printer-keyboard. The operator can then assign SYSRDR to the device containing the control statements for the first job.
3. If a permanent assignment does not exist for SYSRDR, a diagnostic message is printed on SYSLOG.

## I/O Device Assignments

Symbolic names are used to reference all input/output devices in the system. These names are divided into two classes: system logical units and programmer logical units. A listing of the logical units, their functions, and the actual devices to which they can be assigned is shown in Figure 4.

System logical units (SYSIPT, SYSLNK, SYSLOG, SYSLST, SYSPCH, SYSRES, SYSRDR, SYSREC, SYSSLB, and SYSRLB) are used by the control program and by various IBM-supplied processing programs. All of these units (except SYSLNK and SYSREC) can also be used by user programs operating in the background or either foreground problem-program area.

Programmer logical units are defined at system-generation time for each class of problem program (background, foreground-one, and foreground-two) to be run in the system. In a multiprogramming environment, the same SYSnnn can be defined for the background and both foreground areas. For example SYS000 can be assigned to separate physical devices in all three program areas. The combined number of programmer logical units for all program classes defined for the system may not exceed SYSmax -- the highest numbered programmer logical unit available for a partition. SYSmax is determined by the installation at system generation time. SYSmax is not a symbolic name.

For the convenience of the user, two additional system logical unit names are defined for batch processing programs. These names are used only in certain Job Control statements (e.g., CLOSE, ASSGN, and EXTENT).

Symbolic Name	Function	May be Assigned to	Remarks
SYSRES	System residence unit	Disk Storage Drive: 2311 or 2314	Assignment is established by the system during an IPL and cannot be altered until another IPL occurs.
SYSRDR	Job control batch job program input device	Card Readers: 1442, 2501, 2520, or 2540 Magnetic Tape Units: 2400 Series (Note 2) Disk Storage Drive: 2311 or 2314	1. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 2. If the 1052 printer-keyboard is inoperable, SYSRDR must be assigned to a card reader.
SYSIPT	Processing program input device	Card Readers: 1442, 2501, 2520, or 2540 Magnetic Tape Units: 2400 Series (Note 2) Disk Storage Drive: 2311 or 2314	1. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 2. If the 1052 printer-keyboard is inoperable, SYSIPT must be assigned to a card reader. 3. SYSIPT and SYSRDR may be assigned to the same physical device. 4. Required for system generation and maintenance, and language translators.
SYSIN	Assign SYSIPT and SYSRDR to the same physical device	Same units as SYSIPT	1. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 2. If the 1052 printer-keyboard is inoperable, SYSIN must be assigned to a card reader.
SYSPCH	Punched output	Card Punches: 1442, 2520, or 2540 Magnetic Tape Units: 2400 Series (Note 2) Disk Storage Drive: 2311 or 2314	1. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 2. If the 1052 printer-keyboard is inoperable, SYSPCH must be assigned to a card punch. 3. SYSLST and SYSPCH may be assigned to a single magnetic tape (see SYSOUT). 4. Required for system generation and maintenance, and for language translators. 5. If SYSPCH is assigned to a tape, no programmer logical unit may be assigned to this device.
SYSREC	System recorder	Disk Storage drive: 2311 or 2314	SYSREC must be a permanent assignment and is required: 1. Before first job card when RF = YES or CREATE in SET command. 2. To execute EREP program or when RF = NO.
SYSLST	System output unit	Printers: 1403, 1404, 1443, or 1445 Magnetic Tape Units: 2400 Series (Note 2) Disk Storage Drive: 2311 or 2314	1. Tape units may be either 7- or 9-track (dual density). 2. 1404 used for continuous forms only. 3. If SYSPCH and SYSLST are assigned to a tape unit, they can be assigned to the same physical device (see SYSOUT). 4. If the 1052 printer-keyboard is inoperable, SYSLST must be assigned to a printer. 5. The 1445 printer must be used as a 1443 printer. 6. Required for system generation and maintenance, and for language functions. 7. SYSLST must be assigned to a printer for foreground dump (SPI mode). 8. If SYSLST is assigned to a tape, no programmer logical unit may be assigned to this device.
SYSOUT	Assign SYSPCH and SYSLST	2400 Series Magnetic Tapes <u>only</u> (Note 2)	1. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 2. If the 1052 printer-keyboard is inoperable, SYSOUT <u>cannot</u> be assigned.
SYSLNK <sup>1</sup>	Compile link edit and execute system file	Disk Storage Drive: 2311 or 2314	1. Must be a single extent.
SYSLOG	Operator messages	Printer-Keyboards: 1052 Printers: 1403, 1404, 1443, or 1445	1. Can be used by any program. 2. If the 1052 printer-keyboard is inoperable, SYSLOG must be assigned to a printer.
SYS5LB SYSRLB	Contains source statement and/or relocatable library	Disk Storage Drive: 2311 or 2314	
SYS000 to SYSmax <sup>3</sup>	I/O operations for processing programs	Card Readers: 1442, 2501, 2520, or 2540 Card Punches: 1442, 2520, or 2540 Printers: 1403, 1404, 1443, or 1445 Magnetic Tape Units: 2400 Series Optical Reader: 1285, 1287, 1288 Magnetic Ink Character Readers: 1412, 1419, 1259 Tape Cartridge reader: 2495 Disk Storage Drive: 2311 or 2314 Data Cell Drive: 2321 Paper Tape Readers: 2671 or 1017 Paper Tape Punch: 1018 Printer-Keyboards: 1052 Data Collection System: 1030 Data Communication System: 1050 or 1060 Audio Response Units: 7770 or 7772 Selective Calling Stations: AT&T 83B3 Teletypewriter Terminal: AT&T Models 33 and 35 Western Union Plan: 115A Outstation Binary Synchronous Communication: System/360 (Models 25,30,40,50,65,75) 1130 Computing System, 2760 Data Transmission Terminal World Trade Telegraph Terminals (WTTA)	1. SYS000 through SYS009 are the minimum number of units defined in any system. 2. Tape units may be either 7- or 9-track (dual density). If 7-track, the data conversion feature is required. 3. The 1404 printer is used for continuous forms only.

Note 1. SYSLNK cannot be assigned to a foreground program.

Note 2. A tape written in 1600 bpi mode must have a tape mark written on it before this tape can be used on a 7- track or 9- track drive operating in 800 bpi mode.

Note 3. The highest numbered programmer logical unit available for a partition. SYSmax is not a symbolic name.

Figure 4. Symbolic Unit Names

SYSIN--Name that can be used when SYSRDR and SYSIPT are assigned to the same card reader, or magnetic tape unit. This name must be used when SYSRDR and SYSIPT are assigned to the same disk extent.

SYSOUT--Name that must be used when SYSPCH and SYSLST are assigned to the same magnetic tape unit.

Some system logical units must be assigned to certain selected devices. For example, the system logical unit SYSLOG is usually assigned to a 1052 printer-keyboard. If a 1052 printer-keyboard is not available, SYSLOG must be assigned to a printer. SYSLOG can never be assigned to any other physical device.

When the system is generated, the symbolic names for the background problem-program area are assigned to certain standard physical devices. These assignments can be changed by the operator at any time the system will accept operator-to-system communications. Device assignments made by the operator can be either permanent or temporary, i.e., they remain the same from job-to-job or are reset to the standard assignment by the next /& or // JOB statement. The assignments that were made during system generation become effective after an IPL. The system logical unit SYSOUT must be a permanent assignment.

## Running Batch Jobs

This section contains general information applicable to running batched jobs in one or in all three programming partitions. For specific details concerning the initiation or termination of batch processing in a foreground area, refer to the appropriate section of this manual.

Once the IPL procedure is complete, batch processing can be initiated in the background (or foreground partition(s) if this option was selected at system generation time). If the operator is not certain that the necessary boundary alignment was established, either at system generation time or by a previous operator, he should issue the MAP command before initiating batch processing in any partition. The MAP command may be followed by any necessary ALLOC command(s) to establish the required boundaries for each partition.

All batch jobs for one or for all three partitions are submitted by the programmer as a complete package(s). The operator is concerned only with I/O assignments, removable volumes, and device setup. Each job must begin with a JOB statement and end with an end-of-job statement, /&. The system accepts the UNBATCH command only after job completion.

The operator may have to assign symbolic units to actual physical devices in all three programming partitions. A listing of all symbolic units that must be assigned to execute IBM-supplied programs is shown in Figure 5. In this illustration, it is assumed that each of these programs is in the core image library and that each program has been edited to run with the control program. The EXEC statement calls the program from the system pack into main storage for execution. A discussion of EXEC statements for each program follows.

For language translators:

```
// EXEC ASSEMBLY  Calls the Assembler
                    program.
// EXEC COBOL     Calls the COBOL compiler.
// EXEC FCOBOL    Calls the USA standard
                    COBOL compiler.
// EXEC LCPC      Calls the COBOL language
                    conversion program.
// EXEC FORTRAN   Calls the Basic FORTRAN
                    compiler.
// EXEC FFORTRAN  Calls the FORTRAN IV
                    compiler.
// EXEC PL/I      Calls the PL/I compiler.
// EXEC RPG       Calls the RPG compiler.
```

For the Linkage Editor:

```
// EXEC LNKEDT    Calls the Linkage Editor
                    program that edits all
                    programs to run in the
                    system.
```

For the Librarian:

// EXEC CSERV      Calls the service program that punches or writes on tape or disk user programs from the core image library during maintenance.

// EXEC MAINT      Calls the maintenance program that catalogs (adds) elements to the system libraries, deletes elements from the libraries, renames elements in the libraries, and condenses and reallocates the libraries.

// EXEC RSERV      Calls the service program that displays (prints) and/or punches the contents of the relocatable library.

// EXEC SSERV      Calls the service program that displays and/or punches the content of the source statement library.

// EXEC CORGZ      Calls the organization program that selectively or completely copies the resident system.

// EXEC DSERV      Calls the service program that displays the content of the directories.

For EREP:

// EXEC EREP      Calls the environmental recording and printing program.

For Sort/Merge:

// EXEC DSORT      Calls the Disk Sort/Merge program.

// EXEC TSRT      Calls the Tape Sort/Merge program.

// EXEC SORT      Calls the Tape and Disk Sort/Merge program.

For Autotest:

// EXEC ATLEDT      Calls the Autotest program.

For the Utilities:

// EXEC CRDD      Calls the copy disk-to-disk program.

// EXEC CRDT      Calls the copy disk/data cell to-tape program.

// EXEC CRTD      Calls the restore tape-to-disk/data cell program.

// EXEC CRDC      Calls the copy disk-to-card program.

// EXEC CRCD      Calls the restore card-to-disk program.

// EXEC INTD      Calls the initialize disk program.

// EXEC INTM      Calls the initialize data cell program.

// EXEC ATAD      Calls the alternate track assign disk program.

// EXEC ATAM      Calls the alternate track assign for data cell.

// EXEC CDPD      Calls the card-to-printer/punch program.

// EXEC CDTP      Calls the card-to-tape program.

// EXEC CDDK      Calls the card-to-disk program.

// EXEC TPCD      Calls the tape-to-card program.

// EXEC TPTP      Calls the tape-to-tape program.

// EXEC TPPR      Calls the tape-to-printer program.

// EXEC TPDK      Calls the tape-to-disk program.

// EXEC TPDC      Calls the tape-to-data-cell program.

// EXEC TPCP      Calls the tape compare program.

// EXEC DKCD	Calls the disk-to-card program.	// EXEC CLRDSK	Calls the clear disk program.
// EXEC DKDK	Calls the disk-to-disk program.	// EXEC VOC72UT	Calls the vocabulary file utility program for the 7772 Audio Response Unit.
// EXEC DKPR	Calls the disk-to-printer program.	// EXEC LISTVTOC	Calls the VTOC display program.
// EXEC DKTP	Calls the disk-to-tape program.	// EXEC [euname]	Calls the emulator program cataloged by the user.
// EXEC DKDC	Calls the disk-to-data-cell program.		
// EXEC DCDC	Calls the data-cell-to-data-cell program.		
// EXEC DCPR	Calls the data-cell-to-printer program.		
// EXEC DCTP	Calls the data-cell-to-tape program.		
// EXEC DCDK	Calls the data-cell-to-disk program.		
// EXEC CLDC	Calls the clear data cell program.		

Because batch processing operates in a stacked-job environment, processing proceeds from one job to the next until an end-of-file condition is sensed on SYSRDR (e.g., no more cards are in the control card reader). When this condition occurs, message 1C00A ATTN. cuu is issued. When the next job is loaded and ready to be processed, the operator enters Ⓟ through the 1052 to resume processing.

If the 1052 is inoperable, an end-of-file message 1C00A ATTN c uu is issued on the printer assigned to SYSLOG. This message is immediately followed by 0P08 INTERV REQ. To continue processing the operator must reload the reader and enter 01 (hexadecimal) in byte 4 of main storage and press the INTERRUPT key on the console.



Symbolic Unit	Operand of EXEC Statement	Language Translators					Linkage Editor	Autotest	
		ASSEMBLY	FCOBOL COBOL LCP	PL/1	RPG	FORTTRAN FFORTTRAN	LNKEDT	ATLEDT	
SYSIPT	Required: Function: Device Type:	Always Input for program Card reader or tape unit, or disk							
SYSLOG	Required: Function: Device Type:	Always Operator communication 1052 printer - keyboard				Always Operator messages 1052 printer - keyboard			
SYSLST	Required: Function: Device Type:	Always Programmer messages, listing, etc. Printer or tape unit, or disk							
SYSPCH	Required: Function: Device Type:	If DECK specified in OPTION statement <sup>1</sup> Punched output Card punch or tape unit, or disk				No	No		
SYSRDR	Required: Function: Device Type:	Always Job control statement input Card reader or tape unit, or disk							
SYSLNK	Required: Function: Device Type:	If LINK or CATAL is specified in the OPTION statement Receive input for linkage editor Disk unit				Always Input Disk Unit	Always Output <sup>5</sup> Disk Unit		
SYS001	Required: Function: Device Type:	Always Mixed workfile Disk or tape unit <sup>2</sup>	Always Workfile Disk or tape unit <sup>3</sup>	Always Mixed workfile Disk or tape unit <sup>4</sup>	Always <sup>6</sup> Workfile Disk or tape unit				
SYS002	Required: Function: Device Type:	Always Mixed workfile Disk or tape unit <sup>2</sup>	Always Workfile Disk or tape unit <sup>3</sup>	Always Mixed workfile Disk or tape unit <sup>4</sup>	No <sup>7</sup>	No	No		
SYS003	Required: Function: Device Type:	Always Mixed workfile Disk or tape unit <sup>2</sup>	Always Workfile Disk or tape unit <sup>3</sup>	Always Mixed workfile Disk or tape unit <sup>4</sup>	No	No	No		
SYS004	Required: Function: Device Type:	No	Optional <sup>8</sup> Debug packets Disk or tape Unit	No	No	No	No		
SYS005	Required: Function: Device Type:	No				No	Optional Output Tape unit		

- 1 SYSPCH is also required for the Assembler if SYM is specified in the OPTION statement and unless the NODECK option is specified for COBOL LCP.
- 2 Assembler has three variants --one using tape workfiles only, a second using disk workfiles only, and a third using mixed workfiles. The background partition must be 14K or larger for mixed workfiles.
- 3 If disk is used, SYS001, SYS002, SYS003, must be disk; if tape is used, they must be tape.
- 4 For mixed workfiles, the background partition must be 12K or larger.
- 5 Autotest workfile.
- 6 For autotest, used only by the autotest linkage editor.
- 7 Required for FFORTRAN with mixed tape or disk workfiles.
- 8 Required workfile for FCOBOL.

Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 1 of 7)

		Librarian						
Symbolic Unit	Operand of EXEC Statement	MAINT	RSERV	SSERV	CSERV	DSERV	CORGZ	EREP
SYSIPT	Required: Function: Device type:	When cataloging to the relocatable or source statement library Book or module input Card reader or tape unit, or disk	Yes	Yes	Yes	Yes	Yes	No
SYSLOG	Required: Function: Device type:	Always Operator Messages 1052 Printer-Keyboards						
SYSLST	Required: Function: Device type:	Always Programmer Messages and/or listings Printer or tape unit, or disk						
SYSREC	Required: Function: Device type:	For ERRLOG and MCRR Device error statistics 2311 or 2314						Always
SYSPCH	Required: Function: Device type:	No	If punch function is specified Punched output Card punch, tape unit, or disk			No	No	No
SYSRDR	Required: Function: Device type:	Always Control statement input Card reader or tape unit, or disk						No
SYS000	Required: Function: Device type:	No	No	No	No	No	No	No
SYS001	Required: Function: Device type:	No	No	No	No	No	No	No
SYS002	Required: Function: Device type:	No	No	No	No	No	Always Output Disk unit	No

Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 2 of 7)

Symbolic Unit	Operand of EXEC Statement	Disk Sort/Merge	Tape Sort/Merge	7772 Vocabulary File Utility
		DSORT	TSRT	VOC72U1
SYSIPT	Required: Function: Device type:	Always Input for program Card reader, tape unit, or disk		Always Input for program Card reader or tape unit
SYSLOG	Required: Function: Device type:	Always Operator Messages 1052 Printer-Keyboard		Always Operator messages 1052 Printer-Keyboard
SYSLST	Required: Function: Device type:	Always Programmer Messages Printer, tape unit, or disk		Always Listings Printer or tape unit
SYSPCH		Not Used		Not Used
SYSRDR	Required: Function: Device type:	Always Job Control statement input Card reader, tape unit, or disk		Always Job Control statement input Card reader or tape unit
SYSLNK		Not Used		Not Used
SYS000	Required: Function: Device type:	Optional Input, work area, or output Disk unit	No	See Note 1
SYS001	Required: Function: Device type:	Only for tape output Input, work area, or output Disk or tape unit	Always Output Tape unit	
SYS002	Required: Function: Device type:	Only for tape input Input, work area, or output Disk or tape unit (AA)	Always Input (A) Tape unit (H)	
SYS003	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (BB)	Always for sort, optional for merge Workfile for sort, input for merge (B) Tape unit	See Note 2 Input Vocabulary Files Tape unit
SYS004	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (CC)	Always for sort, optional for merge Workfile for sort, input for merge (C) Tape unit	
SYS005	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (DD)	Always for sort, optional for merge Workfile for sort, input for merge (D) Tape unit	
SYS006	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (EE)	Optional Workfile for sort, input for merge (E) Tape unit	See Note 1
SYS007	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (FF)	Optional Workfile for sort, input for merge (F) Tape unit	
SYS008	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (GG)	Optional Workfile for sort, input for merge (G) Tape unit	
SYS009	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (HH)	No	Notes. 1. SYSnnn is used as a utility workfile. SYSppp is used to record Operative Vocabulary File. SYSnnn and SYSppp are assigned unique extents in 2311 disk storage. SYSnnn is always required for Operative Vocabulary File updating. It is required for Operative Vocabulary File building only when tables are to be created. Building an Operative Vocab- ulary File made up of only a residuum does not require SYSnnn.  2. If the Input Vocabulary is in the form of punched cards, it can be added to the control card deck; the resulting deck is the system input file (which may be copied on a magnetic tape) to be read from SYSIPT. If the Input Vocabulary is in the form of a magnetic tape file, it must be read from SYS004 while the control statements must be read from SYSIPT.
SYS010	Required: Function: Device type:	Optional Input, work area, or output Disk or tape unit (II)	No	

Note: There are no mandatory assignments of symbolic units for DSORT with disk input/output units.  
Any logical unit SYSnnn may be assigned.

- (A) Must be user's first input file, for merge
- (B) Must be user's second input file, for merge
- (C) Must be user's third input file, for merge
- (D) Must be user's fourth input file, for merge
- (E) Must be user's fifth input file, for merge
- (F) Must be user's sixth input file, for merge
- (G) Must be user's seventh input file, for merge

(H) If multi-file input with alternate drives is specified, the IOCS CLOSE routine will not switch to the alternate drive when encountering an end-of-file condition. The operator must mount the first volume of the next file on the same tape unit on which the last volume of the preceding file was mounted.

- (AA) Must be user's first tape input file (FILE A)
- (BB) Must be user's second tape input file (FILE B)
- (CC) Must be user's third tape input file (FILE C)
- (DD) Must be user's fourth tape input file (FILE D)
- (EE) Must be user's fifth tape input file (FILE E)
- (FF) Must be user's sixth tape input file (FILE F)
- (GG) Must be user's seventh tape input file (FILE G)
- (HH) Must be user's eighth tape input file (FILE H)
- (II) Must be user's ninth tape input file (FILE I)

Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 3 of 7)

		Tape and Disk Sort/Merge
Symbolic Unit	Operand of EXEC Statement	SORT
SYSIPT	Required: Function: Device Type:	Always Input for program Card reader, tape unit, or direct access device
SYSLOG	Required: Function: Device Type:	Always Operator Messages 1052 Printer - Keyboard
SYSLST	Required: Function: Device Type:	Always Programmer Messages Printer, tape unit, or direct access device
SYSPCH		Not used
SYSRDR	Required: Function: Device Type:	Always Job control statement input Card reader, tape unit, or direct access device
SYSLNK		Not used
SYS000	Required: Function: Device Type:	Optional: Checkpoint device Tape unit or direct access device
SYS001	Required: Function: Device Type:	Unless user routines read input and write output Input, work area, or output Tape unit or direct access device
SYS002	Required: Function: Device Type:	Always Input, work area, or output Tape unit or direct access device
SYS003 to SYS(N)	Required: Function: Device Type:	Optional (See Note) Input, work area, or output Tape unit or direct access device

Note: Symbolic unit numbers are assigned as follows:

- If the Sort/Merge program reads input and writes output, input units are numbered SYS002 - SYS (N+1), work units are numbered SYS (N+2) - SYS (N+M+1), and the alternate work unit is numbered SYS (N+M+2).
- If a user routine reads input, there are no input units, work units are numbered SYS002 - SYS (M+1), and the alternate work unit is numbered SYS (M+2).
- If a user routine writes output, input units are numbered SYS001 - SYS (N), work units are numbered SYS (N+1) - SYS (N+M), and the alternate work unit is numbered SYS (N+M+1).
- If user routines read input and write output, there are no input units, work units are numbered SYS001 - SYS (M), and the alternate work unit is numbered SYS (M+1).

(N = the specified number of input files, M = the specified number of work files.)

**Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 4 of 7)**

		Utilities							
		Alternate Track ASSGN	Card To Printer/Punch	Card To Tape	Card To Disk	Copy Disk To Card	Copy Disk To Disk	Copy Disk/Data Cell to Tape	Restore Card To Disk
Symbolic Unit	Operand of EXEC Statement	ATAD ATAM	CDPP	CDTP	CDDK	CRDC	CRDD	CRDT	CRCD
SYSIPT	Required: Function: Device Type:	Always Utility control statement input Card reader, tape unit, or disk							
SYSLOG	Required: Function: Device Type:	Always Operator Messages 1052 Printer - Keyboard							
SYSLST	Required: Function: Device Type:	Always Programmer Messages Printer, tape unit, or disk							
SYSPCH		Not Used							
SYSRDR	Required: Function: Device Type:	Always Job Control statement input Card reader, tape unit, or disk							
SYSLNK		Not Used							
SYS000		Always	Not Used						
SYS001		Not Used							
SYS002		Not Used							
SYS003		Not Used							
SYS004	Required: Function: Device Type:	Not Used	Always Input for program Card reader			Copy volume always a disk			Always Card Reader
SYS005	Required: Function: Device Type:	Not Used	If printed output is specified Printed	Always Ⓐ Tape unit	Always Ⓑ Disk unit	No	No	Always Ⓐ Tape unit	No
SYS006	Required: Function: Device Type:	Not Used	If punched out - put is specified Card punch	No	No	Always Ⓐ Card punch	No	No	No
SYSnnn						Copy file only always a disk			Always a disk
<p>Note: The DASD (direct access storage device) utility programs are not restricted to the use of SYS004, SYS005, and SYS006 for input or output. Any logical unit SYSnnn may be assigned.</p> <p>Ⓐ Tape output and alternate tape output  Ⓑ Disk output and alternate disk output  Ⓒ Data cell output and alternate data cell output</p>									

Figure 5. Symbolic Units required for IBM-Supplied Programs (Part 5 of 7)

		Utilities							
		Restore Tape to Disk/Data Cell	Initialize Disk	Tape To Card	Tape To Tape	Tape To Printer	Tape To Disk	Tape To Data Cell	Tape Compare
Symbolic Unit	Operand of EXEC Statement	CRTD	INTD INIM	TPCD	TPTP	TPPR	TPDK	TPDC	TPCP
SYSIPT	Required: Function: Device Type:	Always Utility control statement input Card reader, tape unit, or disk							
SYSLOG	Required: Function: Device Type:	Always Operator Messages 1052 Printer - Keyboard							
SYSLST	Required: Function: Device Type:	Always Programmer Messages Printer, tape unit, or disk							
SYSPCH		Not Used							
SYSRDR	Required: Function: Device Type:	Always Job Control statement input Card reader, tape unit, or disk							
SYSLNK		Not Used							
SYS000		Not Used	Always	Not Used					
SYS001		Not Used							
SYS002		Not Used							
SYS003		Not Used							
SYS004	Required: Function: Device Type:	Always Ⓐ Tape unit	No	Always Tape input and alternate tape input Tape unit					Always Tape to be compared
SYS005	Required: Function: Device Type:	No	No	No	Always Ⓐ Tape unit	Always Printer	Always Ⓑ Disk unit	Always Ⓒ Data cell	Always Tape to be compared
SYS006	Required: Function: Device Type:	No	No	Always Card punch	No	No	No	No	No
SYSnnn		Always a disk							
<p>Note: The DASD (direct access storage device) utility programs are not restricted to the use of SYS004, SYS005, and SYS006 for input or output. Any logical unit SYSnnn may be assigned.</p> <p>Ⓐ Tape output and alternate tape output            Ⓑ Disk output and alternate disk output            Ⓒ Data cell output and alternate data cell output</p>									

Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 6 of 7)

Symbolic Unit	Operand of EXEC Statement	Utilities												List VTOC
		Disk to Card	Disk to Disk	Disk to Printer	Disk to Tape	Disk to Data Cell	Data Cell to Data Cell	Data Cell to Printer	Data Cell to Tape	Data Cell to Disk	Clear Data Cell	Clear Disk	VTOC Display	
		DKCD	DKDK	DKPR	DKTP	DKDC	DCDC	DCPR	DCTP	DCDK	CLDC	CLRDSK		
SYSIPT	Required: Function: Device Type:	Always Utility control statement input Card reader, tape unit, or disk											No	
SYSLOG	Required: Function: Device Type:	Always Operator messages 1052 printer-keyboard												
SYSLST	Required: Function: Device Type:	Always Programmer messages Printer, tape unit, or disk											No	
SYSPCH		Not used												
SYSRDR	Required: Function: Device Type:	Always Job control statement input Card reader, tape unit, or disk												
SYSLNK		Not required												
SYS000		Not required												
SYS001		Not required												
SYS002		Not required												
SYS003		Not required												
SYS004		Not required											Always Input disk	
SYS005	Required: Function: Device Type:	No	No	Always Printer	Always <sup>(A)</sup> Tape unit	No	No	Always Printer	Always <sup>(A)</sup> Tape unit	No	No	No	Always Output P-T-D	
SYS006	Required: Function: Device Type:	Always Card output Card punch	No	No	No	No	No	No	No	No	No	No	No	

Note: The DASD (direct access storage device) utility programs are not restricted to the use of SYS004, SYS005, and SYS006 for input or output. Any logical unit SYSnnn may be assigned.

(A) Tape output and alternate tape output  
(B) Disk output and alternate disk output  
(C) Data cell output and alternate data cell output

Figure 5. Symbolic Units Required for IBM-Supplied Programs (Part 7 of 7)

## EXAMPLE OF A JOB

Figure 6 is an example of the job-control statement input required to perform a background batch processing job where SYSRDR is not the same device as SYSIPT. The job illustrates a series of six job steps that includes: a FORTRAN compilation, an assembly, the execution of the combined linkage-edited output, and the execution of a program that uses subroutines kept in the relocatable library.

Each of the following items is immediately preceded by a number that corresponds to the number at the left of the job-control statements in Figure 6.

1. JOB statement for the series of job steps to be performed.
2. ASSGN statements required for the job steps. (It is assumed that these assignments differ from those currently specified in the PUB table.) The new assignments will be carried through for the entire job, and will be reset at the end of the job to the standards established during system generation and/or to any permanent modifications made by the operator.
3. OPTION statement specifying that the output of the FORTRAN compilation and Assembler assembly is to be written on SYSLNK for subsequent linkage editing and that the dump option is to be exercised for an abnormal end of job.
4. EXEC statement for a Basic FORTRAN compilation. This statement must be followed by the FORTRAN source deck and the end-of-data-file indicator (/\*) when SYSIPT is the same device as SYSRDR.
5. EXEC statement for an assembly. This statement must be followed by the source deck and the end-of-data-file indicator when SYSIPT is the same as SYSRDR.
6. EXEC statement for the Linkage Editor. The Linkage Editor edits the combined Basic FORTRAN and Assembler object programs on SYSLNK and writes the edited program temporarily in the core image library.
7. EXEC statement for the linkage-edited object program in the temporary core image library. The input data for the program execution (with end-of-data-file indicator) must follow this statement when SYSIPT is the same device as SYSRDR.
8. PAUSE statement that requests special operator action. Operator commands might also be issued at this time.
9. OPTION statement specifying that the no-dump option be exercised. The link option is included to enable a new linkage edit.
10. INCLUDE statements for modules in the relocatable library that are to be included with the object deck on SYSIPT. (The INCLUDE statement with a blank operand indicates that the program to be included follows on SYSIPT.) EXEC causes the resulting program to be edited and written in the core image library.
11. EXEC statement for the program to be executed. (The blank operand indicates that the program is in the core image library.) The data for the execution (with end-of-data-file indicator) must follow when SYSIPT is the same device as SYSRDR.
12. PAUSE statement requests operator action. Operator commands might also be issued at this time.
13. End-of-job indicator. All temporary symbolic unit assignments are reset to the standards established when the system was generated (plus any permanent modifications made by the operator). When SYSIPT is a device other than SYSRDR, a /& statement is required to indicate end-of-job in SYSIPT.
14. JOB statement for the next job.



Note: Broken lines indicate where the input in SYSIPT would be placed if SYSIPT and SYSRDR were the same unit.

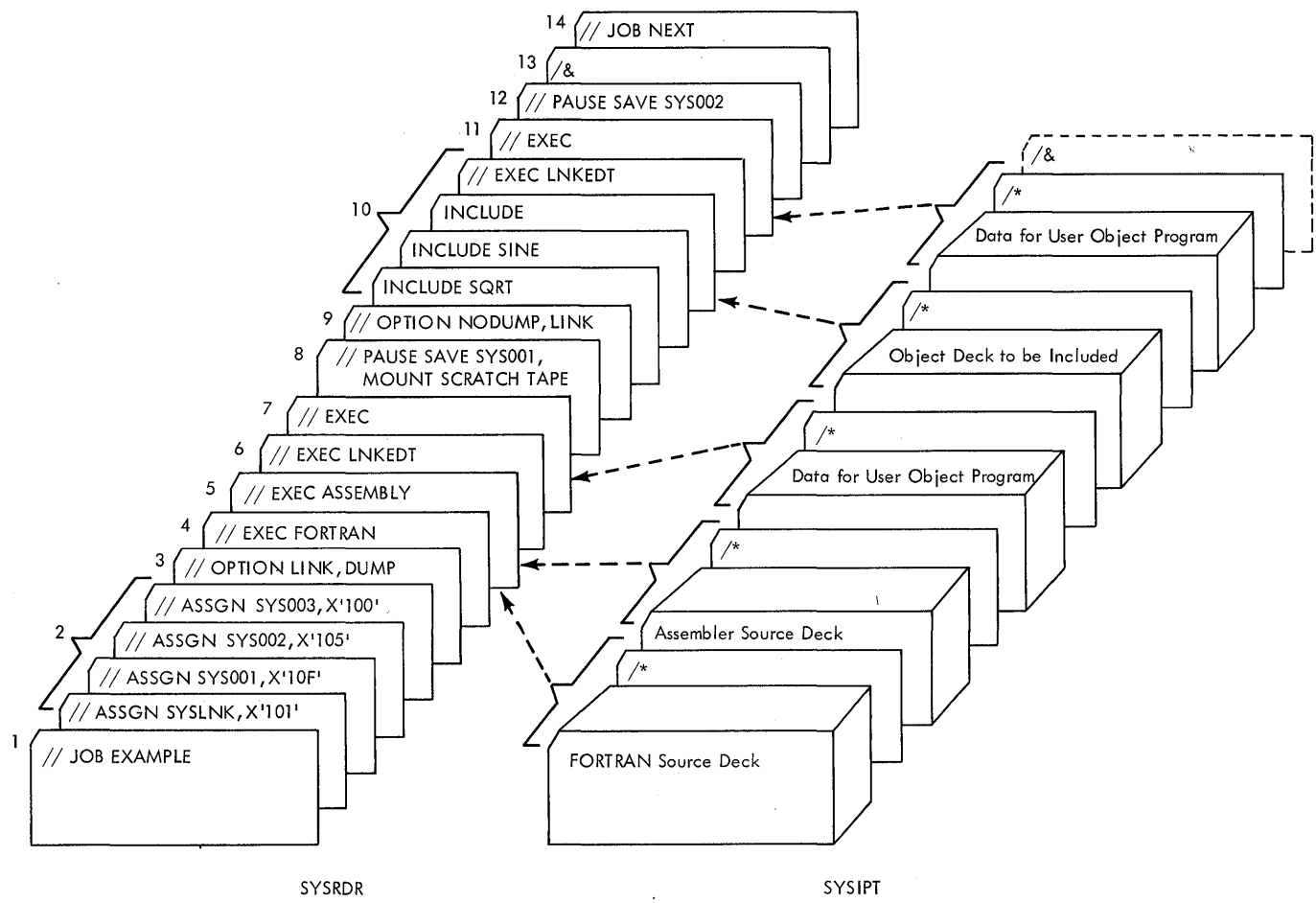


Figure 6. Example of a Job Control Statement Input (Background Only)

## Initiating Batch Processing in a Foreground Area

Before batch processing can be initiated in one or both foreground areas, the following conditions must exist:

1. The storage capacity for the machine must be sufficient to support the foreground area(s).
2. The foreground batch processing option must have been specified when the system was generated.
3. Each foreground area, when operating in a batched-job foreground mode, must have a minimum of 10K.
4. The required separate input/output devices for the foreground areas must be available.
5. No job in the batch job stream may require the use of SYSLNK or the maintenance function of the Librarian.
6. The batch job input package must be on the appropriate input device.

If these conditions are satisfied, the operator can initiate a batch job stream in a foreground area by entering the BATCH command with the appropriate operand. The BATCH command must be entered through SYSLOG.

## Terminating Batch Processing in a Foreground Area

Once batch processing has begun in a foreground area, Job Control processes the job stream in the same manner as it does in the background. When the last job in the input reaches an end-of-job condition, the operator is notified of this condition by a message on SYSLOG. If there are no other batched jobs to be processed in this area, the operator may free the partition by issuing the UNBATCH command, so that SPI jobs can be run in the same area.

Because the UNBATCH command does not have an operand, it is important that Job Control be in control for the partition to be terminated at the time the UNBATCH command is issued. If a PAUSE command for the partition to be terminated was the last card read by Job Control, then UNBATCH can immediately be entered through the 1052 printer-keyboard to free the partition (refer to UNBATCH command). UNBATCH cannot be entered through any other device. If Job Control for the partition to be

released is not active when the operator wishes to free the partition, he must press the request key on the 1052 and enter a PAUSE command (with the EOJ operand) for the appropriate partition. The operator can then enter the UNBATCH command when the partition is free.

## Regaining Operator Control from Job Control

During system operation, exceptional cases may arise where it is desirable for the operator to regain control from Job Control. In some cases, what appears to be a logical reply to a Job Control message may result in the same (or different) message being issued after each operator response. The result is an operator-system loop from which the operator must regain control if processing is to continue. Two general situations may indicate to the operator that this unique action is desirable.

1. When attempting to process Job Control statements, a record (for example, a data record) may be read that cannot be recognized by Job Control.
2. When attempting to process Job Control statements, a statement (or data record) cannot be read by the system device, resulting in an error recovery procedure.

The two typical examples that follow illustrate each of these cases in which the operator should perform special action to regain control.

For the first case, assume that SYSRDR (or SYSIPT) is assigned to a tape unit. A tape reel with several files (separated by tapemarks) is mounted on this device. A tapemark has just been sensed after reading the last record (job control statement) in one of the files. The system issued the message:

1C00A ATTN. c uu

to inform the operator of this condition. The operator decides to continue processing with the next file because he thinks the following file consists of a new job preceded by the necessary job control statements. He therefore replies IGNORE to the preceding message to tell the system that it will find the next job stream following the tapemark. The system, therefore, expects to find job control statements next. Suppose, instead, that the following file is a data file as illustrated.

JC	TM	JC	TM	JC	TM	DATA	TM	DATA	TM
						FILE		FILE	

1C00A ATTN. c uu

as before. The operator again decides to reply IGNORE to this message. But this time the system responds with the message:

0P11 DATA CHECK

The first record following the tapemark (arrow) is read by Job Control and analyzed for correct format. Because this record is not a job control statement (a data record), the system prints out the contents of the record just read on SYSLOG and issues the following message:

1S0nD INVALID STATEMENT

The operator's next decision determines what action the system will take. The operator looks at the record text printed out ahead of the last message and decides that it is not a job control statement that he can fix. He therefore enters a reply CANCEL and expects the system to scan and bypass the remaining records until the next /& statement is read, and to resume processing with the following job. However, immediately after entering the CANCEL reply, the system again issues the message:

1S0nD INVALID STATEMENT

This result could have been avoided if the operator had carefully examined the record printed out before message 1S0nD to determine the possibility of a user data file. If the record was a user data file, the operator should not have replied CANCEL or IGNORE to message 1S0nD, because either reply causes the system to read the following record(s) searching for a /&.

When the operator realized that the record printed before message 1S0nD was part of a user data file, he should have mounted a new tape containing job control statements for other jobs to be executed and reassigned the same or a different unit. Note that this action is identical to the action the operator should have taken in response to the very first message (1C00A).

The next example shows the same situation occurring for less obvious reasons than in the last example. In this case, assume that everything is the same as before, except that the record following the tapemark (arrow in preceding illustration) cannot be read by the device. Perhaps the mounted reel was previously used as a scratch tape on a 7-track drive. The first few files on this reel consist of 9-track records. The reel is mounted on a 9-track drive and the tapemark following the last file (written in 9-track) is sensed. The system issues the message:

Because the record just read was a 7-track data record, the system automatically enters an error recovery procedure for the device. After trying unsuccessfully to read the record 100 times, the system issues the preceding message. Because the operator does not know why this message was issued (he cannot know the record is 7-track) he decides to reply IGNORE. Job Control analyzes the record and finds that it is not valid and issues the message:

1S0nD INVALID STATEMENT

as in the first example. The operator now faces the same decision as in the first example, and his action determines if he and the system enter another loop. If the operator replies CANCEL to message 0P11, the results are the same. In this case, the operator should mount a new reel and reassign the unit after message 1S0nD is issued.

The same conditions and procedures apply if true Job Control statements, in the proper mode (9-track in this case), cannot be read due to some sort of physical error such as a dirty or crumpled tape.

## Restarting a Job from a Checkpoint

When a job is canceled before the normal end-of-job, it can be restarted immediately or at some later time. If checkpoints are not taken as part of the job, the job must be re-executed from the beginning as a new job.

If the programmer has included checkpoints in his job, the message,

0C00I CHKPT nnnn WAS TAKEN ON SYSxxx=cuu

is given each time a checkpoint is taken.

Checkpoint/restart capabilities are provided for background and foreground programs operating in a batched mode, within the following limitations:

1. The checkpoint job must be restarted in the same partition in which the checkpoint was taken.
2. Checkpoint records written by previous versions of the system cannot be restarted in the current system.

3. It is possible to increase the size of the partition between the time the checkpoint is taken and the time the program is restarted, provided the starting address of the partition remains unchanged.
4. The checkpoint can be recorded on a tape or 2311/2314 disk unit.
2. A printer must be assigned to SYSLST. If the same printer is assigned to both SYSLOG and SYSLST, system-to-operator messages may be embedded within user output.
3. A card reader must be assigned to SYSRDR and SYSIPT. This may be the same card reader or two different ones.

Most programs can be restarted after a checkpoint by using the following procedure. Some IBM-supplied programs (e.g. Disk Sort Merge) use other procedures for restarting from a checkpoint. For these cases, the appropriate program specifications manual should be consulted for the correct restarting procedure.

1. Replace the // EXEC statement with a // RSTRT statement using the information in the last 0C00I message received. The programmer should have specified the checkpoint unit when the job was submitted. There is no need to linkage edit the program again. When labeled multi-volume tape reels are concerned, the volume sequence number must be changed to reflect the volumes for restarting if they are other than specified for volume number 1. Otherwise, a header check error will occur when trying to open subsequent volumes for the files. All other Job Control statements should be the same as when the job was originally run. If necessary, the channel and unit addresses for the // ASSGN statement may be changed.
2. Rewind all tapes used by the program being restarted and mount them on devices assigned to the symbolic units required by the program.
3. Execute the job.

Note: If the Job Control statements were read from a tape or disk, the operator might not be able to restart the job conveniently. In this case, the job should be returned to the programmer.

## System Operation Without a 1052

Certain requirements must be met when a 1052 printer-keyboard is not available on the system:

1. A printer must be assigned to SYSLOG. Messages to the operator are printed on SYSLOG, after which an assumed operator response, where applicable, is taken. In most cases, the assumed response results in the termination of the job.

4. A card punch must be assigned to SYSPCH.
5. There are no multiprogramming capabilities without the 1052 printer-keyboard.

When a 1052 printer-keyboard is not available, total throughput in the individual installation may suffer because jobs containing errors (such as incorrect job steps, I/O assignments) will be canceled. In many instances, such errors could be corrected by the operator, using the 1052 printer-keyboard. The operator cannot communicate with the system except to respond to certain I/O error messages. The message is printed on the printer assigned to SYSLOG, and the system enters the wait state. The operator must then store a response in byte 4 of main storage and press the interrupt key.

The printed message also appears in bytes 0-3. The contents of main storage bytes 0-3 are described in the following section. If a response is required by the operator, it is always entered in byte 4 of main storage.

### DEFAULT OPERATION WITHOUT A 1052 PRINTER-KEYBOARD

If the IBM 1052 Printer-Keyboard is inoperable, limited operations (refer to System Operation Without a 1052) may continue, under some circumstances, by displaying messages in low core and entering the proper reply directly in core. In this section, IPL messages and device error recovery messages are described.

### IPL Error Messages

If the machine enters the wait state during an IPL procedure, the operator should display the first five bytes of low core. The IPL error message number and action code are displayed in hexadecimal in these bytes (see Figure 7). For example:

Byte 0 (Binary) Message	Byte 1 (BCD)	Byte 2 (Binary)	Byte 3 (Binary)	Action
00	S	Not used	Not used	Machine Check. System must be IPL'ed. Load SEREP (see next section).
01	S	Reserved	Reserved	Channel Failure: Interface Control Check, or Channel Control Check. System must be IPL'ed. Load SEREP (see next section).
02				Reserved
03	W	Channel	Unit	DOS - Irrecoverable disk error during program fetch. The first six sense bytes are placed in hex Bytes 5-A. System must be IPL'ed.
04	W	Not used	Not used	Cancel condition has occurred while performing a Supervisor function. (Not a Supervisor detected problem-program error.) Normally a Program Check while in Supervisor State. System must be IPL'ed.
05	W	Channel	Unit	I/O Error Queue has overflowed as the result of an I/O error on a program fetch channel program. System must be IPL'ed.
06				Reserved
07	W	Channel	Unit	IPL I/O error. Channel and unit indicate whether SYSRES or communication device. System should be re-IPL'ed.
08-60	Action Indi- cator	Channel	Unit	Error recovery messages. Refer to OP messages in the DOS operator communications publication.

Figure 7. Low Core Error Bytes

Message 0I11A appears in low core bytes 0-4 as

F0C9F1F1C1

The operator should look up this message (refer to the DOS operator communications publication referred to in the Preface) and perform the indicated action.

#### Device Error Recovery Messages

Figure 7 shows the information that might be found in the low core error bytes. If byte 0 contains a binary number 08-60, it indicates a (OP) device error recovery message. If the 1052 is inoperable when an error recovery message is issued, the system immediately enters the wait state

until the operator replies. The operator should display the contents of byte 1 to obtain the action code, in EBCDIC.

If code is A (C1):

The operator should refer to the DOS operator communications publication referenced in the Preface. If the operator decides to try to continue operations, it will be necessary to display the next two bytes (2 and 3) of low core to obtain the channel and unit number of the device. The operator should then:

1. Perform any manual recovery procedures implied by the error condition. (Refer to component description and

operating procedures manual for the device.)

2. Ready the device. No response is necessary. If the operator wishes to cancel, he should insert X'03' in byte 4 and press INTERRUPT.

If code is D (C4): A trial-and-error procedure must be performed. The operator should first store X'01' (RETRY) in byte 4, then press INTERRUPT on the console. If the system accepts this reply, the machine exits from the wait state. If not, store one of the following replies in byte 4:

- X'02' (IGNORE)
- X'03' (CANCEL)

Then press INTERRUPT. When the reply is accepted by the system, the machine will exit from the wait state.

## SEREP (System Environment Recording, Editing, and Printing)

SEREP (System Environment Recording, Editing, and Printing) is a program distributed as part of the diagnostic package for each System/360 installation. The program, with its operating procedures, is available to the installation's IBM Customer Engineer. (Each System/360 model has a different version of the SEREP program. Operating procedures, however, are the same for all versions.)

SEREP provides a means of printing the system status information stored in main storage at the time of a machine malfunction. When a condition occurs requiring the use of SEREP, the wait state is entered, and main storage byte 1 contains an S. The WAIT light on the CPU is not necessarily ON when such a condition occurs. Also, if a channel has outstanding status when all interrupts are masked off, the SYSTEM light on the CPU will be ON.

The SEREP program must be loaded via the standard IPL procedure. Malfunction information is produced as output on an online printing device. The SEREP printout indicates the environment of the error and the device involved.

The address of the I/O device printed on the SEREP report is compared with the valid device addresses available to the system. The printing of a valid address indicates that a machine malfunction has occurred. The printing of an invalid device address indicates that a programming error has occurred. After SEREP is completed, the system is restarted via the IPL procedure.

MCRR (machine check recording and recovery) support reduces the number of SEREP conditions to the following:

- If MCRR is handling an error and another error occurs before the first error is processed.
- A permanent I/O error on SYSRES.
- A CPU or channel error occurs in the Supervisor area of core.
- SYSRES active on a damaged channel.
- Recorder File (SYSREC) not active.

## Linkage Editing Foreground Programs

Programs must be linkage edited to run at the starting boundary for the partition. (Refer to ALLOC command.) A save area is always automatically reserved at the beginning of either foreground partition by the linkage editor. This area contains the program name, return PSW, and all machine registers. Also, if labels are specified (// LBLTYP card) a label area is reserved immediately following the save area. The remaining core in the partition is available for the user's program.

An example of linkage editing a program to run in the F2 area (assume F1=4K, F2=12K, BG=32K, 16K supervisor in a 64K machine) follows:

```
// JOB name
// OPTION CATAL
    PHASE phasename,F+48K
```

In the preceding example, the F in the phase card signifies to the linkage editor that a foreground area is being used.

If foreground allocations are set in the supervisor, the following is an example of linkage editing a program to run in F2.

```
// JOB CATAL
// OPTION CATAL
    ACTION F2
    PHASE phasename
```

## Single Program Initiation in a Foreground Area

Single programs are initiated in a foreground area by the operator from the printer-keyboard assigned to SYSLOG. The operator may initiate an SPI program whenever an allocated foreground area does not contain a program, or has been released by an UNBATCH command after processing batched jobs in the area.

The operator initiates an SPI program by pressing the request key on the printer-keyboard. Control is given to the ATTN routine, which reads commands from the operator via the printer-keyboard.

Since the ATTN routine is called into the transient area, the request will be posted if a previous routine occupies the transient area. The START command indicates that an SPI program is to be initiated. The ATTN routine determines if the area specified in the START command is allocated and does not contain a program. If so, it transfers control to the SPI routine; otherwise, the operator is notified that he has given an invalid command.

The SPI routine reads subsequent commands required to initiate the program. These commands are used primarily to specify I/O assignments and label information. When an I/O assignment is attempted, the following verification is made.

1. The symbolic unit is a programmer logical unit SYS000-SYSmax and system logical units SYSRDR, SYSIPT, SYSPCH, SYSIST.
2. The programmer logical unit is contained within the number specified for the area when the system was generated (SYS000 - SYSmax).
3. If the symbolic unit is to be assigned to a non-DASD, the device is neither in use by the other foreground program (if applicable), nor is it assigned to a background job either as a standard, temporary, or alternate unit.

When the EXEC command is encountered, the SPI routine directs the Supervisor to load the program to be executed into the designated foreground area. If the program has not been cataloged to the core image library, a diagnostic message will be issued on SYSLOG. If the program cannot be loaded, diagnostic messages are issued on SYSLOG for the specified foreground area.

## Single Program Initiation Examples

The following examples of SPI are presented for several system configurations. One of these examples shows how SPI can be accomplished by using the 1052 terminal alone. Another example illustrates the same procedure when at least two card readers are available. Finally, three examples are included for installations with a single card reader.

### Example 1

This procedure should be followed to initiate an SPI program at IPL time when one card reader is available and assigned to SYSIN.

1. Place the Job Control cards for the foreground program in the card reader, followed by any batch job cards.
2. Ready the reader.
3. Perform the IPL procedure with a 1052 as described under Starting the System (IPL Procedure).

4. Type:

```
ASSGN SYSIN,UA (B)
STOP (B)
```

5. Press the request key and wait for the message:

```
AR 1I60A READY FOR COMMUNICATIONS
```

6. Type:

```
START { F1 } (B)
      { F2 }
READ X'cuu' (B)
```

7. Wait for the foreground program to begin processing. This will occur as soon as the EXEC control statement is processed.

8. Press the request key and enter commands:

```
START BG (B)
ASSGN SYSIN,X'cuu' (B)
(B)
```

### Example 2

This is an example of a planned procedure for initiating a foreground job at some

time other than IPL time. One card reader is assumed to be assigned to SYSIN. If during the normal processing of background jobs, a // PAUSE statement instructs you to initiate a foreground program, the following procedure should be followed. Unless the message states otherwise, you may assume that the necessary foreground control cards are in the input job stream immediately following the // PAUSE statement.

1. Enter the following commands using the 1052 printer-keyboard.

```
ASSGN SYSIN,UA  (B)
STOP  (B)
```

2. Press the request key and wait for the message:

```
AR 1C60A READY FOR COMMUNICATIONS
```

3. Type:

```
START {F1} (B)
      {F2}
READ X'cuu' (B)
```

4. Wait for the foreground program to begin processing. This will occur as soon as the EXEC command is processed.

5. Press the request key and enter commands:

```
START BG  (B)
ASSGN SYSIN,X'cuu' (B)
(B)
```

### Example 3

This example is similar to Example 2.

- Either, you are verbally instructed to initiate a foreground job at the earliest opportunity;
- Or, an active program in either a background or foreground area issues a request to start a foreground program.

As in the case in Example 2, one card reader is assumed to be assigned to SYSIN.

1. Press the request key on the 1052 printer-keyboard and enter the following commands:

```
PAUSE  (B)
(B)
```

2. WAIT for the message:

```
BG 1I60A READY FOR COMMUNICATIONS
```

This message will appear at the completion of the current job step.

3. Run out the cards in the reader and separate the ones that have been processed from those that have not been processed.
4. Place foreground control cards in the reader, followed by the batch job cards that have not been processed.
5. Perform the steps shown in Example 2.

### Example 4

This example is similar to Example 3. However, the system has two or more card readers.

1. Press the request key on the 1052 printer-keyboard and enter:

```
START {F1} (B)
      {F2}
```

2. Type:

```
LISTIO UA  (B)
```

3. Determine which of the card readers is unassigned, and place the foreground control cards in that reader.

4. Type:

```
READ X'cuu' (B)
```

### Example 5

This example is for systems that do not have any card readers. All initiation is accomplished by using the 1052 printer-keyboard. If there are a great number of commands necessary, such as several DLBL and EXTENT statements for multiple-file processing, this method of initiation can be very time consuming. The system throughput may be greatly affected, because system processing can be continued only while the logical transient area is not being used by an active program. From the standpoint of system throughput, foreground initiation using two or more card readers is the most efficient method. Somewhat less desirable is initiation using a single card reader or a 1052 printer-keyboard.



1. Press the request key on the 1052 printer-keyboard and enter the following commands:

START { F1 } ⓑ  
           { F2 }

2. Type in programmer request control statements.

## Single Program Termination

An SPI program is terminated under its own control by issuing an EOJ, DUMP, or CANCEL macro instruction, or through operator action, program error, or certain input/output failures. When an SPI program is terminated, the following action is taken:

1. All I/O operations that the program has requested are completed. If telecommunication device I/O requests are outstanding, they are terminated by the Halt I/O.
2. Tape error statistics (if specified when the system was generated) are typed on the printer-keyboard for tapes used by the program.
3. DASD extents in use by the program for purposes of DASD file protection are dequeued. (DASD file protection is an option that may be selected when the system is generated.)
4. The operator is notified that the program is completed and of the cause of termination, if abnormal. The main storage used by the program remains allocated for the appropriate foreground program area.
5. The program is detached from the system's task selection mechanism.
6. All I/O assignments are reset unless a previous HOLD command was issued for the area(s) terminated.

Following the completion of an SPI program, the operator may initiate another program for the specific area.

Foreground programs operating in batch mode, terminate in the same manner as background jobs.

## Printing Main Storage at EOJ

The control program can provide an automatic printout of main storage when an abnormal end-of-job situation occurs. The dump routine outputs the contents of the general registers and main storage from location 0 to the end of the problem program area. For batched mode operation, the device receiving the dump is SYSLSST. SYSLSST may be a tape, disk, or printer. For single program initiation mode, SYSLSST must be assigned to a printer. Because the dump routine is transient, the previous contents of the transient area of storage are destroyed. To obtain an automatic storage printout, the option DUMP must have been specified during system generation or in a previously encountered OPTION statement. In a multiprogramming environment, only the problem program area that caused the dump will be printed.

In certain cases, it is possible for the operator to cancel an abnormal dump prior to its completion. For example, if the operator neglects to make a necessary assignment and starts a job, the job will be automatically canceled and message 0P71I will be issued. If a dump is taken, the operator can regain control prior to its completion by pressing the request key on the 1052 printer-keyboard twice. Message 1I40D, REQUEST CANCEL, will then be issued. The operator can reply CANCEL {BG, F1, F2} to this message.

## Autotest Disaster Continue Routine (Operating Procedure)

Autotest is used to alter a user program and test its effectiveness by means of test requests and end-of-job storage printouts (dumps). The output of these test requests, as well as the storage dump, must be obtained if the user program does not reach its normal end of job. The procedure to accomplish this, used when other methods fail, is called disaster continue.

The machine operator should attempt to intervene manually if the user program enters an unending loop, or destroys part of the Supervisor or Autotest control program. This is done by the cancel command.

If the supervisor can accept the cancel command, Autotest functions as during an abnormal end of job. In most cases, this procedure assures that all Autotest output (up to the time of intervention) is processed. This output, along with an abnormal end-of-job dump, is put out on the unit assigned to SYSLSST.

If this method is unsuccessful (program remains in loop, or supervisor is unable to cancel), the disaster continue procedure must be used to obtain the Autotest output. The purpose of the disaster continue procedure is to get a storage dump, process any Autotest output (on SYSLNK, the Autotest work file) with the normal Autotest routines, and return control to Job Control.

#### Disaster Continue Routine

The machine operator removes the processed cards from the input stream and:

1. Dumps main storage with a stand alone utility program. (This saves the machine condition at the time of intervention for the programmer.)
2. Performs the standard IPL procedure to restore the Supervisor.
3. Ensures that all Autotest I/O unit assignments are the same as at the time of the intervention. This is done by inserting the ASSGN cards for the user program into the job stream. (See step 4.)

Note: If the user program utilized the same set of physical unit assignments as the installation IPI set, this would not be necessary.

4. Inserts the following cards into the input stream, followed by all cards that have not been read:
  - a. A JOB control card for the user program.
  - b. ASSGN cards for the user program, if needed.
  - c. A disaster continue control card. The format of this card is

```
// EXEC ATLECONT
```

Note: If the OPTION STDLABEL was not utilized, the VOL, DLAB, and EXTENT cards for the Autotest work file must be inserted after the JOB control card (step 4a).

5. Places the remainder of cards (from the point of intervention) in the input stream.

At the conclusion of the Autotest post user execution routines, control returns to the Supervisor and normal job processing resumes with the next job.

## Operator Functions Under ERRLOG and MCRR Options

The ERRLOG and MCRR options are provided to assist the customer engineer in his effort to provide the installation with a reliable and serviceable system. Operator intervention in systems using these options is well defined and required only in the following cases:

- Creating the recorder file (SET RF=CREATE)
- At end of day (Issue ROD command)
- Running EREP (environmental recording editing printing) program (// EXEC EREP)
- Responding to error messages

#### Creating the Recorder File

When either the ERRLOG or MCRR features are added to a system, the operator must create the recorder file (on SYSREC). The recorder file is a data set that is defined by the system's file definition statements. These statements must be kept on the standard label cylinder on SYSRES.

To create a recorder file, the operator must perform the following steps after the IPL procedure and before the first job.

1. Assign SYSREC
2. Add the file definition statements for the recorder file to the installation's standard label deck and build the standard label portion of the label cylinder (// OPTION STDLABEL).
3. Initiate the recorder file by entering the parameter RF=CREATE in the SET command.

Once this has been done, the file is created when the first JOB card is encountered, and recording can proceed. On subsequent IPLs (such as at the beginning of each day) the system opens the recorder file when the first job card is encountered and continues updating it without further operator intervention.

The following is an example of how to create the recorder file

```
ADD
.
.   if not in system generation
.
SET DATE=9/29/68
ASSGN
.
.   if not in system generation
.
ASSGN SYSREC,X'190'
// OPTION STDLABEL
// DLBL IJSYSRC,'DOS RECORDER FILE'
// EXTENT SYSREC,,,,1700,43
SET RF=CREATE
// JOB name (the first job card after IPL)
.
.   continue with normal job stream
.
```

In this example, IJSYSRC file begins at cylinder 170 and is 43 tracks long. The recorder file is created when the // JOB card is encountered.

#### At End of Day

When the operator is ready to close down the system at the end of the day, he must assure that statistical data held in core will be added to the recorder file. This is done by issuing the ROD (record on demand) command.

#### Running EREP

The EREP (environmental recording editing printing) program should be run at the request of the customer engineer. Because EREP requires no job control cards, the operator can initiate this program from the IBM 1052 Printer-Keyboard by typing // EXEC EREP. This can be done at any time Job Control is active and reading from SYSLOG (for example, after a PAUSE). The only system devices used by EREP are SYSREC (input) and SYSLST (output).

#### Responding to Error Messages Issued by ERRLOG and MCRR Options

On encountering the first JOB card after an IPL, the system activates the recorder file. If the recorder file cannot be opened, the system issues a diagnostic message and the operator is expected to re-IPL the system and correct the error condition. Examples of such error conditions might be to assign SYSREC, to provide file definition statements, or to suppress recording. When information is being placed on the recording file, the operator is warned if there is a danger that the information may be lost. In such cases, he may schedule the execution of the EREP program and recreate the file or he may ignore the errors. In these cases, the operator is warned of the condition by an informational message (suffix-I) and processing continues while the operator decides on his future action.

# Communications

## Messages from the System

The system communicates with the operator by issuing messages on SYSLOG, normally assigned to an IBM 1052 Printer-Keyboard. If no response or action is required of the operator, an I (for information) is appended to the message number. If the operator must take a specific action or make a decision, an A or D will be appended to the message number. Whenever operator action or a decision is necessary, the program responsible for issuing the message usually waits until the operator enters an acceptable reply via the IBM 1052 Printer-Keyboard. An exception would be a message indicating intervention-required action for a specific device, where the operator need only satisfy the condition (e.g. reader out of cards).

The system-to-operator messages are fully described in the DOS operator communications publication referenced in the Preface.

## Communication to the System

There are two means of communicating with the system: job-control statements and operator commands. Job-control statements are distinguished by the double slash (//), in columns 1 and 2. Operator commands do not have this characteristic. The following table shows the differences between these two forms of communication.

//	<u>Job-Control Statement</u> Operation Code	Operand(s)
	<u>Operator Command</u> Operation Code	Operand(s)

Operator commands apply to either background (where applicable) or foreground programs. They may be entered through either SYSRDR or SYSLOG. Job-control statements are issued for batched job processing programs only and are normally entered through SYSRDR. Because operator commands are acceptable at any time operator-to-system responses are enabled, it is preferable to use the command whenever possible. If an operator forms this habit, it is not necessary for him to

remember when job-control statements are acceptable.

The operator communicates with the system by entering certain commands into the system. Commands are usually entered by using the 1052 printer-keyboard (SYSLOG). Communication is possible in any of the following instances.

- The operator has pressed the REQUEST key (see Using the Request Key).
- The programmer or operator has requested operator response by inserting a PAUSE statement in the input stream for a problem program running in a batch job environment. (A PAUSE statement in the input job stream is not valid for SPI programs.)
- The operator is responding to Job Control action or decision type messages.

Once a command has been processed, the printer-keyboard is unlocked to permit the operator to issue additional commands. Operator-to-system Job Control commands are recognized on SYSRDR as well as on SYSLOG.

Each operator-to-system command consists of an operation code and one or more operands. The operation code describes the pending action and consists of from one to eight alphabetic characters. The operation code must be separated from the first operand by at least one blank. Any operands that follow are separated by commas.

There are four types of operator-to-system commands. A description of all commands is contained in Operator Command Formats.

1. Job Control--issued between jobs or job steps for batch processing in a multiprogramming environment.
2. Attention (ATTN)--issued at any time by pressing the request key on the 1052 printer-keyboard. Some of these commands can be issued only in a multiprogramming environment.
3. Single Program Initiation--may be issued only in a multiprogramming environment following the ATTN command: START [F1 or F2].

#### 4. IPL--Initial Program Loading

By using the appropriate operator-to-system command, the operator can perform the following operations.

- Temporarily suspend processing. The PAUSE statement or command causes the system to pause between jobs (or job steps), while operating in a batch mode. A programmer may use a // PAUSE statement to request operator action.
- End-of-block. The end-of-block character Ⓟ signifies the end of each operator command entered through the 1052 printer-keyboard. It is entered by holding the alter code key down and typing a 5.
- Resume processing. The end-of-communications character Ⓟ signifies the end of all operator commands and causes processing to continue. It is entered into the 1052 by holding the alter code key down and typing a 5.
- Cancel jobs. The CANCEL command, which can be issued at any time during the execution of a background, foreground-one, or foreground-two program, terminates the execution of that job after all outstanding interruptions have been handled.
- Change input/output device assignments. The ASSGN (ASSIGN) command assigns a symbolic name to a physical input/output device. The DVCDN (DeViCe Down) command informs the system that a device is inoperative. The DVCUP (DeViCe UP) command informs the system that a formerly inoperative device is now operational. The RESET command resets temporary input/output assignments to the standard established at system generation time. Any temporary modifications made by the operator are also reset by this command.
- Perform magnetic tape operations. The MTC (Magnetic Tape Control) command performs magnetic tape operations such as rewinding tapes, rewinding and unloading tapes, etc.
- Closing files. The CLOSE command closes any magnetic tape unit assigned to SYSLST, SYSPCH, SYSOUT, SYSnnn, or to any disk file assigned to SYSRDR, SYSIPT, SYSIN, SYSPCH, or SYSLST, and allows a new device assignment to be made.
- Get information from the system. The LISTIO command prints a listing of input/output device assignments. The

LOG command prints all job-control statements and/or SPI commands as they occur on SYSLOG. (The NOLOG command suppresses the logging of most job-control statements or SPI commands.)

#### • Set system values.

During IPL:

SET--Sets the value for date and time

ADD--Adds device to PUB table

DEL--Deletes device from PUB table

Before first job:

SET--RF=[CREATE, YES, NO]

Between job steps:

SET--Sets the values for line count, UPSI bytes, time, date, record count for SYSLST=disk, and SYSPCH=disk, and optionally inactivates the recorder file (RF=NO).

The SET, ADD, and DEL commands are described in the section Starting The System (IPL Procedure).

- Multiprogramming. The ALLOC, BATCH, TIMER, HOLD, MAP, RELSE, START, STOP, UNA, and UNBATCH commands are valid only in a multiprogramming system.

ALLOC--Allows the operator to allocate main storage partitions to the desired sizes.

BATCH--Initiates batch job processing in BG, F2, or F1, or continues batch processing in BG, F2, or F1 after a STOP command.

HOLD--Holds the current I/O assignments for the foreground area(s) until released by RELSE command.

MAP--Prints the current main storage partitions on SYSLOG.

TIMER--Internal timer support.

RELSE--Sets the current I/O assignments for the specified foreground area(s) to unassigned at the completion of the active program for that area.

START--Starts SPI in F2 or F1 or continues processing after a STOP command.

STOP--Halts batch job operation temporarily. Job Control does not issue a read command to SYSLOG. Batch job operation can be resumed following a STOP command by issuing either a BATCH or START command.

MSG--Gives control to a foreground program operator communication routine.

UNA--Causes physical units currently assigned to a foreground area(s) under the HOLD command to be unassigned. The specified foreground area must be inactive.

UNBATCH--Terminates batch job operation and releases partitions. All logical I/O units are unassigned.

These commands are described in greater detail in Operator Command Formats. Although the normal communication device is SYSLOG (1052 printer-keyboard), operator-to-system commands (except multiprogramming commands) are also recognized on SYSRDR.

## Using the Request Key

While processing in either the background or foreground problem areas, the 1052 printer-keyboard is locked. If the operator presses the request key, message 1I60A READY FOR COMMUNICATIONS is printed. The keyboard is then unlocked and any valid ATTN command can be entered.

The attention request is ignored if:

1. The system is executing a condense function.
2. The system is executing a re-allocation function.

If the logical transient area in the Supervisor is active when the request is made, the request is held until the logical transient area is released by the problem program. There are some program failures that will never release the logical transient area. For example, the logical transient area will not be released if there is a loop in a user-label routine while opening a file. In such a case, the attention key may be pressed again. The following message will be issued:

1I40D REQUEST CANCEL

The operator may either ignore the message (respond Ⓟ) or respond with the CANCEL operation command. If the message is ignored, the original request remains pending.

## Operator Command Formats

The valid operator-to-system commands are listed in Figure 8.

Some entries in the operand field of operator-to-system commands are represented in hexadecimal form. The hexadecimal form is signified by X'cuu'. The letters cuu represent the physical address of a device and can be the numeric characters 0-9 and the alphabetic characters A-F.

Each operator-to-system command is described in the following section. The conventions used to illustrate these commands are as follows:

1. Uppercase letters and punctuation marks (except as described in items 3 and 4 below) represent information that must be coded exactly as shown.
2. Lowercase letters and terms represent information that must be supplied by the operator.
3. Information contained within brackets [ ] represents an option than can be included or omitted depending on the requirements of the program.
4. Options contained within braces { } represent alternatives, one of which must be chosen.
5. Options that are underlined indicate the assumed value if no operand is provided.

### ADD -- Add a Device to the PUB Table

ADD is an optional control command that is used to add a device (not assigned during system generation) to the PUB table. It is read from the operator communication device (either the 1052 or a card reader) and is acceptable only during the IPL procedure. The format of the ADD command is:

Operation	Operand
ADD	X'cuu'[(k)],devicetype[,X'ss']

X'cuu' = channel and unit numbers.

k = S, if the device can be switched (attached to two adjacent channels). The designated channel (X'cuu') is the lower of the two channels.

k = 0-255 indicates the priority of a device that cannot be switched. The highest priority is 0. If k is not given, a priority of 255 is assumed. In a multiprogramming environment, all devices on a channel automatically have equal priority.

devicetype = (see following)

- 1017 for 1017 paper tape reader with 2826 control unit model 1
- 1017TP for 1017 paper tape reader with 2826 control unit model 2
- 1018 for 1018 paper tape punch with 2826 control unit model 1 (X'ss' operand required)
- 1018TP for 1018 paper tape punch with 2826 control unit model 2 (no X'ss' operand required)
- 1050A for 1052 printer-keyboard
- 1285 for 1285 optical reader
- 1287 for 1287 or 1288 optical reader
- 1403 for 1403 printer
- 1403U for 1403 printer with UCS feature
- 1404 for 1404 printer
- 1412 for 1412 magnetic ink character reader
- 1419 for 1259 or 1419 magnetic ink character reader
- 1419P for 1419 primary control unit address on dual address adapter
- 1419S for 1419 secondary control unit address on dual address adapter
- 1442N1 for 1442N1 card reader punch
- 1442N2 for 1442N2 card punch
- 1443 for 1443 printer
- 1445 for 1445 printer
- 2260 for 1. Local display station (no X'ss' operand required)  
2. 1053 attached to 2848 (X'ss' operand required)
- 2311 for 2311 disk drive (DASD)
- 2314 for 2314 disk drive (DASD)
- 2321 for 2321 data cell drive (DASD)
- 2400T7 for 7-track magnetic tapes
- 2400T9 for 9-track magnetic tapes
- 2495TC for tape cartridge reader
- 2501 for 2501 card reader
- 2520B1 for 2520B1 card reader punch
- 2520B2 for 2520B2 card punch
- 2520B3 for 2520B1 card punch
- 2540P for 2540 punch
- 2540R for 2540 card reader
- 2671 for 2671 paper tape reader
- 2701 for 2701 data adapter unit. The code '2701' should be used only for lines with the following adapters:
  - IBM terminal adapters types I, II, and III
  - Synchronous data adapter type II
  - Telegraph terminal adapters types I and II

- 2702 for 2702 transmission control unit.
- 2703 for 2703 transmission control unit or for IBM System/360 Model 25 with the integrated communication attachment.
- 7770 for 7770 audio response unit
- 7772 for 7772 audio response unit
- UNSPB for unsupported device attached to channel 0, which is either overrunable or operates in burst mode.
- UNSP for unsupported device. If attached to channel 0, it is not overrunable and does not operate in burst mode.

X'ss'= Device specifications. X'01' must be coded when the device type is a 2260 for 1053 attached to a 2848 Local. If absent, the following values are assumed, depending on the value specified in the DVCGEN macro at system generation time or by the ADD command at IPL time.

- X'C0' for 9-track tapes
- X'90' for 7-track tapes
- X'00' for non-tapes

There are two possible device specifications for 9-track tape units -- X'C0' and X'C8'. By definition, C0 is the normal reset mode for the device. C8 is an alternate mode setting for 9-track dual-density tapes only. When the system is generated, it is possible to make an explicit selection of mode setting for each magnetic tape unit, or let the system take a standard action. If the latter action is chosen, the system will always assume C0 for the device.

X'00', X'01', X'02', and X'03' are invalid as X'ss' for magnetic tape. This parameter is used to specify SADxxx requirements for 2702 lines:

- X'00' for SAD0
- X'01' for SAD1
- X'02' for SAD2
- X'03' for SAD3

The previous information is not accepted on the ASSGN statement.

COMMAND	MEANING	IPL <sup>1</sup>	JC <sup>2</sup>	AR <sup>3</sup>	SPI <sup>4</sup>	WHEN ACCEPTED
ADD	Add a device to the PUB table.	X				During IPL SET date and clock only
DEL	Delete a device from the PUB table.	X				
SET	Set values in the communication area.	X <sup>5</sup>	X <sup>8</sup>			
CLOSE	Close magnetic tape input or output file or 2311		X			Between Jobs and Job Steps
DVCDN	Device down (not available to system).		X			
DVCUP	Device up (now available to system).		X			
MTC	Magnetic tape control		X			
RESET	Reset temporary I/O device assignment to system standard.		X			
ROD	Record on demand		X			
STOP <sup>7</sup>	Stop execution of background job.		X			
UNBATCH <sup>7</sup>	Terminate batch processing		X <sup>6</sup>			
UCS	Load universal character set buffer		X			
ALLOC <sup>7</sup>	Allocate core storage.		X	X		Between Jobs and Job Steps and after pressing the request key on 1052
MAP <sup>7</sup>	List core storage allocations.		X	X	X	Between Jobs and Job Steps, after pressing the request key on 1052, and as response to system message, and during single program initiation
PAUSE	Suppress processing (enter WAIT state).		X	X	X	
LOG	Log (print) job control statements.		X	X	X	
NOLOG	Suppress logging control statements.		X	X	X	
CANCEL	Cancel execution of current job.		X	X	X	
Ⓑ	End-of-block or communications	X	X	X	X	During IPL between Jobs and Job Steps, after pressing the request key on 1052, and as response to system message, and during single program initiation.
Ⓒ	Cancel terminal response (1052).	X	X	X	X	
ASSGN	Assign logical name.		X		X	Between Jobs and Job Steps and during single program initiation.
HOLD <sup>7</sup>	Hold current foreground assignments.		X		X	
LISTIO	List current I/O assignments.		X		X	
RELSE <sup>7</sup>	Release current foreground assignments and unassign them at the end of any job initiated for that area.		X		X	
UNA <sup>7</sup>	Set all assignments for foreground area to unassigned. The specified area must be inactive.		X		X	
MSG <sup>7</sup>	Give control to a foreground communication routine.			X	X	After pressing the request key on the 1052 and during single program initiation
TIMER	Transfers timer support to indicated program.			X	X	
START <sup>7</sup>	Initiates a foreground program or resumes batch processing.			X		After pressing request key on 1052
BATCH <sup>7</sup>	Initiate batch processing.			X <sup>6</sup>		
DLAB	Disk label information.				X	During Single Program Initiation
DLBL	Disk label information.				X	
EXEC	Initiate single program execution.				X	
EXTENT	Disk extent information.				X	
LBLTYP	Label information.				X	
READ <sup>7</sup>	Specifies a card reader from which further single program initiation commands are read.				X	
TLBL	Tape label information.				X	
TPLAB	Tape label information.				X	
VOL	Disk volume information.				X	
XTENT	Disk extent information.				X	

1. Initial Program Loader (IPL).
2. Job Control (JC).
3. ATTN Routine (AR).
4. Single Program Initiation for F1 or F2.

5. Date and clock only.
6. Valid only if batch job foreground option was specified at system generation.
7. Valid only in a multiprogramming system.
8. Refer to SET Command for RF parameters.

Figure 8. Valid Operator Commands



The tape specifications are:

Density (Bytes Per Inch)	Parity	Convert Feature	Translate	ss
200	odd	on	off	10
200	odd	off	off	30
200	odd	off	on	38
200	even	off	off	20
200	even	off	on	28
556	odd	on	off	50
556	odd	off	off	70
556	odd	off	on	78
556	even	off	off	60
556	even	off	on	68
800	odd	on	off	90
800	odd	off	off	B0
800	odd	off	on	B8
800	even	off	off	A0
800	even	off	on	A8
800	single-density 9-track tapes			C0
1600	single-density 9-track tapes			C0
1600	dual-density 9-track tapes			C0
800	dual-density 9-track tapes			C8

For 1412/1419/1259 magnetic ink readers, X'ss' designates the external bits associated with this reader. These bits correspond to external interrupt PSW bits 26 through 31, respectively. For a 1419 equipped with the dual address adapter, this parameter is needed for both the primary and secondary control units (1419P and 1419S). The possible combinations for the device specification for the 1412/1419 are:

Device Specification	External Line Number
X'01'	7
X'02'	6
X'04'	5
X'08'	4
X'10'	3
X'20'	2

The device specifications for a 1018 paper tape punch with 2826 control unit model 1 are:

X'00' for a 1018 without the error correction feature

X'01' for a 1018 with the error correction feature.

The end-of-block character  $\text{\textcircled{B}}$  (alter code 5) must be given after each ADD command if the communication device is a printer-keyboard.

ALLOC -- Allocate Main Storage Command

The ALLOC command permits the operator to allocate main storage among foreground programs (Figure 9). Any remaining storage is automatically assigned to the background area. The number of bytes to be allocated for one or both foreground areas is specified in 2K (2048 bytes) increments. If only one foreground area is referenced, it is assumed that the amount of storage allocated to the other remains unchanged. Batched-job areas can never be less than 10K. For COBOL and Assembler with tape or disk work file variants, the batched-job area should never be less than 14K.

Operation	Operand
ALLOC	{ F1=nK[, F2=nK] } { F2=nK[, F1=nK] }

The value n must be an even integer.

The following considerations apply to storage allocation among foreground and background programs.

1. The storage areas must always be contiguous.
2. The maximum size of a foreground area is 510K. This restriction does not apply to the background area.
3. To delete a foreground area from the system, an ALLOC command must be given specifying an area of 0K (zero K).
4. If storage allocation was specified when the system was generated, the IPL routine determines the size of main storage and allocates the specified foreground areas downward from high main storage.

Supervisor Storage Protection Key: 0	Permanent Storage Locations Used by CPU Program Information Block (PIB)	
	Communications Region	
Transient Areas Storage Protection Key: 0	EXCP Routine I/O Interruption Routine Start I/O Routine	Channel Scheduler
	Storage Protection (required for multiprogramming)	
	Supervisor Call Routine Program Check Routine Machine Check Routine External Interruption Routine	
	Timer Services (optional)	
	System Loader (Program FETCH and LOAD) Resident Error Processing Routines I/O Units Control Tables (LUB/PUB/JIB/TEB)	
Background Program Area Storage Protection Key: 1 Minimum Size: 10K	Job Control	
	Linkage Editor Librarian Installation Processing Programs	
Foreground - two Program Area Storage Protection Key: 2 Size: 2K Increments To 510K	SPI	
	Save Area Prog Name Return PSW Registers	Batch Mode Job Control
	Label Area (optional)	
Foreground - one Program Area Storage Protection Key: 3 Size: 2K Increments To 510K	Save Area Prog Name Return PSW Registers	Job Control
	Label Area (optional)	
	Installation Processing Programs	Minimum Size: 10K Installation Processing Programs

Figure 9. Main Storage Organization

Storage will not be allocated in the following instances.

- Rule 1. The allocation would cause a decrease in the storage allocated to an active foreground or background program.
- Rule 2. The allocation would result in the relocation of an active foreground program.
- Rule 3A. A Job Control allocation would reduce the background area (or foreground area(s) while operating in the batched foreground mode) to less than 10K bytes.
- Rule 3B. An ATTN allocation would reduce the background area, which is always considered active when allocating storage from the ATTN routine.

Figure 10 shows some examples of valid and invalid storage allocations that could be made by the operator. The operator can issue the MAP command to print on SYSLOG the areas of main storage allocated to programs operating in a multiprogramming environment.

The allocation command shifts the boundary alignment between partitions. For example, assume that the system has 64K with a 10K Supervisor. If the following allocation is made

ALLOC F1=16K,F2=16K

the boundary alignment will be:

AREA	No. K	UPPER LIMIT
SP	10K	10239
BG	22K	32767
F2	16K	49151
F1	16K	65535

If the MAP command is issued following the preceding allocation, a storage map similar to that printed here appears on SYSLOG.

All programs run in either foreground partition must be linkage edited so that they fall within the partition boundaries. They must also be cataloged into the core image library. In the preceding example, all programs initiated for F2 or F1 must be linkage edited for at least 32K and 48K, respectively.

**NOTE:** The operator should be aware that program phases previously cataloged into the core image library may not be executable if the boundary alignment is changed by the ALLOC command.

Present Program Allocation	Area	Area Status	New Allocation	Result	Reason
10K 4K	BG F1	Active	F1=2K	Invalid	Rule 1.
10K 2K 4K	BG F2 F1	Active Inactive	F1=6K F2=2K  F1=2K F2=4K	Invalid Invalid  Valid	Rule 2. Active program in F2 must be relocated to expand F1. Rule 2. Active program in F2 must be relocated to maintain contiguous storage between F1 and F2.  Storage added to active program while maintaining contiguous areas.
10K 2K	BG F2	Active	F2=4K	Invalid	Rule 3a or 3b.

Figure 10. Storage Allocation Examples.

ASSGN -- Assign Logical Name Command

The ASSGN command is used to assign a logical I/O unit to a physical device. It can be used to change any device assignment that was previously specified. Its form is:

Operation	Operand
ASSGN	SYSxxx, address [ { , X'ss' } ] [ , TEMP ] [ , ALT ]

The entries in the operand represent the following:

SYSxxx Symbolic unit name, which may be one of the following:

- SYSREC\*\*\*\*
- SYSRDR\*
- SYSIPT\*
- SYSIN
- SYSPCH\*
- SYSLST\*
- SYSOUT
- SYSLNK\*\*
- SYSLOG
- SYSSLB\*, \*\*
- SYSRLB\*, \*\*
- SYS000-SYSmax\*\*\*

\* These system logical units may only be assigned to unit record devices for SPI. SYSIPT or SYSRDR is assigned to a card reader or reader punch, SYSPCH to a card punch or reader punch, and SYSLST to a printer.

\*\* Background only.

\*\*\* SYSmax is not an operand of the ASSGN command. It represents the highest numbered programmer logical unit available for a partition.

\*\*\*\* SYSREC must be a permanent assignment.

Assignments for SYSOUT must be permanent (that is, not reset between jobs), and are only valid for a tape unit. If a system unit is assigned to a tape or DASD device, the unit must be closed before it is free for another assignment. A system or programmers logical unit must be permanently unassigned prior to any subsequent assignment to another partition (for example, from BG to F1).

SYSxxx can only be SYS000 through SYS221 for all partitions. The address can be expressed as X'cuu', UA, or IGN.

X'cuu' Indicates the channel and unit number (in hexadecimal).  
c = 0 for multiplexor channel  
c = 1-6 for selector channels 1-6  
uu = 00-FE (unit number; 0-254 in hexadecimal)

UA Indicates the logical unit is to be unassigned. Any operation attempted on an unassigned device results in job cancelation.

IGN Indicates that the logical unit is to be unassigned, and that all program references to the logical device are to be ignored. This operand is not valid for SYSRDR, SYSIPT or SYSIN.

TEMP Specifies a temporary assignment for batched-job programs only.

X'ss' Device specifications (used to specify mode settings for 7-track and 9-track tapes). If X'ss' is not specified, the following values are assumed depending upon the value specified in the DVCGEN macro at system generation time or in the ADD command at IPI time.

X'C0' for 9-track tape  
X'90' for 7-track tape

(For additional information, refer to device specifications under ADD command.) The LISTIO command may be used to determine the current mode settings for all magnetic tape units. The specifications are as shown here.

ALT Indicates an alternate magnetic tape unit that is used when the capacity of the original assignment is reached. The characteristics of the alternate unit must be the same as those of the original unit. Multiple alternates may be assigned to a symbolic unit.

Note: The ALT operand is not valid for any system input file (e.g., SYSRDR, SYSIPT, SYSIN). It is also invalid for SYSLNK and SYSLOG.

Device Specifications:

ss	Bytes per Inch	Parity	Translate Feature	Convert Feature	
10	200	odd	off	on	Valid for
20	200	even	off	off	
28	200	even	on	off	
30	200	odd	off	off	
38	200	odd	on	off	
50	556	odd	off	on	7-track
60	556	even	off	off	
68	556	even	on	off	
70	556	odd	off	off	
78	556	odd	on	off	tape
90	800	odd	off	on	only
A0	800	even	off	off	
A8	800	even	on	off	
B0	800	odd	off	off	
B8	800	odd	on	off	
C0	800	single-density 9-track tapes			
C0	1600	single-density 9-track tapes			
C0	1600	dual-density 9-track tapes			
C8	800	dual-density 9-track tapes			

If more than one temporary assignment is made to the same logical unit but to a different physical unit to set the mode for tape within a job, only the last mode setting is reset at end-of-job. For example, consider the following three assignments:

```
ASSGN SYS001,X'180',X'68'
ASSGN SYS001,X'180',X'A8',TEMP
ASSGN SYS001,X'181',X'A8',TEMP
```

At end-of-job, the temporary mode setting for device 180 is not reset. This situation can be avoided if SYS001,X'180' is reset before reassigning this unit to 181. Either a // RESET statement or a RESET command may be used.

BATCH -- Batch Command

The BATCH command is used to start batch processing in either foreground partition or to continue batch processing in the background. (For additional information, refer to Initiating Batch Processing in a Foreground Area.) If the specified partition is available, Job Control will read the operator's next command from SYSLOG. The operator can give command to

another input device by typing ASSGN  
 SYSRDR, X'cuu' followed by the  
 end-of-communications ⓑ indication.

If the specified partition was temporarily halted by a STOP command, it is made active, and the attention routine communication with the operator is terminated following a BATCH command. If the partition is active, processing continues, and an invalid statement message (150ND) follows. When the partition is free, the BATCH command should be re-entered.

Operation	Operand
BATCH	{ blank } { BG } { F1 } { F2 }

CANCEL -- Cancel Command

The CANCEL command with a blank operand can be used in any partition to:

- Cancel single program initiation. When this command is issued, all previous SPI commands are ignored and control is returned to the Supervisor.
- Cancel a job operating in a multiprogramming environment. The job is canceled after all outstanding interruptions are handled. When this command is issued for the background or foreground area operating in batched mode, SYSRDR (and SYSIPT if assigned to a device other than SYSRDR) is read up to the first statement following the /% control statement (if the job begins with a // JOB statement). If a job does not begin with a // JOB statement and it is canceled before detecting a /% statement, the remaining job-control statements will not be automatically bypassed. To bypass these statements, the operator should type on the 1052 printer-keyboard the following commands:

```
// JOB xxxxxxxx
CANCEL ⓑ ⓑ
```

The remaining job-control statements are then bypassed up to the statement immediately following the next /%.

The CANCEL command with an operand is used while in the ATTN routine to cancel either the background job or either foreground job. The form of the CANCEL command is as follows.

Operation	Operand
CANCEL	{ blank } { BG } { F1 } { F2 }

The operands BG, F1, and F2 must be used in the ATTN routine only (message prefix AR).

- BG Indicates the background program is to be canceled.
- F1 Indicates the foreground-one program is to be canceled.
- F2 Indicates the foreground-two program is to be canceled.

If operand is blank, BG is assumed.

ⓐ -- Cancel 1052 Response Command

The ⓐ (Alter Code 0) command cancels the 1052 response and allows the operator to enter a new response. This command is useful if the operator has detected an error and wishes to correct it. The form of the command is:

Operation	Operand
ⓐ	blank

ⓐ is alter code 0.

CLOSE -- Close Unit Command

The CLOSE command is used to close either a system or programmer output logical unit assigned to a magnetic tape, or a system logical unit assigned to a disk. The logical unit may be optionally reassigned to another device, unassigned, or, in the case of a magnetic tape file, switched to an alternate unit. Note that when SYSxxx is a system logical unit (SYSLSI, SYSPCH, etc.), one of the optional parameters must be specified. When closing a programmer logical unit (SYS000-SYSmax), no optional parameter is required. When none is specified, the programmer logical unit is closed and the assignment remains unchanged. Closing a magnetic tape unit consists of writing a file mark, an EOVT trailer record, two file marks, and rewinding and unloading the tape.

Operation	Operand
CLOSE	SYSxxx [ ,X'cuu' [,X'ss'] ,UA ,IGN ,ALT ]

**SYSxxx** For 2311 or 2314: SYSIN, SYSRDR, SYSIPT, SYSPCH, or SYSLST.  
For magnetic tape: SYSPCH, SYSLST, SYSOUT, or SYS000-SYSmax.

**X'cuu'** Specifies that after the logical unit is closed, it will be assigned to the channel and unit specified. c is the channel number (0-6) and uu is the unit number 00-FE (0-254) in hexadecimal. In the case of a system logical unit, the new unit will be opened if it is either a disk, or a magnetic tape positioned at load point.

**X'ss'** Device specifications (used to specify mode settings for 7-track and 9-track tapes). If X'ss' is not specified, the mode settings remain unchanged. The LISTIO command may be used to determine the current mode settings for all magnetic tape units.

**UA** Specifies that the logical unit is to be closed and unassigned.

**IGN** Specifies that the logical unit is to be closed and unassigned with the ignore option. This operand is invalid for SYSRDR, SYSIPT, or SYSIN.

**ALT** Specifies that the logical unit is to be closed and an alternate unit is to be opened and used. This operand is valid only for system output logical units (SYSPCH, SYSLST, or SYSOUT).

#### DEL -- Delete A Device From the PUB Table

DEL is an optional control statement that is used to delete a device from the PUB table. It is read from the operator communication device (either the 1052 or a card reader) and is acceptable only during the IPL procedure. Its form is:

Operation	Operand
DEL	X'cuu'

where cuu is the channel and unit numbers of the device to be deleted.

The end-of-block **ⓑ** (alter code 5) must be given after each DEL statement if the communication device is a printer-keyboard.

#### DLAB -- DASD Label Information Command

The DASD label command (completed on a continuation line) contains file label information for DASD label checking and creation. This command must immediately follow the volume (VOL) command and precede the XTENT command. Any deviation from this sequence results in a statement out of sequence error message. If a mistake is made while entering the continuation line on the 1052, both lines of the DLAB command must be re-entered. The DLAB command and its continuation line have the following format.

Op	Operand
DLAB	'label fields 1-3', xxxx,yyddd,yyddd,'systemcode'[ ,type]

#### 'label fields 1-3'

The first three fields of the Format-1 DASD file label are contained just as they appear in the label. This is a 51-byte character string, contained within apostrophes and followed by a comma. The entire 51-byte field must be contained in the first of the two statements. Column 72 must contain a continuation character.

Fields 1-3 are:

File Name. 44-byte alphanumeric including file ID and, if used, generation number and version number of generation.

Format Identifier. 1-byte, EBCDIC 1.

File Serial Number. 6-byte alphanumeric, must be the same as the volume serial number in the volume label of the first or only pack of the file.

**C** Continuation character in column 72.

**xxxx** Volume Sequence Number. This 4-digit EBCDIC number is the equivalent of the 2-byte binary volume sequence number in field 4 of the Format 1 label. This number must begin in column 16 of the continuation statement. Columns 1-15 are blank.

yyddd,yyddd

The File Creation Date, followed by the File Expiration Date. These two 5-digit numbers are the EBCDIC equivalent of the 3-byte discontinuous binary dates in fields 5 and 6 of the Format 1 label. yy is the year (00-99), and ddd is the day of the year (001-366).

'systemcode'

This field is never used by the Disk Operating System. A string of 13 characters or blanks must be enclosed within apostrophes as shown.

type

Indicates the type of file label (SD, DA, ISC, or ISE). SD is assumed if this entry is omitted.

DTFSD or DTFPH with Mounted = single: type = SD or blank

DTFDA or DTFPH with Mounted = ALL: type = DA

DTFIS using Load Create: type = ISC

DTFIS using other than Load Create: type = ISE.

DLBL -- DASD Label Information Command

The DLBL command replaces the VOL and DIAB combination used in earlier systems. It contains file label information for DASD label checking and creation. The DLBL command must not be followed by the XTENT command. The current system will, however, continue to accept the VOL, DLAB and XTENT combination. The DLBL command has the following format:

Op	Operand
DLBL	filename, ['file-ID'], [date], [codes]

filename

From one to seven characters and identical to the symbolic name of the program DTF, which identifies the file.

'file-ID'

The name associated with the file on the volume. From 1 to 44 bytes of alphanumeric data, contained within apostrophes, including file-ID and, if used, generation number and version number of

generation. If fewer than 44 characters are used, the field is left justified and padded with blanks. If this operand is omitted, "filename" is used.

date

From 1 to 6 characters indicating either the retention period of the file (in the format d through dddd) or the absolute expiration date of the file (in the format yy/ddd). ddd cannot exceed 366. If this operand is omitted for an output file, a 7-day retention period is assumed and the current date is the creation date. If present, this operand is ignored for an input file.

codes

A 2-3 character field indicating the type of file label as follows:

SD for sequential disk or for DTFPH with MOUNTED=SINGLE.

DA for direct access or for DTFPH with MOUNTED=ALL.

ISC for indexed sequential using Load Create.

ISE for indexed sequential using Load Extension, Add, or Retrieve.

If this operand is omitted, SD is assumed.

Additional fields in the standard disk file label are filled with default options for output files and "DOS/360 VER 3" is used as the system code.

DVCDN -- Device Down Command

The DVCDN (DeViCe Down) command specifies that a device is no longer physically available for system operation. If a standard or temporary assignment was made to the specified device, the symbolic unit(s) is unassigned when the command is accepted. If an alternate assignment was made, the alternate is removed. A DVCUP command must be issued before any subsequent references to this device. This command is used when a device is being serviced or when a device is inoperative.

The DVCDN command uses the logical transient area, and will prevent operator communication until this area is free.

Operation	Operand
DVCDN	X'cuu'

The operand entry X'cuu' is expressed in hexadecimal form, where c is the channel number (0-6) and uu is the unit number, 00-FE (0-254 in hexadecimal).

#### DVCUP -- Device Up Command

The DVCUP (DeViCe UP) command is used to inform the system that a device, which was inoperative, is now available for system operations. An ASSGN operator command (or job-control statement) must be used to reassign this device.

The DVCUP command uses the logical transient area, and will prevent operator communication until this area is free.

Operation	Operand
DVCUP	X'cuu'

The operand entry X'cuu' is expressed in hexadecimal form, where c is the channel number (0-6) and uu is the unit number, 00-FE (0-254 in hexadecimal).

#### Ⓟ -- End-of-Block Command

The end-of-block command, Ⓟ, must be issued after each operator command. Whenever the operator has finished communicating with the system, an additional Ⓟ must be issued, which causes the communication routine to return control to the mainline job. When SPI commands are entered through a card reader (as a result of a READ command), and an invalid command is encountered, an error message is printed on the printer-keyboard. It is now possible for the operator to enter valid commands through the 1052 printer-keyboard. The end-of-communications command, Ⓟ, causes input reading to be switched back to the device specified in the READ command.

Operation	Operand
Ⓟ	blank

Ⓟ is alter code 5.

1. End-of-block -- issued after each command
2. End-of-communication -- issued after final end-of-block to resume processing, or as the first character of an operator response to a message. The BATCH, START, MSG, and CANCEL commands also terminate the ATTN routine.

#### EXEC -- Execute Single Program Initiation Command

The EXEC command is used to specify the SPI program to be executed. The program must be cataloged in the core image library of the system. This command terminates the SPI routines and causes the named foreground program to be loaded into main storage.

Operation	Operand
EXEC	progname

progname Represents the name of the program in the core image library to be executed. The program name can be one to eight alphanumeric characters.

When control is given to the foreground program, register 2 contains the address of the uppermost byte of storage available to the program.

#### EXTENT -- DASD Extent Information Command

The EXTENT command defines each area (or extent) of a DASD file. One or more EXTENT commands must follow each DLBL command, (except for single volume input files for Sequential Disk) on either a 2311 or 2314, for which the DEVADDR parameter was specified in the DTF table. The format of the EXTENT command is as follows.



Operation	Operand
EXTENT	[symbolic-unit], [serial-number], [type], [sequence-number], [relative-track], [number-of-tracks], [split-cylinder-track], [B=bins]

**symbolic unit** A six-character field indicating the symbolic unit (SYSxxx) of the volume for this extent. If this operand is omitted, the symbolic unit of the preceding EXTENT command is used. This operand is not required for a single volume, IJSYSxxx filename or for a file defined with the DTF DEVADDR=SYSnnn.

**serial number** From 1 to 6 characters indicating the volume serial number for this extent. If fewer than six characters are used, the field is right-justified and padded with zeros. If this operand is omitted, the volume serial number of the preceding EXTENT is used. If no serial number was provided in the EXTENT command, the serial number is not checked, and the files may be destroyed if the wrong volume is mounted.

**type** One of the following characters to indicate the extent type:

- 1 - data area (no split cylinder)
- 2 - overflow area (for indexed sequential file)
- 4 - index area (for indexed sequential file)
- 8 - data area (split cylinder)

If this operand is omitted, type 1 is assumed.

**sequence number** One to three characters containing a decimal number from 0 to 255, indicating the sequence number of this extent within a multiextent file. Extent sequence 0 is used for the master index of an indexed sequential file. If a master index is not used, the first extent of an indexed sequential file has the sequence number 1. The extent sequence number for

all other types of files begins with 0. If this operand is omitted for the first extent of an ISFMS file, the extent is not accepted. This operand is not required for SD or DA files.

**relative track** One to five characters indicating the sequential number of the track (relative to zero) where the data extent is to begin. For example, track 0, cylinder 150 on a 2311 equals 1500 in relative track. If this field is omitted on an ISFMS file, the extent is not accepted. This operand is not required for SD input files because the extents from the file labels on a disk are used. This operand must be specified for DA input files.

**number of tracks** One to five characters indicating the number of tracks to be allotted to the file. For SD or DA input files, this operand may be omitted. For split cylinders, the number of tracks must be an even multiple of the number of tracks per cylinder specified for the file.

**split cylinder track** One or two characters, from 0 to 19, indicating the upper track number for the split cylinder in SD files.

**bins** One or two characters identifying the 2321 bin for which the extent was created or on which the extent is currently located. If this field is one character, the creating bin is assumed to be zero. There is no need to specify a creating bin number for SD or ISFMS files. If this operand is omitted, bin zero is assumed for both characters. If this operand is included and positional operands are omitted, only one comma is required preceding the key-word operand (bins). (One comma for each omitted positional operand is acceptable, but not necessary.)

HOLD -- Hold Foreground Unit Assignments Command

This command causes all I/O assignments for the foreground area(s) specified, operating in SPI mode, to stay in effect until released by RELSE command. If the

assignments in a foreground area are held, they will be overridden by any new assignments made during subsequent SPI for that same area.

If DASD file protection has been specified as a supervisor generation option, the HOLD command may cause the JIB (Job Information Block) table to expand so much that it will be impossible to initiate jobs in the partitions involved. The DASD file protect function uses the JIB table to store information concerning the DASD extents (used by the OPEN macro) along with other information for the job. When the HOLD command is used, assignments and JIB information are held across jobs. When the JIB table is loaded with extent information, an attempt to initiate additional jobs in the partition results in the error message indicating that no more JIBs are available. It is possible to circumvent this situation by limiting or avoiding use of the HOLD command for DASD devices used by the foreground partitions when the DASD file protect option has been specified. The format of the HOLD command is:

Operation	Operand
HOLD	{ F1[,F2] } { F2[,F1] }

LBLTYP -- Label Information Command

The LBLTYP command defines the amount of main storage to be reserved for processing tape and nonsequential disk file labels in the problem area of main storage. It should be submitted immediately before the EXEC command for the program. This command is required for SPI only when a self-relocating program is to use tape or nonsequential DASD label information from the standard label cylinder. The format of the LBLTYP command is:

Operation	Operand
LBLTYP	{ TAPE[(nn)] } { NSD(nn) }

TAPE[(nn)] used only if tape files, requiring label information, are to be processed, and no nonsequential DASD files are to be processed. The parameter (nn) is optional and is provided for future expansion.

NSD(nn) Used if any nonsequential DASD files are to be processed, regardless of other file types used. The parameter (nn) specifies the largest number of extents used for a single file.

The amount of storage that must be reserved for label information is:

1. For any number of tape labels: 80 bytes per label.
2. For sequential DASD and DTFPH MOUNTED=SINGLE: 0 bytes.
3. For DTFIS, DTFDA, and DTFPH MOUNTED=ALL: 84 bytes plus 20 bytes per extent.

The area reserved is that required by the file with the largest label requirements. This area is used during OPEN.

LISTIO -- List I/O Assignment Command

The LISTIO command is used to cause the system to print a listing of I/O assignments on the printer-keyboard (SYSLOG). Some of the operands in the following list can be issued only between job steps. Others can be issued only during SPI. A third group can be issued either between job steps or during SPI. The form of the list I/O command is:

Operation	Operand
LISTIO	{ BG } { DOWN } { PROG } { SYS } { SYSxxx } { UNITS } { X'cuu' } { ALL } { F1 } { F2 } { UA }

Physical units are listed with current device specification for magnetic tape units. Logical units are listed with ownership (background, foreground-one, or foreground-two), where applicable. List I/O uses the logical transient area, and will prevent operator communication until this area is free.

The following operands are valid between job steps and during SPI.

- ALL Lists the physical units assigned to all logical units.
- F1 Lists the physical units assigned to all foreground-one logical units.
- F2 Lists the physical units assigned to all foreground-two logical units.
- UA Lists all physical units not currently assigned to a logical unit.

The following operand is valid only during SPI.

- BG Lists the physical units assigned to all background system and programmer logical units.

The following operands are valid only between job steps.

- DOWN Lists all physical units specified as inoperative.
- PROG Lists the physical units assigned to all background programmer logical units.
- SYS Lists the physical units assigned to all background system logical units.
- SYSxxx Lists the physical units assigned to the specified logical unit. SYSOUT and SYSIN are not valid in this command.
- UNITS Lists the logical units assigned to all physical units.
- X'cuu' Lists the logical units assigned to the specified physical unit.

LOG -- Log Command

The LOG command is used to cause the system to log columns 1-72 of all Job Control statements and/or SPI commands on SYSLOG until a NOLOG command is sensed.

Operation	Operand
LOG	blank

The operand field is ignored by the system.

MAP -- Map Main Storage Command

The MAP command is used to cause the system to print on SYSLOG the areas of main storage allocated to programs in a multiprogramming environment. It indicates what programs are being executed, and which has access to the interval timer. The form of the MAP command is as follows.

Operation	Operand
MAP	blank

The map of main storage produced is in the following format.

Field 1	Field 2	Field 3	Field 4
SP		upper limit	
BG	size	upper limit	name
F2	size	upper limit	name
F1 T	size	upper limit	name

The fields indicate the following:

- Field 1 (area identification)
  - SP - Supervisor
  - BG - Background area
  - F2 - Foreground-two area
  - F1 - Foreground-one area
  - T - Indicates which program has interval timer support

Field 2 (size of area allocated)  
 The number of bytes allocated to the area in main storage. The size is printed in even multiples of 2K, where 2K is equal to 2048 bytes. For the background area, this represents the number of full 2K blocks. For example, if the area were actually 11.2K, the map would indicate 10K.

Field 3 (area upper limit of main storage)  
 The highest storage allocated to the corresponding area is printed in decimal.

Field 4 (user name)  
 BG - Background job name  
 F2 - Foreground-two program name  
 F1 - Foreground-one program name

When the name field is blank for F2 or F1 (SPI mode), no active program is being executed in the area. When there is no active program in a batched-job area, 'NO NAME' appears in this field.

MSG -- Transfer Control Command

The interrupt key allows the operator to communicate with the background partition. The MSG command gives the operator this same capability for foreground areas. The format of the MSG command is:

Operation	Operand
MSG	{ F1 } { F2 }

F1,F2 Used to request a foreground-one, or foreground-two, program.

If the program in the specified area has not established any operator communication linkage, a message is printed on the printer-keyboard informing the operator of this condition.

MTC -- Magnetic Tape Command

The MTC command is used to initiate magnetic tape control operations on 2400 series magnetic tapes. The first entry in the operand specifies the operation to be performed. The form of the MTC command is:

Operation	Operand
MTC	opcode, { SYSxxx[,nn] } { X'cuu' }

The entry in the operand can be:

Op code	Meaning	Possible Use
BSF	<u>B</u> ack <u>S</u> pace <u>F</u> ile	Backspace one file so tape is positioned for reading the tapemark preceding the file backspaced.
BSR	<u>B</u> ack <u>S</u> pace <u>R</u> ecord	Backspace record.
ERG	<u>E</u> Rase <u>G</u> ap	Erase gap
FSF	<u>F</u> orward <u>S</u> pace <u>F</u> ile	Used when restarting a program. The tape is positioned beyond the tapemark following the file spaced over.
FSR	<u>F</u> orward <u>S</u> pace <u>R</u> ecord	Locate a specific record within a file.
RUN	<u>R</u> ewind and <u>U</u> nload	Rewind and unload (from the console) a tape on a specific unit.
REW	<u>R</u> EWind	Rewind (from the console) a tape on a specific unit.
WTM	<u>W</u> rite <u>T</u> ape <u>M</u> ark	Write a tapemark on an output file.

The second entry, X'cuu', is expressed in hexadecimal form, where c is the channel number (0-6) and uu is the unit number, 00-FE (0-254 in hexadecimal). The alternate second entry, SYSxxx, represents any logical unit assigned to this device.

The optional third entry, nn, is a decimal number (01-99) that represents the number of times the specified operation is to be performed.

Although the IBM-supplied programs do not require the operator to perform magnetic tape operations, the MTC command may be very helpful to the user in performing magnetic tape operations from the 1052 printer-keyboard.

NOLOG -- Suppress Logging Command

The NOLOG command is used to cause the system to suppress the logging of all Job Control statements and/or SPI commands on

the 1052 printer-keyboard until a LOG command is sensed. The Job Control statements, JOB, PAUSE, \*, and /%, are always logged. Any control statement in error is also logged. The form of the NOLOG command is:

Operation	Operand
NOLOG	blank

The operand field is ignored by the system.

#### PAUSE -- Pause Command

The PAUSE command is used to cause Job Control processing to pause at the end of the current program job step, or at the end of the current job (EOJ operand). At that time, the printer-keyboard is unlocked for message input. The end-of-communications command  $\textcircled{B}$  causes processing to continue. The form of the PAUSE command is:

Operation	Operand
PAUSE	blank BG[,EOJ] F1[,EOJ] F2[,EOJ]

If blank, BG is assumed.

#### READ -- Specify Reader Command

The READ command is used to assign a card reader from which further SPI commands are read. The device specified must not be assigned to any other program. The form of the READ command is:

Operation	Operand
READ	X'cuu'

The entry X'cuu' is expressed in hexadecimal form, where c is the channel number (0-6) and uu is the unit number, 00-FE (0-254) in hexadecimal.

#### RELSE -- Release SPI Assignments Command

This command causes all specified I/O assignments for the foreground area(s), operating in SPI mode only, to be unassigned at the end of the current job active for that area. The form of the command is:

Operation	Operand
RELSE	{ F1[,F2] } { F2[,F1] }

#### RESET -- Reset I/O Assignments Command

The RESET command is used to reset designated background I/O assignments to the system standard. The standard assignments are those specified when the system was generated and those permanent modifications made by the operator using the ASSGN command (without the TEMP option). The form of the RESET command is:

Operation	Operand
RESET	{ SYS } { PROG } { ALL } { SYSxxx }

**SYS** Resets all system logical units to their standard assignments.

**PROG** Resets all programmer logical units to their standard assignments.

**ALL** Resets all logical units to their standard assignments.

**SYSxxx** Resets the logical unit specified to its standard assignment. SYSIN and SYSOUT may not be specified.

#### ROD -- Record On Demand Command

The ROD command should be issued by the operator any time the system is shut down. This command causes the in-core SDR (statistical data recording) counters to be written out on SYSREC, thereby assuring that no statistical data is lost. When all counters have been updated, message 1I82I is issued to inform the operator. For teleprocessing devices, refer to BTAM/QTAM SRLs for processing requirements of in-core

counters at close time. This command is only accepted by Job Control. The form of the ROD command is:

Operation	Operand
ROD	blank

Anything entered in the operand field is ignored.

#### SET -- Set Value Command

The SET command is used to initialize the date, clock, and UPSI configuration. It is also used to specify the number of lines to be printed on SYSLST and the remaining disk capacity when either SYSLST or SYSPCH is assigned to a disk. The form of the SET command is as follows.

Operation	Operand
SET	[DATE=n1][,CLOCK=n2] [,UPSI=n3][,LINECT=n4] [,RCLST=n5][,RCPCH=n6] [,RF= <u>YES</u> ,NO,CREATE]

The entries in the operand field represent the following.

**DATE=n1** Must be specified at IPL time. (This operand is valid also during Job Control.) Sets the system date permanently to the specified value. n1 has one of the following formats.

mm/dd/yy  
dd/mm/yy

mm specifies the month; dd specifies the day; yy specifies the year. The format used is selected when the system is generated.

**CLOCK=n2** Must be specified at IPL time if the timer feature is present. (This operand is valid also during Job Control.) Sets the system clock to the specified value. n2 has the following format:

hh/mm/ss

hh specifies hours (00-23);  
mm specifies minutes (00-59);  
ss specifies seconds (00-59).

**UPSI=n3** Never given at IPL time, but can be used at other times. Sets the bit configuration of the UPSI byte in the communication region. n3 consists of one to eight digits, either 0, 1, or X. Positions containing 0 are set to 0; positions containing 1 are set to 1; positions containing X are unchanged. Unspecified rightmost positions are assumed to be X.

**LINECT=n4** Never given at IPL time, but can be used at other times. Sets the standard number of lines to be printed on each page of SYSLST. n4 is an integer between 30 and 99.

**RCLST=n5** Never given at IPL time, but can be used at other times. n5 is a decimal number ( $100 \leq n5 \leq 65535$ ) indicating the minimum number of records remaining to be written on SYSLST when assigned to disk before a warning is issued to the operator that the capacity of the extent is near. If no value is given, the system sets RCLST equal to the value specified when the system was generated. If no value was specified, the system sets RCLST equal to 1000.

**RCPCH=n6** Never given at IPL time, but can be used at other times. n6 is a decimal number ( $100 \leq n6 \leq 65535$ ) indicating the minimum number of records remaining to be written on SYSPCH when assigned to disk before a warning is issued to the operator that the capacity of the extent is near. If no value is given, the system sets RCPCH equal to the value specified when the system was generated. If no value was specified, the system sets RCPCH equal to 1000.

**RF=**  $\left\{ \begin{array}{l} \text{YES} \\ \text{NO} \\ \text{CREATE} \end{array} \right\}$  This operand is used to define the status of the Recorder File (SYSREC) used by the OBR/SDR or MCRR functions.

- RF = YES indicates that an active Recorder File exists on the system and can be found by opening the file as an input file. The open is performed when the first JOB card is processed.

- RF = CREATE indicates that the system should create a

new Recorder File. This is done when the first JOB card is processed.

- RF = NO indicates that no recording is to be done on the Recorder File. RF = NO can be given at any time the OBR/SDR function is active. RF = NO returns the system to its prior state before OBR/SDR was evoked. If OBR/SDR or MCRR function is specified in the Supervisor and no RF parameter is given, YES is assumed.

The SET command is also discussed in the section Starting the System (IPL Procedure).

START -- Start Single Program Initiation Command

The START command can be used to initiate an SPI program. The form of the start command is:

Operation	Operand
START	{ BG } F1 F2

BG Background processing is resumed. The operator must enter the next command. The START BG command is effective only if a STCP command was issued previously.

F1 or F2 Specifies an SPI program is to be initiated. The SPI routines are given control. Commands that may be issued following the START command are shown in Figure 8. If the specified foreground area is either being used by a program or has no area allocated to it, a message is printed on the printer-keyboard informing the operator of this condition.

STOP -- Stop Batch Job Processing Command

The STOP command can be used in a multiprogramming environment to suspend batch job processing in any programming partition. STOP must be issued within the partition to be stopped. The form of the STOP command is:

Operation	Operand
STOP	blank

This command removes the batched partition from the system's task selection mechanism. If no other partitions are active, the system is placed in the wait state. Processing of batched jobs can be continued by using the BATCH or START command or canceled by the CANCEL command.

Note that in a multiprogramming environment, it may be advisable to use a STOP command instead of a PAUSE command. The PAUSE command causes a read to be issued to SYSLOG, tying up the 1052 until the operator responds.

TIMER -- Interval Timer Command

The TIMER command causes interval timer support to be given to the program specified. The form of the TIMER command is:

Operation	Operand
TIMER	{ BG } F1 F2

If interval timer support is already allocated to the program specified, the command is ignored. (This may result from a timer option specified when the system was generated, or a previous TIMER command.) If the interval timer was allocated to a different program and that program has an existing STXIT or SETIME linkage established, a message is printed on the printer-keyboard. A subsequent STXIT or SETIME instruction issued by the program previously having access to the timer causes the cancellation of that program. Once established, timer support remains with an area from program-to-program until changed by a TIMER command, or a new IPL procedure is performed.

TLBL -- Tape Label Information Command

The TLBL command replaces the VOL and TPLAB command combination used in earlier systems. This former combination (VOL and TPLAB) will continue to be recognized by the system. The TLBL command contains file

label information for tape label checking and writing. The format of the TLBL command is:

Operation	Operand
TLBL	filename, ['file-ID'], [date], [file-serial-number], [volume-sequence-number], [file-sequence-number], [generation-number], [version-number]

**filename** From one to seven characters and identical to the symbolic name of the program DTF, which identifies the file.

**'file-ID'** One to 17 characters, within apostrophes, indicating the name associated with the file on the volume. This operand may contain embedded blanks. If this operand is omitted (or included but left blank) for output files, the "filename" is used. If this operand is omitted on input files, no checking is done.

**date** Four to six characters (in format yy/ddd), indicating the expiration date for output files or the creation date for input files. (The day of the year may have from 1 to 3 characters and must be less than 367.) For output files, a one to four character retention period (d through dddd) may be specified. If this operand is omitted, a 0-day retention period is assumed for output files, and the current date is used as the creation date. For input files, no checking is done if this operand is omitted or if a retention period is specified.

**file serial number** One to six numeric characters, indicating the volume serial number of the first (or only) reel of the file. If fewer than six characters are specified, the field is right-justified and padded with zeros. If this operand is omitted on output, the volume serial number of the first (or only) reel of the file is used. If omitted on input, no checking is done.

**volume sequence number** One to four characters in ascending order for each volume of a multiple volume file. This number is incremented automatically by OPEN/CLOSE routines as required. If omitted on output, BCD 0001 is used. If omitted on input, no checking is done.

**file sequence number** One to four characters in ascending order for each file of a multiple file volume. This number is automatically incremented by OPEN/CLOSE routine as required. If omitted on output, BCD 0001 is used. If omitted on input, no checking is done.

**generation number** One to four characters which modify the file/ID. If omitted on output, BCD 0001 is used. If omitted on input, no checking is done.

**version number** One or two characters which modify the generation number. If omitted on output, BCD 01 is used. If omitted on input, no checking is done.

Additional fields in the standard tape file label are filled with default options for output files and "DOS/TOS/360" is used as the system code.

TPLAB -- Tape Label Information Command

The tape-label information command contains file label information for tape label checking and writing. This command must immediately follow the volume (VOL) command. Any deviation from this sequence results in a statement out-of-sequence error message. The TPLAB command contains an image of a portion of the standard tape file label. Label fields 3-10 are always included just as they appear in the label. These are the only fields used for label checking. The form of the TPLAB command is as follows.

Operation	Operand
TPLAB	{ 'label fields 3-10' } { 'label fields 3-13' }



'label fields 3-10'

This is a 49-byte character string, included within apostrophes (8-5 punch), identical to positions 5-53 of the tape file label. These fields can be included in one line.

'label fields 3-13'

This is a 69-byte character string, included within apostrophes (8-5 punch), identical to positions 5-73 of the tape file label. These fields are too long to be included on a single line. The character string must extend into column 71, a continuation character (any character) is present in column 72, and the character string is completed on the next line. The continuation line starts in column 16.

UCS -- Load Universal Character Set Buffer Command

The UCS command (not logged on SYSIST) causes the 240-character Universal Character Set contained in the core image library phase specified by "phasename" to be loaded as buffer storage in the IBM 2821 Control Unit. The 240 EBCDIC characters correspond to the 240 print positions on 1403 chains and trains. A character sent to the printer for printing is matched against the characters in the UCS buffer, and when a match occurs, the corresponding chain/train character is printed in the print line position that the output character occupied.

The logical unit must be assigned to a 1403 printer with the UCS feature. It is the user's responsibility to assemble, linkage-edit, and catalog his UCS buffer phases into the core image library, and to mount the new chain or train before the UCS command is executed. The format of the UCS command is:

Operation	Operand
UCS	SYSxxx, phasename[, FOLD] [, BLOCK][, NULMSG]

SYSxxx The name of the logical unit assigned to a 1403 UCS printer to be loaded.

phasename

The symbolic name of the core image library phase containing the 240 EBCDIC characters to be loaded followed by an 80-character verification message. Each phase may have any valid phasename.

FOLD

Signifies that the buffer is to be loaded with the folding operation code in the CCW.

BLOCK

Signifies that the 2821 latch is to be set to inhibit data checks generated by the 1403 UCS printer due to print line-character mismatches with the UCS buffer.

NULMSG

Signifies that the 80-character verification message is not to be printed on the 1403 after the buffer is loaded. If this parameter is not specified, after the UCS buffer has been loaded, the program will skip to channel one, issue a print of the last 80 characters in the phase specified by the first parameter, and again skip to channel 1. This identifies the phase, if the phase name is incorporated in the verification message. If the user's chain/train is identified by a unique character, this message may also be used to verify that the mounted chain or train is compatible with the contents of the UCS buffer. This can be done by including the unique character in the verification message.

The UCS phase format consists of a 240-character UCS buffer load and an 80-character verification message. (For more information on the UCS command, consult the IBM 2821 Control Unit publication, Form A24-3312.)

UNA--Unassign Command (Single Program Initiation)

This command causes all I/O assignments for the specified foreground area(s) to be unassigned. A previous hold for the area remains in effect; i.e., any future assignments initiated in that area will be held. Both UNA and RELSE commands must be used to immediately unassign an area and prevent an assignment from being held. The foreground area must be inactive. This command is intended to be used to free physical units currently assigned to a foreground area under the HOLD command. The format of the UNA command is as follows.

Operation	Operand
UNA	{ F1[,F2] } { F2[,F1] }

#### UNBATCH -- Terminate Batch Job Processing

The UNBATCH command is accepted only from SYSLOG and is valid only for foreground partitions (operating in batch mode) when no job is in process for that partition. All tape/disk files must have been previously closed. When this command is issued, batch processing is terminated and the partition is released. (For specific information concerning the termination of batch job processing in a foreground partition, refer to Terminating Batch Processing in a Foreground Area.) Following the UNBATCH command, the attention routine will accept BATCH or START commands for the released partition. The format of the UNBATCH command is:

Operation	Operand
UNBATCH	blank

#### VOL -- Volume Information Command

The VOL (volume) command is used when specifying a set of label information for a magnetic tape file or a DASD file, unless the DLBL or TLBL commands are used. A VOL command must be used for each file on a multifile volume (when the DLAB or TPLAB commands are used). The form of the VOL command is:

Operation	Operand
VOL	SYSnnn,filename

SYSnnn Symbolic unit name.

filename File name. This can be one to seven characters and is identical to the symbolic address of the program DTF that identifies the file.

#### XTENT -- DASD Extent Information Command

The extent command defines each area, or extent, for a DASD file. One or more XTENT commands must follow each DLAB command. Any deviation from this sequence results in a statement out of sequence error message. The form of the XTENT command is:

Operation	Operand
XTENT	type,sequence,lower,upper, 'serial no.',SYSxxx[,B <sub>2</sub> ]

type Extent Type. 1 or 3 columns, containing:

- 1 = data area (no split cylinder)
- 2 = overflow area (for indexed sequential file)
- 4 = index area (for indexed sequential file)
- 128 = data area (split cylinder). If type 128 is specified, the lower head is assumed to be H<sub>1</sub>H<sub>2</sub>H<sub>2</sub> part of the operand lower, and the upper head is assumed to be H<sub>1</sub>H<sub>2</sub>H<sub>2</sub> part of the operand upper.

sequence Extent Sequence Number. 1-3 columns, containing a decimal number from 0 to 255, indicating the sequence number of this extent within a multi-extent file. Extent sequence 0 is used for the master index of an indexed sequential file. If the master index is not used, the first extent of an indexed sequential file has sequence number 1. The extent sequence for all other types of files begins with 0.

lower Lower Limit of Extent. Nine columns, containing the lowest address of the extent in the form B<sub>1</sub>C<sub>1</sub>C<sub>1</sub>C<sub>2</sub>C<sub>2</sub>C<sub>2</sub>H<sub>1</sub>H<sub>2</sub>H<sub>2</sub>, where:

B<sub>1</sub> = initially assigned cell number.

0 for 2311,2314  
0 to 9 for 2321

C<sub>1</sub>C<sub>1</sub> = Subcell number.

00 for 2311,2314  
00 to 19 for 2321

$C_2C_2C_2$  = cylinder number.

000 to 199 for 2311,2314  
or  
strip number:

000 to 009 for 2321

$H_1$  = head block position.

0 for 2311,2314  
0 to 4 for 2321

$H_2H_2$  = head number.

00 to 09 for 2311  
00 to 19 for 2314,2321

Although a part of the address  
(such as  $B_1$  or  $C_2C_2C_2$ ) can be  
zero, a lower extent of all zeros  
is invalid.

upper

Upper Limit of Extent. Nine  
columns containing the highest  
address of the extent, in the same  
form as the lower limit.

Note: The last four strips of  
subcell 19 are reserved for  
alternate tracks on the 2321 data  
cell.

'serial no.'

Volume Serial Number. This is a  
6-byte alphanumeric character  
string, contained within  
apostrophes. The number is the  
same as in the volume label  
(volume serial number) and the  
Format 1 label (file serial  
number).

SYSxxx This is the symbolic address of  
the DASD drive.

$B_2$  Currently assigned cell number.

0 for 2311,2314  
0-9 for 2321

This field is optional. If  
missing,  $B_2=B_1$  is assumed.

# General Operating Techniques

This section contains a group of techniques and related data that the operator may find helpful during system operation. Because some of the techniques vary from model to model, they are described in groups according to model number.

## Model 30 Techniques

### DISPLAYING THE CURRENT PSW

Storage displaying, including displaying the current PSW, is done one byte at a time on the Model 30.

- Hit STOP.
- Turn the DISPLAY STORE SELECTION switch E to 'AS' with red flag up.
- Turn switch A to LS or numeric 7.
- Turn MAIN STORAGE switches: B to zero, C and D to the desired location. PSW fields will be found at the locations below.

System Mask	B8
Protect key	B9 (high order 4 bits)
AMWP	B9 (low order 4 bits)
Interruption Code	External old PSW (bits 16-31)
Instruction Length	AC (bits 4 and 5)
Condition Code	BB (high order 4 bits)
Program Mask	BB (low order 4 bits)
Instruction Address	A9 & AA (or I & J register)

Note: Condition code is displayed as four bits (8, 4, 2, 1), one bit at a time.

- Hit DISPLAY to display the data in the main storage data register and the address in the low order eight bits of the main storage address register.

### ALTERING THE CURRENT PSW

- Proceed as in displaying the current PSW.
- Put new data in the DATA switches H and J.
- Hit STORE and the new data will be entered.

### DISPLAYING MAIN STORAGE

- Hit STOP.
- Turn the DISPLAY STORE SELECTION switch E to MS with the red flag up.
- Turn the MAIN STORAGE ADDRESS switches A, B, C, and D to the address to be displayed.
- Hit DISPLAY. The data will be in the main storage data register, while the address will be in the main storage address register.

### CLEARING MAIN STORAGE

- Hit STOP.
- Turn INSTRUCTION ADDRESS switches to 0BF9.
- Set ROS CONTROL to ROS SCAN.
- Set CHECK CONTROL to DISABLE.
- Hit SYSTEM RESET.
- Hit ROAR RESET.
- Hit START.
- To stop the clearing process, set RATE switch to SINGLE CYCLE.
- Hit SYSTEM RESET.

#### ALTERING MAIN STORAGE

- Hit STOP.
- Set up address as you would in displaying main storage (machine must be in manual mode).
- Put new data in the DATA switches H and J (use hexadecimal representation of data).
- Hit STORE; the new data is displayed in the main storage data register.

#### DISPLAYING A GENERAL PURPOSE REGISTER (GPR):

- Hit STOP (put machine in manual mode).
- Turn switch A to LS.
- Turn switch B to zero.
- Turn switch C to desired GPR.
- Turn switch D to desired byte of GPR - that is, to 0, 1, 2, or 3. The data is displayed in the main storage data register.

#### DISPLAYING A FLOATING POINT REGISTER (FPR)

Floating point registers are an optional feature. If your machine has this feature, you can display an individual FPR following the same procedure used in displaying a GPR, with the following differences.

- Hit STOP.
- Turn switch C to desired FPR.

- Turn switch D to desired byte of FPR:

<u>FPR byte</u>	<u>Switch D setting</u>
0	8
1	9
2	A
3	B
4	C
5	D
6	E
7	F

- The data is displayed in the main storage data register.

#### ALTERING REGISTERS

- Follow same procedure as in displaying a register.
- Put the new data in the DATA switches H and J.
- Hit STORE.

#### STOPPING ON ADDRESS COMPARE

- Hit STOP.
- Put the address you wish to stop on in address switches A, B, C, and D.
- Turn ADDRESS COMPARE switch to SAR DELAYED STOP.
- The CPU STATUS MATCH indicator will come on when the address is reached.

## Model 40 Techniques

### DISPLAYING THE CURRENT PSW

Storage displaying, including displaying the current PSW, is done two bytes at a time on the Model 40.

- Hit STOP.
- Set the HALF WORD SELECT switch to PSW.
- Set the STORAGE ADDRESS bit switches as follows, depending on which halfword you want to see:

All bits off for the first halfword of the PSW.

Bit 7 on for the second.

Bit 6 on for the third.

Bits 6 and 7 on for the last.

- Hit DISPLAY. The halfword will be displayed in the storage data lights.

### ALTERING THE CURRENT PSW

- Proceed as in displaying the current PSW.
- Put new data in the STORAGE DATA bit switches.
- Hit STORE and the new data will be entered.

### DISPLAYING MAIN STORAGE

- Hit STOP.
- Set the STORAGE SELECT switch to MS.
- Set the STORAGE ADDRESS bit switches to the address to be displayed.
- Hit DISPLAY. The data will be displayed in the STORAGE DATA lights.

### CLEARING MAIN STORAGE

- Hit STOP.
- Disable the interval timer.
- Hit SYSTEM RESET.

- Set the RATE switch to SINGLE CYCLE.
- Enter 1000 (hexadecimal) in STORAGE DATA keys.
- Flip up the STORE STATS switch.
- Set RATE switch to PROCESS.
- Set DIAGNOSTIC CONTROL switch to MS ADDRESS.
- Hit START. The microprogram light should come on when main storage is cleared. If any other red lights are on, main storage is not fully cleared; repeat procedure.
- Set DIAGNOSTIC CONTROL switch to OFF.
- Hit SYSTEM RESET.

### ALTERING MAIN STORAGE:

- Set up address as you would in displaying main storage.
- Put the new data in the STORAGE DATA bit switches.
- Hit STORE.

### DISPLAYING REGISTERS

- Hit STOP.
- Set STORAGE SELECT switch to GP (to display a general purpose register) or to FP (to display a floating point register).
- Enter into the REGISTER SELECT bit switches the number in binary of the desired register, and into the HALFWORD SELECT bit switches the desired halfword (see Displaying the Current PSW).
- Hit DISPLAY. The halfword will be displayed in the STORAGE DATA lights.

#### ALTERING REGISTERS

- Follow same procedure as in displaying a register.
- Put data in STORAGE DATA bit switches.
- Hit STORE.

#### STOPPING ON ADDRESS COMPARE

- Hit STOP.
- Put the address you wish to stop on in the storage address keys.
- Turn ADDRESS COMPARE switch to MS STOP.

## Model 50 Techniques

### DISPLAYING THE CURRENT PSW

Storage displaying, including displaying the current PSW, is done 4 bytes (one word) at a time on the Model 50.

- Hit STOP (put machine in manual mode).
- Set the ADDRESS bit switches to 170.
- Set the STORAGE SELECT switch to LOCAL.
- Hit DISPLAY.
- Rotate roller 3 (CPU 1) to position 1, showing the L register which contains the first half of the PSW.
- Rotate roller 4 to position 3 and examine bits 6-13, labeled PSW, to find the first byte of the second word of the PSW.
- The last three bytes of the PSW are in the instruction address register.

### ALTERING THE CURRENT PSW

- Hit STOP (put machine in manual mode).
- Set the ADDRESS keys to 170.
- Set the STORAGE SELECT switch to LOCAL.
- Put new data in the DATA keys.
- Hit STORE and the new data will be entered.

### DISPLAYING MAIN STORAGE

- Hit STOP (put machine in manual mode).
- Set the ADDRESS keys to the address to be displayed.
- Set the STORAGE SELECT switch to MAIN.
- Hit DISPLAY. The data will be in the storage data register.

### CLEARING MAIN STORAGE

- Hit STOP.

- Hit SYSTEM RESET.
- Set INSTRUCTION ADDRESS REGISTER to zero.
- Set RATE switch to SINGLE CYCLE.
- Put 0200 in the DATA keys.
- Flip ROS REPEAT INSN down.
- Hit START.
- Set RATE switch to PROCESS.
- Flip up all DATA keys.
- Flip up ROS REPEAT INSN.
- Hit START.
- Hit SYSTEM RESET.
- Hit STORE.

### ALTERING MAIN STORAGE

- Hit STOP (put machine in manual mode).
- Set address to be stored into, in the ADDRESS keys.
- Set the STORAGE SELECT switch to MAIN.
- Put data to be stored in the DATA keys.
- Hit STORE.

Note: Any location not ending in 0, 4, 8, or C, must be stored at its proper byte location in the selected word.

### DISPLAYING LOCAL STORAGE

There are four "sectors" in local storage:

00 - Channel Sector  
01 - Working Sector  
10 - Floating Point Registers (FPR)  
11 - General Purpose Registers (GPR)

- Hit STOP (put machine in manual mode).
- Put sector number to be displayed in ADDRESS keys 22 and 23.
- Put word to be displayed in ADDRESS bit switches 24-27.
- Set STORAGE SELECT switch to LOCAL.



- Hit DISPLAY. The display will appear in the L register.

#### ALTERING LOCAL STORAGE

- Hit STOP (put machine in manual mode).
- Put sector number in ADDRESS keys 22 and 23.
- Put word to be stored into in ADDRESS bit switches 24-27.
- Set STORAGE SELECT to LOCAL.
- Put data in the DATA keys.
- Hit STORE.

#### STOPPING ON ADDRESS COMPARE

Do not perform the following steps while a program is executing.

- Hit STOP.
- Put address to be stopped on in the ADDRESS keys.
- Set IAR switch to STOP.
- The instruction pointed to by the ADDRESS bit switches will be executed and the next address in the program will be displayed in the instruction address register.
- If the instruction pointed to by the ADDRESS keys is a branch instruction and the branch is taken, the address of the branch instruction will be displayed in the instruction address register.

## How to Analyze Input/Output Commands

- Look at the channel address word (CAW) at location 48 hex to find the channel command word (CCW). If command chaining was used, the CAW points to the first CCW in the chain.
- Look at the channel status word (CSW) at location 40 hex:
  1. The command address (bits 8-31) points to the last CCW executed plus 8 bytes.
  2. The status portion (bits 32-47) tells the status of the channel control unit or subchannel, and the status of the device the command was issued to (each device has its own meanings for the status bits -- see your hardware manuals). The address of the device is found in bits 16-31 of the I/O old PSW at location 3A hex.
  3. The residual byte count should be zero. If it is not, one of three things is indicated: a wrong-length record was met, indicating a problem with the channel program; the command was rejected by the channel, also indicating a fault in the channel program; a data check during a read or write stopped data transfer and device motion.  
  
Channel end, device end, unit check, and incorrect length indications are in the CSW, and the residual byte count may show how much data was not transferred.
  4. When working with variable-length records, the wrong-length indicator (bit 34 of the CCW) should be on to prevent I/O interruptions.
- Look at the channel command word (CCW) to find the data address, byte count of the data, command code naming the actual operation, and flag bits for command and data chaining. Except for the transfer-in-channel (TIC) command, there must be a byte count of one or more for any I/O operations.

## Permanent Main Storage Assignments

Hex Address	Length	Content
0	8 bytes	Initial program loading PSW
8	8 bytes	Initial program loading CCW1
10	8 bytes	Initial program loading CCW2
18	8 bytes	External old PSW
20	8 bytes	Supervisor call old PSW
28	8 bytes	Program old PSW
30	8 bytes	Machine check old PSW
38	8 bytes	Input/output old PSW
40	8 bytes	Channel status word
48	4 bytes	Channel address word
4C	4 bytes	Unused
50	4 bytes	Timer
54	4 bytes	Unused
58	8 bytes	External new PSW
60	8 bytes	Supervisor call new PSW
68	8 bytes	Program new PSW
70	8 bytes	Machine check new PSW
78	8 bytes	Input/output new PSW
80	up to 256 bytes	Diagnostic scan-out area

### PROGRAM STATUS WORD

The PSW contains information required for program execution. By storing the PSW, the control program can preserve the status of the CPU for later inspection. By loading a new PSW or part of a PSW, the status of the CPU can be changed.

The format of old and new PSWs is the same as that of the current PSW, shown under the heading "Displaying the Current PSW."

The interruption code (bits 16-31) in the old PSWs indicates the source of the most recent interruption.

### External Old PSW -- Hex location 18

Code	Interruption Source
0001	External Signal 7
0002	External Signal 6
0004	External Signal 5
0008	External Signal 4
0010	External Signal 3
0020	External Signal 2
0040	Interrupt Key
0080	Timer

External interruptions from more than one source can occur at one time. An interruption code of 008A means, for example, that an interruption was requested by the timer and external sources 4 and 6.

Supervisor Call Old PSW -- Hex location 20

<u>Code</u>	<u>Interruption Source</u>
00xx	SVC instruction in a program

In the interruption code, xx is the I field of the SVC instruction that was given.

Program Old PSW -- Hex location 28

<u>Code</u>	<u>Interruption Source</u>
0001	Op code incorrect
0002	Privileged operation
0003	Execute error
0004	Protection
0005	Addressing
0006	Specification
0007	Data
0008	Fixed point overflow
0009	Fixed point divide
000A	Decimal overflow
000B	Decimal divide
000C	Exponent overflow
000D	Exponent underflow
000E	Significance
000F	Floating point divide

Machine Check Old PSW -- Hex location 30

<u>Code</u>	<u>Interruption Source</u>
0000	CPU or channel error

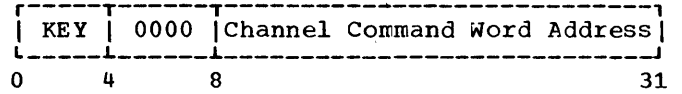
Input/Output Old PSW -- Hex location 38

<u>Code</u>	<u>Interruption Source</u>
00xx	Multiplex channel
01xx	Selector channel 1
02xx	Selector channel 2
03xx	Selector channel 3
04xx	Selector channel 4
05xx	Selector channel 5
06xx	Selector channel 6

In the interruption code, xx is the control unit and device address.

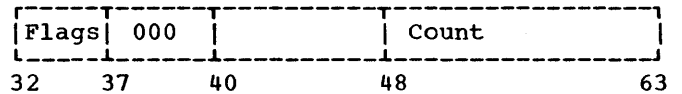
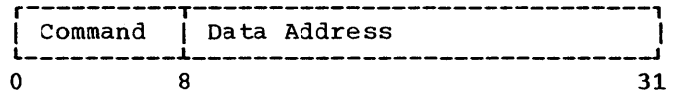
CHANNEL ADDRESS WORD

The CAW specifies the storage protection key and the address of the first channel command word associated with the START I/O instruction. The CAW is found at hex location 48.



CHANNEL COMMAND WORD

The CCW specifies the command, the storage area to be used for I/O operations, and the action to be followed when the operation is completed. CCWs can be anywhere in main storage, and can exist singly or in a group called a channel program.



Bits 0-7 give the command code (m identifies a modifier bit, while x indicates that the bit position is ignored):

- mmmm0100 Sense command
- xxxx1000 Transfer in channel command
- mmmm1100 Read backward command
- mmmmmm01 Write command
- mmmmmm10 Read command
- mmmmmm11 Control command

Bits 8-31 give the location of a byte in main storage.

Bit 32 causes the address portion of the next CCW to be used.

Bit 33 causes the command code and data address in the next CCW to be used.

Bit 34 causes a possible incorrect length indication to be suppressed.

Bit 35 suppresses the transfer of data into main storage.

Bit 36 causes a program-controlled interruption (PCI).

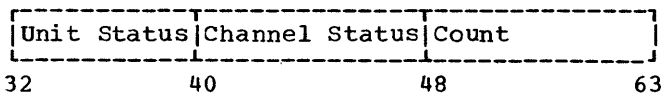
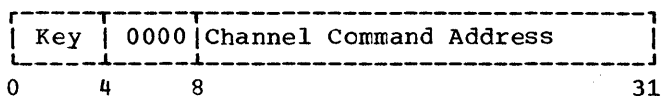
Bits 37-39 contain zeros.

Bits 40-47 are ignored.

Bits 48-63 specify the number of bytes in the operation.

#### CHANNEL STATUS WORD

The CSW provides information about the termination of an input/output operation. The CSW is found at hex location 40. It can be made up or changed by input/output interruptions as well as by START I/O, TEST I/O, and HALT I/O instructions.



Bits 0-3 contain the protection key used in the last operation.

Bits 4-7 contain zeros.

Bits 8-31 contain the address plus 8 of the last CCW used.

Bits 32-39 contain the unit status byte:

- Bit 32 -- attention
- Bit 33 -- status modifier
- Bit 34 -- control unit end
- Bit 35 -- busy
- Bit 36 -- channel end
- Bit 37 -- device end
- Bit 38 -- unit check
- Bit 39 -- unit exception

Bits 40-47 contain the channel status byte:

- Bit 40 -- program-controlled interruption
- Bit 41 -- incorrect length
- Bit 42 -- program check
- Bit 43 -- protection check
- Bit 44 -- channel data check
- Bit 45 -- channel control check
- Bit 46 -- interface control check
- Bit 47 -- chaining check

Bits 48-63 contain the residual count of the last CCW used.

## Operating Hints

### How to Handle Punched Cards

- Avoid nicking of cards -- hold a card deck by its front and back rather than by its edges.
- When removing cards from a stacker, ruffle them before you place them into a card tray; be sure to tightly clamp the card compressor in the tray.

### How to Handle Tape Reels

- Avoid dust or any other foreign substances on tape; touch a tape as little as possible; keep tapes in tape cases or in tape seals when the tapes are not in use.
- Hold a tape reel always at its hub rather than by its rims.
- Write on or post tape stickers (if required) before you paste them on tape reels.
- Keep tape drive windows closed, except when mounting or demounting tape reels.
- When mounting a tape reel, keep the tape taut and be sure the load point has well passed the read/write heads before you close the tape drive and hit LOAD REWIND.

### How to Handle Disk Packs

- Avoid dust or any other foreign substances on the disk surfaces.
- To label disk packs, use installation approved stickers on the recessed portion of the hub or write your disk pack identification on the hub using a pen; do not use a lead pencil.
- Never use an abrasive such as an eraser.
- If stickers are used to label disk packs, write on or post stickers before you paste them on disk packs.
- To store disk packs, be sure you (1) place them flat on a shelf, (2) place one disk pack beside the other (never one on another), and (3) keep them out of direct sunlight.

- To mount a disk pack, (1) set the pack on the drive spindle, (2) turn the disk pack top cover (by its handle) clockwise until it stops, (3) lift the cover from the pack, and (4) close the cover of the drive.
- To demount a disk pack, (1) turn the disk pack top cover counterclockwise until it locks in (at least two full turns) and (2) lift the pack off (vertically until clear of drive) and firmly fasten the bottom cover to the disk pack. Close the disk drive if you don't mount another disk pack.

#### How to Handle Data Cells

- Keep the two-piece protective cover closed at all times, except when you must open it to install the data cell or to return the data cell after this has been removed from the data cell drive.
- To store data cells, be sure you (1) keep them out of direct sunlight and (2) place them in your storage location one beside the other (never one on another).
- To install or remove a data cell, be sure to check the operator panel for

AC = on,  
 Drive Op = on,  
 Drive Ready = on,  
 DC = on, and  
 Drive Select = off

before you open the entry door.

- To label a data cell, use a sticker on the front surface of the cell. Use a pen (never a lead pencil) to write on, post, or otherwise alter a data cell label. You must never use an abrasive such as an eraser.

#### 1403 Printers

- To insert new forms, you can, after having opened the print gate and the tractor covers, lift up the partially printed page and underlay the new forms.
- To install a carriage control tape, be sure the numbers on the tape are on the outside and the locking knob is adjusted for no noticeable slack.
- When a paper runaway occurs, hit CARRIAGE STOP on the printer and check the carriage control tape.

If the tape is worn, replace it by a new one.

If the tape is in good condition, cancel the job via your console and report the reason for the cancellation to your programmer.



Indexes to systems reference library manuals are consolidated in the publication IBM System/360 Disk Operating System Master Index, Form C24-5063. For additional information about any subject listed below, refer to other publications for the same subject in the Master Index.

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