File No. S360-20
Order No. GC28-6551-16

OS

IBM Systems Reference Library

IBM System/360 Operating System:

Storage Estimates

OS Release 21.7

This publication is intended for three types of users: system planners, system programmers, and problem programmers. It contains instructions, formulas, and figures that can be used to estimate the main and auxiliary storage requirements for any machine configuration, control program, and control program option of the IBM System/360 Operating System. Main storage requirements are divided into two categories: fixed main storage and dynamic main storage. Fixed main storage contains the resident portions of the control program and the optional services and load modules that can be made resident to improve the performance of the operating system. Dynamic main storage is the area where program processing is done.

Each type of user can use this publication differently.

- System planners can use this publication to plan the storage requirements of a new system, including the effects of options and different machine configurations on the total storage requirement.
- System programmers can use this publication to determine the amount of main and auxiliary storage that has to be allocated during system generation and to determine the amount of storage available to the problem programmer.
- Problem programmers can use the dynamic storage sections to estimate the requirements of their jobs.

This publication should be used in conjunction with IBM System/360 Operating System: System Generation, GC28-6554.

Seventeenth Edition (April, 1973)

This is a major revision of, and obsoletes, GC28-6551-15 and GC28-6551-14 and Technical Newsletters GN28-2517 and GN28-2533. See the Summary of Amendments following the Contents. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

This edition applies to release 21.7 of IBM System/360 Operating System, and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/360 and System/370 Bibliography, GA22-6822, for the editions that are applicable and current.

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, Publications Development Department D58, Building 706-2, PO Box 390, Poughkeepsie, N. Y. 12602. All comments become the property of IBM.

Preface

The purpose of this publication is to enable system planners, system programmers, and problem programmers to estimate the main and auxiliary storage requirements for any machine configuration, control program, and control program option of the IBM System/360 Operating System.

HOW THIS PUBLICATION IS ORGANIZED

This publication is divided into seven sections. The introduction explains how to calculate a total storage requirement and briefly describes the different control programs and how they use main storage.

Each of the next two sections describes how to estimate fixed and dynamic main storage requirements for one of the control programs (MFT, or MVT and M65MP) and the associated control program options selected during system generation. In these sections, the descriptive material is in the beginning of the section and the figures are grouped together at the back. A prerequisite for this section is the publication IBM System/360 Operating System: System Generation, GC28-6554.

Section 4 contains dynamic main storage requirements for the following IBM-supplied service programs: the loader, the 1130/360 data transmission program, system environment recording, the overlay supervisor, and graphic programming support.

Section 5 describes how to estimate the dynamic main storage requirements for data access methods.

Section 6 describes the auxiliary storage required for the IBM-supplied control programs and processing programs. In addition it describes the requirements for the work space that these programs use.

The appendixes contains a list of load modules that can be made resident when the system is initialized.

HOW TO USE THIS PUBLICATION

Page 9 contains a general table of contents with tab markers to each of the descriptive and figure sections. Follow the tabs to quickly locate sections you are interested in.

The following notation conventions are used in this publications:

1. A number that appears in parentheses after a column heading or a figure entry indicates the number of a note found at the bottom of the figure. For example, 132 (2) refers the reader to note 2 for more information on the entry 132.
2. A bullet (•) is used both to itemize when used in text or a figure, and to indicate multiplication when used in a formula.
3. Asterisk (*) is used to indicate an estimate that has not been verified.

PREREQUISITE AND RELATED PUBLICATIONS

For a better understanding of the facilities of the IBM System/360 Operating System, it is suggested that the reader also be familiar with the following publications:

IBM System/360 Operating System:

Operator's Reference, GC28-6691

Job Control Language Reference, GC28-6704

MFT Guide, GC28-6939

MVT Guide, GC28-6720

Supervisor Services and Macros,

Data Management Services and Macros,

Summary of Amendments for GC28-6551-16 OS Release 21.7

TCAM LEVEL 4
Additions and changes in module storage requirements.

READER/INTERPRETER MODULES
Addition of modules resident in the MVT link pack area.

BTAM
Addition of 3270 support.

DADSM FUNCTIONS
Selections and changes in various modules.

Summary of Amendments for GC28-6551-14 as Updated by GN28-2533 OS Release 21.6

TSO PARSE ROUTINE

Changes are made to support the new load module IKJPARS2 which is used with the TSO Parse service routine. Areas affected are: dynamic storage requirements for TSO service routines, auxiliary storage requirements for SYS1.LINKLIB, and SYS1.MACLIB, and the list of modules which can be made resident in the time sharing link pack area.

Miscellaneous

Miscellaneous changes area reflected in the auxiliary storage requirements, the fixed storage requirements, and the Type 3 and 4 SVC module list.

Summary of Amendments for GC28-6551-14 as Updated by GN28-2517 Component Release 360-OS-586

DYNAMIC SPECIFICATION of DCB PARAMETERS

Storage requirements are provided to support the 360S-OS-586 component release that provides dynamic specification of DCB parameters through use of the ATTRIB command.

nary of Amendments
GC28-6551-14
Release 21

ICS SUPPORT

torage requirements for the Graphics ption have been changed in the fixed equirements for Control Program ptions, the Graphic Access Method ection and in the lists of modules sed for graphics support.

S DISPLAY

torage requirements for Status Display ave been added to the requirements for QA.

AND 2260 SUPPORT (DIDOCS)

torage requirements for the 2250 and 260 display consoles have been added o fixed storage requirements for ontrol program options and the equirements for SYS1.DCMLIB were added o Auxiliary Storage Requirements.

ALIZED TRACE FACILITY

torage requirements for GTF have been dded to the fixed IOS requirements and o the Dynamic Storage Requirements. he requirements for the link library ave also been increased to support TF.

EM DETERMINATION

roblem Determination support is ocated throughout the release. Many tems; Service Aids and Utilities, YS1.LOGREC changes, error handling outines, Oltep, GTF, Logout pending nd the basic nucleus requirements have een changed or added to include this upport.

LOGREC REVISIONS

he fixed requirements for the YS1.LOGREC data set in the Auxiliary torage section have been changed to eflect improvements to the LOCREC ecorder.

DOS/OS INTERCHANGE ENVIRONMENT

Storage requirements are provided to support the improvements to DOS/OS sequential access method (SAM) compatability. Supporting changes have also been made to the modules in Appendix A.

OPEN/CLOSE/EOV REPACK

The dynamic storage requirements for OPEN/CLOSE/EOV have been completely revised. Extensive changes have also been made to the lists of OPEN, CLOSE, and EOV modules in Appendix A.

3420/3803 MAGNETIC TAPE SUBSYSTEM

Fixed storage requirements for extended 3420/3803 support have been added to the fixed IOS requirements.

SYSTEM 370/135 RMS

Recovery management support has been updated to include support for the Model 135. Changes have been made in the fixed RMS requirements section and in the SVC library and SYS1.LOGREC sections of Auxiliary Storage.

3505/3525 CARD READER/PUNCH

Storage requirements have been added for new device support in the fixed IOS requirements section.

EXTENDED SVC ROUTING

Requirements to support addition SVCs have been added to the basic fixed MFT, MVT & M65MP requirements.

GENERAL CONTENTS

Follow Tabs ——————————→

Introduction - Contents

The IBM System/360 Operating System (the operating system) is a set of control program and processing modules that you can combine in a variety of ways during system generation. The storage requirements of each installation are different and must be estimated separately.

Storage Requirements

The storage required by your installation depends on: your machine configuration, the control program that your system runs under, and the control program and programming options that you select. Any operating system, however, uses two types of storage: main storage and auxiliary storage. For your operating system, the total storage requirement is the sum of its main and auxiliary storage requirements.

MAIN STORAGE REQUIREMENT

The total main storage needed for your operating system is the sum of its fixed and dynamic storage requirements.

- Fixed main storage requirement is main storage used by the resident portions of the control program, including the optional modules and services that you make resident.
- Dynamic main storage requirement is main storage used during program processing by nonresident system functions, processing programs, and problem programs.

AUXILIARY STORAGE REQUIREMENT

Your operating system requires input/output devices for system residence and for work space used by the control program and the processing programs. The minimum device requirement is: a direct access device for system residence, an operator's console, a system input device, and a system output device. The total auxiliary storage requirement is the total of the auxiliary storage allocated for system residence and the work space required by control and processing programs.

Operating System Configurations

The amount of main and auxiliary storage required by your installation depends on the particular operating system configuration you select during system generation. The operating system has three configurations: multiprogramming with a fixed number of tasks (MFT), multiprogramming with a variable number of tasks (MVT), and Model 65 Multiprocessor (M65MP).

Each configuration offers the facilities of primary data management[1] and contains a supervisor that provides for:

- Overlapping of central processing unit operations and input/output channel activity.
- Supervision and processing of interruptions.
- Error checking and standard input/output error recovery procedures.
- Satisfaction of requests for supervisor services.

The following text summarizes the characteristics of each configuration. The rest of this section discusses how storage is organized in each configuration.

MFT CONFIGURATION

The primary characteristic of the MFT configuration is that the dynamic area is divided into two or more discrete areas called partitions. Each partition can service as many as three job queues, with priority of the queues based on the order in which they were initially specified (at SYSGEN, system initialization, or during operation); i.e., if a partition is assigned to service work in job classes A,B, and C, A jobs are scheduled into that partition first, and C jobs are scheduled only when there are no A or B jobs. Additionally, several partitions may be assigned to service the same job class queues to keep the partitions busy.

The MFT job scheduler reads input job streams and enqueues jobs on one of 15 available input job queues corresponding to the CLASS parameter on the JOB statement. Position on a queue is determined by the PRTY parameter on the JOB statement; jobs of equal priority are enqueued first-in first-out (FIFO). Jobs are dequeued from the input queues and initiated according to their place on the queue.

The MFT configuration controls the concurrent operation of more than one task. Each task represents a step of a separate job; up to fifteen problem program tasks can be performed concurrently. Multitask operation is achieved by using the wait time of one task to perform processing for another task of lower priority. The dispatching priority of a task is determined by the partition in which the task resides. The partition with the highest main storage address has highest priority; each lower partition has a correspondingly lower priority. When an event occurs for which a task is waiting and if the currently active task has a lower priority, processing of the lower priority task is suspended, and processing of the higher priority task resumes.

In a MFT system that has subtasking, up to 249 tasks can be performed concurrently: the task that becomes active is the highest priority task that is ready.

---

[1]Primary data management includes the queued sequential, basic sequential, and basic partitioned access methods (QSAM, BSAM, and BPAM).

MVT CONFIGURATION

The MVT configuration reads one or more input streams and schedules the jobs according to priority. Each job initiated operates in an area of storage called a region and up to 15 independent jobs can be performed concurrently. The job steps within a single job are performed in sequential order since one step may depend on the successful completion of another. However, within a job step, any number of tasks can be initiated. These tasks are performed concurrently with one another and with tasks initiated by other jobs, as well as with system tasks initiated by the control program.

Some of the system tasks that operate concurrently with the tasks initiated by a job step are those tasks performed by the job scheduler routines (the reader/interpreter, the initiator/terminator, and the output writer). All these tasks can operate concurrently and each system task also operates in a region.

However, the initiator/terminator operates alternately in the region of the last job step initiated and the region of the next step to be initiated. When a job step terminates, its region is freed and a new region is obtained. The new region occupies the highest contiguous area large enough for either the minimum job initiation requirement or the next job step, whichever is larger.

M65MP CONFIGURATION

The Model 65 Multiprocessor (M65MP) configuration consists of two interconnected Model 65 CPUs. When the system is operating in the "multisystem" mode, main storage is shared by both CPUs and the services of a single control program are used. M65MP is a version of MVT and is completely dependent upon a functional MVT system. Most configurations, functions, and options available with MVT are also available with M65MP; the exceptions are Main Storage Hierarchy Support, and 2816 Switching Unit Support for more than one console per CPU.

MFT - Contents

Figures

MFT - Fixed and Dynamic Main Storage Requirements

The total amount of main storage required, for MFT, is the sum of its fixed and dynamic storage requirements.

- Fixed main storage is the main storage used by the resident portion of the control program.
- Dynamic main storage is main storage used during program execution by nonresident system functions, processing programs, and problem programs.

The total amount of fixed main storage that your system requires is determined by four factors:

1. The basic fixed storage requirement -- for MFT this is the storage required by the nucleus, the system queue area, and the operator communication areas.
2. The optional fixed storage requirement -- this amount depends on the control program options you select during system generation.
3. The recovery management storage requirement -- this amount depends on the recovery management facilities you select during system generation.
4. The input/output supervisor (IOS) storage requirement -- this amount depends on the nature of the input/output devices you select during system generation.

The sum of storage required by these four factors is the fixed storage size necessary for your system.

Dynamic storage requirements, for MFT, depend on the storage required by the jobs or job steps to be run concurrently in the system and the number of readers and/or writers that you establish in the system. Figure 1 shows how main storage is organized for a system running under MFT.

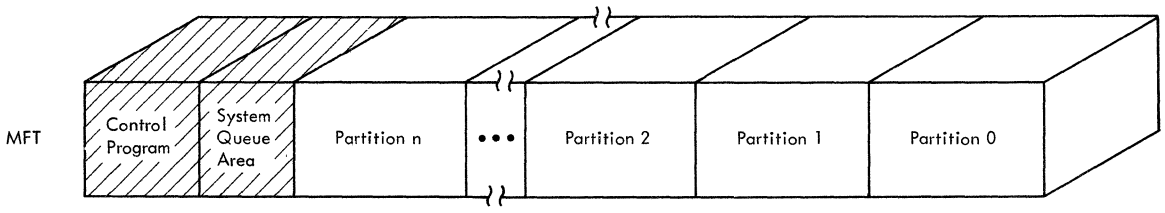


Figure 1. Main Storage for a System Running Under MFT

Basic Fixed Requirement

The basic fixed requirement for MFT is the amount of storage required by the nucleus, the system queue area, and the operator communication areas. The nucleus requirement depends on the number of partitions that you generate. The system queue area requirement depends on: the number of partitions that you generate, whether you select MFT with subtasking, whether you select SMF, and whether you select remote job entry. The operator communication areas, which allow interaction between the control program and the operator, involve two types of areas: (1) buffers, used to transmit information to the operator and write-to-log buffers, and (2) reply queue elements, used to transmit information to the control program. (The user specifies the number of buffers and reply queue elements in the SCHEDULR macro instruction during system generation.)

BASIC MFT = NUCLEUS + SQA + OPERATOR
= [28,414+XP] + (see formula for SQA)+[(148•L)
+ (144•B)+(24•E)] + 132•J + 16•S

Where: X = the size of the control blocks for each task
X = 312 bytes if the central processing unit has floating-point registers
X = 280 bytes if these registers are not present

P = the number of partitions generated and must be greater than or equal to two

B = the number of write-to-operator buffers specified at SYSGEN. If your system has MCS, then add:
$(16 \bullet T)+(24 \bullet B_1)+24$
where: T = the number of secondary consoles specified at SYSGEN.

$B_1 = 2T+2$, if $\frac{B_1}{T+1} \leq 2$ otherwise $B_1=B$

L = the number of write-to-log buffers specified at SYSGEN.

E = the number of reply queue elements

J = the number of partitions if job step timing is selected: otherwise 0.

S = the number of partitions if SMF is selected: otherwise 0. If you select SMF, you must also select job step timing.

Notes:
If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.

The round-up factor for MFT is necessary to make the total fixed storage a multiple of 1K when the storage protection option is not included in the system, or a multiple of 2K when the storage protection option is included.

If the SMF option is selected, resident reenterable routines must include certain modules (see System/360 Operating System: MFT Guide, GC28-6939.

SQA for MFT:

```
SQA = A + B + 184C + (224 + 56D) P + 32M + 96R + 48W + (528+92T) + 176

Where:  A = 192 if MCS is not in the system.
        A = 216 if MCS is in the system.

        B = the size of the tables required for the active consoles:

            B = 144 for each active 1052 console
            B = 248 for each active composite console

        C = the number of active or pending commands.

        D = the number of nontemporary DSNAMEs in a job.
            (26-character DSNAMEs are assumed.  If longer DSNAMEs are
            used, increase the value 56 by one for each extra
            character used.  For example, if 42-character DSNAMEs are
            used, use the value 72 instead of the value 56.)

        P = the number of partitions.

        M = the number of consoles if MCS is in the system, or 0 if
            MCS is not in the system.

        R = the maximum number of RJE central commands that may be
            queued for processing at one time, or 0 if RJE is not in
            the system.

        T = number of CRJE line groups.

        W = the number of direct system output writers started.
```

ADDITIONAL SYSTEM QUEUE AREA FOR MFT WITH SUBTASKING

If you select MFT with subtasking during system generation, additional storage is required in the system queue area. The additional storage can be estimated by the following formula:

Additional SQA = S(216 + T + F)

Where: S = number of concurrently active subtasks. The maximum value for S = 255-(number of system tasks + the number of partitions).

T = 112 if the interval timer is selected: otherwise 0.

F = 32 if there are floating point registers: otherwise 0.

ADDITIONAL SYSTEM QUEUE AREA FOR SYSTEM MANAGEMENT FACILITIES (SMF)

If SMF is selected, additional space is required in the system queue area. The size of the area required for SMF can be estimated by the following formula:

SMF Area = 380 + Timing Control Table Size (TCTSIZE) + SMF Control Table Size + SMF I/O Buffer Size

TCTSIZE: One TCT is created for each active job (no. of TCT's = no. of active initiators); if OPT = 2 is selected, the size of the TCT can be estimated by the following formula:

TCT = 100 + 12(maximum no. of DDs per step) + 8(no. of devices in each DD statement)

If OPT = 1 the TCTIOT will not be constructed and the TCT will be 96 bytes in length.

SMF Control Table: The size of the SMF control table = 124 bytes.

SMF I/O Buffer: The SMF I/O buffer requires space in the system queue area. The minimum buffer size is 400 bytes which is twice the size of the largest record that can be written on the SMF data set. The maximum buffer size is 64K bytes.

Optional Fixed Requirement

You can add control program options that: (1) change the organization and size of fixed main storage by making certain modules and tables resident, and (2) increase the size of fixed main storage by adding extra services to your system.

Four control program options change the organization of storage and cause the fixed area to be increased. Although these options decrease the dynamic area, they improve the performance of the operating system. The following options are involved:

- Resident type 3 and 4 supervisor call (SVC) routine option -- allows reenterable modules of type 3 and 4 SVC routines to be resident.
- Resident reenterable load module (RENT) option -- allows access method modules and reenterable load modules to be resident.
- Resident link library directory (BLDLTAB) option -- allows all or a portion of the directory for the link library or the SVC library to be resident.
- Resident error recovery procedure (ERP) option -- allows selected error recovery procedures to be resident.

Figure 2 shows how main storage is organized when you specify all of these options.

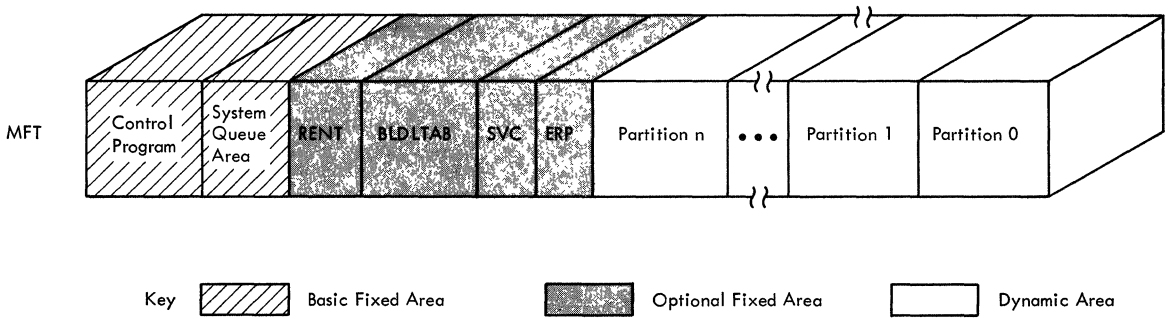


Figure 2. Effect of Control Program Options on the Organization of Main Storage for a System Running Under MFT

During system generation, you can add control program options that tailor the system to your installations needs. These options require additional fixed storage and are specified by the following macro instructions:

- CTRLPROG -- specifies the operating system configuration.
- DATAMGT -- specifies the optional access methods.
- GRAPHICS -- specifies the graphics programming services.
- SCHEDULR -- specifies job scheduler options.
- SECONSLE -- specifies secondary consoles for MCS.
- SUPRVSOR -- specifies task supervisor options.
- SCVTABLE -- specifies supervisor call (SVC) routines.
- CENPROCS -- specifies central processing unit.

Figure 1a
contains the fixed storage requirements for the options specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and CENPROCS macro instructions.

Figure 2a
contains the fixed storage requirements for the options specified in the SCHEDULR and SECONSLE macro instructions.

Figure 3a
contains the fixed storage requirements for the options specified in the SUPRVSOR macro instruction.

When you estimate the optional fixed storage requirements, include the storage required by:

1. Resident user-added SVC routines.
2. Resident BLDLTAB entries.
3. Resident reenterable load modules.
4. Resident type 3 and 4 SVC routines.
5. Resident error recovery procedures.
6. The round-up factor for MFT necessary to make the total fixed storage a multiple of 1K when the storage protection option is not included in the system, or a multiple of 2K when the storage protection option is included.

Recovery Management Requirement

The operating system requires storage in order to perform recovery management. The recovery management procedures consist of recording system environment data at the time of a machine malfunction and providing an analysis of this data to determine whether recovery is feasible. The data is arranged in a usable format and written on the SYS1.LOGREC data set.

There are six recovery management facilities available for MFT.

- System Environment Recording (SER0): SER0 is an independent function that determines the type of malfunction and, if possible, write the error on SYS1.LOGREC. It does not use any operating system facilities to collect and record data. SER0 consists of a resident module and a nonresident module. The nonresident module is loaded into the dynamic area without regard to what was previously there. After SER0 completes its operation, no further operations are allowed and the system goes into a wait state.

- System Environment Recording (SER1): SER1 is a completely resident function that uses operating system facilities to collect and record data. SER1 resides on the SYS1.LINKLIB and is attached to the nucleus at IPL/NIP time. When SER1 completes recording the data associated with the malfunction, it attempts to determine (1) the effect and extent of the damage caused by the malfunction, and (2) whether the failure affected only a specific task. If the failure has not damaged the supervisor, and if the malfunction can be related to a specific task, the task is terminated. If the supervisor is damaged or if the malfunction cannot be related to a specific task, all operations are terminated and the system goes into a wait state.

- Machine Check Handler (MCH): MCH records the data associated with a machine check error and attempts a recovery by retrying the failing instruction. If retry is not possible, MCH attempts to determine the task affected by the failure and to terminate the associated job step. MCH also includes the facility of refreshing areas of main storage if the associated load module has the refreshable attribute. The system is placed in a wait state only when the effects of the failure cannot be definitely determined, when non-refreshable program damage has occurred in the supervisor, or when a non-recoverable machine failure exists. The machine check handlers for the models 135 and 145 do not refresh the affected areas of storage.

- Channel Check Handler (CCH): CCH intercepts channel check conditions, performs an analysis of the environment, and facilitates recovery from channel check conditions by allowing for the scheduling of device dependent error recovery procedures by the input/output supervisor, which will determine whether the failing channel operation can be retried. CCH also constructs a channel error inboard record entry to be written onto SYS1.LOGREC by the outboard recorder routine (OBR) of the I/O supervisor. If CCH is not present in the system, one of the other recovery management facilities receives control and writes an error record for the channel failure and the error causes system termination.

- Alternate Path Retry (APR): APR allows an I/O operation that developed an error on one channel to be retried on another channel. The alternate channel must be one that has been assigned to the device performing the I/O. APR also provides the capability to logically connect a channel path to a device online or offline by use of the VARY command. The selective retry function of APR is optional for MFT. The VARY PATH function is standard for MFT.

- Dynamic Device Reconfiguration (DDR): DDR allows a demountable volume to be moved from one device to another and repositioned, if necessary, without abnormally terminating the affected job or reperforming IPL. A request to move a volume can be initiated by the operator, or by the system after a permanent I/O error on a demountable SYSRES or non-SYSRES volume. DDR is optional for MFT.

The desired recovery management facility is specified at system generation in the SUPRVSOR macro instruction. If you do not specify recovery management, the systems assigns a default of either SER0 or SER1 depending on the size of main storage.

Figure 4a
contains the storage requirements for the recovery management facilities available on each model.

Input/Output Supervisor Requirement

The operating system requires storage for the input/output supervisor (IOS). Part of the storage required for IOS is included in the basic fixed storage requirement. The total amount of storage required by IOS depends on the I/O configuration selected during system generation.

Figure 5a
contains the fixed storage requirements for the I/O channel configuration.

Figure 6a
contains the fixed storage requirements for the type of I/O devices specified.

Figure 7a
Contains the storage requirements that depend on the type of IBM-supplied processing program selected.

Example 1 -- Estimating a Fixed Storage Requirement for MFT

Example 1 shows how the fixed storage requirement was estimated for a MFT configuration with two partitions: the high priority partition is to contain a telecommunications application and the low priority partition is to process batched jobs. Five WTO buffers and five reply queue elements are used. The system does not have Multiple Console Support, or SMF. The standard list IEAIGG00 is resident.

System/360 Configuration
- Model 50 with 128K bytes of storage and storage protection
- SER1
- FIFO queuing, with 30 I/O requests queued on the channels
- Multiplexor channel with:
  - One 2540 card reader punch
  - One printer
  - One 1052 console
  - Two telecommunications line groups with four lines each
- One selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
- A second selector channel with:
  - Four magnetic tape drives

Control Program Options:
- BTAM
- Interval timer
- Storage protection
- Resident reenterable modules

BASIC fixed requirements for MFT = NUCLEUS + SQA + OPERATOR

- NUCLEUS = 28414+XP..... 28,974 Bytes
  X=280 - no floating point registers
  P=2
- SQA = A+B+184C+(224+56D)P+32M+96R+48W+(528+927)+176. 3,032 Bytes
  A=192 - no MCS
  B=144 - no composite console, one 1052 console
  184C=552 - assume 3 active or pending commands therefore C=3
  D=10 - assume limit of 10 non temporary DSNAMES in a job
  (224+56D)P=1568 - P=2 and assume limit of 26 character DSNAMES
  32M=0 - M=0 because no MCS
  96R=0 - R=0 because no RJE
  48W=48 - assume limit of 1 direct system output writer
  Therefore W=1
  528+92T=528 - no CRJE, therefore T=0
- OPERATOR = [(144•B)+(148•L)+(24•E)]+132(J)+16(S)..... 840 Bytes
  144•B=720 - B=5 (5 write to operator buffers)
  148•L=0 - assume NOLOG
  24•E=120 - E=5 (5 reply queue elements specified)
  132(J)=0 - no job step timing assumed
  16(S)=0 - no SMF

BASIC fixed requirement for MFT..... 32,846 Bytes

OPTIONAL fixed requirement from Figure 1a and 2a:

- BTAM (186 + 72)..... 258 Bytes
- Alternate console..... 20 Bytes

OPTIONAL fixed requirement from Figure 3a:

- Storage protection..... 460 Bytes
- Interval timing 1,978 + 2(112)..... 2,202 Bytes
- Standard list IEAIGG00..... 8,580 Bytes

11,520 Bytes

RECOVERY management requirement from Figure 4a:

- SER1..... 3,816 Bytes

IOS channel requirement from Figure 5a:

- Multiplexor channel..... 60 Bytes
- Two selector channels 2(50)..... 100 Bytes
- One channel path with direct access devices..... 32 Bytes
- 30 I/O requests 30(12)..... 360 Bytes

552 Bytes

IOS I/O device requirement from Figure 6a:

- Four unit record devices 4(56)..... 224 Bytes
- Magnetic tape capability..... 102 Bytes
- Four 2400 series magnetic tape drives 4(62).... 248 Bytes
- Telecommunications capability..... 62 Bytes
- Two line groups 2(20)..... 40 Bytes
- Eight lines 8(58)..... 464 Bytes
- Direct access capability..... Included
- Four IBM 2311 Disks with record overflow 4(182)..... 728 Bytes
- Resident error routine..... 1,616 Bytes

3,484 Bytes

Round-up factor to make requirement a multiple of 2K..... 1,030 Bytes

FIXED MAIN STORAGE REQUIREMENT FOR EXAMPLE 2..... 53,248 Bytes

Dynamic Storage Requirements in MFT

Several factors determine the dynamic storage requirements for MFT. The primary consideration is the number of jobs (or job steps) to be run concurrently and the storage required by them. During system generation, the maximum number of partitions should be established, along with their size and job class(es). The number, size, and job class(es) of partitions may be modified during system generation or during operation. There is one restriction on estimating the dynamic storage requirement: there must be one partition large enough to initiate a job and it must not contain an unending job, such as telecommunications or graphics.

The size of the partitions is affected by:

- The storage necessary to initiate the job step.
- The storage required for the load module.
- The storage required for an IBM-supplied program that the job step may use.
- The storage required for supervisor services requested by the job step and for the Checkpoint Restart work area if Checkpoint Restart is specified.
- The storage required for the data management access methods used by the job step.

Once you have established the maximum number of problem program partitions, along with their size and job class(es), you should decide how many reader and/or writers to establish in the system. Reader/interpreters and output writers operate as separate tasks and require their own partitions if they are to be resident in the system.

READER/INTERPRETER PARTITION REQUIREMENT

The size of a partition required for a reader/interpreter depends on the size of the scheduler chosen during system generation, and the size and number of input, output, and procedure buffers. (Records from the procedure library are read into a procedure buffer when a job step in the input stream invokes a cataloged procedure.)

The input and output buffer sizes (BUFL) and buffer numbers (BUFNO) are specified in the reader cataloged procedure invoked when a reader is started. The publication IBM System/360 Operating System: MFT Guide, GC28-6939 includes the reader cataloged procedure supplied by IBM. The size of a procedure buffer is the blocksize specified for the procedure library. The number of procedure buffers used by the reader/interpreter is always one. If input, output, or procedure buffer sizes or buffer numbers are changed, the partition size must be adjusted accordingly. The following formula can be used to estimate the partition size for the reader/interpreter.

If the modules used by BSAM and QSAM are not resident, the partition size required by the Reader/Interpreter must be increased by the size of these modules and then rounded accordingly.

```
PARTITION = SCHEDULER + IB + PB + OB

Where:  SCHEDULER = either 30,720 or 45,056, and is the size of the
                    scheduler selected during system generation.

        IB = the storage required by the input buffers; it is
             calculated as follows:
             IB = AB + AC
             Where: A = the number of input buffers
                    B = the size of an input buffer
                    C = the size of the input/output block (IOB)

        PB = the storage required by the procedure buffers; it is
             calculated as follows:
             PB = AB + AC
             Where: A = the number of procedure buffers
                    B = the size of a procedure buffer
                    C = the size of the input/output block (IOB)

        OB = the storage required by the output buffers; it is
             calculated as follows:
             OB = AB + AC
             Where: A = the number of output buffers
                    B = the size of an output buffer
                    C = the size of the input/output block (IOB)

• IB+PB=0 if unblocked single buffering is used for both.

• OB=0 if unblocked single or double buffering is used.

• For a description of the IOB, refer to the publication IBM
  System/360 Operating System: System Control Blocks, GC28-6628.

• The partition size must be rounded to the next highest multiple of
  1K, unless the storage protection feature is included in the system.
  When the storage protection feature is included, the partition size
  must be rounded to the next highest multiple of 2K.

• Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4
  must be resident if your system includes 2305 or 3330 devices.
```

OUTPUT WRITER PARTITION REQUIREMENT

The size of a partition required for an output writer depends on the size of the data set writer used, and the size and number of output buffers, and the size of the input buffers. The output buffer size (BUFL) and the buffer number (BUFNO) are specified in the cataloged procedure used when a writer is started. The input buffer sizes are specified for the SYSOUT data set in the problem program. The output writer partition contains two input buffers of this size. The publication IBM System/360 Operating System: MFT Guide contains the cataloged procedure supplied by IBM. If the buffer size or the buffer number in the procedure is overridden, the partition size must be adjusted accordingly.

If the standard (10K) data set writer is used, the partition requirement for the writer is:

PARTITION = 10,240 + IB + OB

Where: IB = the storage required by the input buffers.
IB = 2E + 2F
Where: E = the size of the input buffer
F = the size of the input/output block (IOB)
OB = the storage required by the output buffers.
OB = AB + AC
Where: A = the number of output buffers
B = the size of the output buffer
C = the size of the input/output block (IOB)

*Round the sum of OB and IB to the next highest multiple of 1K, or 2K if the storage protection option is in the system.

- For a description of the IOB, refer to the publication IBM System/360 Operating System: System Control Blocks, GC28-6628.
- If the output writer uses command chaining with machine code control character output, more than three buffers, and a unit record output device, then PARTITION = 11,264 + IB + OB.
- If variable spanned record are being used on input or output then the formula is 12,288 + IB + OB. In this case nothing extra need be added for command chaining.
- Add 2K if the output device is a 3211 printer.
- The partition size must be rounded to the next highest multiple of 1K, unless the storage protection feature is included in the system. When the storage protection feature is included, the partition size must be rounded to the next highest multiple of 2K.
- Adjust the partition size if a nonstandard data set writer is used. (For information on providing a nonstandard data set writer, see the publication IBM System/360 Operating System: MFT Guide.)
- If the log is being used, the size of the output buffer must be equal to or greater than the number on the "BLKSIZE=" parameter of the log data set.
- Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4 must be resident if your system includes 2305 or 3330 devices. If QSAM modules for locate-mode GET and PUT are not resident, additional space may be needed.
- Only one input buffer is used if the maximum blocksize for the input data set exceeds 3000 bytes.

REMOTE JOB ENTRY PARTITION REQUIREMENT

Remote job entry (RJE) operates as a system task, much like a combined reader/interpreter and output writer. RJE accepts jobs submitted by remote users, passes them to the initiator/terminator for scheduling and execution, and returns the output to the remote user. The partition required for RJE can be estimated by the following formula:

PARTITION = 46,596 + 408A + 1516B + 76C + 24D + 18E + F + 48G + 16H + (13+10I)J + (13+9I)K + L + M + N + O + P + Q + R + [(624+S_1) + (624+S_2) +...+ (624+S_n)] + 64U + 8V

Where:
- A = the number of line groups
- B = the number of lines
- C = the number of terminals
- D = the number of jobs
- E = the number of users
- F = 0 if compress/expand is not selected and if compress/expand is selected, F = 832
- G = the number of completed jobs that can be in the central RJE system
- H = the number of dial lines
- I = the maximum number of terminals connected on a multipoint line
- J = the number of multipoint lines for 2780s
- K = the number of multipoint lines for 1130s
- L = 30720 if the 30K scheduler is used or L = 45056 if the 44K scheduler is used.
- M = 1,112.
- N = 6000.
- O = 0 if BTAM is resident. If BTAM is not resident, O = 5,000.
- P = the size of the JOBACK user exit option, including dynamic work areas. If the JOBACK user exit option is not selected, P=0.
- Q = the size of the JOBCARD user exit option, including dynamic work areas. If the JOBCARD user exit option is not selected, Q=0.
- R = the size of the COMMERR user exit option, including dynamic work areas. If the COMMERR user exit option is not selected, R=0.
- S_1 to S_n = the blocksizes of the SYSOUT data sets for each line simultaneously sending output
- U = the total number of MSG QEB's specified in the RJELINE macros. It will equal 4 if the default is used.
- V = the total number of JOB QEB's specified in the RJELINE macros. It will equal 10 if the default is used.

- The partition size must be rounded to the next highest multiple of 1K, unless the storage protection feature is included in the system. When the storage protection feature is included, the partition size must be rounded to the next highest multiple of 2K.

CONVERSATIONAL REMOTE JOB ENTRY (CRJE) PARTITION REQUIREMENT

CRJE allows remote access to the operating system from conversational terminals. The terminal user may prepare and update programs and data, submit them for processing, and receive the output at the terminal. CRJE jobs are processed concurrently with jobs submitted normally. CRJE operates in dynamic storage. The partition size necessary to run CRJE can be calculated by the following formula:

```
PARTITION = 54,258 + AA' + 388B + 992C + (552 + D')D + 104E
            + (1376 + F) + 48G + 32H + 32J + 16K + L + M + N + O + P
            + Q + R + S + 768T + U + V
```

Where:
- A = number of line groups.
- A' = 52 if device I/O modules are resident
  - = 332 if the device is a 1050 and the I/O modules are not resident
  - = 300 if the device is a 2740 with checking and the I/O modules are not resident.
  - = 212 if the device is a 2741 and the I/O modules are not resident.
- B = number of lines.
- C = number of active users.
- D = number of users receiving job output at one time.
- D' = blocksize of sysout data set.
- E = number of START RDRs pending.
- F = maximum blocksize of an OS data set to be EDITed.
- G = number of completed jobs submitted by CRJE.
- H = number of active users projected to be in syntax checker mode at one time.
- J = number of active users projected to be using EXEC command at same time.
- K = number of active users projected to be using TABSET at the same time.

(Continued)

L = syntax checker requirements

FORTRAN = {16384 / 19456 / 21504} + 192

Where: 16384 bytes are required if the E level syntax table, only, is to be resident.

19456 bytes are required if the G and H level syntax table is to be resident

21504 bytes are required if both the E level and the G and H level syntax checkers are to be resident

PL/I = {17408 / 21504 / 28672} + 300(PLINO)

Where: 17408 bytes are required for the resident restricted checker

21504 bytes are required for full checking with partial dynamic structure

28672 bytes are required for full checking with resident structure

PLINO is the maximum number of PL/I statement lines allowed under CRJE.

Note: If both checkers are selected, include (300 PLINO).

M = 0 if BTAM is fully resident or 6000 if BTAM is not resident.
N = size of user LOGON exit routine if included in CRJE.
O = size of user LOGOFF exit routine if it is included in CRJE.
P = size of user JOBCARD exit routine if it is included in CRJE.
Q = size of user specified command processors included in CRJE.
R = 0 if BTAM Online Test is not included.
= 2128 if BTAM Online Test is included.
S = 5760.
T = number of BTAM transmission codes used.
U = 0 if the RAM list of modules is resident.
= 1800 if the RAM list of modules is not resident.
V = 952 if one or more 1050s on a leased line with Timeout Suppression feature are supported.
= 0 if no 1050s with Timeout Suppression are supported.

JOB INITIATION

In MFT, the minimum amount of storage required to initiate a job depends on the size of the scheduler and the amount of storage required by an accounting routine, if one is supplied. (System tasks need at least 32K for initiation when the AVR option is selected.) The storage required to initiate a job can be specified, during system generation, in the MINPART parameter of the SCHEDULR macro instruction. The following formulas can be used to calculate MINPART:

MINPART = 30K/44K scheduler requirement + amount of storage required by accounting routine or
or
MINPART = 30K/44K Scheduler requirement + amount of storage required for reader/interpreter
whichever is larger.

If MINPART is not specified, the scheduler design level is used as the default value.

The MFT scheduler has two design levels: 30K and 44K. The design levels of the MFT scheduler specify the amount of storage required for execution of the scheduler. This storage requirement depends on the I/O device specifications made during system generation and on the maximum number of DD statements to be processed in any one job step. The maximum allowed for each condition depends on the scheduler used. If these maximums are exceeded, the size of the scheduler increases.

The following formulas can be used to determine the initiation requirements of the 30K and 44K schedulers. If the result of the formula is less than the design level, then the scheduler operates within its design level; if the result exceeds the design level, then the scheduler requires that amount of storage to operate.

30K scheduler requirement = 30,720 + [(E•N) - 3000] + 250(D-20)

44K scheduler requirement = 45,056 + [(E•N) - 3200] + 250(D-25)
Where:

E = the sum of:
a. the number of UNITNAME macro instructions, and
b. the number of different unit types specified by the UNIT parameter of all IODEVICE macro instructions.

N = is determined by K, where K is the sum of:
a. the number of IODEVICE macro instructions,
b. the number of IODEVICE macro instructions that specify UNIT=2314, multiplied by one less than the number of units specified in the IODEVICE statement.
c. the number of IODEVICE macro instructions that specify UNIT=2321, multiplied by ten,
d. the number of alternate channel paths specified,
e. the number of 2314 IODEVICE macro instructions that specify alternate channel paths, multiplied by one less than the number of units specified in the IODEVICE statement.
f. the sum of all undefined unit addresses on channel 0 up to the first defined unit address for the first defined control unit and,
g. the sum of the undefined unit addresses, associated with each control unit, which would appear between the addresses defined. This applies to all channels.

K is used to determine the value of N as follows:

K	N
0 - 80	32
81 - 110	36
111 - 140	40
141 - 170	44
171 - 200	48
201 - 248	52
249 - 278	56
279 - 308	60
309 - 338	64
339 - 368	68
369 - 398	72
399 - 428	76
429 - 458	80
459 - 488	84
489 - 518	88
519 - 548	92
549 - 578	96
579 - 608	100
609 - 638	104
639 - 668	108
669 - 698	112
699 - 728	116
729 - 768	120

Note: If the value of either of the expressions [(E•N) - 3000] or [(E•N) - 3200] is less than 0, assume 0.

D = the maximum number of DD statements to be processed in any one job step. If the maximum number of DD statements is less than 20 for the 30K scheduler, assume (D-20)=0. If the maximum number of DD statements is less than 25 for the 44K scheduler, assume (D-25)=0.

The storage required to initiate a job increases beyond the computed size of the scheduler if an accounting routine is supplied. The amount of additional storage is equal to 2,750 bytes, plus the size of the accounting routine, plus the additional storage required by the routine (e.g., OPEN, GETMAIN).

With MFT, there must be at least one partition large enough for the operation of initiating a job. This partition must not contain an unending job. If the size required to initiate a job is used as the partition size, this is also the maximum amount of dynamic storage that is available to the job.

IBM-Supplied Program Requirements

IBM-supplied programs require dynamic storage in which to operate. Figures 8a through 15a contain the minimum dynamic storage requirements for these programs.

Figure 8a
: contains the storage requirements for each processor. These estimates include the requirements for the access methods used by the processor. If the access method modules are resident, the requirement can be reduced by the sum of the resident modules.

Figure 9a
: contains the storage requirements for utility programs. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

Figure 10a
: contains the storage requirements for the IEHDASDR system utility program.

Figure 11a
: contains the storage requirements for the IEHDASDR buffer/workarea size.

Figure 12a
: contains the storage requirements for the IEBDG data set utility program.

Figure 13a
: contains the storage requirements for IBM-supplied utility programs when the SYSUTILS macro instruction is specified. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

In addition, dynamic storage is also required by graphic programming support, the overlay supervisors, the system environment recording functions, TESTRAN, the 1130\360 Data Transmission program, and the Loader. Section 3 contains the dynamic storage requirements for these programs.

Supervisor Service Requirements

Dynamic storage is used by the control program both while supervisor services are performed and after control is returned to the program that requires them. In MFT, the storage required for supervisor services is obtained from within the partition.

Figure 14a
: contains the dynamic storage for the supervisor services that perform the opening and/or closing of a data set and the handling of end-of-volume conditions.

Figure 15a
: contains the dynamic storage requirement for the rest of the supervisor services and also gives the duration of the storage requirement.

Access Method Requirements

Section 4 contains the storage requirements for access methods used by the job steps.

MFT - Figures

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
CENPROCS	• Scientific or Universal Instruction Set	98
	• Model 85	1264 (3)
	• Models 135, 145, 155,165	336 (4)
CTRLPROG	• Main Storage Hierachy Support	2100
	• PCI Fetch	2620
	• Time Slicing	432
DATAMGT	• BDAM and/or BTAM and/or ISAM basic requirement	186
	• BTAM (additional)	72
	• ISAM (additional)	252
	• QTAM	600
	• TCAM	600
GRAPHICS	• Graphic Programming Services (1)	570
SVCTABLE	• User Added SVC Routines	24
	Each Resident SVC Routine (2)	4
	Each Transient SVC Routine	2

Notes:
1. For each 2250, model 1, with 4K buffer, add 32 bytes. For each 2250, model 1, with 8K buffer, add 48 bytes. For each 2840 add 168 bytes.
2. The size of the SVC routine(s) must be added to the fixed storage requirement.
3. Add 96 bytes if there are 2880 channels present.
4. Add 128 bytes if there are 2880 channels present on the model 165.

Figure 1a. Fixed Storage Requirements for Control Program Options Specified in the CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and CENPROCS Macro Instructions for MFT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SCHEDULR	• LOG (3)	3036
	• SMF	6296
	• ESV (4)	
	• Single Console Support	
	Alternate Console	70 (2)
	Composite Console (per composite console)	32
	• Multiple Console Support	
	Master Console (7)	
	Each printer-keyboard	316
	Each 2740	216 (1)
	Each 2250	4736
	Each 2260	1464
	Each 3277 model 2 (model 1 cannot be used as a Master Console or Alternate Console)	3072
	Each model 85/165 Console with CRT Display	3464
	Each Card Reader	364
	Each Printer	372
	Display Console (6)	
	2250	44
	2260	64
	3277 model 2	24
	model 85 and 165 consoles	24
SECONSLE	• Secondary Consoles (7)	
	Each printer-keyboard	316
	Each 2740	216 (1)
	Each 2250	4736 (5)
	Each 2260	1464 (5)
	Each 3277 model 1	1126 (5)
	Each 3277 model 2	3072 (5)
	Each model 85/165 Console with CRT Display	3464 (5)
	Each Card Reader	364
	Each Printer	372
	Display Console (6)	
	2250	44
	2260	64
	3277 model 1	24
	3277 model 2	24
	model 85 and 165 consoles	24

Figure 2a. Fixed Storage Requirements for Control Program Options Specified in the SCHEDULR and SECONSLE Macro Instructions for MFT (Part 1 of 2)

Note:

1. When you specify a 2740 for the first time:
   - add 2280 bytes if RAM has been specified, or 2182 bytes if RAM has not been specified.
   - add 6224 bytes if the BTAM modules IGG019MO, IGG019MA, IGG019MB are not resident in the RAM area.

   Each additional 2740 requires only 216 bytes.
2. If you select the interval time, subtract 50 bytes.
3. The log is included unless NOLOG is specified during system generation.
4. If you specify ESV=SMF and you did not include SMF, add 6000 bytes.
5. If you assign a display console to a transient display control module group, the main storage required for the entire group equals 48 bytes for each console in the group plus 36 bytes for each display area defined for consoles in the group plus one resident area large enough to accomodate the console in the group with the largest resident storage requirement (as listed above). This resident area is shared by all consoles in the transient DCM group.
6. Add 544 bytes (only once), if display consoles are included in the system. The amount of storage indicated next to each console type is required (once only) if a console of that type is included in the system. Each PFK key allocated for operator command entry requires 120 bytes of main storage.
7. When using the indicated devices as composite consoles, the storage requirement for each half (input device and output device) of the composite must be included in calculating the total storage requirement for each composite console configuration.

Figure 2a. Fixed Storage Requirements for Control Program Options Specified in the SCHEDULR and SECONSLE Macro Instructions for MFT (Part 2 of 2)

Macro Instruction	Control Program Option	Storage Requirement (in bytes)	
SUPRVSOR	• IDENTIFY Facility		
	Module Nonresident	118	
	Module resident	608	
	• Multiple WAIT	Included	
	• Resident ATTACH (without subtasking)	610	
	• ATTACH (with subtasking)	238	(9)
	• Resident BLDLTAB	284	
	Each Resident LINKLIB Directory Entry	40	(1)
	Each Resident SVCLIB Directory Entry	32	
	• Resident EXTRACT (without subtasking)	276	
	• Resident EXTRACT (with subtasking)	460	
	• Resident Reenterable Load Module	380	
	Each Resident Access Method Module	24	(3)
	Each Resident Module	40	(2)
	• Resident SPIE	98	
	• Resident Type 3 and 4 SVC Routines	128	(4,8)
	Each Resident Module	40	(2)
	• Resident error recovery procedure	100	
	Each resident module	24	(2)
	• Storage Protection	460	(5)
	• Job Step Timing	420	
	• Timing Facilities		
	Time	236	
	Interval Timing	(6)	
	• Trace	416	
	Each Entry in Trace Table	16	
	• Transient SVC Table	106	
	Each User SVC Routine Added	4	
	• Subtasking	2884	(10)
	• Validity Check	244	(5)
	• Verify DASD Vol. Serial No.	Included	(7)
	• On-line-test (ONLNTEST)	644	(11)
	• Sector Convert Routine	332	(12)

Figure 3a. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MFT (Part 1 of 2)

Notes:

1. If you use the standard list IEABID00, storage is required for nine entries. The standard list is given in the IBM System/360 Operating System: MFT Guide, GC28-6939.
2. When you select this option, add the sum of all resident modules to the fixed storage requirement.
3. If you use the standard list IEAIGG00, 31 modules are loaded with a storage requirement of approximately 8,404 bytes. Appendix A indicates the modules that are in the standard list.
4. If this option is selected, the transient SVC table option must also be selected and the required storage added.
5. When you select storage protection, the validity check option is included as a standard feature; the storage requirement for storage protection includes the storage required by validity check.
6. The amount of storage required by the interval timing option depends on the number of partitions generated. Use the formula:
   AMOUNT = 1978 + 112P
   P is the number of partitions.
   If BDAM or ISAM is selected, subtract 66 bytes.
   If SMF and JOBSTEP CPU timing are selected as options, this formula must be used:
   AMOUNT = 1978 + 112P + 290
   P is the number of partitions.
7. The NODAV option cancels verification checking. If you use this option the size of fixed main storage required for IOS resident code is decreased by 132 bytes.
8. If you select the resident reenterable load module option, subtract 46 bytes.
   Add 1048 bytes for system error partitions.
9. Add 2 bytes if there are floating point registers. If the resident ATTACH option (with subtasking) consider the following items;
   Add 652 bytes for the basic support.
   Add 32 bytes if the interval timing function is included.
   Add 10 bytes if there are floating point registers.
   Add 136 bytes if you include time slicing.
10. Add 172 bytes if you include time slicing.
    Add 52 bytes if the job step timing function is included.
    Add 30 bytes if there are floating point registers.
    Add 62 bytes if the resident reenterable load module option is selected.
    Add 24 bytes for shared DASD support.
    Add 90 bytes if you select the validity check option. (If you select main storage hierarchy support along with the validity check option, the storage requirement for both is 116 bytes.)
11. If you test more than two devices within a single test definition, add 80 bytes for each additional device up to a maximum of 14. If your system has 2880 channels, add 140 bytes.
12. 3330, 2305-1 and 2305-2 devices only.

Figure 3a. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MFT (Part 2 of 2)

Description	Storage Requirement (in bytes)	
	Without MCS	With MCS
SER0 on Models 40, 50, 65, 75	262	262
SER1 on Model 40	3544	3878
SER1 on Model 50	3816	4140
SER1 on Model 65, 67-1 in 65 mode	3704	4034
SER1 on Model 75	3672	4002
CCH with:		
135 channels	2580	2580
145 channels	2927	2927
155 channels	2441	2441
2860 or 2870 channel	3489	3489
2860 and 2870 channels	4515	4515
2880 channel	3841	3841
2860 and 2880 channels or 2870 and 2880 channels	4891	4891
2860, 2870 and 2880 channels	5917	5917
MCH on Model 85	8000	8000
MCH on Model 65, 67-1 in 65 mode	6144	6544
MCH on Model 135, 145	5120	5120
MCH on Model 155	5600	5600
MCH on Model 165	6968	6968
APR	420	420
DDR	2630	2630
DDR with DDR SYSRES	4130	4250

Figure 4a. Fixed Storage Requirements for Recovery Management for MFT

Description	Storage Requirement (in bytes)
Multiplexor or high speed multiplexor channel	60
• Priority queuing	6
• Alternate selector channel	4
• Each associated logical channel	6
Selector or Block Multiplexor Channel	
• Each channel (1)	50
• Second channel path on each channel	50
• Each additional channel path on each channel	32
• With priority queuing, each channel path on each channel requires additional storage	6
• First channel path with direct access devices on each channel (2)	32
• Each additional path with direct access on each channel	12
• Each channel switch (3)	18
Queuing capability	
• FIFO - first in, first out	0
• Ordered Seek Queuing	262
• Priority	104
Each queued I/O request (4)	12
One or more channels with an address greater than 6	32

Notes:
1. If the number of devices exceeds 240, add 12 bytes for each logical channel.
2. If you select shared DASD, add 8 bytes.
3. IOS routines do not provide for switching devices onto a multiplexor channel.
4. The maximum number of I/O requests that can be queued, pending satisfaction by the channels, is specified by your installation at system generation time in the MAXIO parameter of the CTRLPROG macro instruction.

Figure 5a. Fixed Storage Requirements for IOS That Depend on the Channel Configuration for MFT

Description	Storage Requirement (in bytes)
Unit record capability	0
• Each graphic device	40
• Each unit record device (1)	56
• Each dummy unit provided	32
• Each 1403 printer with UCS feature	80
• Each 3211 printer with UCS feature	88
• Each optical character reader	54
• Each 2495 tape cartridge reader	78
• Each magnetic character reader	48
• Each 3505-3525 card reader/punch	24
Graphics capability	206
2400 Series Magnetic tape capability	102
Any read/write tape adapter units	42
Any 2400 tape device with FIFO queing	8
Any 2400 tape device with priority queing	8
Any 3400 tape device	76
Any 3400 tape device with FIFO queing	8
Any 3400 tape device with priority queing	8
Each 2400 magnetic tape drive	62(3a)
Each 3420 magnetic tape drive	120(3b)
Each 3410 magnetic tape drive	108(3b)
Telecommunications capability	62
• Each telecommunications line group	20
• Each telecommunications line	58
Direct access capability (2)	Included
• Any drum storage devices except 2305 (4)	36
Any 2305 storage devices (4)	522
with APR	22
with SMF	8
Any 3330 devices (4)	32
• Each 2302, 2303, and 2311 without record overflow	142
• Each 2302, 2303, and 2311 with record overflow	182
• Each 2301	182
• Each 2305	1792
• Each address for a 2314	182
• Each address for 3330	232
• Each 2321 without record overflow	290
• Each 2321 with record overflow	330
• Resident error routine	
Basic support (only 2311 devices)	1368
Any number of 2314 devices	28
Any number of 2301 devices	20
Any number of 2302 devices	70
Any number of 2303 devices	12
Any number of 2321 devices	16
Any number of 2305/3330 devices	600
with record overflow	248
with CCH	88
with DDR	30
with SYSRES DDR	16

Figure 6a. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MFT (Part 1 of 2)

Notes:
1. The following rules apply:
   - A console is considered a unit record device.
   - A 2540 card reader-punch counts as two unit record devices.
   - A card reader and printer used as a composite console are counted as two nonconsole devices.
2. If shared DASD is specified, except for drums and 3330, add 1,239 bytes.
3a. If you select EVA, add 22 bytes + 18 bytes for each tape drive.
   If you select ESV, add 22 bytes + 16 bytes for each tape drive.
   If you select ESV and EVA, add 22 bytes + 16 bytes for each tape drive.
   If any 3400 devices present, then only consider the per device figure. The other 22 bytes are included in the 76 bytes shown above for 3400 support.
3b. VES is always included with 3400 support.
4. Shared DASD for drums and 3330's require 128 bytes.

Figure 6a. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MFT (Part 2 of 2)

Description	Storage Requirement (in bytes)
OLTEP	124(1,2)
GTF (Generalized Trace Facility)	56
Logout pending (3)	312
2305 present with shared DASD	352
2305 present without shared DASD	340
Shared DASD only	320

Note:
1. If your channel configuration includes 2880 channels, add an additional 16 bytes.
2. If a 2305 is included add an additional 32 bytes.
3. Only present with CCH and not present with M65MP.

Figure 7a. Fixed Storage Requirements for IOS That Depend on the Type of IBM-Supplied Processing Program Selected for MFT

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	45,056
Assembler F	QSAM,BPAM,BSAM	49,152
COBOL E	BSAM,BPAM	17,504
American National Standard COBOL	BSAM,BPAM	81,920
FORTRAN IV G	QSAM	81,920 (3)
FORTRAN IV H	QSAM	155,648 (4)
GSP FOR FORTRAN IV	GAM	35,318 (6)
GJP	BSAM,GAM,BPAM	70,000 (7)
Linkage Editor F (44K)	BSAM,BPAM	45,056
Linkage Editor F (88K)	BSAM,BPAM	90,112
Linkage Editor F (128K)	BSAM,BPAM	131,072
OLTEP	BSAM,BPAM	36,000
PL/1 F	SAM,BPAM	45,056
GSP for PL/1 F	GAM	35,318 (6)
RPG E	BSAM	15,360
SGJP	BSAM,BTAM,BPAM	70,000 (7)
Sort/merge	QSAM	16,000 (5)

Figure 8a. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MFT (Part 1 of 2)

Notes:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output are also used, then the minimum main storage requirement is increased by the value of the expression [2+(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.
5. This estimate is for sort/merge with no linkage editor or direct access devices; if a linkage editor is used, the minimum dynamic requirement is the requirement for the linkage editor selected. In addition, conditions such as physical record length greater than 400 bytes, large numbers of intermediate storage data sets, or extracted control fields require additional main storage.
6. This estimate assumes that the modules are loaded with the LOAD macro instruction. Appendix A contains a list of the modules and their dynamic storage requirements.
7. This estimate includes a constant storage requirement of 10,000 bytes and one active partition or region of 60,000 bytes actually performing job control operations (GJP or SGJP). There is no 60,000 byte requirement during execution of a problem program initiated by GJP or SGJP at the display terminal. The 60,000 byte requirement is the minimum size partition that may be specified with a scheduler requirement of 48,000 bytes; larger values are permissible.
8. Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4 must be resident if your system includes 2305 or 3330 devices.

Figure 8a. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MFT (Part 2 of 2)

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHATLAS	9,740 + R + 16(T)
IEHDASDR	(2)
IEHINITT	12,483
IEHLIST	17,800
IEHMOVE	15,360
IEHPROGM	14K
IFHSTATR	2K
IEHIOSUP	11K
• Data set utilities:	
IEBCOMPR	14,813 + 2B + 2L + E
IEBCOPY	27K + M + N + P
IEBTCRIN	10,230 + A + R + E
IEBDG	(7)
IEBEDIT	10,936
IEBGENER	12,164 + 4B + 2L + E + F
IEBISAM	5,000 + R
IEBPTPCH	15,691 + 4B + E + F
IEBUPDAT	8,722 + 2B
IEBUPDTE	16,546 + 4B + 2L + E
• Service Aids	
IFCEREPO	36K
IFCDIP00	2K
IMASPZAP	13K+S
IMAPTFLE	
Generate Function	46K
Application Function	
44K Link Editor	58K
88K Link Editor	103K
128K Link Editor	144K
IMBLIST	38K
IMBMDMAP	36K
IMDPRDMP	64K
IMCOSJQD	20K
GTF	(5)

Figure 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 1 of 3)

Where: A = 2 times the BUFL on SYSUT1

B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, use R instead of B in the formula.

R = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of:
1. Each user exit routine rounded to the next highest multiple of 2K and
2. The storage made available to the user exit routines, by the utility, rounded to the next highest multiple of 2K.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

M = 1K minimum and is the sum of:
1. The maximum number of input data sets referenced in any COPY step multiplied by 10,
2. The maximum number of membernames, including newnames, multiplied by 10 - this number is added only when SELECT or EXCLUDE is used,
3. The maximum number of newnames referenced in any COPY step multiplied by 4, add 4 bytes to this number
4. The maximum number of input members referenced in the largest input data set specified in any COPY step multiplied by 10 - this number should be added when EXCLUDE or "Full Copy" is used and 80 bytes should be added to the total.

N = the sum of:
1. The number of directory blocks allocated to the largest output directory used in the job step multiplied by 276,
2. The maximum number of input members to be copied from any one input data set referenced in the job step multiplied by 74.

* The storage required for N is only necessary for optimal performance.

P = 2K minimum and is twice the maximum input or output blocksize. If you are performing a compress-in-place operation, B = the maximum track capacity of the device being used. If you allow the minimum 2K for P, the maximum input or output blocksize can be only 700 bytes. This number should be rounded up to the next multiple of 1K or 2K if the storage protection option is specified.

S = the larger of 3K or the BLKSIZE for the data set specified on the SYSLIB DD statement.

T = maximum number of records per track.

Figure 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 2 of 3)

Notes:

1. If you are planning to specify the SYSUTILS macro instruction during system generation, use Figure 13a to determine what size to specify.
2. To determine the minimum dynamic storage requirements for the IEHDASDR system utility program, use Figures 10a and 11a.
3. When using the compress facility, the minimum dynamic storage requirement is 28,000 + T.
   Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \bullet 6}{100}$ + 1,000.
4. To determine the minimum dynamic storage requirements for the IEBDG data set utility program, use Figure 12a.
5. To determine the dynamic storage requirements for GTF, refer to the section 'MFT, MVT and M65MP Dynamic Main Storage Requirements'.

Figure 9a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MFT (Part 3 of 3)

Function	Storage Requirement (in bytes) (1)
ANALYZE/FORMAT(3)	15,700 + (N•B) + N(344) + M(280)
ANALYZE(3,4)	16,140 + (N•B) + N(344)
DUMP (5)	17,800 + (N•B) + N(360) + M(280)
GETALT	10,728
LABEL	10,982
RESTORE	12,680 + X + N(344) + M(280)

Where:
- B = a buffer/workarea size determined by the function performed and the device type being used. Figure 11b contains the computed size, rounded to the next highest multiple of 2K.
- M = the number of copies to be made.
- N = the number of operations to be performed, with a minimum of 1 and a maximum of 6. If enough storage is provided, multiple operations will be performed concurrently. (For information on performing multiple functions concurrently, refer to the publication IBM System/360 Operating System: Utilities, GC28-6586.)
- X = a buffer/workarea size required to perform one or more RESTORE operations, and is computed as 2B • (N-1) + B. The computed size provides enough storage to perform multiple RESTORE operations concurrently.

Notes:
1. If the QSAM access method is not resident, add 2,000 bytes to the minimum requirement.
2. The minimum dynamic storage requirement for job steps performing multiple functions is the region size of the function that has the largest region size requirement.
3. If the IPL text is required and is supplied via the input stream, add 3,640 bytes.
4. Use this formula only when ANALYZE is to be performed on an IBM 2321 Data Cell.
5. If a permanent data check or missing address marker is encountered during a dump to SYSOUT, an additional 1000 bytes is required to recover and print the defective track.

Figure 10a. Minimum Dynamic Storage Requirements for IEHDASDR System Utility Program for MFT

	Device Type							
Function	2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305 Drum	3330 Disk
ANALYZE/FORMAT	22,528	6,144	6,144	6,144	8,192	4,096	16,384	14,336
DUMP	26,624	10,240	8,192	8,192	10,240	6,144	18,432	18,432
RESTORE	24,576	8,192	8,192	6,144	12,888	4,096	18,432	16,384

Figure 11a. IEHDASDR Buffer/Workarea Size for MFT

IEBDG = 12,000 + A + B + C + D + E + F + G(176)

Where: A = 520 • (H/8)
Where: H = the number of FD statements. If H is less than or equal to 8, then A=520. The value for A must be a multiple of 520.

B = 512 • (I/18)
Where: I = the number of CREATE statements. If I is less than or equal to 18, then B=512. The value for B must be a multiple of 512.

C = the sum of all field lengths on all FD statements. Each length must be rounded to the next highest multiple of 8. Use one of the following to calculate the value to be used for a particular FD statement, if any of the conditions apply:

- If ripple action and a format of AN, AL, or CO are specified on an FD statement, use the following formula to calculate the field length:

  L = FL + FR

  Where: L = the value to be used for this FD statement when determining the value for C.
  FL = the length of the defined field specified on the FD statement.
  FR = 36 for AN, 26 for AL, or 63 for CO. (If FL is larger than FR, then L=FL.)

- If ripple or wave action and PICTURE are specified, the value to be used for this FD statement is:

  2 • picture length

- If roll action and PICTURE are specified, the value to be used for this FD statement is:

  3 • picture length

D = S + (6•N)
Where: S = the sum of all picture lengths on all CREATE statements. Each length must be rounded to the next highest multiple of 8.
N = the number of pictures.

E = U + 72(N/8)
Where: U = the dynamic storage requirements for all user exit routines.
N = the number of user exit routines.
- The value for E must be a multiple of 8.

F = the logical record length of the output data set. If RECFM=U, then F=blocksize. The value for F must be a multiple of 8.

G = the number of user-specified input and output data sets. The value for G must be a multiple of 8.

Figure 12a. Minimum Dynamic Storage Requirements for IEBDG Data Set Utility Program for MFT

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHDASDR	N/A (2)
IEHINITT	N/A (2)
IEHLIST	31,000
IEHMOVE	21,504 + B (3)
IEHPROGM	23,000
IFHSTATR	2K
IEHIOSUP	11K
• Data set utilitiies:	
IEBCOMPR	23,551 + 2B + 2L + E
IEBCOPY	(See Figure 8a.)
IEBTCRIN	N/A (2)
IEBDG	N/A (2)
IEBEDIT	N/A (2)
IEBGENER	23,551 + 4B + 2L + E + F
IEBISAM	N/A (2)
IEBPTPCH	23,551 + 4B + E + F
IEBUPDAT	23,551 + 2B
IEBUPDTE	23,551 + 4B + 2L + E

Where: B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, then B = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of:

1. Each user exit routine rounded to the next highest multiple of 2K and
2. The storage made available to the user exit routine by the utility, rounded to the next highest multiple of 2K.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

Notes:

1. If you specify a size smaller than 20,479 in the SYSUTILS macro instruction, all of the utility programs operate in the storage shown in Figure 9a. If the size you specify is larger than the minimum storage requirement for a particular utility program, that program will be taken out of overlay structure. In order for all of the affected programs to be taken out of overlay structure, the largest minimum storage requirement must be specified.
2. This utility program is not affected by the size specified in the SYSUTILS macro instruction. It operates in the storage shown in Figure 9a.
3. The IEHMOVE utility program is not in overlay structure. If the size you specify is equal to or greater than 21,534, successive loading of IEHMOVE modules takes place at execution time.
4. When using the compress facility, the minimum dynamic storage requirement is 23,551 + T. Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \bullet 6}{}$ + 1,000.

Figure 13a. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs When the SYSUTILS Macro Instruction is Specified for MFT

Supervisor Service	Storage Requirement (in bytes)
OPEN Minimum = 544 + 500 (n-1)* + X Where: X=B+C+D+E+F+G+H+K+L+M+ the largest of: {A, J}	
a. Security protection	224
b. Each Format 3 Data set control block for BSAM or QSAM	144
C. Each additional Format 1 data set control block for BPAM (concatenated data sets only)	176
D. Each Format 3 data set control block for BPAM (concatenated data sets only)	144
E. Each additional Format 1 data set control block for ISAM and/or BDAM	104
F. Each Format 3 data set control block for ISAM and/or BDAM	144
G. Each ISAM data set	144
H. Each 1403 printer with UCS feature	272
J. Each data set with User label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
K. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
L. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400
M. Each 3211 printer with UCS feature	570
CLOSE Minimum = 544 + 500 (n-1)* + X where: X=E+H+J+ the largest of: {A, B+C+G, D, F}	
A. With RLSE	564
B. With EOV (QSAM only)	544
C. With EXTEND (with EOV, QSAM only)	304
DOS EXTEND	744
D. With Systems Management Facility	264
• each additional UCB (count each use of a UCB for each of ISAM prime, index, and overflow areas as an additional UCB)	24
• ISAM	28
E. Each data set with deferred input user label processing	56
F. Each data set with User Label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
G. With security protection (with EOV only)	224
H. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
J. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400

Figure 14a. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MFT (Part 1 of 2)

Supervisor Service	Storage Requirement (in bytes)
EOV	
Minimum = 544 + X	
Where: X = A+F+G+ the largest of: (B, C, D, E)	
A. With FEOV (i.e., FEOV with EOV)	544
B. Security protection	224
C. With EXTEND	304
• for DOS EXTEND add	744
D. With user label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
E. With System Management Facility	
• base amount	264
• each additional UCB (count each use of a UCB for each of ISAM prime, index and overflow areas as an additional UCB)	24
• ISAM	28
F. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
G. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400

Notes

An additional 1024 bytes of dynamic storage should be added to the totals obtained from Figures 14b and 15b. This additional storage is used by the system to process supervisor services and interrupts that may occur during execution. If this storage is not provided, the job step may terminate due to insufficient storage.

*n = the total number of data sets that are opened or closed in parallel; i.e., with the same OPEN or close macro instruction.

Figure 14a. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MFT (Part 2 of 2)

Supervisor Service	Storage Requirement (in bytes)	Duration of Requirement
ABEND	240	Temporary
•Normal & Abnormal Termination All data sets not closed	700	Temporary
•Abnormal Termination Dump Requested Outstanding Enqueues (MFT with subtasking)	4280 (3)	Temporary
	100	Temporary
ATTACH	656	Temporary
•Load module on link or job library	248	Released when task is terminated
•Load module in main storage	216	Released when task is terminated
•Load Module in RENT area	256	Released when task is terminated
BLDL	496	Temporary
DEQ	100 (2)	Temporary
Execution of job step	156 + (16 + 4D)E + (12 + 4G)F (see note 1)	Released when job step is terminated
FIND	496	Temporary
IDENTIFY	40	Released when load module is released
IMGLIB	448	Temporary
LINK, LOAD, XCTL	656	Temporary
•Load module on link or job library	32	Released when load module is released
•Load module in main storage	0	
•Load Module in RENT area	40	Released when load module is released
•Module in Overlay Mode	(see note 4)	Released when job step is terminated.
RESERVE	34 * R	Temporary
SETPRT	736	Temporary
SPIE	48	Released when task is terminated
STIMER (with exit routine)	72	Released when exit routine completes
STOW	1,738	Temporary
Where: R = the length of the rname used to represent the serially reusable resource (1 to 255 bytes)		

Figure 15a. Dynamic Storage Requirement for Supervisor Services for MFT (Part 1 of 2)

Notes:

1. The variables in this formula are:
   D = the average number of devices in each DD statement.
   E = the number of DD statement.
   F = the number of device pools.
   G = the average number of devices in each device pool.

2. This storage is required only when the shared DASD option has been selected and a DEQ macro instruction is issued to release a device that has been reserved.

3. If BSAM is in the RAM area, then 2928 bytes are required when SYSABEND is not open or 2400 bytes when SYSABEND is open.

4. Additional dynamic storage is required for the synchronous overlay supervisor module, if the module is not already in storage.
   - If your system has the Basic module (synchronous overlay without check), add 436 bytes.
   - If your system has the Advanced module (synchronous overlay with check), add 512 bytes.

Figure 15a. Dynamic Storage Requirement for Supervisor Services for MFT (Part 2 of 2)

Figures

MVT and M65MP -- Fixed and Main Storage Requirements

The total amount of main storage required, for MVT or M65MP, is the sum of the fixed and dynamic storage requirements.

- Fixed main storage is the main storage used by the resident portion of the control program.

- Dynamic main storage is main storage used during program execution by nonresident system functions, processing programs, and problem programs.

The sum of the storage required by the following four factors is the fixed storage size necessary for your system.

1. The basic fixed storage requirement -- for MVT this is the amount of storage required by the nucleus, the master scheduler region, the modules always loaded into the link pack area, and the system queue area; for M65MP this is the storage required by the prefixed storage area 1, the nucleus, the master scheduler region, the modules always loaded into the link pack area, the prefixed storage region 2, and the system queue area.

2. The optional fixed requirement -- this amount depends on the control program options you select during system generation. Since M65MP is a version of MVT and is completely dependent on a functional MVT system, all configurations, functions, and options available with MVT are also available with M65MP. (The exceptions are: Main Storage Hierachy Support, 2816 Switching Unit Support for more than one console per CPU, support for Shared DASD.)

3. The recovery management requirement -- this amount depends on the recovery management facilities you select during system generation.

4. The input/output supervisor (IOS) storage requirement -- this amount depends on the nature of the input/output devices you select during system generation.

The maximum dynamic storage requirement, for MVT or M65MP, is dependent on the number and sizes of the regions that you establish for the job scheduler routines and operator commands. Figures 3 and 4 show how main storage is organized for systems running under MVT and M65MP respectively.

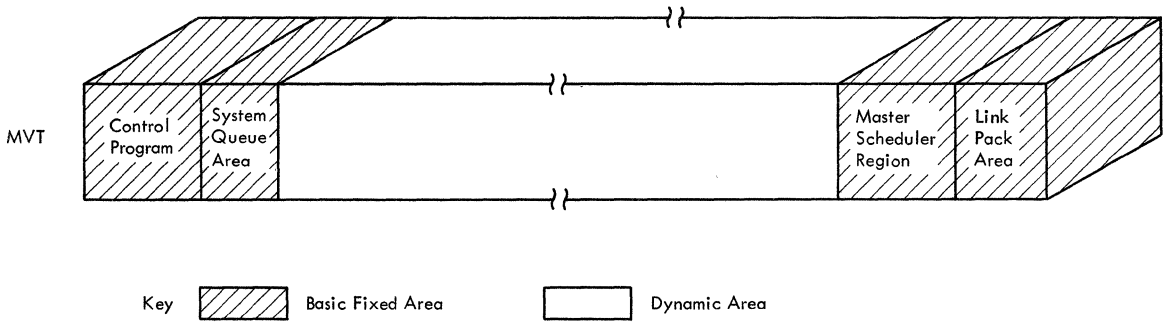


Figure 3. Main Storage for a System Running Under MVT

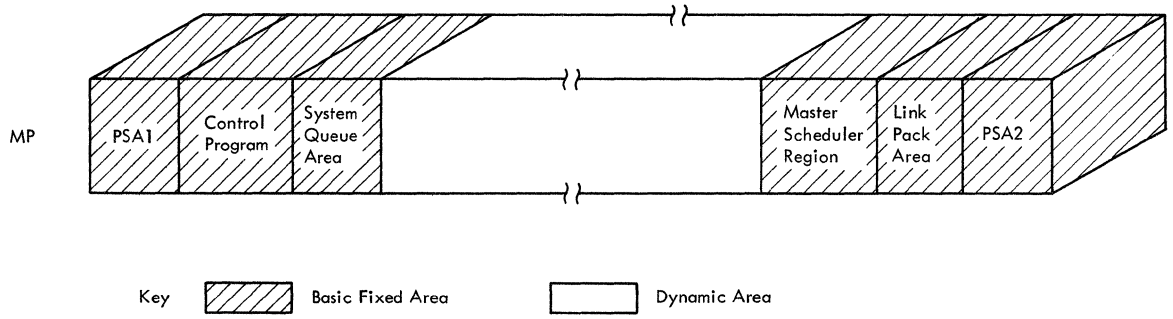


Figure 4. Main Storage for a System Running Under M65MP

Basic Fixed Requirement

WITH MVT

The basic fixed requirement for MVT is the amount of storage required by the nucleus, the master scheduler region, the modules always loaded into the link pack area with MVT, and the system queue area.

BASIC MVT			
NUCLEUS	=	51,095	(1,2,3)
MSR	=	12,288	
LPA	=	6,144	(5,3)
SQA	=		(3,4)

Notes:
1. If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.
2. Add the total of all user-written routines for the system management facilities (SMF).
3. The total fixed requirements for the nucleus and for the LPA must be rounded up to multiples of 2K.
4. A discussion of the requirement for the system queue area follows.
5. Add 728 bytes if TSO is specified.

WITH M65MP

The basic fixed requirement for M65MP is the amount of storage required by the prefixed storage area 1, the nucleus, the master scheduler region, the modules always loaded into the link pack area with MVT, the prefixed storage area 2, and the system queue area.

BASIC M65MP			
PSA1	=	3,379	
NUCLEUS	=	54,727	(1,2,3)
MSR	=	18,432	
LPA	=	6,144	(5,3)
PSA2	=	4,096	
SQA	=		(3,4)

Notes:
1. This requirement includes the MVT nucleus and additional storage required for M65MP.
2. If the link library or the SVC library contains multiple extents, the basic fixed requirement must be increased 16 bytes per additional extent. If the link library consists of more than one volume, the basic fixed requirement must be increased 1 byte per additional volume and 16 bytes per extent on each additional volume.
3. The total fixed requirements for the nucleus and for the LPA must be rounded up to multiples of 2K.
4. A discussion of the requirement for the system queue area follows.
5. Add 728 bytes if TSO is specified.

SYSTEM QUEUE AREA

With MVT, the basic fixed requirement also includes storage required by the system queue area (SQA), which the control program uses for control blocks and work queues. The user specifies the initial size of the system queue area in the CTRLPROG macro instruction during system generation, but the operator may increase the size when the system is initialized. (The size of the SQA may never by decreased below the value set during system generation.) If more storage is required by the SQA and there is free storage contiguous to the area, the SQA will expand upward in 2K blocks.

The number and size of control blocks and work queues within the SQA vary depending on what functions are being performed at the same time. This causes the storage required by the SQA to fluctuate. The following formula can be used to calculate the maximum SQA needed for a specific environment (i.e., a specific number of readers, writers, initiators, etc.). This maximum would only be required when all of the functions need their maximum requirements at the same time. To determine what size you should specify for the SQA, do one of the following: (1) specify the maximum to ensure that there is always enough available storage in the SQA; (2) use 20K as a guideline (most users with four initiators and without remote job entry do not require more than 20K); or (3) examine the formula to see what affects the size of the SQA, and, depending on the environment and the functions being performed, estimate how large the SQA should be.

SQA = 6446 + 144(B+4) + 148•L + (24•Q) + (48•P) + (960•C) + (500•D) + (2808•I) + W + J + Z + R

Where:

B = the number of write-to-operator buffers specified in the SCHEDULR macro during system generation.

L = the number of write-to-log buffers selected during system generation.

Q = the number of reply queue elements selected during system generation.

P = the number of modules and SVC routines resident in the link pack area, excluding the required link pack area modules.

C = the number of operator commands requiring separate regions that may operate concurrently.

D = the number of direct system output writers started.

I = the number of reader/interpreters operating concurrently.

W = 2,920 for one output writer plus 2,240 bytes for each additional output writer operating concurrently.

J = the sum of the amount of space required in SQA by the job steps operating concurrently. Because the SQA requirement of a job step depends on the functions and processors used by the step, and because the job steps that are running concurrently change continually, the amount of SQA space required should be estimated based on the following three values:

1. The minimum workable value for the SQA requirement of a job step is 3,000 bytes per initiator. This value provides enough space for a job step that meets the following requirements:
   a. Consists of a single load module.
   b. Does not multitask.
   c. Uses from three to seven data sets.
   d. Has from one to three data sets open at the same time.
   e. Does not abnormally terminate.

2. A workable value for the SQA requirement of a very large job step is 5,000 bytes per initiator. This value provides sufficient space for the execution either of any IBM-supplied processor or of a job step that meets the following requirements:
   a. Does not multitask.
   b. Has up to five load modules in its region at one time (excluding access method modules).
   c. Uses up to twelve data sets.
   d. Has up to twelve data sets open at the same time.
   e. Has up to seven unique data set names of 44 characters each.
   f. Does not abnormally terminate.

3. If a job step abnormally terminates, 2,000 bytes of additional storage are required in the SQA. Therefore, you will want to take this into consideration when determining the estimated value for J.

R = the round-up factor required to make the system queue area a multiple of 2K.

Z = additional SQA space required. It is determined by adding the supplementary SQA requirements defined by the algorithms included under the applicable component options described below.

SYSTEM QUEUE AREA FOR REMOTE JOB ENTRY

When you select remote job entry (RJE), additional space is required in the system queue area. Estimate the amount of additional storage required with the following formula:

SQA for RJE = 3,568 + 92A + 100B + 80C + 144D + 48E + 96F

Where: A = the number of line groups

B = the number of lines

C = the number of nonresident RJE modules that are active at one time (assume one or two)

D = the number of access method modules that are active at one time (assume four for BTAM, and one or two for BSAM or BDAM)

E = the number of completed remote jobs residing in the central system (the maximum value for E is the number of remote jobs the system will support)

F = number of queued RJE central commands specified on the RJETABL macro.

SYSTEM QUEUE AREA FOR CONVERSATIONAL REMOTE JOB ENTRY

When you select conversational remote job entry (CRJE), additional space is required in the system queue area. Estimate the additional storage required with the following formula:

SQA for CRJE = 2984 + 92A + 40(B + 4) + 144C + 96D

Where: A = number of line groups.
B = the size of the CRJE transient area specified in the PARM field in the EXEC statement of the CRJE procedure.
C = number of access method modules active at one time (assume four for BTAM; two for BSAM).
D = number of queued CRJE commands specified on the CRJETABL macro.

SYSTEM QUEUE AREA FOR THE TIME SHARING OPTION (TSO)

If you specify the time sharing option (TSO), additional space is required in the system queue area. Estimate the additional storage with by the following formula:

SQA for TSO = 4000+228A+B+70C+(Dx(E+14))+F(64+30G+16D+(GxH))

Where: A = the number of active foreground regions.
B = 70 if a data set is provided for TSO Dump; otherwise B = 0.
C = the number of swap data sets.
D = the average number of data sets requested by more than one user.
E = the average length of the data set names that are requested by more than one user.
F = the number of logged-on users.
G = the average number of data sets requested by only one user.
H = the average length of the fully qualified name of data sets requested by one user only.

SYSTEM QUEUE AREA FOR SMF

SMF requires space in the system queue area. Estimate the size of the area required for SMF with the following formula:

SMF Area = 640 + Timing Control Table Size (TCTSIZE) + SMF Control Table Size + SMF I/O Buffer Size

TCTSIZE: One TCT is created for each active job (No. of TCTs = No. of active initiators); if OPT=2 is selected, its size can be estimated by the following formula:

TCTSIZE = 112 + 12(No. of DD statements) + 8(No. of devices)
If OPT=1 is selected, the size of the TCT is 96 bytes.

SMF Control Table: The size of the SMF Control Table = 124 bytes.

SMF I/O Buffer: The SMF I/O Buffer requires space in the SQA. The minimum buffer size is 400 bytes, which is twice the size of the largest record that can be written on the SMF data set. The maximum buffer size is 64K bytes. If you want the I/O involved in writing from the buffer to the SMF data set to occur at the rate of once per job, specify a buffer size that is twice the size of the records produced during the job. For example: a job that produced 929 bytes of information would require a buffer size of approximately 2000 bytes. (For further information on SMF, see the publication IBM System/360 Operating System: System Programmer's Guide.)

SYSTEM QUEUE AREA FOR STATUS DISPLAYS

Additional WTO buffers must be included in the SQA estimate when display areas have been defined for display console screens and/or when use will be made of the monitor active facility (applies only to display consoles).

Use the following algorithm to calculate the number of WTO buffers required by Status Display support under these conditions:

$\frac{(28 \cdot X)-Y}{2}$ = number of buffers required

Where: X = total number of display areas defined.
Y = total number of lines in all display areas planned for use by non-dynamic status displays.

One display area is defaulted per display console at SYSGEN if not specified otherwise. The size of these areas are as follows:

2250	14 lines
2260	8 lines
Consoles for CPU models 85, 165, 91, 195	14 lines

Note: This requirement is in addition to the SQA needed for normal WTO buffer usage.

SYSTEM QUEUE AREA FOR MCS

When you select multiple console support (MCS), additional space is required in the system queue area. Estimate the amount of additional storage required with the following formula:

SQA for MCS = (392•S)+24(B+4)+24

Where: S = the number of secondary consoles specified during system generation.
B = the number of write-to-operator buffers specified in the SCHEDULR macro during system generation, with the following qualification:

if $\frac{B}{S+1} \leq 2$, then B = 2 S+2

otherwise B is as specified during system generation.

SYSTEM QUEUE AREA FOR LOG TASK

When you select the LOG option at system generation, 496 additional bytes are required in the system queue area and at least 4 write-to-log buffers must be specified with the 'L' parameter of the basic SQA formula.

Optional Fixed Requirement

You can add control program options that: (1) change the organization and size of fixed main storage by making certain modules and tables resident, and (2) increase the size of fixed main storage by adding extra services to your system.

Four control program options change the organization of storage and can cause the fixed area to be increased. Although these options decrease the dynamic area, they improve the performance of the operating system. The following options are involved:

- Resident reenterable load module (RENT) option -- allows access method modules to be resident.
- Resident link library directory (BLDLTAB) option -- allows all or a portion of the directory for the link library or the directory for the SVC library to be resident.
- Resident type 3 and 4 supervisor call (SVC) routine option -- allows reenterable modules of type 3 and 4 SVC routines to be resident.
- Resident error recovery procedure (ERP) option -- this option allows selected error recovery procedures to be resident.

Figures 5 and 6 show how main storage is organized when you specify all of these options.

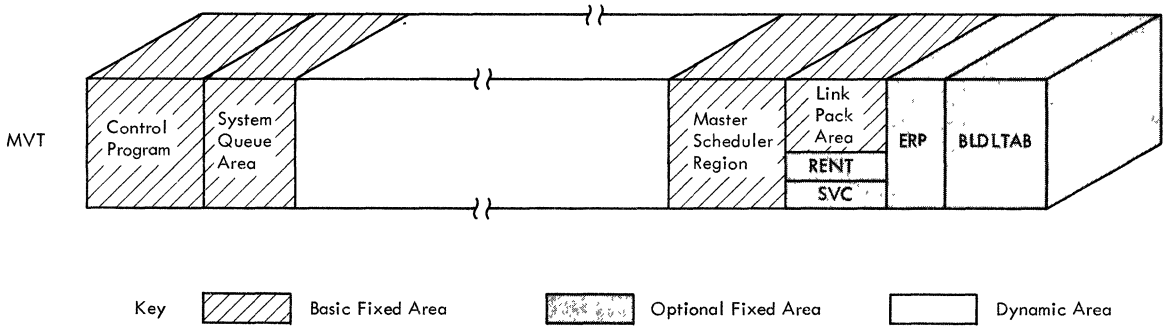


Figure 5. Effect of Control Program Options on the Organization of Main Storage for a System Running Under MVT

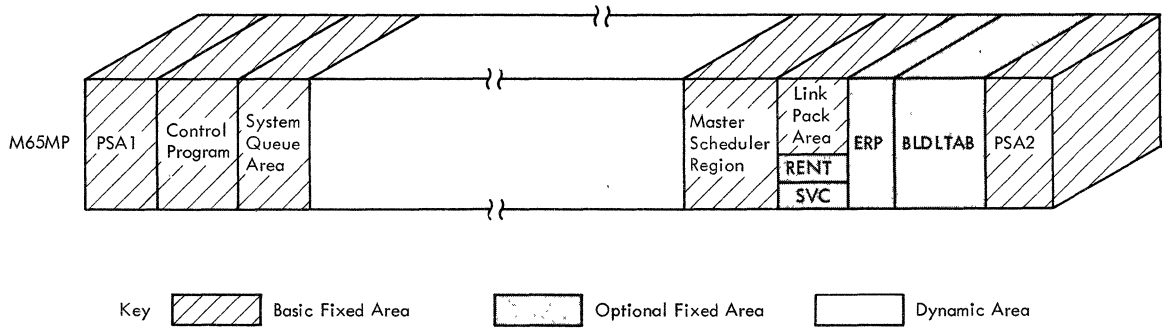


Figure 6. Effect of Control Program Options on the Organization of Main Storage for a System Running Under M65MP

During system generation, you can add control program options that tailor the system to your installations needs. These options require additional fixed storage and are specified by the following macro instructions:

- CENPROCS -- specifies the central processing unit.
- CTRLPROG -- specifies the operating system configuration.
- DATAMGT -- specifies the optional access methods.
- GRAPHICS -- specifies the graphics programming services.
- SCHEDULR -- specifies job scheduler options.
- SECONSLE -- specifies secondary consoles in MCS.
- SUPRVSOR -- specifies task supervisor options.
- SVCTABLE -- specifies supervisor call (SVC) routines.

Figure 1b
contains the fixed storage requirements for the options specified in the CENPROCS, CTRLPROG, DATAMGT, GRAPHICS, and SVCTABLE macro instructions.

Figure 2b
contains the fixed storage requirements for the options specified in the SCHEDULR and SECONSLE macro instructions.

Figure 3b
contains the fixed storage requirements for the options specified in the SUPRVSOR macro instruction.

When you estimate the optional fixed storage requirements, include the storage required by:

1. Resident user-added SVC routines.
2. Resident BLDLTAB entries.
3. Resident reenterable load modules.
4. Resident type 3 and 4 SVC routine modules.
5. Error recovery procedures.
6. The round-up factor for MVT necessary to make the sum of items 1, 2, 3, 4, and 5 a multiple of 2K.

Recovery Management Requirement

The operating system requires storage to perform recovery management. The recovery management procedures save system environment data when a machine malfunction and providing an analysis of this data to determine whether recovery is feasible. The data is arranged in a usable format and written on the SYS1.LOGREC data set.

There are six recovery management facilities available:

- System Environment Recording (SER0): SER0 is an independent function that determines the type of malfunction and, if possible, writes the error on SYS1.LOGREC. It does not use any operating system facilities to collect and record data. SER0 consists of a resident module and a nonresident module. The nonresident module is loaded into the dynamic area without regard to what was previously there. After SER0 completes its operation, no further operations are allowed and the system goes into a wait state.

- System Environment Recording (SER1): SER1 is a completely resident function that uses operating system facilities to collect and record data. SER1 resides on the SYS1.LINKLIB and is attached to the nucleus at IPL/NIP time. When SER1 completes recording the data associated with the malfunction, it attempts to determine (1) the effect and extent of the damage caused by the malfunction, and (2) whether the failure affected only a specific task. If the failure has not damaged the supervisor, and if the malfunction can be related to a specific task, the task is terminated. If the supervisor is damaged of if the malfunction cannot be related to a specific task, all operations are terminated and the system goes into a wait state.

- Machine Check Handler (MCH): MCH records the data associated with a machine check error and attempts a recovery by retrying the failing instruction. If retry is not possible, MCH attempts to determine the task affected by the failure and to terminate the associated job step. MCH can also refresh areas of main storage if the associated load module has the refreshable attribute. The system is placed in a wait state only when the effects of the failure cannot be definitely determined, when non-refreshable program damage has occurred in the supervisor, or when a non-recoverable machine failure exists. The machine check handler for the model 145 does not refresh the affected areas of storage.

- Channel Check Handler (CCH): CCH intercepts channel check conditions, analyzes the environment, and facilitiates recovery from channel check conditions by allowing for the scheduling of device dependent error recovery procedures by the input/output supervisor, which will determine whether the failing channel operation can be retried. CCH also constructs a channel error inboard record entry to be written onto SYS1.LOGREC by the outboard recorder routine (OBR) of the I/O supervisor. If CCH is not present in the system, one of the other recovery management facilities receives control and writes an error record for the channel failure. In this case, the error causes system termination.

- Alternate Path Retry (APR): APR allows an I/O operation that developed an error on one channel to be retried on another channel. The alternate channel must be one that has been assigned to the device performing the I/O. APR also provides the capability to logically connect a channel path to a device online or offline by use of the VARY command. The selective retry function of APR is optional for MVT and is included in M65MP. The VARY PATH function is standard for MVT & M65MP.

- Dynamic Device Reconfiguration (DDR): DDR allows a demountable volume to be moved from one device to another and repositioned, if necessary, without abnormally terminating the affected job or reperforming IPL. A request to move a volume can be initiated by the operator, or by the system, after a permanent I/O error for demountable SYSRES or non-SYSRES volumes. DDR is optional for MVT and is included in M65MP.

The desired recovery management facility is specified at system generation in the SUPRVSOR macro instruction. If you do not specify recovery management, the systems assigns a default of either SER0 or SER1 (except for M65MP) depending on the size of main storage.

Figure 4c
contains the storage requirements for the recovery management facilities available on each model.

Input/Output Supervisor Requirement

In addition to the basic and optional fixed requirement, the operating system requires storage for the input/output supervisor (IOS). Part of the storage required for IOS is included in the basic fixed storage requirement. The total amount of storage required by IOS depends on the I/O configuration selected during system generation.

Figure 5b
contains the fixed storage requirements for the I/O channel configuration.

Figure 6b
contains the fixed storage requirements for the type of I/O devices specified.

Figure 7b
contains the fixed storage requirements for the type of IBM-supplied processing program selected.

Example 2 -- Estimating a Fixed Storage Requirement for MVT

Example 2 shows how the fixed storage requirement was estimated for an MVT configuration with TSO. The scheduler uses one reader/interpreter and three output writers. Multiple console support or SMF is not in the system.

System/360 Configuration:
- Model 65 with 512K bytes of storage with storage protection
- SER1
- Priority queueing, with 40 I/O requests queued on the channels
- One multiplexor channel with:
  - One 2540 card reader punch
  - One console
  - Three printers
- One selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
  - Six magnetic tapes
- A second selector channel with:
  - Four IBM 2311 Disk Storage Drives with record overflow
  - One IBM 2301 Drum Storage Drive
- A channel switch is used to attach four additional magnetic tapes to the two selector channels

Control Program Options:
- Four additional transient areas
- Job step timing
- Resident reenterable load modules
- TSO

BASIC fixed nucleus requirement for MVT..... 51,095 Bytes

OPTIONAL fixed nucleus requirements from Figure 1b
- Two additional pairs of transient area 2(3006)..... 6,021 Bytes

OPTIONAL fixed nucleus requirements from Figure 2b
- TSO..... 3,686 Bytes

OPTIONAL fixed nucleus requirement from Figure 3b
- Job Step timing..... 144 Bytes

OTHER OPTIONAL fixed nucleus requirements

RECOVERY management requirement from Figure 4b
- SER1..... 3656 Bytes

IOS Channel requirement from Figure 5b:
- Multiplexor channel..... 60 Bytes
- Priority queueing on the channel..... 6 Bytes
- Two selector channels 2(50)..... 100 Bytes
- One additional channel path on each channel 2(50)..... 100 Bytes
- Two channel paths on each channel with priority queueing on the channels 2(2) (6).. 24 Bytes
- One channel path with direct access devices on each channel 2(32)..... 64 Bytes
- One channel switch..... 18 Bytes
- Priority queueing..... 104 Bytes
- 40 I/O requests 40(12)..... 480 Bytes

956 Bytes

IOS I/O device requirements from Figure 6b
- Six unit record devices 6(42)..... 252 Bytes
- Magnetic tape capability..... 102 Bytes
- Ten 2400 series magnetic tape devices 10(62)..... 620 Bytes
- 2400 tape device with priority queueing..... 8 Bytes
- Direct access capability..... Included
- One IBM 2301 Drum (36 + 182)..... 218 Bytes
- Eight IBM 2311 Disks with record overflow 8 (182)..... 1,456 Bytes
- Resident error routine..... 1,636 Bytes

Total IOS..... 4,292 Bytes

Figure 7b
- GTF..... 56 Bytes

Fixed Nucleus requirement (subtotal)..... 69,906 Bytes
Rounding factor to next 2K boundary..... 1,774 Bytes
Total fixed nucleus requirement..... 71,680 Bytes

Basic fixed LPA requirement for MVT..... 6,144 Bytes
LPA for TSO option..... 728 Bytes
LPA requirement from Figure 3b
- Resident Reenterable Load Module (Standard List IEAIGG00) 31•24..... 744 Bytes
  sum of module sizes..... 8,580 Bytes

LPA subtotal..... 16,196 Bytes
Round-up..... 188 Bytes
Total LPA requirement..... 16,384 Bytes

SQA requirement for MVT:
- ..... 6,446 Bytes
- 5 WTO buffers 144(5+4)..... 1,296 Bytes
- 5 Reply queue elements 5(24)..... 120 Bytes
- LPA modules 50(48)..... 2,400 Bytes
- Concurrent operator commands 1(960)..... 960 Bytes
- 3 Output writers 2920+2(2240)..... 7,400 Bytes
- Reader 1(2808)..... 2,808 Bytes
- Job step 1(3000)..... 3,000 Bytes

24,430 Bytes

SQA requirement for TSO
- ..... 4,000 Bytes
- Active foreground regions 1(220)..... 220 Bytes
- Data set for TSO dump 1(70)..... 70 Bytes
- Swap data set 1(70)..... 70 Bytes
- Shared data sets 15(8+14)..... 330 Bytes
- Private data sets 30(64+30(4)+16(15)+((4)(8))13,680 Bytes

18,370 Bytes

SQA subtotal..... 40,970 Bytes
SQA round-up..... 2,038 Bytes
SQA total..... 43,008 Bytes

Total Fixed Main Storage requirement for MVT
- Nucleus+LPA+SQA+MSR..... 173,872 Bytes

Dynamic Storage Requirement in MVT

Several factors must be considered when you estimate the dynamic storage requirements. Because the job scheduler routines and operator commands require separate regions in the dynamic area, the number and sizes of these regions in use at any one time affects the amount of dynamic storage available for allocation to job steps. In addition, when remote job entry or conversational remote job entry is selected during system generation, another region is required.

The size of a region for a job step is affected by the following factors:

- The storage necessary to initiate the job step.
- The storage required for the load module.
- The storage required for an IBM-supplied program that the job step may use.
- The storage required for supervisor services requested by the job step and for the Checkpoint Restart work area if Checkpoint Restart is specified.
- The storage required for the data management access methods used by the job step.

If you select TSO (Time Sharing Option), storage in the dynamic area is required for the following:

- The time sharing control region.
- Each user foreground region, which includes the minimum storage required to run the largest of: the user's program or any of the TSO language processors, command processors, service routines, or utility programs.
- The TSO trace writer and the TSO trace data set processor which run in separate regions if both are selected.
- The data management access methods used by TSO.

See the section called "Time Sharing Region Requirement" for a detailed description of TSO requirements.

READER/INTERPRETER REGION REQUIREMENT

The reader/interpreter cataloged procedure, the automatic SYSIN batching (ASB) reader, and the background reader cataloged procedure are available to read and interpret the input stream. The region requirement depends on which cataloged procedure is invoked when a reader is started. The publication IBM System/360 Operating System: MVT Guide, GC28-6720 contains the cataloged procedures supplied by IBM. The region requirement for each is supplied below.

1. The reader cataloged procedure is invoked by a START RDR command. Each reader requires one region that remains in use until the input stream is exhausted; then the region is automatically freed for use by other tasks. The region required for a reader depends on whether any modules of the reader/interpreter are in the link pack area, and the size and number of input, output, and procedure buffers. Records from the procedure library are read into a procedure buffer when a job step in the input stream invokes a cataloged procedure.

   The input and output buffer sizes (BUFL) and buffer numbers (BUFNO) are specified in the reader procedure invoked when a reader is started. The size of a procedure is the blocksize specified for the procedure library. The number of procedure buffers used by the reader/interpreter is always one. If input, output, or procedure buffer sizes or buffer numbers are changed, the region size must be adjusted accordingly. The following formula can be used to estimate the region size for each reader.

If the modules used by BSAM and QSAM are not resident, the region size required by the Reader/Interpreter must be increased by the size of these modules and then rounded to the next highest multiple of 2K.

REGION = 48K + IB_1 + IB_2 + OB

Where: IB_1 = AB + AC
Where: A = the number of input stream buffers
B = the size of input stream buffers
C = the size of the input/output blocks (IOB)

IB_2 = AB + AC
Where: A = the number of procedure buffers
B = the size of procedure buffers
C = the size of the input/output blocks (IOB)

OB = AB + AC
Where: A = the number of output buffers
B = the size of output buffers
C = the size of the input/output block (IOB)

- IB_1 + IB_2 must be rounded up to the next highest multiple of 2K except when unblocked single buffering is used for both, in which case: $IB_1+IB_2=0$.

- If either IB_1 or IB_2 does not have unblocked single buffering, then: if $(IB_2+(2K-2IB_2))$ is greater than IB_1, IB_1 + IB_2 should be rounded up to the next highest multiple of 2K. If $(IB_2+(2K-2IB_2))$ is less than IB_1, both IB_1 and IB_2 should be rounded up to the next highest multiple of 2K.

- OB must be rounded up to the next highest multiple of 2K except when unblocked single or double buffering is used, in which case: OB=0.

- The size of the IEFQMSSS load module (see APPENDIX A) may be subtracted from the above formula, if it is in the link pack area. (Region = 48K + IB_1 + IB_2 + OB - 4K).

- 36K may be subtracted from the above formula if all of the following load modules are in the link pack area:

  IEFVHA IEFIRC IEFMVTJA IEFMVTHR
  IEFMVTHM IEFVHN IEFVHI IEZDCODE
  IEFVINA
  (Region = 48K + IB_1 + IB_2 + OB - 36K).

- Note: The smallest possible region size is 8K when all modules are in the link pack area.

- If all of the above load modules are not in the link pack area, the largest load module size not in the link pack area (see APPENDIX A), rounded up to a 2K multiple, must be subtracted from the 36K constant. (Note that the IEFVHA load module must be in the link pack area before considering this variation of the formula.) For example, if IEFVINA is not in the link pack area, the formula would be:
  (Region = 48K + IB_1 + IB_2 + OB - (36K - 6K).

- For a description of the IOB, refer to the publication IBM System/360 Operating System: System Control Blocks, GC28-6628.

- Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4 must be resident if your system includes 2305 or 3330 devices.

2. The ASB reader cataloged procedure is invoked by a START RDRA command. The ASB reader copies system input data onto a direct access volume and writes the job control language statements onto the job queue data set (SYS1.SYSJOBQE). Each ASB reader requires one region that remains in use until the input stream is exhausted;

then the storage is freed for use by other tasks. A region is not required for the interpretation of job control language statements until a user-specified number of jobs (a batch) have been accumulated. When a batch has been accumulated, a region is dynamically acquired and the interpreter is invoked.

The minimum region size required by the ASB reader cataloged procedure is 16K. This value includes the storage required for the following:

- 10 input buffers consisting of 80-character records plus the QSAM control block requirements (approximately 1,400 bytes). If either the number of input buffers or the blocksize is increased, without a corresponding decrease of the other, then the region size for the ASB reader must be increased accordingly.
- Single buffering of the procedure library with a blocksize of up to 3200.
- Single buffering of the input stream data with a blocksize of up to 3200.

Reader/Interpreter Region Requirement using ASB Reader

The size of the region required for the interpreter subroutine used by the ASB reader depends on the size of the procedure buffer and the number of job queue records resident during interpretation of the JCL. The size of the procedure buffer is the blocksize specified for the procedure library. If the blocksize is changed, the region size must be adjusted accordingly. The following formula can be used to estimate the region required for the interpreter.

```
REGION = 54K + PB + 184 + 250N + n(8 + 176N)

Where:  PB = size of the procedure buffer
        N = number of 176-byte job queue records per logical track
        n = number of job queue tracks, in core, during interpretation
            of the JCL

• PB = 0 if unblocked records are used.

• The standard RDRA procedure uses the following values:
       PB = 3200
        N = 12
        n = 4

• The region size must be rounded to the next highest multiple of 2K.

• Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4
  must be resident if your system includes 2305 or 3330 devices.
```

This region is required only when a batch has been accumulated. Once the batch is interpreted, this region is freed for use by the other tasks.

3. The background reader cataloged procedure is invoked by a START BRDR command. The procedure interprets jobs that were entered on the SUBMIT command and places them on the job queue data set. Each background reader requires one region with a size equal to:

   REGION = 10K + size required for reader/interpreter.

OUTPUT WRITER REGION REQUIREMENT

The operator may start and stop output writers as the backlog of work in the output classes changes. One writer can process several classes, and several writers can process the same class. Each output writer requires one region which is retained until the operator stops the writer. The region required for an output writer depends on the size of the input and output buffers and whether the output writer modules are in the link pack area.

The input buffer sizes are specified for the SYSOUT data set in the problem program. The SYSOUT writer region contains two input buffers of this size.

The output buffer size (BUFL) and the buffer number (BUFNO) are specified in the cataloged procedure used when a writer is started. The publication IBM System/360 Operating System: MVT Guide, contains the cataloged procedure supplied by IBM. If the buffer specifications in the procedure are overridden, the region size must be adjusted accordingly.

The following formula can be used to estimate the region required by the output writer:

```
REGION = 12,288 + IB + OB

Where:  IB = the storage required by the input buffers, rounded to the
             next highest multiple of 2K.  The storage required is
             calculated as follows:
             IB = 2E + 2F
             Where:  E = the size of the input buffer
                     F = the size of the input/output block (IOB)

        OB = the storage required by the output buffers, rounded to
             the next highest multiple of 2K.  The storage required is
             calculated as follows:
             OB = AB + AC
             Where:  A = the number of output buffers
                     B = the size of the output buffer
                     C = the size of the input/output block (IOB)
• For a description of the IOB, refer to the publication IBM
  System/360 Operating System:  System Control Blocks, GC28-6628.
• If the output writer uses command chaining with machine code control
  character output, more than three buffers, and a unit record output
  device, then REGION = 13,312 + IB + OB
• If variable spanned records are being used on input or output, then
  the formula is 14,336 + IB + OB.  In this case nothing extra need be
  added for command chaining.
• Add 2K if the output device is a 3211 printer.
• Subtract 2K if the output writer modules are in the link pack area.
• If the log is being used, the input/output buffer size must be equal
  to or greater than the size specified on the "BLKSIZE=" parameter of
  the log data set.
• Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4
  must be resident if your system includes 2305 or 3330 devices.  If
  QSAM modules for locate-mode GET and PUT are not resident,
  additional space may be needed.
• Only one input buffer is used if the maximum blocksize for the input
  data set exceeds 3000 bytes.
```

The preceding formula assumes that the standard output writer is used. If the user provides a nonstandard data set writer that is not in the link pack area, the size of the region must be adjusted accordingly. (For information on providing a nonstandard data set writer, see the publication IBM System/360 Operating System: MVT Guide.)

OPERATOR COMMAND REGION REQUIREMENTS

The operator can control the number of reader/interpreter, output writers, and initiator/terminators in operation by using a START command. This command requires a separate region only until the task is initiated, then the region is exchanged for a region equal to the size required by the initiated task.

In addition, certain other operator commands require separate regions that are freed once the requested function has been performed. The following is a list of operator commands that require separate regions.

When hierarchy support is used, the region requirement is satisfied in hierarchy 0 storage, except for the START and MOUNT commands. Either hierarchy 0 or hierarchy 1 may be specified on the START and MOUNT commands.

Command	Region Requirement (in bytes)
CANCEL 'jobname'	6,144
DISPLAY 'jobname'	6,144
HOLD 'jobname'	6,144
HOLDQ	6,144
MOUNT 'devicename'	MINPART
RELEASE 'jobname'	6,144
RELEASE Q	6,144
RESET 'jobname'	6,144
START	MINPART
SEND	12K
DISPLAY USERS	6K

Where: MINPART is the minimum requirement for job initiation with MVT; see the section "Job Initiation Requirements."

- The CANCEL command does not require a separate region when the job to be canceled is executing; the job's region is used.

REMOTE JOB ENTRY REGION REQUIREMENT

Remote job entry (RJE) operates as a system task, much like a combined reader/interpreter and output writer. RJE accepts jobs submitted by remote users, passes them to the initiator/terminator for scheduling and execution, and returns the output to the remote user. The region required for RJE can be estimated by the following formula:

$$REGION = 46,596 + 408A + 1,516B + 76C + 24D + 18E + 16G + (13+10H)I + (13+9H)J + K + L + M + N + O + P + Q + [(624+R_1) + (624+R_2) + ... + (624+R_n)] + 64U + 8V$$

Where:
- A = the number of line groups.
- B = the number of lines.
- C = the number of terminals.
- D = the number of jobs.
- E = the number of users.
- G = the number of dial lines.
- H = the maximum number of terminals connected on a multipoint line.
- I = the number of multipoint lines for 2780s.
- J = the number of multipoint lines for 1130s.
- K = 8,192 if module IEFVHA is in the link pack area. If module IEFVHA is not in the link pack area, K=40,960.
- L = 0 if compress/expand is not selected. If compress/expand is selected, L = 832.
- M = 0 if BTAM is resident. If BTAM is not resident, M=5,000.
- N = 6000.
- O = the size of the JOBACK user exit option, including dynamic work areas. If the JOBACK user exit option is not selected, O=0.
- P = the size of the JOBCARD user exit option, including dynamic work areas. If the JOBCARD user exit option is not selected, P=0.
- Q = the size of the COMMERR user exit option, including dynamic work areas. If the COMMERR user exit option is not selected, Q=0.
- R_1 to R_n = the blocksizes of the SYSOUT data sets for each line simultaneously sending output
- U = the total number of MSG QEBs specified in the RJELINE macros. It will equal 4 if the default is used.
- V = the total number of JOB QEBs specified in the RJELINE macros. It will equal 10 if the default is used.

- The sum of R_1 to R_n must be raised to the next highest multiple of 2K; then the total region size must be raised to the next highest multiple of 2K.

CONVERSATIONAL REMOTE JOB ENTRY (CRJE) REGION REQUIREMENT

CRJE allows remote access to the operating system from conversational terminals. The terminal user may prepare and update programs and data, submit them for processing, and receive the output at the terminal. CRJE jobs are processed concurrently with jobs submitted normally.

CRJE operates in dynamic storage. The region size necessary to run CRJE can be calculated by the following formula:

```
REGION = 54,258 + AA' + 388B + 922C + (552 + D')D + 104E + (1376 + F)+
         32H + 32J +16K + L + M + N + O + P + Q + R + S + 768T + U + V
```

Where:
- A = number of line groups.
- A' = 52 if device I/O modules are resident.
  - = 332 if the device is a 1050 and the I/O modules are not resident.
  - = 300 if the device is a 2740 with checking and the I/O modules are not resident.
  - = 212 if the device is a 2741 and the I/O modules are not resident.
- B = number of lines.
- C = number of active users.
- D = number of users receiving job output at one time.
- D' = blocksize of SYSOUT data set.
- E = number of START RDR's pending.
- F = maximum blocksize of an OS data set to be EDITed.
- H = number of active users projected to be in syntax checker mode at one time.
- J = number of active users projected to be using EXEC command at same time.
- K = number of active users projected to be using TABSET at the same time.

(Continued)

L = syntax checker requirements.

FORTRAN = { 16384 / 19456 / 21504 } + 192

Where: 16384 bytes are required if the E level syntax table, only, is to be resident.

19456 bytes are required if the G and H level syntax table is to be resident.

21504 bytes are required if both the E level, and the G and H level syntax checkers are to be resident.

PL/I = { 17408 / 21504 / 28672 } + 300 (PLINO)

Where: 17408 bytes are required for the resident restricted checker.

21504 bytes are required for checking with partial dynamic structure.

28672 bytes are required for checking with fully dynamic structure.

PLINO is the maximum number of PL/I statement lines allowed under CRJE.

Note: If both checkers are selected, include (300 PLINO).

M = 0 if BTAM is fully resident or 6000 if BTAM is not resident.

N = size of user LOGON exit routine if included in CRJE.

O = size of user LOGOFF exit routine if it is included in CRJE.

P = size of user JOBCARD exit routine if it is included in CRJE.

Q = size of user specified command processors included in CRJE.

R = 0 if BTAM On-line Test is not included.
= 2128 if BTAM On-line Test is included.

S = 0 if the modules IEFQMSSS, IEFQMDQ2, and IEFQDELE are resident.
= 5760 if the above modules are not resident.

T = number of BTAM transmission codes used.

U = 0 if the RAM list of modules is resident
= 1800 if the RAM list of modules is not resident

V = 952 if one or more 1050s on a leased line with Timeout Suppression feature are supported.
= 0 if no 1050s with Timeout Suppression are supported.

JOB STEP INITIATION

When MVT is used, the region required to initiate a job step is specified during system generation in the MINPART parameter of the SCHEDULR macro instruction. The amount specified for MINPART must be large enough for operation of the initiator/terminator and must include the storage used by the initiator/terminator to maintain portions of the job queue in main storage.

The size of the scheduler does not increase when automatic volume recognition or SMF is selected.

The size required for the initiator/terminator is approximately 52K (the default value assumed if MINPART is not specified) plus the storage required by an accounting routine, or user-written routines to supplement SMF if they are supplied.

Note: MINPART is the minimum region required by any job step unless module IEFSD061 of the initiator/terminator is resident in the link pack area. If the module is resident, the minimum region for a job step may be greater than or equal to MINPART minus 40K. The minimum region size will be calculated by the system.

The following formula can be used to determine the size of the initiator/terminator region for a specific installation.

MINPART = (45,056 + V + D) + P + INITQBF - IEFSD062

Where: Each term should be a multiple of 2K. The values for V and D are required; the values for INITQBF and IEFSD062 are optional.

V = the amount required for the I/O device specifications made during system generation. The 52K default value includes enough storage to handle approximately 150 I/O device specifications; to calculate the exact amount for a particular installation, use the formula:

V = DMT + DNT (See notes 1 and 2.)

Where: DMT = 4 + 12(A + B + 1) ([K/32]*)4 + 4
DNT = 4 + 12(A + B)

A = the number of UNITNAME macro instructions.

B = the number of different unit types specified by the UNIT parameter of all IODEVICE macro instructions.

K = The sum of:
a. the sum of all IODEVICE macro instructions, each multiplied by the number of units specified within it,
b. the number of IODEVICE macro instructions that specify UNIT=2314, multiplied by one less than the number of units specified in the IODEVICE statement,
c. the number of IODEVICE macro instructions that specify UNIT = 2321, multiplied by 10,
d. the number of alternate channel paths specified,
e. the sum of all IODEVICE macro instructions that specify alternate channel paths, each multiplied by the number of units specified within it.
f. the sum of all undefined unit addresses on channel 0 up to the first defined unit address for the first defined control unit,
g. the sum of the undefined unit addresses, associated with each control unit, that would appear between the unit addresses defined. This applies to all channels.

Notes:
1. If the formula for V yields a number of bytes equal to or greater than 2048, MINPART must be increased by 2K.

2. DMT and DNT represent the storage requirements for the device mask table (DEVMASKT) and the device name table (DEVNAMET). To improve system performance and reduce the dynamic storage required by the initiator/terminator, it is recommended that you place these tables in the MVT link pack area.

* - quotient rounded to whole number

D = the amount required for the DD statements in the job step. The 52K default value includes enough storage (6,144 bytes) to handle approximately 18 DD statements for single volume, single unit requests. Each additional DD statement requires 250 bytes of main storage. DD statements which are multivolume and/or multiunit requests require 12 bytes per additional unit required and 14 bytes per additional volume requested via the volume count parameter on the DD statement or by specific volume serial.
Note: Each member of a generation data group requested in a job step should be considered a separate DD statement.

P = the BLKSIZE specified in the procedure library DCB. Round this value up to the next highest multiple of 2K. If the procedure library is not blocked (i.e., BLKSIZE = 80), P=0.

INITQBF = is optional and is the amount used by the initiator/terminator to maintain portions of SYS1.SYSJOBQE in main storage, rounded up to the nearest multiple of 2K*. This value, when divided by 1024, yields the number of buffers to be specified in the INITQBF parameter of the SCHEDULR macro instruction during system generation. The value is calculated as follows:

INITQBF = 88 + 37•N + L(8 + 176•N)

Where: N = the number of 176-byte records to be included in a logical track of SYS1.SYSJOBQE. (This is the value specified in the JOBQFMT parameter of the SCHEDULR macro instruction during system generation although the values of N and INITQBF are established when the system is generated, they may be varied when the system is initialized.)

L = the number of logical tracks to be maintained in storage.

*A method used to handle the data brought in from SYS1.SYSJOBQE is called track stacking.

IEFSD062 = 9,088 and is the amount required by module IEFSD062. This amount can be subtracted if the module is in the link pack area. The 52K default value includes this amount.

The storage required to initiate a job increase beyond the computed size of the initiator/terminator if an accounting routine is supplied. The amount of additional storage is equal to 2,750 bytes, plus the size of the accounting routine, plus the additional storage required by the routine (e.g., OPEN, GETMAIN).

IBM-Supplied Program Requirements

IBM-supplied programs require dynamic storage in which to operate. Figures 8b through 13b contain the minimum dynamic storage requirements for these programs.

Figure 8b
contains the storage requirements for each processor. These estimates include the requirements for the access methods used by the processor. If the access method modules are resident, the requirement can be reduced by the sum of the resident modules.

Figure 9b
contains the storage requirements for utility programs. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

Figure 10b
contains the storage requirements for the IEHDASDR system utility program.

Figure 11b
contains the storage requirements for the IEHDASDR buffer/work area size.

Figure 12b
contains the storage requirements for the IEBDG data set utility program.

Figure 13b
contains the storage requirements for IBM-supplied utility programs when the SYSUTILS macro instruction is specified. These estimates do not include the requirements of the access methods used by the utility program. The sizes of the access method routines used must be added to the minimum requirements if the routines are not resident.

In addition, dynamic storage is also required by graphic programming support, the overlay supervisors, the system environment recording functions, the 1130/360 Data Transmission program, and the loader. Section 3 contains the dynamic storage requirements for these programs.

Supervisor Service Requirements

Dynamic storage is used by the control program both while supervisor services are performed and after control is returned to the program that requires them. In MVT, the storage required for supervisor services is obtained from subpools within the region.

Figure 14b
: contains the dynamic storage for the supervisor services that perform the opening and/or closing of a data set and the handling of end-of-volume conditions.

Figure 15b
: contains the dynamic storage requirement for the rest of the supervisor services and also gives the duration of the storage requirement.

Access Method Requirements

Section 4 contains the storage requirements for access methods used by the job steps.

Time Sharing Region Requirement

The time sharing option (TSO) allows you to develop, test, and execute programs, at remote terminals, in a time sharing environment. Storage is required in the dynamic area for the time sharing control region and each foreground region. The time sharing control region provides the storage for: the time sharing control task, the time sharing driver, the region control task, several resident SVC routines, the time sharing extension to the link pack area, and various control blocks. The foreground region is the area where the user's program is executed. It provides storage for the user's program, language processors, and the TSO command processors.

TIME SHARING CONTROL REGION - STORAGE REQUIRMENT

The storage required for the time sharing control region can be estimated by the following formula:

REGION = 12K + A + B + C + D + E

Where: A = the storage required by the time sharing control task and is equal to:

800 + 82R + 48(U+1) + 4M(U + R + 1) + RD1

B = the storage required to swap control and is equal to:

(1160 + 40R)(G) for 2301 drum storage devices.
(968 + 40R + 5F) (G) for 2303 devices.
(1352 + 40R + 4F)(G) for 2305, model 1 devices. +RD2
(1480 + 40R + 4F)(G) for 2305, model 2 devices.
(2248 + 40R + 4F)(G) for 2314 devices.
(1112 + 40R + 12F)(G) for 3330 devices.

C = the storage required for the time sharing driver and is equal to:

48 + 36R + 36(RxQ) + 28(U+1)

*Note: If RD1, RD2, or RD3 is greater than C, then C =0.

D = the storage required for terminal handling and is equal to:

84 + 64U + (PxN) + RD3

*E = the size of the time sharing link pack area with modules packed as much as possible.

F = number of cylinders.

G = number of data sets.

M = the number of MAP entries.

N = the number of allocated terminal buffers.

P = the size of a terminal buffer.

Q = the average number of queues per region.

R = the maximum number of active time sharing regions.

U = the maximum number of time sharing users.

RD1, RD2, and RD3 are the factors required to round-up A, B, and D to the next highest multiple of 2K.

*Appendix B, part 3 lists the modules that are always made resident in the time sharing link pack area. Use Figures 16b-20b and Appendix B to determine the size of other components that you can put in the link pack area.

FOREGROUND REGION - STORAGE REQUIREMENT

The storage requirement for each user's foreground region is the larger of L or T and can be estimated by the following formulas:

```
L = 11.5K + LSQA + A + B + C
```

Where:

A = the larger of 52K or MINPART where MINPART can be calculated by the formula given in a preceding section of this publication.

B = the larger of .5K or the number of bytes of MAIL and NOTICES waiting for the user when he logs on.

C = 2K if you use track stacking; 0 otherwise.

LSQA = the local system queue area; 8K is the minimum useable amount for LSQA for a TSO command (more than one TSO command will require 10 to 12K).

```
T = A + (B + B1 + B2) + LSQA + B3
```

Where:

A = 20K if the TSO command system is operating in the foreground region: otherwise A = 0. The TSO command system (TMP) can be made resident in the time sharing link pack area; in this case the storage requirement =12K. The module names and sizes of the TMP are listed in Appendix B.

B = the storage requirement of the largest command processor, or TSO utility program to be run in the foreground region.

B1 = the storage requirement of the largest non-resident TSO service routine or subcommand that will be used with the command processors.

B2 = the storage requirement of the largest language processor or user program that will run under the RUN subcommand of the EDIT command processor, or the storage requirements of the largest user's program that will be run under the TEST command processor.

B3 = 6K if the RAM option is not specified at SYSGEN otherwise B3 = 0.

LSQA = the local system queue area; 8K is the minimum useable amount for LSQA for a TSO command (more than one TSO command will require 10 to 12K).

TSO - COMMAND PROCESSORS, SERVICE ROUTINES, LANGUAGE PROCESSORS, AND UTILITY PROGRAMS

Dynamic main storage is required in the user's foreground region for the TSO command processors, service routines, and any language processor that will be used with the command processors.

Figure 16b.
contains the dynamic main storage requirements for the TSO command processors.

Figure 17b.
contains the dynamic main storage requirements for the TSO service routines.

Figure 18b.
contains the dynamic main storage requirements for the language processors that will be used with TSO.

Figure 19b.
contains the dynamic main storage requirements for the TSO utility programs.

TSO - Trace Writer and Trace Data Set Processor

The TSO trace writer and trace data set processor require a separate region to run in.

Figure 20b
contains the dynamic storage requirements for the trace writer and trace data set processor.

TSO - Access Methods

The section entitled MFT, MVT, and M65MP -- Data Access Method Requirements contains the storage required for the access methods used by TSO.

MVT and M65MP -- Figures

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
CENPROCS	• Model 91	1264
	• Model 85	1264 (5)
	• Model 195	2328
	• Models 145, 155, 165	336 (4)
CTRLPROG	• Each Additional Pair of Transient Areas	3006
	• Main Storage Hierachy Support	1120
	• PCI Fetch	Included
	• Rollout/Rollin	6308 (1)
	• Time-Slicing	974 (2)
DATAMGT	• BDAM	Included
	• BTAM	60
	• ISAM	252
	• QTAM	568
	• TCAM	600
GRAPHICS	• Graphic Programming Services (6)	874
SVCTABLE	• User Added SVC Routines	24
	Each Resident SVC Routine (3)	4
	Each Transient SVC Routine (7)	4

Notes:
1. If you supply routines to modify the operation of this option, the storage required by these routines must be added to the fixed storage requirement. If you select hierachy support, add 36 bytes.
2. Increase the storage requirement by 16 bytes for each time-slice group that is specified. If job step timing is selected, add 14 bytes.
3. The size of the SVC routine(s) must also be added to the fixed storage requirement.
4. Add 128 bytes if there are 2880 channels present on the model 165.
5. Add 96 bytes if there are 2880 channels present.
6. For each 2250 model 1 with 4K buffer, add 32 bytes. For each 2250 model 1 with 8K buffer, add 48 bytes. For each 2840, add 168 bytes.
7. Additional transient areas are recommended for systems making use of facilities provided by nonresident (types 3 and 4) SVC routines. The multiple-line write-to-operator facility requires adequate transient area support to ensure prompt response to operator requests.

Figure 1b. Fixed Storage Requirements for Control Program Options in the CENPROCS, CTRLPROG, DATAMGT, GRAPHICS, SVCTABLE, and TESTRAN Macro Instructions for MVT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SCHEDULR	• Alternate Console	120
	• Composite Console	32
	(per console)	32 (1)
	• Multiple Console Support	4,050
	Master and Alternate Consoles	
	Each printer - keyboard	316
	Each 2740	216
	Each 2250	4,736 (3)
	Each 3277 model 2	3,072 (3)
	Each 2260	1,464 (3)
	Each Model 85/165 Console with CRT Display	3,464 (3)
	Card Reader (Input half only)	364
	Printer (Output half only)	372
	• Display Console (4)	544
	2260 (4)	64
	3277 models 1 and 2	24
	2250, model 91 and 195 consoles (4)	44
	Model 85 and 165 consoles (4)	24
	SMF	1,568
	ESV	(6)
	Time Sharing (TSO)	3,686
SECONSLE	• Each composite console adds additional space as indicated under SCHEDULR(2).	
	• Each non-composite console adds additional space as indicated under SCHEDULR(2).	
	• DIDOCS/SDS considerations when secondary consoles include CRT devices are as indicated under SCHEDULR(2).	
	• 3277 model 1 used as a secondary console (3)	1,126

Notes:

1. 64 bytes, if the primary and alternate are composite consoles.
2. If the BTAM modules IGG019M0, IGG019MA, and IGG019MB are not resident in the RAM area, add 6,224 bytes when you specify a 2740 for the first time. Each additional 2740 requires only 216 bytes.
3. If you assign a display console to a transient display control module group, the main storage required for the entire group equals 48 bytes for each console in the group plus 36 bytes for each display area defined for consoles in the group plus one resident area large enough to accomodate the console in the group with the largest resident storage requirement (as listed above). This resident area is shared by all consoles in the transient DCM group.
4. Required if display consoles are included in the system. The basic requirement is 544 bytes; the amount of storage indicated next to each console type is required (once only) if a console of that type is included in the system. Each PFK key allocated for operator command entry requires 120 bytes of main storage.
5. When using the indicated devices as composite consoles, the storage requirement for each half (input device and output device) of the composite must be included in calculating the total storage requirement for each composite console configuration.
6. If you specify ESV=SMF and do not include SMF, add 1,568 bytes.

Figure 2b. Fixed Storage Requirements for Control Program Options Specified in the SCHEDULR and SECONSLE Macro Instructions for MVT

Macro Instruction	Control Program Option	Storage Requirement (in bytes)
SUPRVSOR	• Decimal Simulation (Model 91 only)	3,520
	• IDENTIFY Facility	
	Module resident	Included
	• Multiple WAIT	Included
	• Resident ATTACH	Included
	• Resident BLDLTAB	284
	Each Resident LINKLIB Directory Entry	56 (1,7)
	Each Resident SVCLIB Directory Entry	32 (7)
	• Resident EXTRACT	Included
	• Resident Reenterable Load Module (Resident Access Method Option)	Included
	Each Resident Module	24 (2,3,7)
	• Resident SPIE	Included
	• Resident Type 3 and 4 SVC Routines	Included (4)
	Each Resident Module	40 (2,5,8)
	• Resident error recovery procedure	100 (7)
	Each resident module	24 (2,7)
	• Storage Protection	Included
	• Timing Facilities	
	• Job Step Timing	144
	Time	Included
	Interval Timing	Included
	• Trace	508
	Each Entry in Trace Table	32
	• Transient SVC Table	Included
	Each User SVC Routine Added	Included
	• Validity Check	Included
	• Verify DASD Vol. Serial No.	Included (6)
	• On-line-test (ONLNTEST)	644 (9)
	• Patch facility	200
	• Sector Convert Routine	332 (10)

Figure 3b. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MVT (Part 1 of 2)

Notes:

1. If you use the standard list IEABLD00, storage is required for nine entries. The standard list is given in the IBM System/360 Operating System: MVT Guide, GC28-6720.
2. When you select this option, add the sum of all resident modules to the fixed storage requirement. Appendix A contains the names and sizes of the modules that may be resident.
3. If you use the standard list IEAIGG00, 31 modules are loaded with a storage requirement of approximately 8,540 bytes. Appendix A indicates the modules that are in the standard list.
4. If this option is selected, the transient SVC table option must also be selected and the required storage added.
5. If you use the standard list, IEARSV00, 33 modules are loaded. Appendix A indicates the modules that are in the standard list.
6. The NODAV option cancels verification checking. If you use this option the size of fixed main storage required for IOS resident code is decreased by 132 bytes.
7. This requirement is in the link pack area.
8. This requirement is in the system queue area.
9. If you test more than two devices within a single test definition, add 80 bytes for each additional device up to a maximum of 14. If your system has 2880 channels, add 140 bytes.
10. 3330, 2305-1 and 2305-2 devices only.

Figure 3b. Fixed Storage Requirements for Control Program Options Specified in the SUPRVSOR Macro Instruction for MVT (Part 2 of 2)

Description	Storage Requirement (in bytes)	
	Without MCS	With MCS
SER0 on Models 40, 50, 65, 75	262	262
SER1 on Model 40	3,512	3,842
SER1 on Model 50	3,760	4,090
SER1 on Model 65, 67-1 in 65 mode	3,656	3,986
SER1 on Model 75	3,624	3,954
SER1 on Model 91/95	6,696	7,026
SER1 on Model 195	8,634	8,980
MCH on Model 85	8,000	8,000
MCH on Model 65, 67-1 in 65 mode	6,144	6,544
MCH on Model 145	4,900	4,900
MCH on Model 155	5,600	5,600
MCH on Model 165	6,968	6,968
CCH with:		
135 channels	2,580	2,580
145 channels	2,927	2,927
155 channels	2,441	2,441
2860 or 2870 channel	3,489	3,489
2860 and 2870 channels	4,515	4,515
2880 channel	3,841	3,841
2860 and 2880 channels or 2870 and 2880 channels	4,891	4,891
2860, 2870 and 2880 channels	5,917	5,917
APR	420 (1)	420 (1)
DDR	1,650	1,650
DDR with DDR SYSRES	3,150	3,270

Notes:
1. For M65MP, add 150 bytes.

Figure 4b. Fixed Storage Requirements for Recovery Management for MVT

Description	Storage Requirement (in bytes)
Multiplexor or high speed multiplexor channel (5)	60
• Priority queueing	6
• Alternate selector channel	4
Each associated logical channel	6
Selector or Block Multiplexor Channel	
• Each channel (1,6)	50
• Second channel path on each channel	50
• Each additional channel path on each channel	32
• With priority queuing, each channel path on each channel requires additional storage	6
• First channel path with direct access devices on each channel (2)	32
• Each additional path with direct access on each channel	12
• Each channel switch (3)	18
Queuing capability	
• FIFO - first in, first out	0
• Ordered Seek Queuing	262
• Priority	104
Each queued I/O request (4)	16
One or more channels with an address greater than 6	32

Notes:
1. If the number of devices exceeds 240, add 12 bytes for each logical channel.
2. If you select shared DASD, add 8 bytes.
3. IOS routines do not provide for switching devices onto a multiplexor channel.
4. The maximum number of I/O request that can be queued, pending satisfaction by the channels, is specified by your installation at system generation time in the MAXIO parameter of the CTLPROG macro instruction.
5. With M65MP increase the storage requirements for a multiplexor channel by 8 bytes.
6. With M65MP increase the storage requirement for each channel by 4 bytes.

Figure 5b. Fixed Storage Requirements for IOS That Depend on the Channel Configuration for MVT

Description	Storage Requirement (in bytes) (1)
Unit record capability	0
• Any graphic devices	20
• Each unit record device (2)	44
• Each dummy unit provided	44
• Each 1403 printer with UCS feature	80
• Each 3211 printer with UCS feature	88
• Each optical character reader	54
• Each 2495 tape cartridge reader	78
• Each magnetic character reader	48
• Each 3505 card reader or 3525 card punch	44
Graphics capability	476
• Each graphic device	112
• Each 2250, Model 1, with 4K buffer	46
• Each 2250, Model 1, with 8K buffer	62
• Each 2840, with 8K buffer	86
• Each 2840, with 16K buffer	118
• Each 2840, with 32K buffer	182
2400 Series Magnetic tape capability	102
• Any read/write tape adapter units	42
• Any 2400 tape device with FIFO queueing	8
• Any 2400 tape device with priority queueing	8
• Any 3400 tape device	76
• Any 3400 tape device with FIFO queueing	8
• Any 3400 tape device with priority queueing	8
• Each 2400 magnetic tape drive	62(4a)
• Each 3420 magnetic tape drive	120(4b)
• Each 3410 magnetic tape drive	108(4b)
Telecommunications capability	62
• Each telecommunications line group	20
• Each telecommunications line	58

Figure 6b. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MVT (Part 1 of 2)

Description	Storage Requirement (in bytes) (1)
Direct access capability (3)	Included
• Any drum storage devices except 2305 (5)	36
• Any 2305 storage devices (5)	522
with APR	22
with SMF	8
• Any 3330 drvices (5)	32
• Each 2302, 2303, and 2311 without record overflow	142
• Each 2302, 2303 and 2311 with record overflow	182
• Each 2301	182
• Each 2305	1792
• Each address for a 2314	182
• Each address for 3330	232
• Each 2321 without record overflow	290
• Each 2321 with record overflow	330
• Resident error routines	
Basic support (only 2311 devices)	1368
Any number of 2314 devices	28
Any number of 2301 devices	20
Any number of 2302 devices	70
Any number of 2303 devices	12
Any number of 2321 devices	16
Any number of 3330/2305 devices	600
with record overflow	248
with CCH	88
with DDR	30
with SYSRES DDR	16

Notes:

1. With M65MP, increase the storage requirement for each type of I/O device specified by 4 bytes. If shared DASD is specified add 56 bytes to the system.
2. The following rules apply:
   - A console is considered a unit record device.
   - A 2540 card reader-punch counts as two unit record devices.
   - A card reader and printer used as a composite console are counted as two non-console devices.
3. If shared DASD is specified except for drums and 3330, add 1353 bytes.

4a. If you select ESV, add 22 bytes + 16 bytes for each tape drive. If you select EVA, add 22 bytes + 8 bytes for each tape drive. If you select ESV and EVA, add 22 bytes + 16 bytes for each tape drive.
If any 3400 devices present, then only consider the per device figure. The other 22 bytes are included in the 76 bytes shown above for 3400 support.

4b. VES is always included with 3400 support.

5. Shared DASD for drums and 3330's require 128 bytes.

Figure 6b. Fixed Storage Requirements for IOS That Depend on the Type of I/O Devices Selected for MVT (Part 2 of 2)

Description	Storage Requirement (in bytes)
OLTEP	124(1,2)
GTF (Generalized Trace Facility)	56
Logout Pending (3) 2305 present with shared DASD 2305 present without shared DASD Shared DASD only	312 352 344 320

Note:
1. If your channel configuration includes 2880 channels, add an additional 16 bytes.
2. If a 2305 is included add an additional 32 bytes.
3. Only present with CCH and not present with M65MP.

Figure 7b. Fixed Storage Requirements for IOS That Depend on the Type of IBM-Supplied Processing Program Selected

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	48K
Assembler F	QSAM,BPAM, and BSAM	50K
COBOL E American National Standard COBOL	BSAM,BPAM BSAM,BPAM	22K 86K
FORTRAN IV G FORTRAN IV H GSP for FORTRAN IV	QSAM QSAM GAM	100K (3) 160K (4) 71K (6,7)
GJP	BSAM,GAM,BPAM	72K (8)
Linkage Editor F (44K) Linkage Editor F (88K) Linkage Editor F (128K)	BSAM,BPAM BSAM,BPAM BSAM,BPAM	54K 96K 136K
OLTEP	BSAM,BPAM	36K
PL/I F GSP for PL/I F	SAM,BPAM GAM	50K 71K (6,7)
RPG E	BSAM	18K
SGJP	BSAM,BTAM,BPAM	72K (8)
Sort/merge	QSAM	18K (5)

Figure 8b. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MVT (Part 1 of 2)

Notes:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output is also used, then the minimum main storage requirement is increased by the value of the expression [2*(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.
5. This estimate is for sort/merge with no linkage editor or direct access devices; if a linkage editor is used, the minimum dynamic requirement is the requirement for the linkage editor selected. In addition, conditions such as physical record length greater than 400 bytes, large numbers of intermediate storage data sets, or extracted control fields require additional main storage.
6. This estimate assumes that the modules are loaded with the LOAD macro instruction. Appendix A contains a list of the modules and their dynamic storage requirements.
7. The region size required for MVT includes storage for one graphic device with four graphic data sets. To determine the storage necessary for additional graphic devices and graphic data sets, see Appendix A.
8. This estimate includes a constant storage requirement of 12,000 bytes and one active partition or region of 60,000 bytes actually performing job control operations (GJP or SGJP). There is no 60,000 byte requirement during execution of a problem program initiated by GJP or SGJP at the display terminal. The 60,000 byte requirement is the minimum size region that may be specified with a reader/interpreter size requirement of 48,000 bytes.
9. Access method modules IGG019EK, IGG019FN, IGG019FP, and IGG019C4 must be resident if your system includes 2305 or 3330 devices.

Figure 8b. Minimum Dynamic Storage Requirement for IBM-Supplied Processing Programs for MVT (Part 2 of 2)

Utility Programm	Storage Requirements (in bytes)) (1)
• System utilities:	
IEHATLAS	14K + R + 16(T)
IEHDASDR	(2)
IEHINITT	14K
IEHLIST	18K
IEHMOVE	16K + B
IEHPROGM	14K
IFHSTATR	2K
IEHIOSUP	11K
• Data set utilities	
IEBCOMPR	18K + 2B + 2L + E
IEBCOPY	27K + M + N + P
IEBTCRIN	12K + A + R + E
IEBDG	(4)
IEBEDIT	14K
IEBGENER	14K + 4B + 2L + E + F
IEBISAM	8K + R
IEBPTPCH	16K + 4B + E + F
IEBUPDAT	12K + 2B
IEBUPDTE	22K + 4B + 2L + E
• Service Aids	
IFCEREP0 (Models 40, 50, 65, 75, 85, 91, 135, 145, 155, 165, 195)	36K
IFCDIP00	2K
IMASPZAP	13K+S
IMAPTFLE	
Generate Function	46K
Application Function	
44K Linkage Editor	68K
88K Linkage Editor	109K
128K Linkage Editor	149K
IMBLIST	38K
IMBMDMAP	36K
IMDPRDMP	64K
IMCOSJQD	20K
GTF	(5)

Figure 9b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MVT (Part 1 of 3)

Where: A = 2 times the BUFL on SYSUT1
B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, use R instead of B in the formula.

R = The maximum logical record length, rounded to the next highest multiple of 1K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = The sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

M = 1K minimum and is the sum of:

1. the maximum number of input data sets referenced in any COPY step multiplied by 10,

2. the maximum number of membernames, including newnames, multiplied by 10 - this number is added only when SELECT or EXCLUDE is used,

3. the maximum number of newnames referenced in any COPY step multiplied by 4, add 4 to the number,

4. the maximum number of input members referenced in the largest input data set specified in any COPY step multiplied by 10 - this number should be added when EXCLUDE or "Full Copy" is used and 80 bytes should be added to the total.

N = the sum of:
1. the number of directory blocks allocated to the largest output directory used in the job step multiplied by 276,

2. the maximum number of input members to be copied from any one input data set referenced in the job step multiplied by 10.

* The storage required for N is only necessary for optimal performance.

P = 2K minimum and is twice the maximum input or output blocksize rounded up to the next multiple of 2K. If you are performing a compress-in-place operation, B = the maximum track capacity of the device being used rounded up to the next multiple of 2K. If you allow the minimum 2K for P, the maximum input or output blocksize can be only 700 bytes.

S = the larger of 3K or the BLKSIZE for the data set specified on the SYSLIB DD statement.

T = maximum number of records per track.

Figure 9b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs and Service Aids for MVT (Part 2 of 3)

Notes:

1. If you are planning to specify the SYSUTILS macro instruction during system generation, use Figure 13b to determine what size to specify.
2. To determine the minimum dynamic storage requirements for the IEHDASDR system utility program, use Figures 10b and 11b.
3. When using the compress facility, the minimum dynamic storage requirement is 28K + T for MVT.
   Where: T = the maximum track capacity of the device being used + $\frac{\text{maximum track capacity} \cdot 6}{100}$ + 1,000.
4. To determine the minimum dynamic storage requirements for the IEBDG data set utility program, use Figure 12b.
5. To determine the dynamic storage requirements for GTF, refer to the section 'MFT, MVT, and M65MP Dynamic Main Storage Requirements'.

Figure 9b. Minimum Dynamic Storage Requirements for IBM-Supplied Utility Programs and Service Aids for MVT (Part 3 of 3)

Function	Storage Requirement (in bytes) (1)
ANALYZE/FORMAT(3)	20K + (N•B)
ANALYZE(3,4)	20K + (N•B)
DUMP(5)	20K + (N•B)
GETALT	12K
LABEL	12K
RESTORE	16K + X

Where: B = a buffer/workarea size determined by the function performed and the device type being used. Figure 11b contains the computed size, rounded to the next highest multiple of 2K.
M = the number of copies to be made.
N = the number of operations to be performed, with a minimum of 1 and a maximum of 6. If enough storage is provided, multiple operations will be performed concurrently. For information on performing multiple functions concurrently, refer to the publication IBM System/360 Operating System: Utilities, GC28-6586.
X = a buffer/workarea size required to perform one or more RESTORE operations, and is computed as 2B • (N-1) + B. The computed size provides enough storage to perform multiple RESTORE operations concurrently.

Notes:
1. If the QSAM access method is not resident, add 2,000 bytes to the minimum requirement.
2. The minimum dynamic storage requirement for job steps performing multiple functions is the region size of the function that has the largest region size requirement.
3. If the IPL test is required and is supplied via the input stream, add 3,640 bytes.
4. Use this formula only when ANALYZE is to be performed on an IBM 2321 Data Cell.
5. If a permanent data check or missing address marker is encountered during a dump to SYSOUT, an additional 1000 bytes is required to recover and print the defective track.

Figure 10b. Minimum Dynamic Storage Requirements for IEHDASDR System Utility Program for MVT

Function	Device Type							
	2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	3330 Disk	2305 Drum
ANALYZE/FORMAT	22,528	6,144	6,144	6,144	8,192	4096	14,336	16,384
DUMP	26,624	10,240	8,192	8,192	10,240	6,144	18,432	18,432
RESTORE	24,576	8,192	8,192	6,144	12,288	4,096	16,384	18,432

Figure 11b. IEHDASDR Buffer/Workarea Size

```
IEBDG = 12,000 + A + B + C + D + E + F + G(280)

Where: A = 520 • (H/8)
         Where:  H = the number of FD statements.  If H is less than
                     or equal to 8, then A=520.  The value for A
                     must be a multiple of 520.
       B = 512 • (I/18)
         Where:  I = the number of CREATE statements.  If I is less
                     than or equal to 18, then B=512.  The value for
                     B must be a multiple of 512.
       C = the sum of all field lengths on all FD statements.  Each
           length must be rounded to the next highest multiple of 8.
           Use one of the following to calculate the value to be
           used for a particular FD statement, if any of the
           conditions apply:
           • If ripple action and a format of AN, AI, or CO are
             specified on an FD statement, use the following formula
             to calculate the field length:
               L = FL + FR
               Where:  L = the value to be used for this FD
                           statement when determining the value for
                           C.
                       FL = the length of the defined field specified
                           on the FD statement.
                       FR = 36 for AN, 26 for AL, or 63 for CO.  (If
                           FL is larger than FR, then L=FL.)

           • If ripple or wave action and PICTURE are specified, the
             value to be used for this FD statement is:
                       2 • picture length

           • If roll action and PICTURE are specified, the value to
             be used for this FD statement is:
                       3 • picture length

       D = S + (6•N)
         Where:  S = the sum of all picture lengths on all CREATE
                     statements.  Each length must be rounded to the
                     next highest multiple of 8.
                 N = the number of pictures.
       E = U + 72(N/8)
         Where:  U = the dynamic storage requirements for all user
                     exit routines.
                 N = the number of user exit routines.
           • The value for E must be a multiple of 8.
       F = the logical record length of the output and input data
           set.  If RECFM=U, then F=blocksize.  The value for F must
           be a multiple of 8.
       G = the number of user-specified input and output data sets.
           The value for G must be a multiple of 8.
• For MVT, add a round-up factor to make the dynamic storage
  requirement for IEBDG a multiple of 2K.
```

Figure 12b. Minimum Dynamic Storage Requirements for IEBDG Data Set Utility Program for MVT

Utility Program	Storage Requirement (in bytes) (1)
• System utilities:	
IEHDASDR	N/A (2)
IEHINITT	N/A (2)
IEHLIST	32K
IEHMOVE	22K + B (3)
IEHPROGM	24K
IFHSTATR	2K
IEHIOSUP	11K
• Data set utilities:	
IEBCOMPR	24K + 2B + 2L + E
IEBCOPY	(See Figure 8b.)
IEBTCRIN	N/A (2)
IEBDG	N/A (2)
IEBEDIT	N/A (2)
IEBGENER	24K + 4B + 2L + E + F
IEBISAM	N/A (2)
IEBPTPCH	24K + 4B + E
IEBUPDAT	24K + 2B
IEBUPDTE	24K + 4B + 2L + E

Where: B = the largest blocksize in the job step, rounded to the next highest multiple of 2K. If the format specified for the data set is VS and LRECL is less than 32K, then B = the maximum logical record length, rounded to the next highest multiple of 2K.

L = 2,048 if user header and trailer labels are to be processed; otherwise, L=0.

E = the sum of the sizes of all the user exit routines. Round the size of each routine to the next highest multiple of 2K and then add.

F = 2,048 for each group of MAX parameters that are less than or equal to 200 bytes.

Notes:

1. If you specify a size smaller than 23,000 in the SYSUTILS macro instruction, all of the utility programs operate in the storage shown in Figure 9b. If the size you specify is larger than the minimum storage requirement for a particular utility program, that program will be taken out of overlay structure. In order for all of the affected programs to be taken out of overlay structure, the largest minimum storage requirement must be specified.
2. This utility program is not affected by the size specified in the SYSUTILS macro instruction. It operates in the storage shown in Figure 9b.
3. The IEHMOVE utility program is not in overlay structure. If the size you specify is equal to or greater than 21,534, successive loading of IEHMOVE modules takes place at execution time.

Figure 13b. Minimum Dynamic Storage Requirement for IBM-Supplied Utility Programs When the SYSUTILS Macro Instruction is Specified for MVT

Supervisor Service	Storage Requirement (in bytes)
OPEN	
Minimum = 544 + 500 (n-1)* + X	
Where: X=B+C+D+E+F+G+H+K+L+M+	
the largest of: {A / J}	
a. Security protection	224
b. Each Format 3 Data set control block for BSAM or QSAM	144
C. Each additional Format 1 data set control block for BPAM (concatenated data sets only)	176
D. Each Format 3 data set control block for BPAM (concatenated data sets only)	144
E. Each additional Format 1 data set control block for ISAM and/or BDAM	104
F. Each Format 3 data set control block for ISAM and/or BDAM	144
G. Each ISAM data set	144
H. Each 1403 printer with UCS feature	272
J. Each data set with User label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
K. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
L. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400
M. Each 3211 printer with UCS feature	570
CLOSE	
Minimum = 544 + 500 (n-1)* + X	
where: X=E+H+J+ the largest of: { A / B+C+G / D / F }	
A. With RLSE	564
B. With EOV (QSAM only)	544
C. With EXTEND (with EOV, QSAM only)	304
DOS EXTEND	744
D. With Systems Management Facility	264
• Each additional UCB (count each use of a UCB for each of ISAM prime, index, and overflow areas as an additional UCB)	24
• ISAM	28
E. Each data set with deferred input user label processing	56
F. Each data set with User Label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
G. With security protection (with EOV only)	224
H. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
J. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400

Figure 14b. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MFT (Part 1 of 2)

Supervisor Services	Storage Requirement (in bytes)
EOV Minimum = 544 + X Where: X = A+F+G+ the largest of: (B, C, D, E)	
A. With FEOV (i.e., FEOV with EOV)	544
B. Security protection	224
C. With EXTEND	304
• for DOS EXTEND add	744
D. With user label processing specified (i.e., LABEL=(,SUL) is coded on the DD statement)	168
E. With System Management Facility	
• base amount	264
• each additional UCB (count each use of a UCB for each of ISAM prime, index and overflow areas as an additional UCB)	24
• ISAM	28
F. ABEND Interpretation and Recovery (any ABEND situation encountered)	128
G. Optional Trace specified (i.e., DCB=DIAGNS=TRACE is coded on the DD statement)	400

Notes

An additional 1024 bytes of dynamic storage should be added to the totals obtained from Figures 14b and 15b. This additional storage is used by the system to process supervisor services and interrupts that may occur during execution. If this storage is not provided, the job step may terminate due to insufficient storage.

*n = the total number of data sets that are opened or closed in parallel; i.e., with the same OPEN or close macro instruction.

Figure 14b. Dynamic Storage Requirement for OPEN/CLOSE/EOV for MFT (Part 2 of 2)

When user label processing is specified (i.e., LABEL=(,SUL) is coded on the DD statement), an additional 168 bytes of dynamic storage are required.

Supervisor Service	Storage Requirement (in bytes)	Sub-pool	Duration of Requirement
ABEND	968	252	Temporary
ATTACH			
•With ETXR	144 (1)	0	Released when task is terminated
•Without ETXR	72 (1)	0	Released when task is terminated
BLDL	456	252	Temporary
BUILD	1,536	252	Temporary
	+ 104	252	Released when storage is needed to satisfy a GETMAIN
CALL (overlay)	1,440	252	Temporary
CATALOG (8)	916	252	Temporary
	816	253	Temporary
DEQ	100 (7)	0	Temporary
FIND	456	252	Temporary
INDEX	916	252	Temporary
	816	253	Temporary
GETPOOL	1,536	252	Temporary
	+ 176	252	Released after buffers are obtained if storage is needed to satisfy a GETMAIN request
	+ buffers (2)	0	Released by FREEPOOL
IMGLIB	448	252	Temporary
LINK,LOAD,XCTL	1,536	252	Temporary
	+ module (3)	251 or 252	Released according to attributes
•Module in overlay mode	+ 1,536	252	Temporary
	+ 992 (4)	252	Released when job step is terminated

Figure 15b. Dynamic Storage Requirement for Supervisor Services in MVT (Part 1 of 2)

Supervisor Service	Storage Requirement (in bytes)	Sub-pool	Duration of Requirement
LOCATE	404 416	252 253	Temporary Temporary
SEGLD	1,560	252	Temporary
SEGWT (if no SEGLD)	1,560	252	Temporary
SETPRT	736	252	Temporary
SPIE (if first for task)	32	0	Released when task is terminated
STIMER (with exit routine)	72	0	Released when exit routine completes
STOW	1,592	252	Temporary

Notes:
1. The appropriate LINK requirements must also be added.
2. The buffer requirement is equal to the length of a buffer multiplied by the number of buffers and rounded up to the next highest multiple of eight.
3. If the module is in storage and is reusable, this amount is not needed. The remainder of the requirements for LINK, LOAD, and XCTL are added if the conditions apply.
4. This amount is for the asynchronous overlay supervisor module and is required only if the module is not already in storage.
5. This amount is for BSAM modules and is required only if the modules are not already in storage.
6. This storage is required only when the shared DASD option has been selected and a DEQ macro instruction is issued to release a device that has been reserved.
7. Requirements for the CATALOG macro are the same for the subfunctions CAT, CATBX, UNCAT, UCATDX, and RECAT. 400 of the 816 bytes are required only if the catalog data set must be extended.

Figure 15b. Dynamic Storage Requirement for Supervisor Services in MVT (Part 2 of 2)

Command	Dynamic Storage Requirement (in bytes)
EDIT	14K + A + B + C + D + F
OUTPUT	3K + B1 + BSIZE + D + 44N + PRINT1
TEST	10K + B2 + D + E + PRINT2 + 24Q + R + S + T + U
LISTBC	3K + B3 + D5
SEND	4K + B4 + D5
ACCOUNT	1.5K + B5 + E + Subcommand Requirement Where: the subcommand requirement is the additional storage required for ACCOUNT when subcommands are processing and is equal to: For ADD 4K + B6 + D1 For LIST 4K + B7 + D1 For DELETE 6K + B8 + D1 For CHANGE 4K + B9 + D1
OPERATOR	1K + B10 + E + H
WHEN	2K + B11 + D6
SUBMIT	6K + B12 + D + BSIZE1 + 76V
CANCEL/STATUS	2K + B13 + D6
HELP	2K + BSIZEHELP + B14 + D4
RUN	1K + B15 + D
CALL	1K + B16 + D
FREE	1K + B17 + D
ATTRIB	1K + D2 + B25
ALLOCATE	1K + B18 + D
EXEC	27K + D3
LINK	B19
LOADGO	The greater of: 11K + size of user program + LD or 1.8K + D2 + B20
LOGON/LOGOFF	2K + B21 + D
PROFILE	2K + B22 + D
TERMINAL	2K + B23 + D
TIME	2K + B24 + D

Figure 16b. Dynamic Storage Requirements for the TSO Command Processors (Part 1 of 4)

Where: A = additional dynamic storage required if the commands HELP and RUN are run under EDIT.

B = 13.5K maximum, or the size of EDIT modules from Appendix B that are not resident in the time sharing link pack area.

BSIZE = the blocksize of the largest data set retrieved by OUTPUT and the combined size of all non-resident BSAM read modules from Appendix A.

BSIZE1 = the blocksize of the largest blocked data set specified in the SUBMIT command.

BSIZEHELP = the blocksize of the HELP data set.

C = 6.5K maximum, or the maximum size of any one of the EDIT subcommands from Appendix B that are not resident in the time sharing link pack area.

D = 12K maximum, or the maximum size of any one of the service routines: PARSE, DAIR, and SCAN that are not resident in the time sharing link pack area. Figure 17b contains the dynamic storage requirements for the TSO service routines.

D1 = 12K maximum if the subcommand is using the PARSE service routine and PARSE is not resident in the time sharing link pack area. If PARSE is resident, D1 = 2K + the size of a user entry in the user attribute data set.

D2 = the storage required for PARSE + DAIR service routines (if non-resident in the TSO link pack area).

D3 = the storage required for the largest of any one of the following:
- STACK service routine (if non-resident in TSO link pack area).
- DAIR service routine (if non-resident in TSO link pack area).
- PARSE
- All BPAM/BSAM access method modules from Appendix A that are not resident in main storage.

D4 = the storage required for the largest of any one of the following:
- PARSE service routine (if non-resident in TSO link pack area).
- DAIR service routine (if non-resident in TSO link pack area).

D5 = the storage required for the largest of any one of the following:
- PARSE
- DAIR service routine (if non-resident in TSO link pack area).
- all BDAM access method modules from Appendix A that are non-resident in main storage.

Figure 16b. Dynamic Storage Requirements for the TSO Command Prcessors (Part 2 of 4)

D6 = The PARSE routine (if not resident in the time sharing link pack area).

E = 1.5K maximum, or the size of the TSO service routine SCAN, if SCAN is not resident in the time sharing link pack area.

F = 10K if the RENUM subcommand is run under EDIT.

H = the additional dynamic storage required to run the HELP command.

LD = 16K maximum, or the size of the Loader modules (from Appendix A) that are not resident in the link pack area.

N = the number of jobs in the job list.

PRINT2 = the storage required for all non-resident QSAM access methods + the storage required for buffers (the default blocksize is equal to 1629), + 148 bytes for a DCB + 50 bytes for each print data set used. Two buffers will be obtained.

PRINT1 = the largest block size of a PRINT data set written in by OUTPUT + the size of all non-resident QSAM PUT modules.

Q = each symbol created with an EQUATE command.
R = 48 bytes for each active breakpoint.
S = 900 bytes + 6.4K if module IKJEGSYM is not in the time sharing link pack area.
T = 36 bytes for each module in storage that was link edited with the TEST attribute and 36 bytes for each module that was run under TEST
U = 16 bytes for each symbolic address used with a test subcommand.
V = the number of data sets specified.

B1 = 12K maximum, or the size of the OUTPUT modules from Appendix B that are not resident in the time sharing link pack area.

B2 = 28K maximum, or the size of the TEST modules from Appendix B that are not resident in the time sharing link pack area.

B3 = 6K maximum, or the size of the LISTBC modules from Appendix B that are not resident in the time sharing link pack area.

B4 = 11K maximum, or the size of the SEND modules from Appendix B that are not resident in the time sharing link pack area.

B5 = 6K maximum, or the size of the ACCOUNT modules from Appendix B that are not resident in the time sharing link pack area.

B6 = 20K maximum, or the size of the ADD modules from Appendix B that are not resident in the time sharing link pack area.

Figure 16b. Dynamic Storage Requirements for the TSO Command Processors (Part 3 of 4)

B7 = 12K maximum, or the size of the LIST modules from Appendix B that are not resident in the time sharing link pack area.

B8 = 15K maximum, or the size of the DELETE modules from Appendix B that are not resident in the time sharing link pack area.

B9 = 22K maximum, or the size of the CHANGE modules from Appendix B that are not resident in the time sharing link pack area.

B10 = 6K maximum, or the size of the OPERATOR modules from Appendix B that are not resident in the time sharing link pack area.

B11 = 2K maximum, or the size of the WHEN modules from Appendix B that are not resident in the time sharing link pack area.

B12 = 19K maximum, or the size of the SUBMIT modules from Appendix B that are not resident in the time sharing link pack area.

B13 = 8K maximum, or the size of the CANCEL/STATUS modules from Appendix B that are not resident in the time sharing link pack area.

B14 = 12K maximum, or the size of the HELP modules from Appendix B that are not resident in the time sharing link pack area.

B15 = 5K maximum, or the size of the RUN modules from Appendix B that are not resident in the time sharing link pack area.

B16 = 3.2K maximum, or the size of the CALL modules from Appendix B that are not resident in the time sharing link pack area.

B17 = 2.5K maximum, or the size of the FREE modules from Appendix B that are not resident in the time sharing link pack area.

B18 = 8K maximum, or the size of the ALLOCATE modules from Appendix B that are not resident in the time sharing link pack area.

B19 = the size required for program IEWL (i.e., the size required for the 44K, 88K, or 128K Linkage Editor.)

B20 = 12K maximum, or the size of the LINK/LOADGO modules from Appendix B that are not in the time sharing link pack area.

B21 = 184 bytes maximum, or 0 if module IKJEFL00 is resident in the time sharing link pack area.

B22 = 2K maximum, or the size of the PROFILE modules from Appendix B that are not resident in the time sharing link pack area.

B23 = 2.5K maximum, or the size of the TERMINAL modules from Appendix B that are not resident in the time sharing link pack area.

B24 = 736 bytes, or 0 if module IKJEFT25 is in the time sharing link pack area.

B25 = 4K maximum, or 0 if module ATTRIB is resident in the time sharing link pack area.

Figure 16b. Dynamic Storage Requirements for the TSO Command Processors (Part 4 of 4)

Service Routine(1)	Dynamic Storage Requirement in bytes
PARSE	12K
PARSE2	8K
SCAN	1.5K
DAIR	12K
DEFAULT	4K
CIR	1K

Notes:
1. The TSO service routines can be made resident in the time sharing link pack area. See Appendix B for a list of the module names and sizes.

Figure 17b. Dynamic Storage Requirements for TSO Service Routines

Processing Program	Access Method Used	Storage Requirement (in bytes)
ALGOL	BSAM,QSAM	48K
Assembler F	QSAM,BPAM, and BSAM	50K
American National Standard COBOL	BSAM,BPAM	86K
FORTRAN IV E	BSAM	42K (1,2)
FORTRAN IV G	QSAM	100K (3)
FORTRAN IV H	QSAM	160K (4)
FORTRAN Syntax Checker	GAM	21K
Linkage Editor F (44K)	BSAM,BPAM	54K
Linkage Editor F (88K)	BSAM,BPAM	96K
Linkage Editor F (128K)	BSAM,BPAM	136K
PL/I F	SAM,BPAM	50K
PL/1 Syntax Checker (16K)	N/A	17K
PL/1 Syntax Checker (20K)	NA	21K
PL/1 Syntax Checker (27K)	NA	28K

Notes:

1. This estimate includes enough work space to process approximately 170 cards. More storage may be required by larger source programs.
2. If the PRFRM option is used, then the minimum main storage requirement is 19,456 bytes. If blocked input or output are also used, then the minimum main storage requirement is increased by the value of the expression [2*(BLKSIZE)] for each data set that contains blocked records.
3. This estimate includes sufficient work space to process approximately 400 cards. More storage may be required by larger source programs.
4. This estimate includes sufficient work space to process approximately 200-300 cards with a blocking factor of five for the SYSPRINT and SYSLIN data sets. More storage may be required by larger source programs; add 18,432 for each additional 100 cards.

Figure 18b. Minimum Dynamic Storage Requirements for Language Processors That Can be Used With TSO

Utility	Dynamic Storage Requirements (in bytes)
LISTDS	7K + A + DF + P + 2048(N) + 2048(Q) + D
LISTALC	7K + A1 + P + 2048(N) + 2048(Q)
LISTCAT	8K + A2 + P + 280(R) + 2048(N) + 2048(Q) + D + CIR
PROTECT	2K + A3 + P + DF
DELETE	3K + A4 + D + CIR + P + DF
RENAME	4K + A5 + D + CIR + P + DF

Where:

A = 8K maximum, or the size of the LISTDS modules from Appendix B that are not resident in the time sharing link pack area.

A1 = 5K maximum, or the size of the LISTALC modules from Appendix B that are not resident in the time sharing link pack area.

A2 = 8K maximum, or the size of the LISTCAT modules from Appendix B that are not resident in the time sharing link pack area.

A3 = 5K maximum, or the size of the PROTECT module from Appendix B if it is not resident in the time sharing link pack area.

A4 = 7K maximum, or the size of the DELETE module from Appendix B, if it is not resident in the time sharing link pack area.

A5 = 9K maximum, or the size of the RENAME module from Appendix B, if it is not resident in the time sharing link pack area.

CIR = the size of the catalog information service routine from Figure 17b.; if this routine is resident in the time sharing link pack area, CIR = 0.

D = the size of the DAIR service routine from Figure 17b; if this routine is resident in the time sharing link pack area, D = 0.

DF = the size of the DEFAULT service routine from Figure 17b; if this routine is resident in the time sharing link pack area, DF = 0.

R = the number of levels of data set name qualifiers minus four.

Q = 1 for each set of 127 aliases in excess of the first 5.

P = the size of the PARSE service routine from Figure 17b; If PARSE is resident in the time sharing link pack area, P = 0.

N = 1 for each set of 184 data set names processed in excess of the first 184 data set names processed.

Figure 19b. Dynamic Storage Requirements for the TSO Utility Programs

Function	Storage Requirement (in bytes)
TSO Trace Writer	8K + N(BLKSIZE + 36) + (NxI) + Y
TSO Trace Writer with Chained Scheduling	8K + N(BLKSIZE + 36) + I1 + N(I2) + Y
TSO Trace Data Set Processor	18K + A(B + C) + D(E + F) + Y

Where: N = the maximum number of buffers to be used for trace data. (This is determined by the amount of core you provide.) If NCP is specified, N=NCP.

BLKSIZE = the maximum size of the trace data buffers.

I = the size of the IOB for each buffer.

A = the number of buffers for the input data set. (usually two)

B = the size of the input data set buffers.

C = the size of the IOB for each input data set buffer.

D = the number of buffers for the output data set.

E = the size of the output data set buffers.

F = the size of the IOB for each output data set buffer.

I1 = the size of the IOB.

I2 = the size of the ICB for each buffer. (See IBM OS/360 Operating System, System Control Blocks, GC28-6628) .

Y = the access method requirement. For the trace writer, Y=0 if all BSAM modules are resident: otherwise [Y = 2K]. For the trace data set processor, Y=0 if all QSAM modules are resident: otherwise Y=2K.

Figure 20b. Minimum Dynamic Storage Requirements for the TSO Trace Writer and the TSO Trace Data Set Processor

Dynamic Storage Requirements Contents

MFT, MVT and M65 -- Dynamic Main Storage Requirements

GRAPHIC PROGRAMMING SUPPORT REQUIREMENT

The graphic programming support routines require dynamic storage. These routines are problem oriented routines (PORs) for the IBM 2250 Display Unit. Only one copy of a routine is required in main storage, regardless of how often the routine is used. With MVT, these routines may be placed in the link pack area. Figure 7 contains the dynamic storage requirement for the problem oriented routines.

Problem Oriented Routine	Storage Requirement (in bytes)
GARC - Circular Arc	2,408
GCGRID - Cartesian Grid	1,368
GCPRNT - Graphic Character Print	1,160
GLABEL - Grid Labeling	1,968
GPGRID - Polar Grid	4,040
GPGVRD - Polar Grid with Vectors	3,548
GSDPLT - Graphic Data Plotting	4,096
GSPLOT - Scale and Plot	3,352
GSTOR - Store Graphic Orders	248
GSVPLT - Scale and Plot with Vectors	2,808
GVARC - Circular Arc with Vectors	2,896
PENTRK - Light Pen Tracking	1,000
Note: If the off-screen, off-grid option is used with problem oriented routines, add 800 bytes for the GOFFSAG module.	

Figure 7. Minimum Dynamic Storage Requirements for Problem Oriented Routines for the IBM 2250 Display Unit

OVERLAY SUPERVISOR REQUIREMENT

If a load module used in a job step is in overlay mode, the amount of storage required by the job step is increased by the size of an overlay supervisor module. Three overlay supervisor modules are furnished with the system:

- Basic module (synchronous overlay without check)
- Advanced module (synchronous overlay with check)
- Asynchronous module

The basic module does not test whether a request for overlay is valid; the other two do. Neither the basic nor advanced modules permit overlay through the SEGLD macro instruction; the asynchronous module does. (The SEGLD macro instruction, however, can be used because it is ignored without causing an error when either the basic or advanced module is used.)

The basic or advanced module may be used with MFT; the asynchronous module may be used with MVT. Figure 8 contains the dynamic storage requirement for each module.

Overlay Supervisor	Storage Requirement (in bytes)
Basic module	436
Advanced module	512
Asynchronous module (MVT only)	992

Figure 8. Dynamic Storage Required by the Overlay Supervisor Modules

An overlay supervisor operates through the use of tables. The linkage editor generates these tables and incorporates them in the overlay program. Because the tables are part of the overlay program, their size must be considered in planning the availability of main storage for processing programs.

Two kinds of tables are created in overlay load modules by the linkage editor:

- A segment table (SEGTAB)
- Entry tables (ENTABs)

The segment table is a control section at the beginning of the root segment of the overlay program. Each segment of an overlay program, including the root segment, may contain one entry table. An ENTAB contains an entry for each symbol referred to by a V-type address constant except when:

- The symbol is defined in a segment in the path of the segment containing the address constant, or
- An ENTAB entry for the symbol exists in a segment in the path of the segment containing the address constant.

In addition to the main storage allocated to the SEGTABs and ENTABs, main storage for a NOTE list is required to execute a program in overlay. Figure 9 contains these storage requirements.

Description	Storage Requirement (in bytes)
Segment Table (SEGTAB)	4N + 24
Each entry table (ENTAB)	12(M+1)
NOTE list	4N + 8
Where: N = the number of segments in program. M = the number of entries in ENTAB.	

Figure 9. Dynamic Main Storage for Overlay Supervisor Tables and Lists

GTF STORAGE REQUIREMENTS

GTFs region requirements vary according to the GTF options that you specify.

If you have requested MODE=INT, you must specify a minimum regions size of 16K bytes of main storage. This minimum will provide you with four 1024-byte buffers. If you need more buffers, you must specify 1K of additional storage for each buffer. If you use the GTFSNP cataloged procedure, or if you use an installation-defined procedure that contains a SNAPDUMP DD statement, you must add 4K to the minimum region size.

If you have requested MODE=EXT, use the following formula to compute your region requirements. Note that all intermediate values must be

rounded up to the nearest 2K multiple. The final region size that you calculate must also be rounded up to the nearest 2K multiple. The final value must not be less than 26K.

region = 16K + n(b+8) + 88(n) + m + a

Where: n = number of trace buffers, usually two unless you have specified more in the START command.

b = the size of the trace buffers, ordinarily 3500 bytes unless you have specified a different value in the START command. Add 8 to this value, to account for the GTF buffer prefix, and round up to the next 2K multiple before multiplying by the number of buffers.

m = total main storage required to process GTF options requested. In some cases, several GTF options are contained within one module. Even if you request two or more GTF functions that are contained in the same module, you only need to provide enough space for one copy of the module. Refer to Figure 10 for a summary of GTF options, the modules that contain them, and the amount of main storage required for each module.
To calculate m, add together the storage requirements for each module that you will need. For example, if you specify EXT, SVC, and USR:

m = 2K + 8K + 0.5K
m = 10.5K

a = the amount of main storage required for ABEND or SNAP processing. If you have requested either ABEND or SNAP, or both, when starting GTF, this value is 4K. If you have not requested ABEND or SNAP, this value is zero.

GTF OPTIONS SELECTED	MODULES REQUIRED	MAIN STORAGE REQUIRED
SYSM	A	1K
DSP EXT PI PI=	B	2K
IO IO= SIO SIO=	C	1K
SVC SVC=	D	8K
SYS SYSP	B,C,D	11K
USR	E	0.5K
IOP SIOP SVCP PIP	F	1K

Figure 10. Main Storage Requirements for GTF Options, by Module

PC1, SSM, TRC, and DSP (when specified with SYSM) can be considered to require 0 (zero K) bytes of main storage.

1130/360 DATA TRANSMISSION PROGRAM

The 1130/360 Data Transmission program allows the FORTRAN programmer to transmit data between an IBM 1130 Disk Monitor System and an IBM System/360 Operating System. This program can be used in any configuration with binary synchronous communication.

Figure 11 contains the formula to be used to determine the minimum dynamic storage requirement for the 1130/360 Data Transmission program.

```
S = 1,048 + A + B + C + D + buffers

Where:  A = is the maximum dynamic storage required to execute the
            user's program, rounded up to the next highest multiple
            of 2K.
        B = is the sum of the sizes of the conversion routines
            required by the user's application.  The storage
            required by each conversion routine is:
            • Converts extended precision numbers = 1,136
            • Converts standard precision numbers = 1,144
            • Converts integer numbers or some alphameric data =
              1,288
        C = 952 • N
            Where:  N = is the number of 1130 Disk Monitor Systems to
                        be supported simultaneously by the user's
                        application program.
        D = is the dynamic storage required by the following
            modules:
            • IKDGTIRB, IKRDWRT, IKDGTCLT, IKDGTNIT, IKDGTEND
            • Required BTAM modules
            If any of these modules are made resident, decrease the
            value for D accordingly.
        buffers = is the sum of the largest input record plus the
                  largest output record plus 32.
```

Figure 11. Minimum Dynamic Storage Requirement for 1130/360 Data Transmission Program

DYNAMIC STORAGE REQUIREMENTS FOR THE FLOATING POINT EXTENDED PRECISION SIMULATOR

If you use the floating point precision simulator, additional storage is required in the dynamic area. The additional storage required is either:

3300 bytes if your hardware does not have the extended precision feature,

or

1450 bytes if your hardware has the extended precision feature.

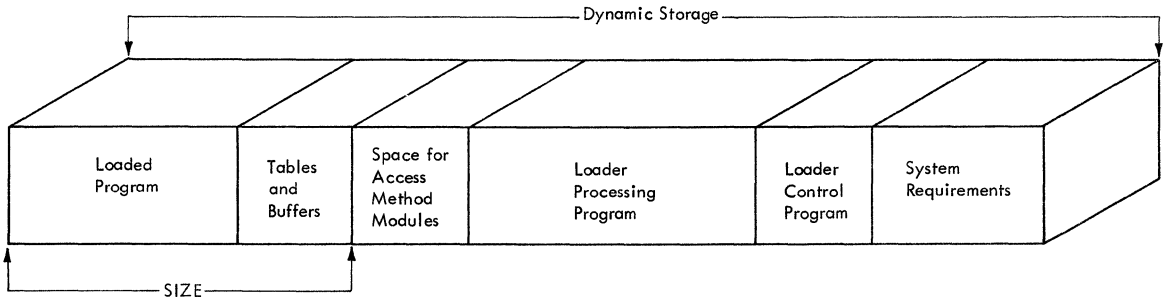
DYNAMIC STORAGE REQUIREMENTS FOR THE LOADER

The amount of dynamic main storage required for the loader depends on the following:

- The size of the loader modules and whether or not they are resident in fixed main storage.
- Data Management Access Methods that are used by the loader.
- The size of the tables and buffers used by the loader.
- The size of the program being loaded.
- The control program (MFT, or MVT).

The maximum amount of dynamic main storage that the loader can obtain for its own tables and buffers, and the loaded program is specified by the SIZE parameter. Figure 12 shows how storage is allocated for the loader in a system with the loader modules resident (A) and in a system where the loader modules are not resident (B).

A. With Loader Modules Not Resident in Fixed Main Storage



B. With Loader Modules Resident in Fixed Main Storage (MFT, MVT)

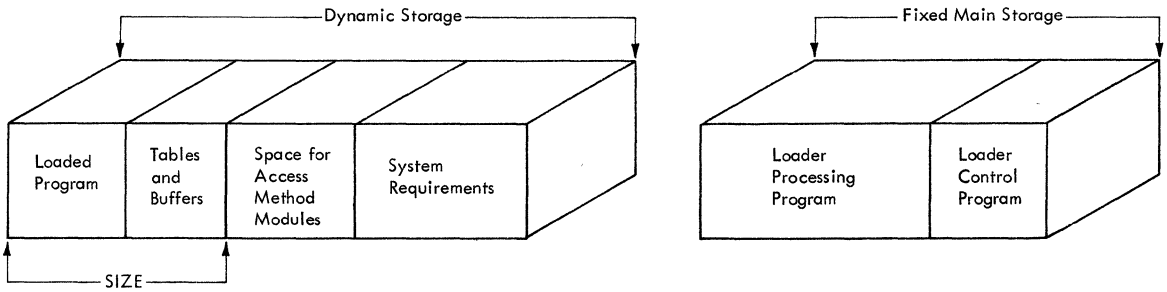


Figure 12. Dynamic Main Storage Required by Loader

The loader will always reserve 4000 bytes of dynamic storage for the access method modules even if they are resident. The amount of storage required by the loader for its tables and buffers is variable and depends on the program being loaded and the processor used: 2K is the minimum required, but PL/1 requires a minimum of 8K and FORTRAN requires a minimum of 3K. Figure 13 shows the storage requirements for the loader.

Control Program	Storage Required (in bytes)					
	Loader Modules		Access Method Modules	Tables and buffers	System Requirements	Loaded Program
	Control	Processing				
MFT	440 (2)	13,350 (2)	4000	3000 (1)	1600	Variable
MVT	2000 (2)	14,000 (2)	4000	3000 (1)	4000	Variable

Notes:

1. 2000 bytes is the minimum size required. The general formula for calculating the storage for the table and buffer area is:

$$S=20a+8b+4x132(c+1)+BUFNO\left(\frac{SYSPRINT}{BLKSIZE+24}\right)+BUFNO\left(\frac{SYSLIN}{BLKSIZE+24}\right)+1506$$

   Where: S = storage required (in bytes)
   a = number of external symbols
   b = number of external relocation dictionary entries that refer to control sections that have not been processed by the Loader
   c = [I/32] where I= number of external symbols in any one input module

2. These modules may be resident in fixed main storage.

Figure 13. Dynamic Storage Requirements for the Loader

Estimating the SIZE Value in MVT

The maximum amount of main storage that is available to the loader's tables and buffers, and the loaded program is specified by the SIZE parameter. In MVT, the formula for determining the actual SIZE value used by the Loader is:

SIZE = Region size-22K

For example: if a REGION of 100K is specified and a SIZE of 100K is specified, the loader will obtain 78K for the tables, buffers, and loaded program.

Figures

MFT, MVT and M65MP -- Data Access Method Requirements

When a data control block is opened, a set of access method modules, tailored to the characteristics of the associated data set, is brought into main storage. An access method module may be used with two or more data sets if the data set characteristics that apply to the module are similar.

If the resident reenterable load module is selected, any or all of the modules may be made resident. (If the Checkpoint/Restart facilities are to be utilized by an installation, all BSAM and BPAM modules must be made resident.) If an MFT system has the system log facility, all BSAM modules must be resident. The amount of dynamic storage required by the program is reduced by the sum of all resident modules used by the program. Appendix A contains a list of all reenterable access method modules.

In addition to the modules, control blocks are created according to the characteristics of the data set and the type of device. With MFT all of the control blocks estimates must be included in the dynamic storage requirement. With MVT, certain control blocks are placed in the system queue area rather than in the partition or region. These control blocks are so indicated and should not be added to the dynamic requirement.

Sequential Access Methods (BSAM and QSAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic sequential or queued sequential access method (BSAM or QSAM) is estimated from the following formula:

$S = A_1 + A_2 + B_1 + B_2 + B_3 + B$ + buffers + record area
Where: A_1 = size of the data control block (DCB) and, for BSAM, the data event control blocks (DECBs). A_2 = size of input/output blocks (IOBs), data extent blocks (DEBs) for MFT only, and channel programs. (Assume one extent in each DEB.) B_1 = size of sharable, directly entered routines for macro instructions. B_2 = size of sharable, indirectly entered routines for macro instructions. B_3 = size of sharable interruption handling routines. B = size of sharable error recovery routines for QSAM. buffers = storage required for the input and output buffers and equals 8+(4•BUFNO)+(BUFNO•BLKSIZE) record area = storage required for the assembly and segmenting of a spanned record and equals: for QSAM = 32 + LRECL when the DCB specifies: BFTEK = A, RECFM = VS or VBS, and locate mode. for BSAM = 12 plus the smaller of the track capacity or blocksize when the DCB specifies: BFTEK = R, RECFM = VS, and MACRF = WL.
Note: For dummy data sets, $S = A_1 + B_1$, where B_1 = 104 bytes.

Estimates A_2, B_1, B_2, B_3, and B represent storage that remains allocated only while the data control block is open (unless it is used concurrently with another data control block). Estimate A_1 includes storage that normally remains allocated for the duration of a job step.

Use Figures 14 through 23 to calculate estimates A_1, A_2 and B_1 through B for each data set to be retrieved or stored with BSAM or QSAM. Add together the entries in each figure that correspond to the attributes of the data set.

Select one entry from Figure 14 for each data set stored or retrieved with BSAM.

I/O Device Type	Storage Requirement (in bytes)
Card reader, card punch, printer or TSO terminal	72 + 20n
Paper tape	80 + 20n
Optical character readers (1285/1287/1288)	88 + 20n
1419 Magnetic character reader	88 + 20n
1275 Optical reader sorter	88 + 20n
Magnetic tape or direct access storage	88 + 20n
Direct access storage (Create BDAM spanned record format)	88 + 24n
Where: n = the number of data event control blocks, i.e., the number of channel programs (when the data control block is open for UPDAT, n ≥ 2).	

Figure 14. Estimate A_1 for BSAM

Select one entry from Figure 15 for each data set stored or retrieved with QSAM.

I/O Device Type	Storage Requirement (in bytes)
Unit record, or TSO terminal	80
Magnetic tape	96
Direct access storage	96
Optical character readers (1285/1287/1288)	96

Figure 15. Estimate A_1 for QSAM

Select one entry from Figure 16 for each data set stored or retrieved with either BSAM or QSAM. If BSAM is used to create a direct data set for use with BDAM, use Figure 17. For MVT, subtract 96 bytes from each entry selected from either Figure 16 or Figure 17.

I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
		Normal Scheduling	Chained Scheduling
Printer or punch	OUTPUT	56n + 96	56n + 144
Card reader	INPUT	96 + n(48 + relevant options)	48n + 144
Magnetic tape	INPUT OUTPUT RDBACK	96 + n(48 + relevant options)	48n + 144
Magnetic tape	INOUT OUTIN	56n + 96	64n + 144
Card read-punch	INOUT	64n + 96	N/A
Optical Character Readers	INPUT (BSAM)	160	N/A
	INPUT (QSAM)	96+n(48+16r)	N/A
Magnetic ink character reader and optical reader sorter (1419/1275)	INPUT (BSAM)	608+28n	N/A
Direct access storage	UPDAT (BSAM)	112 + (120 + relevant options) See Note	N/A
	UPDAT (QSAM)	112 + n(128 + relevant options)	
	INOUT OUTIN	112 + n(128 + relevant options) See Note	192 + n(122 + relevant options)
	INPUT OUTPUT	112 + n(88 + relevant options) See Note	INPUT 192 + n(64)
	INPUT (OFFSET READ)	112 + n(112)	OUTPUT 192 + (64 + relevant options)
TSO terminal	Any	120	0

Figure 16. Estimate A_2 for BSAM and QSAM (Part 1 of 2)

Where relevant, include in the above storage requirement: (record overflow and exchange buffering are mutually exclusive)	
Option	Storage Requirement (in bytes)
Record overflow (normal scheduling, not UPDAT)	48(t - 1)
Write validity check	24 (32 if record overflow but not UPDAT)
Exchange buffering (normal scheduling)	8B - 8
User Totaling	4
Where: n = the number of channel programs (number of buffers for QSAM) for chained scheduling, n≥2. r = number of lines read (BUFL/LRECL). t = the number of tracks that a record may occupy. B = the blocking factor for blocked, fixed-length records (B = 1 when a unit record device is specified).	
Note: If record overflow is used and the data control block is opened for UPDAT, INPUT, INOUT, or OUTIN, then add 96 bytes.	

Figure 16. Estimate A_2 for BSAM and QSAM (Part 2 of 2)

Select one entry from Figure 17 for each direct data set created with BSAM.

Option	Record Format	Storage Requirement (in bytes)
Without record overflow	F	120+128n
	U or V	120+160n
With record overflow	F, U, or V	192+56t+(48+24t)n
Write validity check without record overflow	F	120+176n
	U or V	120+184n
Write validity check with record overflow	F, U, or V	192+72t+(80+24t)n
Where: n = the number of channel programs. t = the number of tracks that a record may occupy.		

Figure 17. Estimate A_2 for BSAM When Creating a Direct Data Set

Select one or more entries from Figure 18 for each data set stored or retrieved with BSAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Macro Instruction	I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
			Normal Scheduling	Chained Scheduling
READ/WRITE	Unit record, magnetic tape, or direct access	INPUT OUTPUT INOUT RDBACK OUTIN	424	424
	Direct access	UPDAT	320	N/A
	TSO terminal	Any	492	N/A
READ	Paper tape	INPUT (translate)	572	N/A
	Optical Reader	INPUT	136	N/A
	Magnetic Reader (1419/1275)	INPUT	176	N/A
	TSO terminal	Any	316	N/A
READ (offset READ of a spanned direct data set)	Direct access	INPUT	104	N/A
CHECK	Unit record, magnetic tape, or direct access	INPUT OUTPUT INOUT RDBACK OUTIN	120	120
	Direct access	UPDAT	144	N/A
	Paper tape	INPUT	288	N/A
	Optical Reader	INPUT	818	N/A
	Magnetic Reader (1419/1275)	INPUT	414	N/A
	TSO terminal	Any	70	N/A
CHECK (creating a direct data set)	Direct access	OUTPUT	192	N/A
CHECK (creating a direct data set with VS format)	Direct access	OUTPUT	387	N/A

Figure 18. Estimate B_1 for BSAM (Part 1 of 2)

Macro Instruction	I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
			Normal	Chained
CNTRL	Magnetic tape	Any	496	N/A
	Card reader	INPUT	176	N/A
	Printer	OUTPUT	192	N/A
	Optical Reader	INPUT	864	N/A
	Magnetic Reader (1419/1275	INPUT	440	N/A
	TSO terminal	Any	2	N/A
NOTE/POINT	Magnetic tape	INPUT OUTPUT INOUT RDBACK OUTIN	368	296
	Direct access with no record overflow	INPUT OUTPUT INOUT OUTIN	280	352
	Direct access with no record overflow	UPDAT	352	N/A
	Direct access with record overflow	Any	352	N/A
	TSO terminal	Any	6	N/A
WRITE (creating a direct data set with F format)	Direct access	OUTPUT	592	N/A
WRITE (creating a direct data set with U or V format)	Direct access	OUTPUT	776	N/A
WRITE (creating a direct data set with record overflow)	Direct access	OUTPUT	1056	N/A
WRITE (creating a direct data set with VS format. BFTEK VS format. BFTEK =R must be specified.	Direct access	OUTPUT	1914	N/A
	TSO terminal	OUTPUT	166	N/A
DSPLY	Optical Reader	INPUT	472	N/A
RESCN	Optical Reader	INPUT	592	N/A
Appendage	Magnetic Reader (1419/1275)	INPUT	3620	N/A

Figure 18. Estimate B_1 for BSAM (Part 2 of 2)

For each data set stored or retrieved with QSAM, select one item either from Figure 19 if simple buffering is used or from Figure 20 if exchange buffering is used. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Macro Instruction	Mode	Record Format	Storage Requirement (in bytes)
GET	Locate	F or U	160
		V	168
		V spanned	184
		V spanned (logical record interface)	634
	Move	F or U	288
		V	264
		V spanned	392
	Data	V spanned	384
GET (reading backwards for magnetic tape)	Locate	F or U	160
	Move	F or U	280
GET (with CNTRL for card reader)	Move	F or U	344
		V	336
GET (with PUTX function)	Data control block open for UPDAT	F, U, or V	400
		V spanned (logical record interface)	1920
GET (paper tape translate)	Move	F or V	800
GET (TSO terminal)	Any	Any	392

Figure 19. Estimate B_1 for QSAM (Simple Buffering) (Part 1 of 2)

PUT (if CNTRL for printer is desired, add 192)	Locate	F or U	168
		V	216
		V spanned	232
		V spanned record interface)	
PUT (includes PUTX function; if CNTRL for printer is desired, add 192)	Move	F or U	264
		V	296
		V spanned	498
	Data	V spanned	484
PUT (TSO terminal)	Any	Any	212
GET (for Optical Readers)	Locate	F	312
		V or U	408
	Move	F	376
		V or U	456
PUT/GET (TSO terminal)	Any	Any	520
CNTRL (for Optical Readers)	N/A	N/A	864
RDLINE(for Optical Readers)	N/A	N/A	232
Note: Each GET macro instruction includes the corresponding RELSE macro instruction; each PUT macro instruction includes the corresponding TRUNC macro instruction.			

Figure 19. Estimate B_1 for QSAM (Simple Buffering) (Part 2 of 2)

Macro Instruction	Mode	Record Format	Storage Requirement (in bytes)
GET	Locate	F, U, or V	128
		F blocked	144
	Substitute	F or U	104
		F blocked	184
PUT (includes PUTX function; if CNTRL for printer is desired, add 192)	Move	F, U, or V	376
		F blocked	336
	Substitute	F or U	376
		F blocked	336
Note: Each GET macro instruction includes the corresponding RELSE macro instruction; each PUT macro instruction includes the corresponding TRUNC macro instruction.			

Figure 20. Estimate B_1 for QSAM (Exchange Buffering)

Select one or more entries from Figure 21 for each data set stored or retrieved with either BSAM or QSAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_2 is calculated for multiple data control blocks open at the same time.

I/O Device Type	Data Control Block Open for	Storage Requirement (in bytes)	
		Normal Scheduling	Chained Scheduling
Card punch or printer (with hardware control character or no control character)	OUTPUT	152	216
Card punch or printer (with ASA control character)	OUTPUT	256	344
Card reader	INPUT	96	240
Magnetic tape	INPUT,OUTPUT,INOUT, OUTIN,RDBACK		
Magnetic Readers (1419/1275)	INPUT	346	N/A
Optical Readers	INPUT	254	N/A
Direct access	INPUT (record format not standard F), INOUT, OUTIN, UPDAT		(N/A for UPDAT)
Direct access	UPDAT (with: record format = VS or VBS and a logical record interface of BFTEK=R, or BUILDRCD macro is issued	1919	N/A
Direct access without record overflow	OUTPUT, OUTIN, INOUT, INPUT, UPDAT (record format Standard F)	544	680
Direct access with record overflow	OUTPUT, OUTIN, INOUT, INPUT	824	N/A
Where relevant, add to the above requirements:			
Option	Storage Requirement (in bytes)		
User Totaling	220 + (n+1)•length of user's totaling area rounded to 1/2 word. Where: n = number of channel programs (number of buffers for QSAM); for chained scheduling n≥2.		

Figure 21. Estimate B_2 for BSAM and QSAM (1)

Select one or more entries from Figure 22 for each data set stored or retrieved with either BSAM or QSAM. An entry must be selected if all attributes listed for that entry apply to the data set, no matter how many entries apply. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_3 is calculated for multiple data control blocks open at the same time.

Scheduling	I/O Device Type	Data Control Block Open for	Record Format	Storage Requirement
Chained	Any	INPUT, OUTPUT, INOUT, OUTIN	Any	1428
	Direct access	INPUT, INOUT, OUTIN	Any	256
Normal	Any except paper tape	INPUT, INOUT, OUTIN, UPDAT	Blocked F including standard	144
		INPUT, INOUT, OUTIN, UPDAT	V	136
	Magnetic tape (processing tape containing embedded DOS CHKPT records)	INPUT	F,FB,U	410
			V,VB	424
	Direct access with record overflow	INPUT, INOUT, OUTIN, UPDAT	Any	600
	Direct access	UPDAT (QSAM only)	Any	248
	Direct access	UPDAT (BSAM only)	Any	152
	Direct access	INPUT, INOUT, OUTIN	Any (except standard F)	152
	Printer	OUTPUT	Any	96
	Direct access	UPDAT	Any	240
	Card reader or magnetic tape (only for input stream when MVT is not specified)	INPUT,RDBACK	Any	80
	Paper tape	INPUT	F or U	56

Figure 22. Estimate B_3 for BSAM and QSAM (Part 1 of 2)

Scheduling	I/O Device Type	Data Control Block Open for	Record Format	Storage Requirement
Normal (Cont'd)	Paper tape	INPUT	Translate tables for ASCII or Burroughs	512
			Translate tables for IBM, teletype, NCR, or Friden	768
	Direct access (creating a direct data set)	OUTPUT	VS (BFTEK=R)	104
	Direct access (offset READ of direct data set)	INPUT	VS (BFTEK=R)	335

Figure 22. Estimate B_3 for BSAM and QSAM (Part 2 of 2)

Select one entry from Figure 23 for each data set stored or retrieved with QSAM. (Estimate B does not apply to BSAM.) Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B is calculated for multiple data control blocks open at the same time.

Data Control Block Open For	Storage Requirement (in bytes)
INPUT	152
OUTPUT	152
UPDAT	640
UPDAT (logical record interface spanned records)	933

Figure 23. Estimate B for QSAM

Checkpoint/Restart Facility

When the installation plans to use the checkpoint/restart facility, six basic resident modules (see Figure 24) are loaded into the fixed main storage area at NIP time. These modules allow checkpoint records to be written on magnetic tape or a direct access device. (The six modules names are already part of the standard RAM list, IEAIGG00.)

If chained scheduling or track overflow will be used to write checkpoint records, the user must obtain the optional modules indicated in Figure 24 for the featurs and add them to his system.

	Always resident	
	These modules are always used for tape and direct access --	IGG019BA* IGG019BB* IGG019CC*
	In addition, if direct access is used these modules are used	IGG019CD* IGG019CH* IGG019BC
Optional modules that can be added		
IF track overflow is used add these modules		IGG019C1 IGG019C2 IGG019C3
IF chained scheduling is used --		
1-add these modules for tape and direct access --		IGG019CU IGG019CW
2-And, if direct access is used add these modules --		IGG019CV IGG019CZ
*See "Notes About the Location of the Modules."		

Figure 24. Resident Modules for the Checkpoint/Restart Facility

For example, if the user decided to use direct access only for the checkpoint data set, using chained scheduling, he would need all the modules except for the three required for track overflow.

The user obtains the optional modules by:

1. Adding the additional names for the modules he will require to the standard list IEAIGG00, which is a member of SYS1.PARMLIB.

2. Building a separate list that contains the names of the modules he requires and add it to SYS1.PARMLIB. Then use the operator communication option at NIP time to get the additional modules loaded as part of the nucleus. The operator communication option is specified in the SUPRVSOR system generation macro instruction.

See the chapter "Using the Resident BLDL Table, Access Method, SVC Routine, and Job Queue Options, the Link Pack Area, and the Link Library List" in the System Programmer's Guide for detail information about modifying the standard RAM list.

Notes About the Location of the Modules

MFT Systems -- The parameter RESIDNT with ACSMETH as one of the subparameters must be specified in the system generation macro instruction SUPRVSOR. The six basic resident modules are access method modules and will be in the RENT area in fixed main storage. Any optional modules chosen will also be in the RENT area and increase its size, provided the correct procedure is followed to obtain them.

*MVT and M65MP Systems -- The parameter RESIDNT with RENTCODE as one of the subparameters must be specified in the system generation macro instruction SUPRVSOR. The first five of the basic resident modules (with the asterisks) are always loaded into the link pack area. The sixth basic resident module will be loaded into the RENT area of fixed main storage. Its name is part of the standard RAM list.

Any optional modules chosen will also be in the RENT area and increase its size, provided the correct procedure is followed to obtain them.

BSAM Example

Fixed-length blocked records are read from one tape and written on another. The CHECK macro instruction and normal scheduling are used.

$S = A_1 + A_2 + B_1 + B_2 + B_3 + buffers$

A_1, DCB and DECB:
  INPUT from tape, 88 + 20(2)..... 128
  OUTPUT to tape, 88 + 20(2)..... 128
A_2, Channel programs, DEB, and IOB:
  INPUT from tape, normal scheduling, 96+2(48)..... 192
  OUTPUT to tape, normal scheduling, 96+2(48)..... 192
B_1, Sharable directly entered routines:
  READ/WRITE..... 408
  CHECK..... 120
B_2, Sharable indirectly entered routines:
  Magnetic tape..... 96
B_3, Sharable interruption routine:
  Normal scheduling, fixed-length blocked records.... 144
Total 1,408 bytes + buffers

QSAM Example

Fixed-length blocked records are read from magnetic tape and written to another tape. Move mode and normal scheduling are used.

$S = A_1 + A_2 + B_1 + B_2 + B_3 + B + buffers$

A_1, Control blocks:
  INPUT from tape..... 96
  OUTPUT to tape..... 96
A_2, Channel programs, DEB, and IOB:
  INPUT from tape, normal scheduling, 96+2(48)..... 192
  OUTPUT to tape, normal scheduling, 96+2(48)..... 192
B_1, Sharable directly entered routines:
  GET, move mode, simple buffering..... 264
  PUT, move mode, simple buffering..... 264
B_2, Sharable indirectly entered routines:
  Magnetic tape..... 96
B_3, Sharable interruption routines:
  Normal scheduling, fixed-length blocked records.... 144
B , Sharable error routines:
  INPUT..... 152
  OUTPUT..... 152
Total 1,648 bytes + buffers

Basic Partitioned Access Method (BPAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic partitioned access method (BPAM) is estimated from the following formula. All estimates for BPAM are calculated from the figures used for BSAM.

$S = A_1 + A_2 + B_1 + B_2 + B_3 + buffers$

Where: A_1 = size of data control block (see Figure 14).

A_2 = size of input/output blocks (IOBs), data extent blocks (DEBs) for MFT only, and channel programs (see Figure 10).

B_1 = size of sharable, directly entered routines for macro instructions (see Figure 18 and include NOTE and POINT macro instructions).

B_2 = size of sharable, indirectly entered routines for macro instructions (see Figure 21).

B_3 = size of sharable interruption handling routines (see Figure 22).

buffers = size of input and output buffers.

Estimates A_2, B_1, B_2, and B_3 include storage that remains allocated only while the data control block is open (unless it is used concurrently with another data control block). Estimate A_1 includes storage that normally remains allocated for the duration of a job step.

Because BPAM uses the same sharable routines as BSAM, storage requirements for sharable routines should not be duplicated when estimates B_1, B_2, and B_3 are calculated for multiple data control blocks open at the same time.

BPAM Example

One member with fixed-length blocked records (not Standard F) is read. Two buffers and the CHECK, NOTE, and POINT macro instructions are used.

$S = A_1 + A_2 + B_1 + B_2 + B_3 + buffers$

A_1, Control blocks:
  Direct access, INPUT, 88 + 20(2)..... 128
A_2, Channel programs, 112 + 88(2)..... 288
B_1, Sharable directly entered routines:
  READ/WRITE, INPUT..... 408
  CHECK..... 120
  NOTE/POINT..... 280
B_2, Sharable indirectly entered routines:
    INPUT..... 96
B_3, Sharable interruption routines:
  Normal scheduling, fixed-length blocked records.... 144
  Normal scheduling, any record format except
   standard F..... 152
Total 1,616 bytes + buffers

Basic Direct Access Method (BDAM)

The dynamic main storage requirement for retrieving or storing a data set with BDAM is estimated from the following formula:

$S = A_1 + A_2 + B_1 + B_2 + B_3 + B$ + Segment area for VRE
Where: A_1 = size of the data control block (DCB), data event control blocks (DECBs), data extent block (DEB) for MFT only, and interruption request blocks (IRB) for MFT only. A_2 = size of input/output blocks (IOBs), and channel programs. B_1 = size of sharable routines for addressing method. B_2 = size of sharable routines for macro instructions. B_3 = size of sharable routines for options. B = 3378 for VRE, 1536 otherwise Segment area = the smaller of the track capacity or the maximum record size.

Select entries from Figure 25 for each data set stored or retrieved with BDAM.

Control Block	Storage Requirement (in bytes)
Data control block	88
Data extent block for MFT only	112
Each data event control block	28,36 for VRE
Interruption request block for MFT only	96

Figure 25. Estimate A_1 for BDAM

Select one entry from Figure 26 for each read or write operation.

Macro Instruction and Type Field	Storage Requirement (in bytes)					
	Without Extended Search or Write Validity Check Options		Additional Bytes With Write Validity Option		Additional Bytes With Extended Search Option	
	non-VRE	VRE	non-VRE	VRE	non-VRE	VRE
READ I	112	120(3)	N/A	N/A	N/A	N/A
READ K	112	120(4)	N/A	N/A	64	96
WRITE I	112	128	24	40	N/A	N/A
WRITE K	112	128	24	24	64	88
WRITE A (record format F)	144	N/A	24	N/A	80	N/A
WRITE A (record format U or V)	168	272	32	48	0	0

Notes:
1. If the dynamic buffering option is included, add 16 bytes for each data control block and include the total size (in bytes) of all buffer areas.
2. If the read exclusive option is used, add 80 bytes for each data control block.
3. If "next address" is requested, add 32 bytes.
4. If "next address" is requested, add 40 bytes.

Figure 26. Estimate A_2 for BSAM

Select one entry from Figure 27 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_1 is calculated for multiple data control blocks open at the same time.

Addressing Method	Storage Requirement (in bytes)	
	Without Feedback Option	With Feedback Option
Relative record	312	520
Relative record with record overflow	632	848
Relative track	296	296
Actual	0	0

Figure 27. Estimate B_1 for BDAM

Select one or more entries from Figure 28 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_2 is calculated for multiple data control blocks open at the same time.

Type Field of Macro Instruction	Storage Requirement (in bytes)			
	Without Extended Search Option		With Extended Search Option	
	non-VRE	VRE	non-VRE	VRE
I	200	648(1)	N/A	N/A
K	160	684(1)	360	936
A (Record format F)	288	N/A	504	N/A
A (Record format U or V)	652	1432	1,792	2496

Note:
1. This number should be used only once if types I and K are being used.

Figure 28. Estimate B_2 for BDAM

Select one or more entries from Figure 29 for each data set stored or retrieved with BDAM. Because these entries represent storage for sharable routines, no entry should be added more than once when estimate B_3 is calculated for multiple data control blocks open at the same time.

Option	Storage Requirement (in bytes)
Write validity check	242
Dynamic buffering	512
Read exclusive	936
Extended search	248
CHECK macro instruction	264

Note: Add 264 bytes once to the total estimate if one or more of the following apply:

- Type field of macro instruction is A and record format is U or V.
- Dynamic buffering.
- Read exclusive.

Figure 29. Estimate B_3 for BDAM

BDAM Example

Read with one channel program and write with another channel program using relative track addressing, validity checking, and key type operations. The extended search, feedback, and dynamic buffering options are not used.

$S = 1{,}536 + A_1 + A_2 + B_1 + B_2 + B_3$

Constant	1,536
A_1, Control blocks:	
Data control block	88
Data extent block	112
Two data event control blocks, 28 (2)	56
Interruption request block	96
A_2, Channel programs:	
READ K without extended search option	112
WRITE K with validity check option	136
B_1, Addressing method:	
Relative track without feedback option	296
B_2, Macro instructions:	
Type K without extended search option	160
B_3, Options:	
Write validity check	160
Total	2,752 bytes

Basic Indexed Sequential Access Method (BISAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic indexed sequential access method (BISAM) is estimated by adding together the buffer area requirements, a coding space estimate, a channel program space estimate, and a control block space estimate. The buffer area requirement for BISAM is determined as follows:

For fixed length records: Area = N(BLKSIZE + 16) + B

For variable length records: Area = N(BLKSIZE + J) + B

Where: N = number of buffers

B = size of BCB (20 for alignment on a fullword boundary and 24 for alignment on a doubleword boundary).

J = 16 if the buffers are aligned on a doubleword boundary and 12 if the buffers are aligned on a fullword boundary.

If new logical records are not written in a data set (i.e., if WRITE KN is not used), refer to Figures 30 and 31. If WRITE KN is used, refer to Figures 32 and 33. In both cases, use Figure 34. When both WRITE KN and any combination of READ K, READ KU, or WRITE K is used, use the total of Figures 31 and 34 for the channel program space estimates.

Without WRITE KN

Select one or more entries from Figure 30 for each data set stored or retrieved using BISAM without WRITE KN. Because these entries represent storage for sharable routines, no entry should be added more than once when coding space is calculated for multiple data control blocks open at the same time.

Macro Instruction and Type Field	Record Format	Write Validity Checking	Levels of Indexing Searched on Device	Storage Requirements (in bytes)
READ K, READ KU, or WRITE K (3)(4)	Fixed	No	None (1)	3,418
	Fixed	No	One or more (2)	3,608
	Fixed	Yes	None (1)	3,684
	Fixed	Yes	One or more (2)	3,874
	Variable			4,056

Notes:
1. Assume only one level of indexing, which is in main storage.
2. Assume one or more levels of indexing, of which the highest level may be in main storage if there are two or more levels.
3. If dynamic buffering is used, add 664 bytes.
4. If CHECK macro is used to test for completion of READ or WRITE, add 112 bytes.
5. Add 3349 bytes if any data set resides on rotation position sensing devices (2305, 3330).

Figure 30. Coding Space Estimate for BISAM Without WRITE KN

Select one entry from Figure 31 for each data set stored or retrieved using BISAM without WRITE KN.

Levels of Indexing Searched on Device	Storage Requirement (in bytes)
None	416M
One	416M + 88
Two or more	416M + 192
Where: M = the value in the NCP field of the data control block.	
Note: For write validity check, add 128M bytes to the above requirement.	

Figure 31. Channel Program Space Estimate for BISAM Without WRITE KN

With WRITE KN

Select one or more entries from Figure 32 for each data set stored or retrieved using BISAM with WRITE KN. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Record Format and Blocking	User Work Area	Write Validity Check	Storage Requirement (in bytes)	
			WRITE KN Used Alone	WRITE KN With READ K, READ KU, or WRITE K
Fixed Length Unblocked	No	No	6,895	10,111
		Yes	7,223	10,587
	Yes	No	6,813	10,029
		Yes	7,255	10,619
Fixed Length Blocked	No	No	7,397	10,613
		Yes	7,709	11,073
	Yes	No	7,835	11,051
		Yes	8,481	11,845
Variable Length	Yes	N/A	9,260	13,484
Note: These estimates assume that no levels of indexing are searched on the device. For WRITE KN used with READ K and WRITE K, the following apply: • Add 288 bytes if one or more index levels are searched on device and the record format is fixed length. • Add 664 bytes if dynamic buffering is used. WRITE KN or READ and WRITE K. • Add 3349 bytes if any data set resides on rotational position sensing devices (2305, 3330).				

Figure 32. Coding Space Estimate for BISAM With WRITE KN

Select entries from Figure 33 for each data set stored or retrieved using BISAM with WRITE KN.

Channel Program Use	Storage Requirement (in bytes)	
	Without Write Validity Check	With Write Validity Check
Basic channel program	800	1,056
Add to the above entry, if relevant:		
Levels of indexing searched on device		
• One	88	88
• Two or more	192	192
Fixed-length unblocked records		
• With user work area	88 + 24N	144 + 32N
• Without user work area	128	184
Fixed-length blocked records		
• With user work area	72 + 40N	128 + 48N
• Without user work area	56	88
Where: N = the number of physical records that fit on one track.		

Figure 33. Channel Program Space Estimate for BISAM With WRITE KN

Select entries from Figure 34 for each data set stored or retrieved with BISAM.

Control Block	Storage Requirement (in bytes)
Data control block	236
Data event control block	26
Input/output block	56
Data extent block for MFT only	84+16E+2M=about 112
Buffer control block for dynamic buffering	24
Interruption request block for MFT only	96
Work area (any BISAM DCB)	56
Work area for WRITE KN (if not supplied by user):	
• Unblocked records	10 + L + R
• Blocked records	L + R + B
Where: E = the number of extents. M = the number of modules. L = the key length. R = the record length (LRECL). B = the block size.	

Figure 34. Control Block Space Estimate for BISAM

BISAM Example

Read with two channel programs simultaneously and update fixed length unblocked records. One level of indexing is searched on the device. The write validity check option is not used.

Sharable routines:		
READ K/WRITE K	3,608	(See Note)
Two channel programs, 416(2) + 88	920	
Control blocks:		
Two data event control blocks, 26(2)	52	
Two input/output blocks, 56(2)	112	
Data control block	236	
Data extent block	112	
Interruption request block	96	
Work area	48	
Total		5,084 bytes

Note: If the record format is variable length unblocked, add 448 bytes.

Queued Indexed Sequential Access Method (QISAM)

To retrieve or store a data set with the queued indexed sequential access method, dynamic main storage is required for the following:

- The buffer area
- Coding space
- Channel program space
- Control block space

Buffer Area Requirement

The buffer area requirement for QISAM is determined by one of the following formulas:

For creating a data set:	Area = N(BLKSIZE + 8) + 8
For scanning a data set with fixed length blocked records:	Area = N(BLKSIZE + 16) + 8
For scanning a data set with variable length blocked records:	Area = N(BLKSIZE + H) + 8
For scanning a data set with fixed length unblocked records or variable length unblocked records when both key and data are to be read:	Area = N(BLKSIZE + G) + 8
For scanning a data set with fixed length unblocked records when only data is to be read:	Area = N(LRECL + 16) + 8 Where: N = number of buffers G = smallest multiple of 8 equal to or greater than KEYLEN + 10 H = 16 if buffers are aligned on a doubleword boundary, or 12 if buffers are aligned on a fullword boundary

Data Set Creation

To determine the coding space required, select an entry from Figure 35 for each data set created with QISAM. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Record Format	Write Validity Checking	Storage Requirement (in bytes)
Fixed Length	Yes	6,248
	No	5,792
Variable Length	Yes	6,542
	No	6,056
If any data set resides on rotational position sensing devices (2305, 3330), add 1274 bytes.		

Figure 35. QISAM Coding Space Estimate for Data Set Creation

Select one entry from Figure 36 for each data set created with QISAM.

Description	Storage Requirement (in bytes)
Unblocked records and relative key position zero	728 + 8N
All other cases	728 + 24N
Where: N = the number of buffers used.	
Notes: 1. For write validity check, add 112 bytes to the above requirement. 2. Add 232 bytes to the above requirement if the last track of the track index also contains data (i.e., if it is a shared track).	

Figure 36. QISAM Channel Program Space Estimate for Data Set Creation

Select entries from Figure 37 for each data set created with QISAM.

Control Block	Storage Requirement (in bytes)
One data control block	236
Data extent block for MFT only	84 + 16E + 2M = about 112
Work area*	784 + 4N + 2L
Where: E = the number of extents. M = the number of modules. N = the number of buffers. L = the key length.	
*Add 8 bytes if the data resides on a rotational position sensing device (2305, 3330).	

Figure 37. QISAM Control Block Space Estimate for Data Set Creation

Data Set Scanning

Select entries from Figure 38 for each data set referred to in the scan mode of QISAM. Because these entries represent storage for sharable routines, no entry should be added more than once when the coding space estimate is calculated for multiple data control blocks open at the same time.

Description	Storage Requirement (in bytes)	
	Variable Length Format	Fixed Length Format
Reading a Data Set	4,554	4,292
Reading and updating a data set • Without write validity check • With write validity check	 4,896 5,406	 4,772 5,282
Notes: The starting point for sequential reference may be expressed as I, B, or K. There are additional storage requirements if the starting point for sequential reference if expressed as either I or K: • If it is I, add 656 bytes. • If it is K, add 2008 bytes. If any data set resides on a rotational position sensing device (2305, 3330), add 682 bytes.		

Figure 38. QISAM Coding Space Estimate for Data Set Scanning

Select one or more entries from Figure 39 for each data set referred to in the scan mode of QISAM.

Description	Storage Requirement (in bytes)
Primary requirement	72 + 56N
Add to the above entry, if relevant:	
Setting limits by I	104
Setting limits by K	376
Where: N = the number of buffers used.	

Figure 39. QISAM Channel Program Space Estimate for Data Set Scanning

Select entries from Figure 40 for each data set referred to in the scan mode of QISAM.

Control Block	Storage Requirement (in bytes)
Work area (2)	312
One data control block	236
Data extent block for MFT only	84+16E+2M = about 112
Interruption request block for MFT only	96
Where: E = the number of extents M = the number of modules	
Notes: 1. Add 10 bytes if the record format is variable length. 2. If any data set resides on a rotational position sensing device (2305, 3330), add 80 bytes.	

Figure 40. QISAM Control Block Space Estimate for Data Set Scanning (1)

QISAM Example

A data set is created with two channel programs, two buffers, and fixed-length records with a key length of 12 bytes. The write validity check option is not used.

```
Sharable routines:
   Primary requirement..............................  5,772 (1)
Channel programs:
   Fixed-length records, 728 + 24(2)................    776
Control blocks:
   Data control block...............................    236
   Data extent block................................    112
   Work area, 784 + 4(2) + 12(2)....................    816
                                          Total          7,712 bytes
```

Note:
1. Add 202 bytes if the record format is variable length.

Basic Telecommunications Access Method (BTAM)

The dynamic main storage requirement for retrieving or storing a data set with the basic telecommunications access method (BTAM) is estimated by adding together a coding space estimate, a control information space estimate, a control block space estimate by line group, a control block space estimate by line, a channel program space estimate by line and a control block space estimate for READ or WRITE macro instructions. Estimates for the 3270 display system are given in Figures 42, 44, 46, 48, 50, 52, and 53.

The coding space estimate (Figure 41) includes the BTAM code required to support the READ, WRITE, REQBUF, and RELBUF macro instructions, and dynamic buffer allocation. This code is sharable across line groups and is not duplicated for multiple data control blocks open at the same time.

Description	Remote Storage Requirement (in bytes)	Local 3270 Storage Requirement (in bytes)
Primary requirement:		
• without buffer management	8,550	4,000
• with buffer pool support (REQBUF and RELBUF)	8,950	4,450
• with dynamic buffering	10,164	N/A
Optional requirement:		
• online test	2,880	660
additional if ONLTST macro is used	464	N/A
• line error print (LERPRT)	374	N/A
• line open (LOPEN)	530	530
• translate (TRNSLATE)	158	N/A
• change entry for Auto Poll or local 3270 (CHGNTRY)	352	72
• if RESET macro is used with POLLING specified	256	200
• if RESET macro is used with ATTENT specified	600	600
• World Trade Telegraph Terminals	1,108	N/A
• change entry for Expanded ID verification (CHGNTRY)	38	N/A
• edit routine TPEDIT, IECTEDIT	2,048	N/A

Figure 41. BTAM Coding Space Estimate

The control blocks in Figure 42 are used for coding space estimates.

Description	Storage Requirement (in bytes)	
	Remote 3270	Local 3270
Primary requirement:		
• without buffer management	8500	4000
• with buffer pool support	8950	4450
• with dynamic buffering	10,164	N/A(1)
Optional requirement:		
• online test	2690	660
• line error print (LERPRT)	374	N/A(1)
• translate (TRANSLATE)	158	N/A(1)
• line open (LOPEN)	530	530
• change entry (CHGNTRY)(2)	352	72
• reset (RESETPL)(2)	600 or 256(3)	600 or 200(4)

1. N/A indicates not applicable.
2. The estimate is for each macro instruction expansion.
3. The lower estimate applies when POLLING is specified.
4. The lower estimate applies when ATTENT is specified.

Figure 42. BTAM Coding Space Estimates (3270 Display System)

Select the appropriate entry from Figure 43 for each type of terminal to be supported under BTAM.

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	248
IBM 1030 Data Communications System with Auto Poll	248
IBM 1050 Data Communications System	248
IBM 1050 Data Communications System on a switched network	344
IBM 1050 Data Communications System with Auto Poll	232
IBM 1060 Data Communications System	216
IBM 1060 Data Communications System with Auto Poll	224
IBM 2260 Display Unit attached as a remote terminal with a 2701 Data Adapter Unit	328

Figure 43. BTAM Control Information Space Estimate by Device Type (Part 1 of 2)

Terminal Device Type	Storage Requirement (in bytes)
IBM 2740 Communications Terminal	144
IBM 2740 Communications Terminal with checking	248
IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit)	296
IBM 2740 Communications Terminal with station control	168
IBM 2740 Communications Terminal with station control and checking	240
IBM 2740 Communications Terminal on a switched network	200
IBM 2740 Communications Terminal with checking on a switched network	304
IBM 2740 Communications Terminal with transmit control on a switched network	216
IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit) on a switched network	376
IBM 2740 Communications Terminal with transmit control and checking on a switched network	304
IBM 2740 Communications Terminal with station control, checking and Auto Poll	240
IBM 2740 Communications Terminal with station control and Auto Poll	160
IBM 2741 Communications Terminal	128
IBM 2741 Communications Terminal on a switched network	160
IBM 3277 Display Station (local)	135
IBM BSC Terminal on a nonswitched, point-to-point network	296
IBM BSC Terminal on a switched network	432
IBM BSC Terminal on a nonswitched multipoint network	328
AT&T Model 33/35 TWX stations	200
AT&T 83B3 Selective Calling Stations	168
Western Union Plan 115A Outstations	160
World Trade Telegraph Terminals	176

Figure 43. BTAM Control Information Space Estimate by Device Type (Part 2 of 2)

Figure 44 contains information space estimates for each device type for the 3270 display system.

Device Type	Storage Requirement (in bytes)
Remote 3270 device	328
Local 3270 device	120

Figure 44. BTAM Control Information Space Estimates for Each Device Type (3270 Display System)

The control blocks in Figure 45 are used for each line group.

Control Block	Remote Storage Requirement (in bytes)	Local 3270 Storage Requirement (in bytes)
Data control block		
• with binary synchronous communication	84	56
• without binary synchronous communication	56	
• Data extent block	104 to 120 plus 4 per line	56 plus 4 per device
• Interruption request block	N/A	124
• Interruption queue element	N/A	24

Figure 45. BTAM Control Block Space for Each Line Group

The control blocks in Figure 46 are used for each line group or device group.

Group Type	Control Blocks	Storage Requirement (in bytes)
Remote 3270 line group	DCB,DEB	188 to 204 + 4 per line
Local 3270 device group	DCB,IRB,IQE,DEB	260 + 4 per line

Figure 46. BTAM Control Block Space for Each Line Group or Device Group (3270 Display System)

The control blocks in Figure 47 are used for each line; select and total the appropriate entries.

Control Block	Remote Storage Requirement (in bytes)	Local 3270 Storage Requirement (in bytes)
Data event control block • with binary synchronous communication • without binary synchronous communication	48 40	40
Input/output block	96	96
Unit control block	20	20
Line error block (LERB macro instruction)	20	N/A

Figure 47. BTAM Control Block Space for Each Line

The control blocks in Figure 48 are used for each line or device.

Line or Device Type	Control Block	Storage Requirement (in bytes)
BSC line for remote 3270 devices	IOB	64
	UCB	20
	Line error block	20
Local 3270 device	IOB	64
	UCB	40

Figure 48. BTAM Control Block Space for Each Line or Device (3270 Display System)

Select entries from Figure 49 for each line according to its device type.

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	64
IBM 1030 Data Collection System (P)	88
IBM 1050 Data Communications System	64
IBM 1050 Data Communications System (P)	80
IBM 1050 Data Communications System (AD)	88
IBM 1060 Data Communications System	56
IBM 1060 Data Communications System (P)	80
IBM 2740 Communications Terminal	40
IBM 2740 Communications Terminal (C)	48
IBM 2740 Communications Terminal (CO)	64
IBM 2740 Communications Terminal (A)	48
IBM 2740 Communications Terminal (D)	56
IBM 2740 Communications Terminal (AC)	48
IBM 2740 Communications Terminal (DC)	64
IBM 2740 Communications Terminal (DCO)	64
IBM 2740 Communications Terminal (ADT)	64
IBM 2740 Communications Terminal (ADTC)	64
IBM 2740 Communications Terminal (S)	56
IBM 2740 Communications Terminal (SP)	88
IBM 2740 Communications Terminal (SC)	64
IBM 2740 Communications Terminal (SCP)	88
IBM 2741 Communications Terminal	48
IBM 2741 Communications Terminal (A)	48
IBM 3277 Display Station (local)	24
IBM BSC Terminal on a nonswitched point-to-point network	72
IBM BSC Terminal on a switched network	80
IBM BSC Terminal on a nonswitched multipoint network	88
IBM 2260 Display Unit (R)	64
AT&T 83B3 Selective Calling Stations	48
AT&T Model 33/35 Teletypewriter Exchange Terminal using the eight-bit Data Interchange Code (A)	56
AT&T Model 33/35 Teletypewriter Exchange Terminal using the eight-bit Data Interchange Code (D)	56
Western Union Plan 115A Outstations	40
World Trade Telegraph Terminals	40

Where: A = Automatic answering
C = Checking
D = Dialing (automatic calling)
P = Auto Poll
R = Remote attachment with an IBM 2701 Type III Adapter
S = Station control
T = Transmit control
O = IBM 2760 Optical Image Unit

Figure 49. BTAM Channel Program Space Estimate by Device Type per Line

The control blocks in Figure 50 are used for channel program space estimates for each line or device.

Line or Device Type	Storage Requirement (in bytes)
BSC line for remote 3270 devices	88
Local 3270 device	24

Figure 50. BTAM Channel Program Space Estimates for each Line or Device (3270 Display System)

Figure 51 contains the storage requirement for code translation tables (AMSTRTAB) per device type.

Description	Storage Requirement (in bytes)
Input Translation (transmission code to EBCDIC)	256
Output Translation (EBCDIC to transmission code)	256

Figure 51. Storage Requirement for Code Translation Tables for BTAM

The control blocks in Figure 52 are used for each READ or WRITE macro instruction.

Macro Instruction	Control Block	Storage Requirement (in bytes)
READ or WRITE for remote 3270	DECB	48
READ or WRITE for local 3270	DECB	40

Figure 52. BTAM Control Block Space for each READ or WRITE Macro Instruction (3270 Display System)

BTAM support for the 3270 display system increases the auxiliary storage requirements by adding to the SVC library, the macro library and the subroutine libraries. The auxiliary storage requirements for BTAM with 3270 display support are shown in Figure 53.

Library	Number of Directory Records	Number of Tracks Required								
		2301	2302	2303	2311	2314	2321	2305-1	2305-2	3330
SYS1.SVCLIB	18	7	NA	24	33	16	NA	14	10	10
SYS1.MACLIB (blocked)	2	13	65	66	70	37	120	20	18	22
SYS1.MACLIB (unblocked)	2	29	79	103	109	69	229	88	49	44
SYS1.TELCMLIB	1	2	2	2	3	2	4	2	2	2

Figure 53. Auxiliary Storage Requirements for BTAM

BTAM Example

This example shows how to estimate the dynamic storage required by a telecommunications application with Auto Poll and buffer pool support but without dynamic buffering and binary synchronous communication.

Assume an MFT configuration of:

One line with three IBM 1050 Data Communications System Terminals
One line with two IBM 1050 Data Communications System Terminals

Basic system information

One line group
Start-stop error recovery procedures
Translation
One DECB per line

```
BTAM coding space estimate (8,950 + 158 + 352)..... 9,460
Control information space by device type.............. 204
Control block space estimate for one line group....... 56
Control block space estimate for two lines 104(2).... 224
Channel program space for two lines 80(2)............. 160
Translation tables for input and output 256(2)....... 512
                                          Total          10,616 bytes
```

Queued Telecommunications Access Method (QTAM)

The dynamic main storage requirement for QTAM is estimated from formulas and tables for message control and message processing.

Message Control

Storage required for message control is estimated from the following formula:

```
S = A + L + C + P + B

Where:  A = the size of message control modules and subroutines.
        L = the size of line procedure specification (LPS) routines
            and linkages to them.
        C = the size of control blocks and information.
        P = the size of channel programs and related areas.
        B = the size of input/output buffer times the number of
            buffers.  To this figure must be added 16 times the number
            of buffers plus 24m.
            m = the number specified in the third operand of the
                BUFFER macro instruction that is the number of channel
                command words QTAM must generate to send the idle
                characters specified by the PAUSE macro instruction.
```

Estimates A, L, C, and P are obtained from Figures 54 through 57.

Module or Subroutines	Storage Requirement (in bytes)
Primary requirement:	
• Implementation module	8,360
• BTAM module	1,056
Optional requirements:	
• Operator control	3,610
• Checkpoint/restart	1,232
• World Trade Telegraph Terminals	1,248

Figure 54. Estimate A for QTAM Message Control

Select entries from Figure 55 according to the Line Procedure Specification (LPS) macro instructions used. Almost all of these macro instructions create inline linkages to modules. These modules also make linkages to second level routines that are used by the modules. These second level routines only need to be included once. The storage requirement is equal to the size of the sharable module and needed second level routine plus the size of the generated linkage. If a macro instruction is used more than once (in either the same or a different LPS), estimate L is increased only by the additional linkages. A few macro instructions produce inline functional code instead of linkages. Each communications line group requires one LPS. Line groups with the same message handling characteristics can use the same LPS.

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
BREAKOFF	8	216	
CANCELM	8	104	
COUNTER	12		
DATESTMP	8	88	80 IECKEXPD
DIRECT	10	0	104 IECKLKUP

Figure 55. Estimate L for QTAM Message Control (Part 1 of 3)

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
ENDRCV	12	0 (3)	
ENDRCV (WTTA)	18	152	
ENDSEND	8	0 (3)	
EOA	22	96	96 IECKSCAN 64 IECKSKPS(5) 40 IECKROUT(5) 24 IECKTYPE(5) 104 IECKLKUP
EOB	6	184	
EOBLC	6	400	
ERRMSG	28	304 + error message	104 IECKLKUP
INTERCPT	12	152	
LOGSEG	14	QSAM (1)	
LPSTART	20	1320	
MODE(C)	14	64 + MODE(U)	96 IECKSCAN
MODE(U) INITIATE MODE(U) PRIORITY MODE(U) CONVERSE	10 10 10	16 24 296	96 IECKSCAN
MSGTYPE(C)	14	56	96 IECKSCAN
MSGTYPE(U)	0	0	
OPCTL	50	3610	104 IECKLKUP 1176 IECKLNCH 96 IECKSCAN
PAUSE	13 + no. of idle characters	272	
POLLIMIT	14	128	
POSTRCV	6	0 (3)	
POSTSEND	8	0 (3)	
RCVHDR	8		
RCVSEG	0	0 (4)	
REROUTE	18	44	104 IECKLKUP
ROUTE	8	40	104 IECKLKUP 96 IECKSCAN

Figure 55. Estimate L for QTAM Message Control (Part 2 of 3)

LPS Macro Instruction	Storage Requirement (in bytes)		
	Inline Linkage or Code	Sharable Modules	Second Level Routine
SENDHDR	16		
SENDSEG	0	0 (4)	
SEQIN	8	128	96 IECKSCAN
SEQOUT	8	112	80 IECKEXPD
SKIP (S)	8 + no. to be skipped	64	96 IECKSCAN
SKIP (CT)	8	40	96 IECKSCAN
SOURCE	8	176	96 IECKSCAN
TIMESTMP	8	144	80 IECKEXPD
TRANS	10	56 + 256T	
WRU	0	0	

Where: C = character operand specified (conditional).

U = character operand null (unconditional).

N = the number of characters in destination code.

S = skip to and include designated character configuration.

CT = skip designated count of nonblank characters.

T = the number of translation tables. Translation tables are: RCVEITA2, RCVET1, RCVET2, RCVEZSC3, RCVE1030, RCVE1050, RCVE1060, RCVE2260, RCVE2740, RCVF2740, RCVF1050, SENDITA2, SENDT1, SENDT2, SENDT3, SENDZSC3, SEND1030, SEND1050, SEND1060, SEND2260, SEND2740.

Notes:

1. QSAM is used with PUT (move mode). The user may specify any device or record format.
2. For operands other than CONVERSE, INITIATE, or PRIORITY, the storage requirement is the user program plus 36 plus IECKSCAN for a C character operand or 10 for a U character operand.
3. These delimiters cause linkages to QTAM routines included in Figure 52.
4. This macro instruction identifies the entry point for the RCVSEG and SENDSEG sections of LPS.
5. If the macro instruction MSGTYPE, ROUTE, or SKIP(S) is used in the program, the storage estimate for IECKTYPE, IECKROUT, or IECKSKPS, respectively, should not be added to the requirement for EOA.

Figure 55. Estimate L for QTAM Message Control (Part 3 of 3)

Select all applicable entries from Figure 56.

Control Blocks and Information	Storage Requirement (in bytes)
Terminal table	
•TERMTBL macro instruction	12
•OPTION macro instruction	the number of bytes specified
•TERM macro instruction	10 + I + D + (U see note 3) Where: (I + U + D) ≤ 243
•DLIST macro instruction	9 + I + 2(N see note 3)+ (134 see note 1) Where (I + 2N) ≤ 243
•PROCESS macro instruction	9 + (Y see note 3)
Polling list (POLL macro instruction) •without Auto Poll	For nonswitched- 4 + 2(N see note 2) For switched IBM terminal- 5 (see note 2) For TWX and WTTA - 3 + (I see note 2)
•with Auto Poll	8 + KN, where For IBM 1030, K=2 For all others, K=3
ENDREADY macro instruction	32
BUFFER macro instruction	8
Data Control Block and Data Extent Block	
•For the checkpoint data set	32 + 93
•For each communication line group	32 + 4L + 72 + 4C
•For each WTTA communication line group	36 + 4L + 72 + 4C
•For each direct access device	32 + 76
Line Control Block	112 for each communication line
Message Control Block for process and destination queues	32X

Figure 56. Estimate C for QTAM Message Control (Part 1 of 2)

Where: N = the number of terminals.

I = the number of bytes in terminal ID.

U = the number of bytes in optional area.

D = the number of bytes in device address area which contains:

- For nonswitched-- address and polling characters.
- For IBM switched terminal-- 1 byte of the number of dial digits + as many bytes as dial digits + addressing characters.
- For TWX -- 1 byte of the number of dial characters + as many bytes as dial digits + 1 byte of the number of ID characters + two times as many bytes as the number of ID characters.
- For WTTA -- 1 byte of the number of ID characters + two times as many bytes as the number of ID characters.

X = the number of lines or terminals (depending on queuing techniques) and the number of process queues.

Y = the number of bytes in name of the process entry in the terminal table (1-8).

L = the number of polling lists in the CPOLL keyword parameter.

C = the number of communication lines in the data set.

Notes:
1. If the macro instruction is used more than once, the 134 should be included only once.
2. Add the number of bytes necessary for alignment on a halfword boundary.
3. Add the number of bytes necessary for alignment on a fullword boundary.

Figure 56. Estimate C for QTAM Message Control (Part 2 of 2)

Select one entry from Figure 57 for each terminal device type used.

Terminal Device Type	Storage Requirement (in bytes)
IBM 1030 Data Collection System	312 + 56N
IBM 1030 Data Collection System with Auto Poll	224 + 96N
IBM 1050 Data Communications System	224 + 56N
IBM 1050 Data Communications System with Auto Poll	200 + 96N
IBM 1050 Data Communications System on a switched network	336 + 80N
IBM 1060 Data Communications System	208 + 48N
IBM 1060 Data Communications System with Auto Poll	192 + 96N
IBM 2260-2848 Display Complex attached as a remote terminal on a switched network	304 + 80N
IBM 2740 Communications Terminal	
Type I: Basic nonswitched network	128 + 80N
Type II: Basic switched network	200 + 80N
Type III: Basic nonswitched network	
with station control	168 + 80N
with station control and Auto Poll	144 + 96N
Type IV: Basic nonswitched network	
with station control and checking	248 + 80N
with station control, checking and Auto Poll	224 + 96N
Type V: Basic switched network with transmit control and checking	304 + 80N
Type VI: Basic nonswitched network with checking	208 + 80N
Type VII: Basic switched network with checking	272 + 80N
Type VIII: Basic switched network with transmit control	200 + 80N
AT&T Model 33/35 TWX Stations	200 + 48N
AT&T 83B3 Selective Calling Stations	173 + 48N
Western Union Plan 115A Outstations	168 + 40N
World Trade Telegrpah Terminals	152 + 64N
Where: N = the number of communication lines	

Figure 57. Estimate P for QTAM Message Control

Message Processing

Storage required for message processing is estimated from the following formula:

S = C + M
Where: C = the size of control blocks. M = the size of macro instruction routines and inline code.

Estimates C and M are calculated from Figures 58 and 59.

Message Processing Data Control and Extent Blocks	Storage Requirement (in bytes)
Main storage process queues	(44 + 140)N
Main storage destination queues	(44 + 140)M
Where: N = the number of MS process queues. M = the number of MS destination queues.	

Figure 58. Estimate C for QTAM Message Processing

Select entries from Figure 59 for each macro instruction used. Almost all of these macro instructions create inline linkages to modules. Their storage requirements are equal to the size of the module plus the size of the generated linkages plus the work area. If the macro instruction is used more than once, the estimate is increased only by the additional linkage.

	Storage Requirement (in bytes)		
Macro Instruction	Work Area (1)	Inline Code	Sharable Module
GET Segment	Variable (2)	14	336
GET Message	Variable (2)	14	408
GET Record	Variable (2)	14	432
PUT Segment	Variable (2)	14	592
PUT Message	Variable (2)	14	564
PUT Record	Variable (2)	14	640
RETRIEVE Destination	(buffer size)-8	12	136
RETRIEVE Sequence number	(buffer size)-8	28	416
COPYQ	32	22	96
COPYP	Up to 255	24	96 + 112 IECKDCBL (4)
COPYT	Up to 252	22	120
CHNGP	Up to 255	24	144 + 112 IECKDCBL (4)
CHNGT	Up to 252	22	240
RELEASEM	None	18	264
STOPLN	None	30	1176 IECKLNCH (3) + 112 IECKDCBL (4)
STARTLN	None	14	1176 IECKLNCH (3) + 112 IECKDCBL (4)
CLOSEMC	None	6	288 + 1176 IECKLNCH (3)
CKREQ	None	120	

Notes:
1. The same work area can be used more than once.
2. Use the length specified in the SOWA subfield of the macro instruction.
3. When combinations of STOPLN, STARTLN, and CLOSEMC are used, the requirement for IECKLNCH is included only once.
4. The requirement for IECKDCBL is to be added only when the terminal name is given as an operand in the macro instruction.

Figure 59. Estimate M for QTAM Message Processing

QTAM Example

This example contains the coding used and the storage required for the following telecommunications application.

Assume a telecommunications configuration of:

- One line with two IBM 1050 Data Communications System terminals (BOST,PHIL)
- One line with a IBM 1050 Data Communications System terminal (WASH)
- One line with two Western Union Plan Outstations (NYCX,CHIX)
- One direct access device

Basic system information:

- Two line groups
- Two line procedure specification routines
- No logging
- One main-storage process queue
- One main-storage destination queue
- Three buffers per line for the IBM 1050 terminal
- Two buffers per line for Western Union Plan 115A Outstation
- Two buffers for the message processing program
- Ninety-two bytes per buffer

Note: An ampersand (&) indicates that the sharable module or second line routine for this macro instruction is already included in the storage requirement. An ampersand also indicates that a work area is being reused.

Message Control Requirement = A + L + C + P + B
A: Message control modules and subroutines..... 9,416 bytes
L: LPS routines and linkages

Name	Macro	Operand	Inline Code	Sharable Modules
LPS1	LPSTART	10,TERM=(1050)	20	1320
	RCVSEG		0	
	TRANS	RCVF1050	10	312
	RCVHDR		8	
OPERCTL	OPCTL	CTLMSG=QQQ,TERM=WASH,		
		ALTERM=BOST,INTRCPT=YES	50	4986
	ROUTE	4	8	40&
	EOA	C'.'	22	184&
	MODE	CONVERSE,C'C'	10	296&
	MODE	PRIORITY,C'P'	10	24&
	MODE	INITIATE,C'I'	10	16&
	MSGTYPE	C'S'	14	56&
	SOURCE	4	8	176&
	SEQIN	3	8	128&
	ENDRCV		12	
	EOBLC		6	424
	ERRMSG	X'8000',SOURCE,		
		=C'.DESTINATION ERROR'	28	322&
	POLLIMIT	=X'1'	14	128
	POSTRCV		6	
	SENDHDR		16	
	SEQOUT	4	8	192
	TIMESTMP	6	8	144&
	SENDSEG		0	
	PAUSE	X'15',13X'5E'	26	272
	TRANS	SEND1050	10	256&
	ENDSEND		8	
	EOBLC		6	&
	POSTSEND		8	
		Totals	334	9,276

Total for LPS1..... 9,290 bytes

LPS2	LPSTART	10,TERM=(1050)	20	&
	RCVSEG		0	
	TRANS	RCVET1	10	256&
	BREAKOFF	200	8	216
	RCVHDR		8	
	ROUTE	4	8	&
	EOA	C'.'	22	&
	MODE	CONVERSE,C'C'	10	&
	MODE	PRIORITY,C'P'	10	&
	MODE	INITIATE,C'I'	10	&
	ENDRCV		12	
	ERRMSG	X'8000',SOURCE,		
		=C'.DESTINATION ERROR'	28	&
	POSTRCV		6	
	SENDHDR		16	
	SEQOUT		8	&
	SENDSEG		0	&
	PAUSE	X'15',2X'1F'	15	&
	TRANS	SENDT1	10	256&
	POSTSEND		8	
		Totals	209	728

Total for LPS2..... 937 bytes

Total L..... 10,547 bytes

C: Control Blocks and Information

Name	Macro	Operand	Requirement
DISK	DCB	DSORG=CQ,MACRF=(G,P), DDNAME=SYSQUEUE	
DCB1	DCB	DSORG=CX,MACRF=(G,P), CPOLL=(POLL1,POLL2),CPRI=E, BUFRQ=3,ACLOC=13,CLPS=LPS1, DDNAME=LINES	
DCB2	DCB	DSORG=CX,MACRF=(G,P),CPRI=E, CPOLL=POLL3,BUFRQ=2,ACLOC=13, CLPS=LPS2,DDNAME=TLINE	

Message Queue control blocks 32(4)..... 128

Data control block and data extent block
Line group one:32 + 4(2) + 72 + 4(2)..... 120
Line group two:32 + 4(1) + 72 + 4(1)..... 112
Direct access device:32 + 76..... 108

Line control block 3(112)..... 336
Total 804

Name	Macro	Operand	
	OPEN	(DISK,DCB1,(INOUT), DCB2,(INOUT))	In transient area
	ENDREADY		32
	CLOSE	(DISK,DCB1,DCB2)	In transient area
POLL1	POLL	(BOST,PHIL)	8
POLL2	POLL	(WASH)	6
POLL3	POLL	(NYX,CHIX)	8
	BUFFER	10,092,6	8
	TERMTBL	ALLP	12
PROC	PROCESS		16
BOST	TERM	L,DCB1,1,62026215	21
PHIL	TERM	L,DCB1,1,64026415	21
WASH	TERM	L,DCB1,2,62026215	21
CHIX	TERM	L,DCB2,1,13131307	21
NYCX	TERM	L,DCB2,1,18131807	21
ALLP	DLIST	(PROC,BOST,PHIL,WASH, CHIX,NYCX).....	160
		Total	355

Total C..... 1,159 bytes

P: Channel program area 224 + 56(2) + 168 + 40..... 544 bytes

B: Buffer areas 10(92) + 16(10) + 24(6)..... 1,224 bytes

Total dynamic requirement for Message Control..... 22,890 bytes

Message Processing Requirement = C + M

C: Control Blocks

Name	Macro	Operand	Requirement
DCBI	DCB	DSORG=MQ,MACRF=G,DDNAME=INPUT, BUFRQ=2,SOWA=74,RECFM=S, EODAD=EOD,TRMAD=LOCIN, SYNAD=ERROR	
DCBO	DCB	DSORG=MQ,MACRF=P,DDNAME=OUTPUT, RECFM=S,TRMAD=LOCOUT	

Data control block and data extent block
Main storage process queue: 44 + 140 184
Main storage destination queue: 44 + 140 184

Total C..... 368 bytes

M: Macro instruction Routines and Inline Linkages

Name	Macro	Operand	Work Area	Inline Code	Sharable Modules
	OPEN	(DCBI,(INPUT), DCBO,(OUTPUT))		In transient area	
BEGIN	GET	DCBI,AREA	74	14	336
	Processing: If a close down branch to STOP If not, branch to TEST				
STOP	CLOSEMC			6	1464
	CLOSE	(DCBI,DCBO)		In transient area	
	Processing: Return to control program				
TEST					
	Processing: If a control message, branch to CHANGE If not, branch to WRITE				
CHANGE	COPYT	NYCX,WORKAREA	20	22	120
	CHNGT	NYCX,WORKAREA	&	22	240
WRITE	PUT	DCBO,AREA	&	14	592
		Totals	94	78	2,560

Total M..... 2,732 bytes

Total dynamic requirement for Message Processing..... 3,100 bytes

Graphic Access Method (GAM)

The dynamic main storage requirement for the I/O and attention-handling operations of the graphic support routines are estimated from the following formula. No dynamic storage is required for buffer management facilities because these are SVC routines and, as such, are executed in the SVC transient area.

$S = A_1 + A_2 + B_1 + B_2$
Where: A_1 = size of the data control block(DCB), input/output block(IOB), and unit control block(UCB). A_2 = size of macro instructions. B_1 = size of sharable I/O routines. B_2 = size of sharable interruption handling routines.

Select one entry from Figure 60 for each type of device used.

I/O Device Type	Storage Requirement (in bytes)
2250	4X + 52Y + 72Z
2260	4X + 52Y + 72Z
Where: X = the number of unit control blocks. Y = the number of data control blocks. Z = the number of input/output blocks.	

Figure 60. Estimate A_1 for Graphic Support

Select one or more entries from Figure 61 for each macro instruction used.

I/O Device Type	Storage Requirement (in bytes)
2250	70M + 60A + 36B + 4D
2260	70M + 60A
Where: M = number of input/output macro instructions used. A = number of attention handling macro instructions used. B = number of buffer management macro instructions used. D = number of order and data-generation macro instructions used.	

Figure 61. Estimate A_2 for Graphic Support

Select one entry from Figure 62 for the particular device type used. Include this estimate only once if both devices are used.

I/O Device Type	Storage Requirement (in bytes)
2250	2,952
2260	2,952

Figure 62. Estimate B_1 for Graphic Support

Select one entry from Figure 63 for the particular device type used. Include this estimate only once if both devices are used.

I/O Device Type	Storage Requirement (in bytes)
2250	1,875
2260	1,875

Figure 63. Estimate B_2 for Graphic Support

2250 Example

An installation employs four 2250 Display Units, Model 3, attached to a 2840 Display Control. In the program being considered, the buffer management and attention handling facilities are being used with a single display unit. The program includes three input/output, two buffer management, and four attention handling macro instructions.

$S = A_1 + A_2 + B_1 + B_2$

A_1, control blocks (4 UCBs, 1 DCB, 3 IOBs, 1 DEB).... 358
A_2, macro instructions 70(3) + 60(4) + 36(2)..... 522
B_1, sharable I/O routines..... 2,952
B_2, sharable attention handling routines..... 1,875
Total 5,707 bytes

2260 Example

An installation employs eight 2260 Display Stations attached to a single 2848 Display Control. In the program being considered, four 2260 Display Stations are associated with each of two DCBs. Attention handling is used. The program includes two input/output and eight attention handling macro instructions.

$S = A_1 + A_2 + B_1 + B_2$

A_1, control blocks (8 UCBs, 2 DCBs, 2 IOBs, 2 DEBs).. 428
A_2, macro instructions 70(2) + 60(8)..... 620
B_1, sharable I/O routines..... 2,952
B_2, sharable attention handling routines..... 1,875
Total 5,875 bytes

Telecommunciations Access Method (TCAM)

If you select the TSO option of MVT, you must use TCAM. You can estimate the dynamic storage requirement for TCAM by using the following figures and formulas for the message control program requirements and the message processing program requirements.

Message Control Program Requirements

The dynamic main storage requirement for the message control program is:

```
S = M + L + C + P +(A+B)(K+12) + O + TS + OC

Where:  M = the size of the message handler macro expansions.

        L = the size of the message control modules.

        C = the size of the control blocks and information.

        P = the size of the channel programs, translation tables, and
            special character tables.

        A = the value of the MSUNITS operand on the INTRO macro.

        B = the value of the LNUNITS operand on the INTRO macro.

        K = the value of the KEYLEN operand on the INTRO macro.

        O = the size of selected TCAM options.

       TS = 0 if the TSO option is not selected:  otherwise
            TS = 16,510 + Y.

            Where:  Y = the size of selected TSO macros from Figure
                        62.

       OC = (operator control) = 3620 bytes
```

Use Figures 64 through 69 to calculate the storage requirements for M,L,C,P,A,B,K,O, and Y.

Macro Instruction	Storage Requirements in bytes	
	First use of macro	Each subsequent use of macro
CANCELMG (1)	12	8
LEVEL=BLK	12	8
with a mask	12	8
CHECKPT (1)	8	4
CODE		
with tablename operand, in INHDR group	60	52
with tablename operand, not in INHDR group	22	18
with no operand, in INHDR group	56	48
with no operand, not in INHDR group	18	14
COMMBUF	24+c	20+c
COUNTER (1)	18	14
CTBFORM		
with no operand	20	16
with option field	22	18
without option field and with ENCHAR=NO and DVCID=NO	18	14
CUTOFF	18	14
DATETIME (1)	38	30
ERRORMSG (1,2)	28+c	20+c
with 'EXIT' operand	32+c	24+c
ERRSET (1)	16	16
FORWARD (1)	26+c	22+c
with EXIT= operand	34+c	30+c
with DEST=PUT operand	20	20
with DEST=ORIGIN operand	22	22
with DEST=REG(No.) operand	40	46
HOLD (1)	12	8
with INTVL operand	16	12
INBLOCK	0	0
INBUF	0	0
with PATH operand	28	28
INEND	2	2
with no INMSG macro or with INMSG macro that uses PATH operand	22	22

Figure 64. Estimate M for TCAM Message Control Program (Part 1 of 4)

Macro Instruction	Storage Requirements in bytes	
	First use of macro	Each subsequent use of macro
INHDR	28	24
with PATH= operand	60	52
INITIATE (1)	16	16
with characters operand	52+c	52+c
INMSG	8	8
with PATH operand	36	36
LOCK (1)	16	12
with characters operand	44+c	40+c
LOCOPT (1)	14	14
LOG (1)		
in INHDR, INBUF, OUTHDR, or	18	14
OUTBUF in INMSG or OUTMSG	12	8
MHGET		
with REG= operand	20	16
with WORK=REG(No.) operand	20	16
with WORK=name operand	24	20
MHPUT		
with WORK=REG(No.) operand	20	16
with WORK=name operand	24	20
MSGEDIT (1,3)	28	14
in INBLOCK	62	42
with characters operand	34+c	20+c
in outgoing group	32	14
in outgoing group with characters operand	38+c	20+c
in INBUF with length operand	36	18
MSGFORM (1,4)	16	12
with BLOCK= or SUBBLCK= operand	18	14
with BLOCK= and SUBBLCK= operands	19	15
with BLOCK= and SENDTRP=	22	18
in outheader subgroup	26	14
with ENDCHAR= and COUNT= operand	18	14
in inblock subgroup with character string	42	26
in inblock subgroup with character string and option field	50	30
MSGGEN	13+c	9+c
with the fieldname operand	16	12
with the 'CODE' operand	17+c	13+c
with fieldname and 'CODE' operands	20	16
MSGLIMIT (1)		
with integer operand	20	16
with opfield operand	46	42

Figure 64. Estimate M for TCAM Message Control Program (Part 2 of 4)

Macro Instruction	Storage Requirements in bytes	
	First use of macro	Each subsequent use of macro
MSGTYPE (1)	4	4
with characters operand	36+c	36+c
with TABLE= operand	64	64
ORIGIN (1)	20	16
OUTBUF	0	0
with 'PATH' operand	28	28
OUTEND	2	2
with no OUTMSG macro or with OUTMSG that uses PATH= operand	14	14
OUTHDR	12	12
with 'PATH' operand	40	40
OUTMSG	16	12
with PATH= operand	54	54
with CTBFORM macro and no MSGFORM macro	22	14
with CTBFORM macro and MSGFORM macro with ENDCHAR= operand	42	22
with CTBFORM macro and MSGFORM macro without ENDCHAR= operand	30	14
with MSGFORM macro and ENDCHAR= operand without CTBFORM macro	36	20
with MSGFORM macro without CTBFORM macro and ENDCHAR= operand	32	16
PATH (1)	24	24
with characters operand	60+c	60+c
PRIORITY (1)	40	40
with characters operand	56+c	56+c
QACTION	22	18
REDIRECT (1,5)	12	8
with mask operand	16	12
RETRY	8	4
SCREEN		
without characters operand	18	14
with characters operand	52+c	48+c
SEQUENCE (1)		
in inheader subgroup	36	32
in outheader subgroup	16	12

Figure 64. Estimate M for TCAM Message Control Program (Part 3 of 4)

Macro Instruction	Storage Requirements in bytes	
	First use of macro	Each subsequent use of macro
SETEOF (1)	8	8
with characters operand	44+c	44+c
SETEOM	56+c	32+c
SETSCAN (1)	14	14
with characters operand	23+c	19+c
SLOWPOLL	16	12
STARTMH	38	18
with LC=OUT, STOP=YES	38	18
with option field	50	22
TERRSET	16	16
TGOTO	24	18
TYPETABL	6	4
last entry	10	8
UNLOCK (1)	16	12
with characters operand	44+c	40+c

Where: c = the number of characters coded in the character string operand of the macro.

Notes:

1. May not be used in a TSO message handler.
2. If the REDIRECT macro is coded before ERRORMSG, 4 bytes can be subtracted from this value.
3. If the MSGFORM macro is coded before MSGEDIT, 8 bytes can be subtracted from this value; if MSGEDIT is in an outgoing group, 4 additional bytes can be subtracted.
4. If the MSGEDIT macro is coded before MSGFORM, 8 bytes can be subtracted from this value; if the MSGEDIT, DATETIME, ERRORMSG, or SEQUENCE macros were coded in an outgoing group before MSGFORM, 4 more bytes can be subtracted from this value.
5. If the ERRORMSG macro is coded before REDIRECT, 4 bytes can be subtracted from this value.

Figure 64. Estimate M for TCAM Message Control Program (Part 4 of 4)

Select entries from the following figure. Each entry should be included only once regardless of the number of times the associated option is used in the Message Control Program. More than one entry may be included for one macro depending upon the operands coded. One entry may also encompass more than one mace. If more than one entry applies to a particular macro whose size is being determined, add the storage requirement for each applicable entry to determine the total number of bytes required for the macro.

Option	Storage Requirement (in bytes)
Required Modules	12275
CANCELMG macro coded with LEVEL=MSG	166
coded with LEVEL=BLK	786
Checkpt macro coded	85
CODE macro coded in any group	320
coded only in inheader subgroup (additional)	130
COMMBUF macro coded	572
COUNTER macro coded	105
CTBFORM macro coded	2718
CUTOFF macro coded	520
DATETIME macro coded	235
DATETIME, ERRORMSG, MSGEDIT, or MSGFORM macros for any group or SEQUENCE macro for outgoing group only	380
ERRORMSG macro coded	420
ERRORMSG or REDIRECT macro coded	290
FORWARD macro coded with any operands	1000
coded without DEST=PUT (additional)	161
coded with EOA specified (additional)	655
coded with option field (additional)	174
HOLD macro coded	1520
LOCK macro coded	150
LOG macro coded in either INHDR, INBUF, OUTHDR, or OUTBUF groups	220
coded in either INMSG or OUTMSG (additional)	690
MHGET macro coded	706
MHPUT macro coded	706
MSGEDIT macro coded with any operands	848
MSGEDIT macro coded for any insert operation	1440
coded for remove operation using an offset (additional)	664
coded for insert operation using an offset (additional)	286
coded for insert operation using a count (additional)	344
MSGEDIT or MSGFORM coded in inblock subgroup (additional)	339
MSGFORM macro coded (also see MSGEDIT and DATETIME entries above)	1560
MSGFORM macro coded with ENDCHAR=, SUBBLCK=, BLOCK=, COUNT=, or no operands	516
coded in the outheader subgroup (in addition see MSGEDIT macro coded with any operands)	1520
coded in inblock subgroup with option field specified (in addition, see MSGEDIT macro coded with any operands and coded in inblock subgroup)	176

Figure 65. Estimate L for TCAM Message Control Program (Part 1 of 3)

Option	Storage Requirement (in Bytes)
MSGGEN macro coded	230
MSGLIMIT macro coded	190
ORIGIN macro coded with a concentrator specified	500
coded without a concentrator specified	138
QACTION macro coded	1506
RETRY macro coded	268
SETEOM macro coded	1402
SCREEN macro coded	728
SEQUENCE macro coded in an incoming group	160
coded in an outgoing group	140
(also see DATETIME entry above)	
SETSCAN, FORWARD, or MSGEDIT macro coded with a character string	435
SETSCAN macro coded with POINT=BACK	175
SETSCAN macro coded with an integer	0
SLOWPOLL macro coded	350
STARTMH macro coded with any operands	848
coded with STOP=YES, or CONT=YES	1776
TGOTO macro coded	272
TLIST macro coded for distribution list	185
TLIST macro coded for cascade list	185
TRANLIST macro coded	445
UNLOCK macro coded	40
Any macro coded with the name of an option field (that is, COUNTER, LOCOPT, PATH, STARTMH, FORWARD, REDIRECT, ERRORMSG, MSGFORM, MSGEDIT, MSGLIMIT, TRANSLIST, CTBFORM, or SETEOM)	160
Operands on the INTRO macro	
COMMBUF=(n_1,n_2,n_3)	316
DTRACE=0 (Default)	475
DTRACE≠0	575
FEATURE=(,,TIMER) (Default)	980
FEATURE=(,,NOTIMER)	15
FEATURE=(,2741) (default)	1180
FEATURE=(NODIAL,NO2741)	1070
FEATURE=(DIAL,NO2741)	1334
FEATURE=(,,CONCO)	1367
INTVL≠0	665
LINETYP=BOTH (Default)	12087
LINETYP=BISC	9465
LINETYP=MINI	4441
LINETYP=STSP and ENVIRON=MIXED or TSO	7633
LINETYP=STSP and ENVIRON=TCAM	6079
MSUNITS≠0 and DISK=YES (Default)	10410
MSUNIT≠0 and DISK=NO	6080
MSUNITS=0 and DISK=NO	0
MSUNIT=0 and DISK=YES	7060
PRIMARY=SYSCON	580
TREXIT=0 and TRACE=0	530

Figure 65. Estimate L for TCAM Message Control Program (Part 2 of 3)

Option	Storage Requirement (in bytes)
Opened data control blocks with following options	
Message Queues data set	
CPB=1 on INTRO macro	720
CPB>1 on INTRO macro	1480
OPTCD=R on DCB or (MSUNITS=0 and DISK=YES)	4096
Line Group data set	
PCI≠(N,N) on DCB macro	1136
Dial lines	540
Leased lines	450
2260 local lines	650
FEATURE=(,2741) on INTRO macro (Default)	1180
FEATURE=(NODIAL,NO2741) on INTRO macro	760
FEATURE=(DIAL,NO2741) on INTRO macro	1055
BFDELAY=0 on TERMINAL macro	1840

Figure 65. Estimate L for TCAM Message Control Program (Part 3 of 3)

Control Blocks and Information	Storage Estimates (in bytes)
Address Vector Table INTRO macro, DISK=NO DISK=YES ENVIRON=TSO	 1152 1278 1128
READY macro	44
Termname Table TTABLE macro OLTERM=n	 82+N(3+C) 132n
Terminal Table TERMINAL macro	 20+On+Dn+(68+28Pn)** [35+W+[15Pn]]**
Terminal Table TERMINAL macro TLIST macro PROCESS macro LOGTYPE macro	 20+H+D+(68+28P)* 6+2T 88+H+28P 115
Station Control Block Concentrator device ID Table (there is one device ID table for each concentrator defined)	(84+4R)(S+U+L+Q+V)*** 9+4Y+H(3+Z)
Process Control Block PCB macro	 88
Line Control Block non-switched lines switched lines (generated as a result of OPEN macro)	 144 for each opened nonswitched line 152 for each opened switched line
Data Control Blocks Message Queues Data Set Checkpoint Data Set Line Group Data Set	 44 44 40+4I
Invitation Lists INVLIST macro	 9+3E+EA
Option Table OPTION macro	 10+FX
Disk Input/Output Blocks (generated as a result of OPEN macro)	52 for each extent of an opened message queues data set
Disk Channel Program Blocks (generated as a result of execution of INTRO macro	B(84+K)

Figure 66. Estimate C for TCAM Message Control Program (Part 1 of 2)

Control Blocks and Information	Storage Estimates (in bytes)

WHERE: N = the number of entries defined by TERMINAL, PROCESS, TLIST or LOGTYPE macros
C = the number of characters in the longest entry name (as specified in the TTABLE macro)
H = the number of device ID entries that have DVCID=CHARS
D = the length of device-dependent data specified on the TERMINAL macro: BUFSIZE=, ADDR=, BFDELAY=, BLOCK=, SUBBLCK=, NTBLKSZ=, TBLKSZ, RETRY=, LMD=, DVCID=, or TRANSP=operands
P = the number of priority levels (LEVEL operand) specified on TERMINAL or PROCESS macros
T = the number of entries specified for a TLIST macro
R = the value of the USEREG operand on the INTRO macro
S = the number of TERMINAL macros specifying BFDELAY
I = the number of invitation lists specified on the INVLI operand of the DCB macro
E = the number of entries defined for the INVLIST macro
A = the length of the addressing characters defined for each entry in the INVLIST macro
F = the number of TERMINAL or PROCESS macros which define data for the option field
X = the number of bytes defined by the OPTION macro (include the bytes necessary for the requested alignment)
B = the value of the CPB operand on the INTRO macro
K = the value of the KEYLEN operand on the INTRO macro
U = the number of lines whose TERMINAL macros do not specify BFDELAY=, LMDF=, MB=, QCNTRL=, or DVCID=CONC
L = the number of TERMINAL macros specifying LMD=YES or MB=YES
Q = the number of TERMINAL macros specifying QCNTRL=
V = the number of lines whose TERMINAL macros specify DVCID=CONC
W = the length of the delimiter (3rd suboperand of QCNTRL=)
Y = the number of device ID entries that have DVCID=NONE
Z = the length of device ID characters

*NOTE: If outgoing messages are queued by line (68+28P) should be included for only one terminal on the line.
*If the TERMINAL macro specifies TERM=367C, add 32 rather than (68+28P).
**Applies if QCNTRL= is specified. If QCNTRL= with level is specified, add 15Pn
***No more than one SCB due to the DVCID=CONC entry is generated per line.

Figure 66. Estimate C for TCAM Message Control Program (Part 2 of 2)

Add 520 bytes for each different translation table specified for line group DCBs. Select one of the following entries from Figure 67 for each terminal device type associated with an opened DCB.

Terminal Device Type	Storage Requirements (in bytes)
IBM 1030 Data Collection System	80 + 56n
IBM 1030 Data Collection System with Auto Poll	80 + 88n
IBM 1050 Data Communication System	80 + 56n
IBM 1050 Data Communication System with Auto Poll	80 + 88n
IBM 1050 Data Communication System on a switched network	80 + 80n
IBM 1060 Data Communication System	80 + 56n
IBM 1060 Data Communication System with AUTO Poll	80 + 88n
IBM 2260 Display Complex attached as a remote terminal on a switched network	80 + 56n
IBM 2260 Display Complex attached with a local configuration	80 + 40n
IBM 2265	80 + 56n
IBM 2740 Communication Terminal	
Type I: Basic nonswitched network	80 + 80n
Type II: Basic switched network	80 + 56n
Type III: Basic switched network with transmit control	40 + 72n
Type IV: Basic nonswitched network with Auto Poll	80 + 88n
IBM 2741 Communication Terminal	80 + 48n
IBM 2741 Communication Terminal or 5041 line on a switched network	80 + 64n
IBM 2760 Communication Terminal on a switched network	80 + 56n
IBM 2760 Communication Terminal on a nonswitched network	80 + 80n
IBM 2770 Communication Terminal	80 + 80n
IBM 2770 Communication Terminal with Auto Poll	80 + 88n
IBM 2780 Communication Terminal	80 + 80n
IBM 2780 Communication Terminal with Auto Poll	80 + 88n
IBM 3735 Programmable Buffered Terminal on a switched network	80 + 88n
IBM 3735 Programmable Buffered Terminal with Auto Poll	80 + 88n
IBM 3270 Information Display System	80 + 88n
IBM 2715 Transmission Control Unit	80 + 80n
IBM 2715 Transmission Control Unit with Auto Poll	80 + 88n

Figure 67. Estimate P for TCAM Message Control Program (Part 1 of 2)

Terminal Device Type	Storage Requirements (in bytes)
IBM 3670 Brokerage Communication System	80 + 80n
IBM 3670 Brokerage Communication System with Auto Poll	80 + 88n
IBM 7770 Audio Response Unit	80 + 32n
AT&T Model 33/35 TWX Stations	80 + 64n
AT&T 83B3 Selective Calling Stations or Western Union Plan 115A Outstations	80 + 56n
World Trade Telegraph Terminals	80 + 48n
Where: n = the number of opened communication lines	

Figure 67. Estimate P for TCAM Message Control Program (Part 2 of 2)

Name of Function	Selected Option	Storage Requirement (in bytes)
Subtask Trace Table	DTRACE=a on INTRO macro	16(a+1)
Interrupt Trace Table	TRACE=t and TREXIT=exit on INTRO macro	32(t+1)
Cross Reference Table	CROSSRF=c on INTRO macro	16(c+1)
Checkpoint/Restart	OPEN executed for checkpoint DCB	
IEDQNF Executor		354
IGG019RA-Appendage		100
Work area		296+3E+6(C+3) Where: E=value of CPRCDS operand on INTRO macro c=value of CKREQS operand on INTRO macro
Disk I/O Buffers (for Checkpoint/ Restart		300n Where: n=1. If n is greater than 1, efficiency may be increased by overlapping I/O and processing.
Transient area		850
On Line Test	OLTEST=X on INTRO macro	1024X
Trap Facility	COMWRTE=YES on INTRO macro	
IEDQFW-Executor		1918
Trace routine		1044
Application Program Processing	TCAM DCB opened in a Message Processing Program	
Work area		(396+4R)Q Where: R=value of USEREG operand on INTRO macro Q=number of Opens
IEDQEU-Open/Close Subtask		1140
One or more schedulers:		
IEDQEC-Put Scheduler	DCB(s) for output	1500
IEDQEW-Get Scheduler	DCB(s) for input	2200
IEDQEZ-Get Scheduler	DCB(s) for input	24
IEDQE7-Retrieve Scheduler	QTAM Compatable DCB(s)	860
QREST Facility		
IEDQGR-QREST service routine	QREST macro expansion	496 (TCAM application program region)
IEDQGQ-Queue reset executor	QBACK=YES on TPROCESS macro	720 (MCP region)

Figure 68. Estimate O for Message Control Program

Macro Instruction	Storage Requirement (in bytes)
ATTEN	16
CARRIAGE	18
TSINPUT	64
LOGON	25
SIMATTN	20
HANGUP	12
TRANLIST	4+4T+L

Where:
T = the number of translation tables specified
L = the total size of all specified control character strings

Figure 69. Estimate Y for TSO Macro Instructions

Message Processing Program

Storage required for a message processing program can be estimated from the following formula:

S=810+A+W+T+408F

Where: A = the size of the access method modules

W = the size of the work area specified by the 'BLKSIZE' operand of the DCB macro

T = the size of the TCAM macro expansions

F = 0, if SYNADAF is not executed

F = 1, if SYNADAF is executed

Estimates A and T are obtained from Figures 70 and 71.

Option	Storage Requirements (in bytes)
SAM DCB opened for input	3000
QTAM DCB opened for input	2150
SAM DCB opened for output	1010
QTAM DCB opened for output	500
BSAM DCB opened	340
POINT MACRO is used	345
TCOPY MACRO	530
QCOPY MACRO	516
TCHNG MACRO	645
ICOPY MACRO	280

Figure 70. Estimate A for TCAM Message Processing Program

Include the size of the macros in Figure 71, once for each time the macro is coded.

Macro Instruction	Storage Estimate (in bytes)
CHECK	14
CKREQ	22
GET	14
ICHNG	58
ICOPY	42
MCOUNT	182
MCPCLOSE with password	78
without password	68
MRELEASE with password	78
without password	68
POINT	16
PUT	14
QCOPY	36
with LIMIT= operand	42
QRESET	18
QSTART	0
READ	34
RETRIEVE	24
SLOWPOLL	12
with mask	16
TCHNG with password	62
without password	48
TCOPY	34
WRITE	34

Figure 71. Estimate T for TCAM Message Processing Program

TCAM Example

This example contains the coding used and the storage requirement for the following telecommunications application:

- One line with two IBM 1050 data communication system terminals (RAL1&RAL2).
- One line with two IBM 2741 terminals (RTP1&RTP2).
- One direct access device (defined by the DS DISKDCB DCB macro instruction on the following page).

The TCAM code on the following page defines the terminals, lines, buffers, and data sets for the configuration used in the example, and provides for activating and deactivating the TCAM message control program.

```
MCP         CSECT
            INTRO       KEYLEN=116,LNUNITS=5,CPB=3,
                        UNETYP=SYSP,FEATURE=(NODIAL,
                        NO2741),DISK=YES,OLTEST=0,
                        ENVIRON=TCAM
            OPEN        (DISKDCB,(INOUT),RALDCB,(INOUT),
                        RTPDCB,(INOUT))
            READY
            CLOSE       (RTPDCB,,RALDCB,,DISKDCB)
            L           13,4(13)
            RETURN      (14,12)

DISKDCB     DCB         DSORG=TQ,MACRF=(G,P),OPTCD=R
RALDCB      DCB         DSORG=TX,MACRF=(G,P),TRANS=105F,
                        MH=MH1050,
                        SCT=1050,PCI=(N,N,INVLIST=(INVRALI,
                        A,A,INVRAL2)
RTPDCB      DCB         DSORG=TX,MACRF=(G,P),TRANS=2740,
                        MH=MH2740,SEC=2740,PCI=(N,N)
                        INVLIST=(INVRTP,A,A)

            TTABLE      LAST=RTP2,MAXLEN=5
SWITCH      OPTION      H
LIST        TLIST       TYPE=D,LIST=(RAL1,RAL2,RTP1,RTP2)
RAL1        TERMINAL    QBY=L,DCB=RALDCB,RLN=1,TERM=1050,
                        QUEUES=DR,ADDR=6202,ALDEST=RAL1
                        SECTERM=YES,OPDATA=0,LEVEL=(241,
                        242,243)
RAL2        TERMINAL    QBY=L,DCB=RALDCB,RLN=2,TERM=1050,
                        QUEUES=DR,ADDR-6402,ALTDEST=RAL2
                        SECTERM=YES,OPDATA=Q,LEVEL=(241,
                        242,243)

RTP1        TERMINAL    QBY=T,DCB=RTPDCB,RLN=1,TERM=274I,
                        QUEUES=DR,ADDR=37E201,ALTDEST=RTP1,
                        SECTERM=YES,BFDELAY=5

RTP2        TERMINAL    QBY=T,DCB=RTPDCB,RLN=1,TERM=274I,
                        QUEUES=DR,ADDR=37E401,ALTDEST=RTP2
                        SECTERM=YES,BFDELAY=5

INVRAL1     INVLIST     ORDER=(RAL1+6215)
INVRAL2     INVLIST     ORDER=(RAL2+6415)
INVRTP      INVLIST     ORDER=(RTP1+E201,RTP2+E401)
```

This message control program is for a message-switching application. It contains two message handlers. No provision is made for an application program. The code for the message handlers is given below.

Message Control Program Requirement=M+L+C+P+(A+B)(K+12)+O+TS
M: The size of the message handler macro expansions

Name	Macro	Operand	In Line Code
MHI050	STARTMH	LC=OUT	38
	INHDR		28
	CODE	1050	60
	SETSCAN	C'X'	24
	SEQUENCE		36
	FORWARD	DEST=**	26
	SETSCAN	C'/'	20
	MSGTYPE	C'P'	37
	PRIORITY		40
	MSGTYPE		4
	INBUF		0
	INMSG		10
	INEND		2
	OUTHDR		12
	SEQUENCE		16
	CODE	1050	22
	OUTEND		14
		Total for MH1050.....	389

Name	Macro	Operand	In Line Code
MH2740	STARTMH	LC=OUT	18
	INHDR		24
	CODE	2740	52
	SETSCAN	C'X'	20
	SEQUENCE		32
	FORWARD	DEST=**	22
	INEND		22
	OUTHDR		12
	SEQUENCE		12
	CODE		14
	MSGFORM		20
	OUTEND		14
		Total for MH2740.....	262
		Total M.....	651 Bytes

L: The size of the message control modules

Required Modules	12775
CODE macros	450
FORWARD macros	1000
MSGFORM macro	2884
SEQUENCE macros	400
SETSCAN macros	435
STARTMH macros	848
TLIST macro	185
INTRO macro with	
DTRACE=0	475
FEATURE=(,,TIMER)	980
INTVL=0	0
LINETYP=STSP,ENVIRON=TCAM	5550
MSUNITS=0,DISK=YES	7060
PRIMARY=SYSCON	0
TRACE=0	0
CPB=3	1480
FEATURE=(NODIAL,NO2741)	1070
Message Queues Disk Data Set, OPTCD=R	3510
Leased Line Data Set	450
BFDELAY=5 on TERMINAL macro	1840
Total L.....	41,392 Bytes

C: The size of the control blocks and information

Name	Macro	Control Block	Operand	Requirement
	INTRO	Address Vector Table	DISK=YES,ENVIRON=TCAM	1278
	READY			44
	TTABLE	Termname Table	MAXLEN=5	122
RAL1	TERMINAL	Terminal Table	QBY=L,OPDATA=0,LEVEL=(241,242,243),ADDR=6202	
		Queue Control Block		175
RAL2	TERMINAL	Terminal Table	QBY=L,OPDATA=0,LEVEL=(241,242,243),ADDR=6402	
RTP1	TERMINAL	Terminal Table	QBY=T,BFDELAY=5,ADDR=37E201	
		Queue Control Block		95
RTP2	TERMINAL	Terminal Table	QBY=T,BFDELAY=5,ADDR=37E401	
		Queue Control Block		95
LIST	TLIST	Terminal Table	IIST=(RAL1,RAL2,RTP1,RTP2)	14
		Station Control Blocks		252
		Line Control Blocks		248
DISKDCB	DCB	Data Control Block		44
RALDCB	DCB	Data Control Block		48
RTPDCB	DCB	Data Control Block		44
INVRAL1	INVLIST	Invitation List		14
INVRAL2	INVLIST	Invitation List		14
INVRTP	INVLIST	Invitation List		19
SWITCH	OPTION	Option Table		14
		Disk Input/Output Blocks		52
		Disk Channel Program Blocks		576
		Total C.....		3148 Bytes

P: The size of the channel programs, translation tables, and special character tables.

```
Translation Table                          1,040
Special character table                      160
Channel Program                              160
                    Total P.............. 1,360 Bytes
```

(A+B)(K+12): The size of buffer units

```
                    Total (A+B)(K+12)... 640 Bytes
```

O: The size of selected options

```
                    Total O..... 0
```

TS=0, TSO option not selected

Total dynamic requirement for Message Control Program.... 47,191 Bytes

Checkpoint/Restart Work Area Requirement

When using the Checkpoint/Restart facilities, the user must provide enough free core to allow CHECKPOINT/RESTART to do a GETMAIN for a work area. This work area is required only when a checkpoint is taken, and at all other times may be used for other purposes. The size of the work area can be computed using the following formula:

```
S = 1,108 + T + 48(N-2) + D + E
```

Where: T = the size of the TIOT when a checkpoint is taken. The size is computed as:
T = 28 + 20A + 4B

Where: A = the total number of data sets defined in the job step, including JOBLIB, if one is present
B = the sum of devices allocated to each data set, not including the first device

N = the number of data sets that were open when the checkpoint was taken. The value for N must be at least 2 and must include the checkpoint data set, even if this data set was not open.

D = 344 for MFT (for 3 RBs)
0 for MVT/M65MP

E = 0 if the user opens the checkpoint data set.
or
the sum of the lengths of the IOBs created by the open routines, if the checkpoint/restart facility opens the checkpoint data set -- plus (for MFT) the size of the DEB.

- Increase the size of the work area by 560 bytes if all of the following conditions apply: (1) the user adds to a direct access output data set after a checkpoint is taken, (2) a new extent is required, and (3) a restart is then attempted.

Auxiliary Storage - Contents

Figures

Estimating the Auxiliary Storage Requirement

Every operating system configuration uses auxiliary storage on direct access devices for system residence and for work space. The total auxiliary storage requirement is the sum of its system residence and work space requirements plus the auxiliary storage required for input stream(s) and system output data. This section contains figures and formulas to be used in estimating the direct access auxiliary storage requirements.

System Residence

The total amount of auxiliary storage required for system residence is determined by the libraries and data sets to be used by the system, and on the direct access devices selected. The system residence requirements may be split between several volumes, one of which is the system residence volume. The following libraries and data sets are required for every operating system and must be on the system residence volume:

- SYSCTLG (System Catalog) -- The system catalog contains pointers to all cataloged data sets.
- SYS1.NUCLEUS (Nucleus library) -- This library contains the resident portion (nucleus) of the control program and consists of modules selected and link edited during system generation.
- SYS1.SVCLIB (SVC library) -- The members of the SVC library are the nonresident SVC routines, the data management access methods, the system's standard error recovery routines, and the modules for Machine Check Handler when this level of recovery management is selected.
- SYS1.LOGREC -- This data set is used by recovery management to record statistical data about machine errors.

The following data sets are required and must be on a direct access volume, not necessarily the system residence volume:

- SYS1.LINKLIB (Link library) -- The members of the link library are programs and routines that can be referred to by XCTL, ATTACH, LINK, or LOAD macro instructions, or by EXEC statements. Nonresident operating system programs, e.g., the COBOL compiler, are contained in this library.
- SYS1.SYSJOBQE -- This data set is used as a work area by the job scheduler.
- SYS1.PARMLIB -- This data set contains the resident access methods list, the resident BLDLTAB list, and the resident SVC parameter list, which are used by the nucleus initialization program (NIP) the PRESRES list, which is used by the master scheduler, and the SMFDEFLT list, that is used by the SMF routines.
- SYS1.PROCLIB (Procedure library) -- The members of the procedure library include those cataloged procedures used to perform certain system functions, e.g., compile-link edit-go.

- SYS1.IMAGELIB -- This library will contain the 1403 UCB images, 3211 UCB images, and 3211 FCB images.

The following libraries and data sets are optional and, if selected, must be on a direct access volume, not necessarily the system residence volume:

- SYS1.MACLIB (Macro library) -- The members of the macro library include the macro definitions for the system macro instructions.

- SYS1.SORTLIB (Sort library) -- The members of the sort library are the load modules from which a sort/merge program is produced at execution time.

- SYS1.ALGLIB (ALGOL library) -- The members of the ALGOL library are load modules (ALGOL subroutines).

- SYS1.ASRLIB (Recovery management library for MCH) -- When MCH is selected, this library contains all refreshable nucleus modules. It must be placed on the SYSRES device.

- SYS1.COBLIB (COBOL library) -- The members of the COBOL library are load modules (COBOL subroutines).

- SYS1.FORTLIB (FORTRAN library) -- The members of the FORTRAN library are load modules (FORTRAN subprograms).

- SYS1.PL1LIB (PL/I library) -- The members of the PL/I library are load modules (PL/I subprograms).

- SYS1.ROLLOUT (The rollout data set) -- This data set must be large enough to contain the entire dynamic area.

- SYS1.TELCMLIB (Telecommunications library) -- The members of the telecommunications library are load modules (telecommunications subroutines).

- SYS1.SYSVLOGX and SYS1.SYSVLOGY (System log data sets) -- These data sets are used to record write-to-log (WTL) messages before they are printed on the system output unit.

- Data set for Checkpoint/Restart for telecommunications -- This data set contains all the information necessary to restart the telecommunications system.

- SYS1.ACCT (accounting data set) -- This data set contains accounting information that the user wishes to keep.

The following data sets are optional.

- SYS1.MAN (SMF Data Set) -- The SMF data set may reside on tape or on direct access. If the SMF data set resides on tape only a primary data set (SYS1.MANX) is required. If it resides on direct access, a primary data set (SYS1.MANX) and an alternate data set (SYS1.MANY) are required. Whatever volume is selected becomes PRESRES.

- SYS1.DUMP -- This data set may reside on tape or direct access. It is used to contain a core image dump written by the ABEND routines, if a system failure occurs.

The following data sets are required if TSO (Time Sharing Option) is selected.

- SYS1.SWAP -- This data set contains TSO user regions that have been swapped out of main storage. It must be on a direct access device. SYS1.SWAP is an optional name; you may supply your own name(s).
- SYS1.BRODCAST -- This data set contains two types of TSO messages: MAIL and NOTICES. It must be on a direct access device.
- SYS1.UADS -- This data set contains a list of the terminal users who are authorized to use TSO along with information about each of the terminal users. It must be on a direct access device.
- SYS1.HELP -- This data set is required if the TSO HELP command is going to be used. It contains information regarding the SYNTAX, OPERANDS, AND FUNCTIONS OF A TSO command. It must be on a direct access device.
- SYS1.CMDLIB -- This data set contains TSO command processors, service routines, and utilities. It must be on a direct access device.
- SYS1.DCMLIB -- This data set contains all the Display Control modules in the system and all the PFK (program function key) areas defined on the consoles.

The following data sets are optional if TCAM is selected during system generation.

- TCAM Message Queues Data Set.
- TCAM Checkpoint Data Set.

The System Catalog (SYSCTLG)

The number of tracks required on the system residence volume for the system catalog is estimated from the following formula:

$$\text{Number of tracks} = \left(\frac{\text{Number of blocks required}}{\text{Number of blocks on each track}}\right) + 1$$

The number of blocks required is calculated as follows:

$$\text{Number of blocks} = L + 1.17X_{\ell} + K\left(\frac{D_{\ell} - 3X_{\ell}}{6} + 1\right) + N + \frac{V_n}{20} + \frac{A + C}{14} + 1$$

Where: L = the number of index levels.
X_{ℓ} = the number of indexes defined at level ℓ. (Each index level should be evaluated separately and the result added to the total requirement.)
D_{ℓ} = the number of data sets cataloged at level ℓ. (Each index level should be evaluated separately and the result added to the total requirement.)
K = 0 if $(D_{\ell} - 3X_{\ell})$ is negative; otherwise, K=1.
N = the number of data sets that occupy six or more volumes.
V_n = the number of volumes occupied by the nth data set that resides on six or more volumes. (Each data set should be evaluated separately and the result added to the total requirement.)
A = the number of high level aliases.
C = the number of pointers to the control volume (CVOL).

Note: Round off all fractions to next lower integers before calculating totals.

The number of blocks on each track is as follows:

- IBM 2301 Drum Storage - 45
- IBM 2302 Disk Storage - 14
- IBM 2303 Drum Storage - 12
- IBM 2311 Disk Storage - 10
- IBM 2314 Disk Storage - 17
- IBM 2305-1 Drum Storage - 16
- IBM 2305-2 Drum Storage - 26
- IBM 3330 Disk Storage - 28

The Nucleus Library (SYS1.NUCLEUS)

The number of tracks required on the system residence volume for the nucleus is estimated from the following formula:

$$\text{Number of tracks} = \frac{S}{1024 \cdot T} + \frac{12}{T} + I$$

Where: S = the size of the nucleus in bytes and is equal to the fixed storage requirement, excluding the storage required by items which may be altered when the system is initialized. These items include:

- resident BLDLTAB list
- resident reenterable load modules
- resident type 3 and 4 SVC routines
- resident error procedures
- system queue area in MVT

T = a device parameter, defined as follows:

- IBM 2301 Drum Storage, T = 11
- IBM 2303 Drum Storage, T = 2.2
- IBM 2311 Disk Storage, T = 2
- IBM 2314 Disk Storage, T = 4
- IBM 2305-1 Drum Storage, T = 5
- IBM 2305-2 Drum Storage, T = 6.8
- IBM 3330 Disk Storage, T = 6.8

I = an allowance for CSECT identification records. It can be estimated as 2% of the subtotal given by:

$$\frac{S}{1024 \cdot T} + \frac{12}{T}$$

Note 1: The number of tracks also depends on the number of modules in the nucleus and the number of entry points in each module.

Note 2: When allocating space for SYS1.NUCLEUS, you must indicate in the SPACE parameter the number of 256-byte records to be allocated for a directory. In most cases, one 256-byte record is sufficient. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.)

The SVC Library (SYS1.SVCLIB)

The amount of auxiliary storage required by the SVC Library depends on the components in the system being measured. The actual amount of storage is the sum of all applicable entries from Figure 72 plus the number of tracks required for directory records.

Description	No. of Directory Records(1)	Number of Tracks Required						
		2301 Drum	2303 Drum	2311 Disk	2314/2319 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
•Primary data management/ other control pgm functions								
for MFT(2,7)	102	55	226	251	150	158	94	87
for MVT(5)	99	51	206	240	136	139	85	80
for M65MP(3)	102	49	200	232	132	NA	NA	NA
•BDAM	7	3	13	15	8	9	6	5
•BISAM/QISAM	22	18	74	88	50	47	30	29
•BTAM	18	6	21	29	16	12	10	10
•Chkpt/Restart	7	3	11	17	9	8	5	5
•DDR	2	1	4	5	3	3	2	2
•GAM	3	3	8	11	6	5	3	3
•GJP(4)	1	1	1	1	1	1	1	1
•MCH								
model 65	3	3	15	17	9	7	5	5
model 85	3	3	10	11	6	6	4	4
model 135	2	2	4	6	3	3	2	2
model 145	2	2	4	6	3	3	2	2
model 155	2	2	5	6	4	3	2	2
model 165	3	2	6	7	4	4	3	3
•MCS(6)	5	4	13	15	9	9	6	5
•OLTEP	2	1	4	4	2	2	2	1
•QTAM	12	4	16	26	14	11	8	8
•SGJP(4)	1	1	1	1	1	1	1	1
•TCAM	51	30	116	133	77	84	50	47
•TSO	12	7	29	33	16	16	11	11

Notes:

1. Number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication Job Control Language Reference.) The number of directory records that can be contained on a track is as follows:
   - •IBM 2301 Drum Storage - 45
   - •IBM 2303 Drum Storage - 12
   - •IBM 2311 Disk Storage - 10
   - •IBM 2314 Disk Storage - 17
   - •IBM 2305-1 Drum Storage - 16
   - •IBM 2305-2 Drum Storage - 26
   - •IBM 3330 Disk Storage - 28
2. These estimates include the storage required by the following SVC routines: ATTACH (SVC 42); EXTRACT (SVC 40); IDENTIFY (SVC 41); and SPIE (SVC 14). If any of these routines are made resident at system generation, the storage requirement for the SVC Library is decreased by the size of the SVC routine.
3. These estimates include the tracks required for MCH.
4. If both GJP and SGJP are used, add only the storage requirement for one of these components.
5. If SMF is specified during system generation, add the following: one directory record, one track for a 2301, 2314, 2305 or 3330, two tracks for a 2311 or 2303.
6. If a 2740 is specified as a console in MCS and there is no BTAM support, add the following: 1 directory entry, 1 track for a 2301, 4 tracks for a 2303, 5 tracks for a 2311, or 3 tracks for a 2314.
7. If subtasking is included, add: 5 directory entries, 2 tracks on a 2311 or 2303 and 1 track on a 2314 or 2301.

Figure 72. Auxiliary Storage Requirements for the SVC Library

The Machine Error Recording Data Set (SYS1.LOGREC)

The user must not allocate space for this data set; however, the amount of space used must be known in order to estimate the total storage requirement of the operating system.

The number of tracks required on the system residence volume for the SYS1.LOGREC data set is estimated from the following formula:

$$\text{Number of tracks} = R + \frac{D}{S}$$

Where: D = the number of uniquely addressable I/O devices in the system.
R,S = device parameters defined in Figure 73.

The space for SYS1.LOGREC is for an average installation and may be increased or decreased depending on specific requirements, for example if there is no dismount record recording (3410,3420) or no TCAM, the size of SYS1.LOGREC could be decreased after SYSGEN. The procedure for reallocating the data set is described in the IFCDIP00 service aid in the IBM System/360 Operating System: Service Aids, GC28-6719.
Note: Round off fractions to the next higher integer.

Device Parameters	2301 Drum	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
R							
•without MCH							
(models 30,40,50,65,75)	6	26	35	17	10	10	10
(model 91)	10	N/A	52	28	15	15	15
(model 195)	10	43	52	28	15	15	15
•with MCH							
(model 65)	10	43	52	28	15	15	15
(models 85,135,145,155,165)	10	43	52	28	15	15	15
S	85	25	25	30	40	40	50

Figure 73. Device Parameters for SYS1.LOGREC

The Parameter Library (SYS1.PARMLIB)

Device Type	Number of Tracks
IBM 2301 Drum	1
IBM 2303 Drum	2
IBM 2311 Disk	2
IBM 2314 Disk	1
IBM 2305-1	1
IBM 2305-2	1
IBM 3330	1

Note: The number of directory records is 1. (When allocating space for SYS1.PARMLIB, the number of 256-byte directory records to be allocated for a directory must be indicated in the SPACE parameter. See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language Reference.)

Figure 74. Auxiliary Storage Requirements for the Parameter Library

The Link Library (SYS1.LINKLIB)

The amount of auxiliary storage required by the link library depends on two factors: (1) the components in the system being generated and (2) whether LBMAINT=E or LBMAINT=F is specified in the GENERATE macro instruction during system generation. Figure 75 gives the auxiliary storage requirements for the link library with a specification of LBMAINT=E. Figure 76 gives the auxiliary storage requirements for the link library with a specification of LBMAINT=F. The actual amount of storage required for this library is the sum of all applicable entries from Figure 75 or Figure 76 plus the number of tracks required for directory records.

Description	No. Directory Records (1)	Number of Tracks Required							
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
•Control program modules for job management and utilities (8)									
for MFT with 30K scheduler	59	93	336	377	467	252	233	151	147
for MFT with 44K scheduler	52	86	311	347	434	233	213	140	137
for MVT (11)	59	90	328	365	457	346	226	147	143
for M65MP (2)	52	90	326	365	454	244	N/A	N/A	N/A
•Accounting data set writer (10)	1	1	1	1	1	1	1	1	1
•ALGOL	5	6	23	25	31	17	15	10	10
•Assembler F	2	8	30	33	41	25	18	13	13
•American National Standard COBOL	2	25	98	103	136	69	54	39	39
•Channel Check Handler	2	1	3	4	4	2	3	2	2
• COBOL E	9	18	70	74	96	50	N/A	N/A	N/A
• CRJE	9	7	22	25	31	17	16	10	10
•EREP Model Independent	15	8	34	34	52	25	12	12	13
Mod 195	2	4	16	16	23	10	6	5	5
Mod 165	1	1	6	7	11	5	2	1	1
Mod 155	2	3	9	10	16	7	2	1	1
Mod 145	1	2	7	7	12	6	3	3	3
Mod 135	1	1	3	3	5	2	1	1	1
Mod 91	3	2	4	4	17	8	N/A	N/A	N/A
Mod 85	1	1	7	7	11	5	N/A	N/A	N/A
Mod 75	1	1	3	3	4	2	N/A	N/A	N/A
Mod 65	1	1	6	6	8	4	N/A	N/A	N/A
Mod 50	1	1	6	7	11	5	N/A	N/A	N/A
Mod 40	1	1	6	7	11	5	N/A	N/A	N/A
RDE	1	1	3	3	6	4	3	2	2
3330	2	1	6	6	8	4	2	2	2
2715	1	1	3	3	4	2	1	1	1
2305	1	1	4	4	6	3	2	2	2
2860 Channel	1	1	2	1	2	1	1	1	1
2870 Channel	1	1	2	1	2	1	1	1	1
2880 Channel	1	1	3	3	4	2	1	1	1
•SER0	1	1	1	1	1	1	N/A	N/A	N/A
•SER1	1	1	1	1	1	1	N/A	N/A	N/A
•FORTRAN IV G	2	5	18	20	25	14	11	8	8
•FORTRAN IV H	1	29	114	122	161	82	64	45	46
•FORTRAN Syntax Checker	2	2	6	6	7	4	3	2	2
•GJP and SGJP	9	10	33	37	46	25	9	7	7
•Graphics									
GPS	13	6	19	22	27	15	15	10	9
PORs (4)	6	3	11	11	14	8	8	5	5
GJP (9)	8	10	35	39	48	26	24	17	17
•Linkage editor F - 44K	1	4	15	16	21	11	9	7	7
•Linkage editor F - 88K	1	4	14	14	19	10	9	7	7
•Linkage editor F - 128K	1	4	15	16	21	11	8	6	6
•Loader	1	2	4	5	6	4	3	3	3

Figure 75. Auxiliary Storage Requirements for Link Library, LBMAINT=E (Part 1 of 2)

Description	No. Directory Records (1)	Number of Tracks Required							
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
•MCH(models 85,135,145,155,165)	1	1	3	3	4	2	2	2	2
•OLTEP	7	8	26	36	35	20	20	13	12
•PL/IF (5)	52	73	278	307	383	205	169	117	117
•PL/I Syntax Checker									
16K Version	1	2	7	8	10	9	4	3	3
20K Version	1	3	8	9	10	6	5	3	3
27K Version	1	3	12	13	16	9	6	4	5
•1130/360 Data Transmission (6)	1	1	2	2	3	2	2	1	1
•1130/360 Data Transmission (7)	5	1	4	4	5	3	1	1	1
•RJE	13	5	14	17	19	12	14	8	7
•RPG E	4	10	36	40	50	27	8	28	31
•SGJP (9)	7	7	26	28	38	19	7	26	28
•Sort/merge	1	5	17	19	23	12	11	8	8
•TCAM	19	13	50	52	63	35	35	22	21
•TSO	18	19	67	75	94	51	40	30	30

Notes:

1. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2305-1 Drum Storage - 16
   - IBM 3330 Disk Storage - 28
   - IBM 2305-2 Drum Storage - 26
2. These estimates include the tracks required for EREP without SER on the Model 65.
3. If system error recovery is to support more than one CPU, the total link library storage requirement is the sum of the value for model independent EREP plus the values for EREP and SER0 or SER1 for each CPU to be supported.
4. ATTINQ storage requirement of 675 bytes has been included in the requirements for the PORs.
5. These estimates include the PL/I F compiler, macro processor, and library modules that are invoked dynamically. If you select the shared library feature, see Figure 87 for the storage requirements.
6. Use this estimate if user callable modules have been generated into SYS1.FORTLIB.
7. Use this estimate if all 1130/360 Data Transmission modules are generated into the link library.
8. Add the auxiliary storage requirement for an accounting routine, if one is supplied.
9. When both GJP and SGJP are used, see the entry "GJP and SGJP" in this figure.
10. This auxiliary storage requirement must be added only when accounting routine inclusion is specified in the SCHEDULR macro instruction during system generation.
11. If SMF is specified during system generation add the following: one directory record, one track for a 2301, 2303, or 3330, three tracks for a 2303, three tracks for a 2311, or 2 tracks for a 2314.

Figure 75. Auxiliary Storage Requirements for Link Library, LBMAINT=E (Part 2 of 2)

Description	No. of Directory Records (2)	Number of Tracks Required							
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
•Control program modules for job management and utilities (9)									
for MFT with 30K scheduler	59	83	354	383	489	244	186	131	133
for MFT with 44K scheduler	52	79	331	351	455	226	169	132	124
for MVT (12)	59	80	345	370	480	239	182	127	130
for M65MP (3)	52	81	342	369	479	239	N/A	N/A	N/A
•Accounting data set writer (11)	1	1	1	1	1	1	1	1	1
•ALGOL	4	6	23	25	33	17	13	10	10
•Assembler F	2	8	36	40	47	26	14	12	13
•American National Standard COBOL	2	25	99	103	136	68	54	38	35
•Channel Check Handler	2	1	3	3	4	2	2	2	2
•COBOL E	9	18	70	73	96	50	N/A	N/A	N/A
•CRJE	9	7	24	27	33	17	17	11	11
•EREP Model Independent	15	8	34	34	52	25	12	12	13
Mod 195	2	4	16	16	23	10	6	5	5
Mod 165	1	1	6	7	11	5	2	1	1
Mod 155	2	3	9	10	16	7	2	1	4
Mod 145	1	2	7	7	12	6	3	3	3
Mod 135	1	1	3	3	5	2	1	1	1
Mod 91	3	2	4	4	17	8	N/A	N/A	N/A
Mod 85	1	1	7	7	11	5	N/A	N/A	N/A
Mod 75	1	1	3	3	4	2	N/A	N/A	N/A
Mod 65	1	1	6	6	8	4	N/A	N/A	N/A
Mod 50	1	1	6	7	11	5	N/A	N/A	N/A
Mod 40	1	1	6	7	11	5	N/A	N/A	N/A
RDE	1	1	3	3	6	4	3	2	2
3330	2	1	6	6	8	4	2	2	2
2715	1	1	3	3	4	2	1	1	1
2305	1	1	4	4	6	3	2	2	2
2860 Channel	1	1	2	1	2	1	1	1	1
2870 Channel	1	1	2	1	2	1	1	1	1
2880 Channel	1	1	3	3	4	2	1	1	1
•SER0	1	1	1	1	1	1	N/A	N/A	N/A
•SER1	1	1	1	1	1	1	N/A	N/A	N/A
•FORTRAN IV G	2	5	23	23	26	14	9	8	9
•FORTRAN IV H	1	27	128	131	163	84	60	50	50
•FORTRAN Syntax Checker	2	2	6	6	7	4	3	2	2
•GJP (10)	8	9	36	39	50	26	23	16	31
•GJP and SGJP	9	9	34	37	48	24	9	7	7
•Graphics									
GPS	13	6	19	22	27	15	15	10	9
PORs (5)	6	3	11	11	14	8	8	5	5
•Linkage Editor F - 44K	1	4	18	18	21	10	7	6	6
•Linkage Editor F - 88K	1	4	14	15	20	11	7	6	7
•Linkage Editor F - 128K	1	4	18	18	22	10	7	6	6
•Loader	1	1	5	5	7	4	3	3	3
•MCH (models 85,135,145,155,165)	1	1	3	3	4	2	2	1	1
•OLTEP	7	7	27	29	37	20	17	11	11
•PL/I F	52	74	278	350	446	223			129

Figure 76. Auxiliary Storage Requirements for Link Library, LBMAINT=F(1) (Part 1 of 2)

Description	No. of Directory Records (2)	Number of Tracks Required							
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
•PL/I Syntax Checker									
16K Version	1	2	7	8	10	9	4	3	3
20K Version	1	3	8	9	10	6	4	3	3
27K Version	1	3	12	13	16	9	5	4	4
•1130/360 Data Transmission (7)	1	1	2	2	3	2	2	1	1
•1130/360 Data Transmission (8)	5	1	4	4	5	3	1	4	4
•RJE	13	5	14	17	19	12	14	8	7
•RPG E	4	9	41	42	60	31	N/A	N/A	N/A
•SGJP (10)	7	7	26	28	37	21	7	26	28
•Sort/Merge	1	4	17	19	26	13	9	7	8
•TCAM	19	13	45	52	64	34	35	22	21
•TSO	18	18	76	81	104	52	39	29	29

Notes:

1. These estimates were computed using the 44K level F linkage editor; value$_2$ of the SIZE option was 6K.
2. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Stoage - 17
   - IBM 2305-1 Drum Storage - 16
   - IBM 3330 Disk Storage - 28
   - IBM 2305-2 Drum Storage - 26
3. These estimates include the tracks required for EREP without SER on the Model 65.
4. If system error recovery is to support more than one CPU, the total link library storage requirement is the sum of the value for model independent EREP plus the values for EREP and SER0 or SER1 for each CPU to be supported.
5. ATTINQ storage requirement of 675 bytes has been included in the requirements for the PORs.
6. These estimates include the PL/1 F compiler, macro processor, and library modules that are invoked dynamically. If you select the shared library feature, see Figure 87 for the storage requirements.
7. Use this estimate if user callable modules have been generated into SYS1.FORTLIB.
8. Use this estimate if all 1130/360 Data Transmission modules are generated into the link library.
9. Add the auxiliary storage requirement for an accounting routine, if one is supplied.
10. When both GJP and SGJP are used, see the entry "GJP and SGJP" in this figure.
11. This auxiliary storage requirement must be added only when accounting routine inclusion is specified in the SCHEDULR macro instruction during system generation.
12. If SMF is specified during system generation, add the following: one directory record, one track for a 2301, 2305 or 3330, three tracks for a 2303, three tracks for a 2311, or two tracks for a 2314.

Figure 76. Auxiliary Storage Requirements for Link Library, LBMAINT=F(1) (Part 2 of 2)

Work Space for the MFT or MVT Schedulers (SYS1.SYSJOBQE)

The following formula can be used to estimate the space required for the job queue data set for the MFT or MVT scheduler:

$$\text{Number of tracks} = QCR + \frac{(B+C+T(IWA/176)+L+Z+S(NI+1))(N+1)}{K}$$

Where:

- $B = (Q_1 \bullet I_1) + (Q_2 \bullet I_2) + \ldots\ldots + (Q_n \bullet I_n)$; n = number of input classes
- $C = (R_1 \bullet O_1) + (R_2 \bullet O_2) + \ldots\ldots + (R_n \bullet O_n)$; n = number of output classes
- Q = the maximum number of jobs that will be queued at any one time on the input queue for class i.
- I = the average size (in logical tracks) of a job in the input queue for class i.
- R = the maximum number of jobs that will be queued at any one time on the output queue for class i.
- O = the average size (in logical tracks) of a job in the output queue for class i.
- T = the number of transient readers required. For MVT, T = 0.
- IWA = size of the interpreter work area saved for each transient reader. For MFT, IWA = 2048; for MVT, IWA = 0.
- N = the number of records per logical track.
- K = the number of 176-byte records on each physical track for one of the following direct access devices:
  - IBM 2311 Disk Storage, K = 15
  - IBM 2301 Drum Storage, K = 66
  - IBM 2303 Drum Storage, K = 17
  - IBM 2314 Disk Storage, K = 25
  - IBM 2305-1 Drum Storage, K = 23
  - IBM 2305-2 Drum Storage, K = 39
  - IBM 3330 Disk Storage, K = 42
- L = the number of logical tracks required when the automatic SYSIN batching (ASB) reader is used; it is calculated as follows:

  $$L = J \bullet \left(\frac{X}{3} - Y\right) + 2$$

  Where:
  - J = the number of jobs in an ASB reader batch
  - X = the average number of job control language statements per job
  - Y = the number of records per logical track

  - The minimum value for the expression $\left(\frac{X}{3} - Y\right)$ is 1.
  - For MFT, L =0; for MVT when the ASB reader is not used, L = 0.
- Z = the size (in logical tracks) of the records reserved for termination.
- S = the size (in logical tracks) of the records reserved for initiators, plus 1 logical track for overflow.
- NI = the maximum number of initiators that will be active.
- QCR = the number of tracks required for 76 queue control records (36 bytes each) on the direct access device.

Note: A 2301, 2303, 2311 or 2305 may be completely allocated for the job queue; however, the 2314 is restricted to a maximum of 1,215 tracks and the 3330 is restricted to 745 tracks.

The average size of a job in the input and output queues can be computed by using the following two formulas. The following rules apply:

- These requirements must include calculations for all cataloged procedures to be executed.
- All fractions must be rounded to the next highest integer.

The following formula can be used to estimate the size (in logical tracks) of a job in the input queue for class 1:

$$I_1 = \frac{1+2B/3+2C+E/28+F/176+2G+G_1+(H-5)/15+(2D-L)/118+T+2P(C+1)+2M}{N}$$

Where:
- B = the number of passed data sets in the job.
- C = the number of steps in the job.
- E = the number of volume serial numbers for all job steps that use existing data sets or specific volumes. Each job step should be evaluated separately and the result added to the total.
- F = the number of characters in data set names, including qualifiers, for all job steps that use the VOLUME=REF=dsname DD statement parameter. Each job step should be evaluated separately and the result added to the total.
- G = the number of DD statements in the job including those generated by the system for data sets in generation data groups.
- G_1 = G - the number of system output DD statements of class i in the job (G).
- H = the number of volume serial numbers for all data sets (if $H \leq 5, \frac{H-5}{15}=0$). (Each data set should be evaluated separately and the result added to the total requirement.)
- D = the number of non-temporary data set names in the job.
- L = the total length of the non-temporary data set names.
- T = the number of records for TIOT for the largest step in the job: ((24+20X)/172)+1, where X= the number of DD statements in the largest step. Add 4 for each additional unit (more than one) required.
- N = the number of records per logical track.
- P = 0 if a JOBLIB DD statement is not included, or 1 + the number of DD statements concatenated to the JOBLIB DD statement.
- M = the number of EXEC statements of the form:
  // EXEC pgm=*.ddname

The following formula can be used to estimate the size (in logical tracks) of a job in output queue 1. (There are 36 output queues, one for each system output device class.)

$$O_1 = \frac{(J/2)+2G_1+(H_1-5)/15+A}{N}$$

Where:
- J = 0 if MSGCLASS≠1 for the job, or
  2 if MSGLEVEL=0 for the job, or
  the number of job control language records for the job if MSGLEVEL≠0.
- G = the number of system output DD statements of class 1 in a job.
- H = the number of volume serial numbers for all system output data sets of class 1 in the job. (Each data set should be evaluated separately and the result added to the total.)
- A = 0 if MSGCLASS≠1, or
  the number of DD statements (G) in the job if MSGCLASS=1.
- N = the number of records per logical track.

For additional information see IBM System/360 Operating System: System Programmer's Guide, GC28-6550.

The Procedure Library (SYS1.PROCLIB)

IBM supplies cataloged procedures to perform many routine operations. The storage required by these procedures depends on the device on which the library resides and on whether the procedure library is unblocked or blocked. Figure 77 gives the auxiliary storage requirements for the IBM-supplied cataloged procedures. These track requirements reflect the storage needed when the procedure library is unblocked. If the user supplies additional cataloged procedures for the library, the additional storage requirements must be added. If the user blocks the procedure library, the auxiliary storage requirements must be adjusted accordingly.

Device Type	Number of Tracks
IBM 2301 Drum	9
IBM 2302 Disk	22
IBM 2303 Drum	29
IBM 2311 Disk	30
IBM 2314 Disk	20
IBM 2321 Data Cell	65
IBM 2305-1 Drum	28
IBM 2305-2 Drum	15
IBM 3330 Disk	14

Note: The number of directory records is 5. (When allocating space for SYS1.PROCLIB, the number of 256-byte directory records to be allocated for a directory must be indicated in the SPACE parameter. See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language Reference.)

Figure 77. Auxiliary Storage Requirements for the Procedure Library

The Image Library (SYS1.IMAGELIB)

The number of tracks required on a permanently mounted volume for SYS1.IMAGELIB can be estimated from the following formula:

$$\text{Number of tracks} = \frac{280+(A*180)+((B+C)*270)+((D+E)*525+80*F}{1024*t}$$

$$\text{Number of Directory Blocks} = \frac{(4+2(B+D)+A+C+E+F)*52}{256} + 1$$

WHERE:
- A = Number of expected user defined FCB images.
- B = Number of 1403 UCS images supplied by IBM.
- C = Number of user defined 1403 UCS images.
- D = Number of 3211 UCS images supplied by IBM.
- E = Number of user defined 3211 UCS images.
- T =
  - 11 for 2301 Drum storage
  - 2.2 for 2303 Drum storage
  - 2 for 2311 Disk storage
  - 4 for 2314 Disk storage
  - 5 for 2305-1 Drum storage
  - 6.8 for 2305-2 Drum storage
  - 6.8 for 3330 Disk storage
- F = The number of expected DPI images for the 3525.

System Log Data Sets for MVT and MFT (SYS1.SYSVLOGX and SYS1.SYSVLOGY)

The number of tracks required for the system log data sets can be estimated from the following formula:

Number of tracks = N/K

Where:
- N = the maximum number of variable length records (record lengths can vary from 5 bytes to 148 bytes) to be written in the data set before a full data set condition is reached.
- K = the number of variable length records on each track for any one of the following direct access devices: IBM 2301 Drum, IBM 2302 Drum, IBM 2303 Drum, IBM 2311 Disk, the IBM 2314 Disk, IBM 2305 Drum, and the IBM 3330 Disk.

The Macro Library (SYS1.MACLIB)

The amount of auxiliary storage required by the macro library depends on two factors: (1) whether the library is blocked or unblocked, and (2) the components in the system being measured. Figure 78 gives the auxiliary storage requirements for the blocked and unblocked macro library. The actual amount of storage required by the library is the sum of all applicable entries from Figure 78 plus the number of tracks required for directory records.

Description	No. of Directory Records (1)	Number of Tracks Required								
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
Blocked (2)										
•Basic macro instructions (3)	9	80	417	417	438	226	755	136	112	129
•BTAM	3	19	101	101	108	58	186	32	18	22
•Graphics	7	21	105	107	117	59	204	19	17	18
•OCR	1	3	16	16	17	9	29	6	5	5
•QTAM	5	12	60	60	74	36	126	20	18	19
•TCAM	10	51	263	263	306	151	512	87	71	74
•TSO	7	55	283	283	296	154	513	93	76	91
Unblocked										
•Basic macro instruction (3)	9	183	503	675	701	441	1469	N/A	333	289
•BTAM	3	44	121	161	168	106	351	151	80	44
•Graphics	7	46	126	169	175	110	368	87	46	40
•OCR	1	7	20	26	27	17	56	24	13	12
•QTAM	5	26	72	96	99	63	210	91	48	43
•TCAM	10	82	221	251	315	179	604	284	151	117
•TSO	7	126	336	450	467	295	978	420	223	193

Notes:

1. The number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2321 Data Cell - 5
   - IBM 2305-1 Drum Storage - 16
   - IBM 2305-2 Drum Storage - 26
   - IBM 3330 Disk Storage - 28
2. The blocking factor for all devices except the IBM 2311 and the IBM 2321 is equal to 3360 bytes per block; the blocking factor for the IBM 2311 is equal to 3600 bytes per block; and the blocking factor for the IBM 2321 is equal to 2000 bytes per block.
3. These are the macro instruction used by the control program, primary data management, BDAM, BISAM/QISAM, and RJE.

Figure 78. Auxiliary Storage Requirements for the Macro Library

The Subroutine Libraries

The auxiliary storage required by these subroutine libraries is given in Figure 79. The size of any subroutine library is the sum of all applicable entries for the library plus the number of tracks required for directory records.

Description	No. of Directory Records (1)	Number of Tracks Required								
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
•SYS1.ALGLIB	14	3	10	12	14	8	30	8	5	5
•SYS1.ASRLIB	1	1	N/A	4	4	3	N/A	1	1	5
•SYS1.COBLIB										
American National Standard COBOL	29	5	15	18	20	12	42	16	9	8
COBOL E	18	3	6	8	9	6	19	NA	NA	NA
•SYS1.FORTLIB (2,3)										
FORTRAN IV G or H (4) with error message facility	27	7	21	25	29	17	63	18	11	11
FORTRAN IV G or H (4) without error message facility	28	7	21	25	29	17	63	18	11	10
1130/360 Data Transmission	4	1	2	2	2	2	4	3	2	2
•Graphic Subroutine Package (GSP) (5)	2	1	1	2	2	1	3	1	1	1
•SYS1.PL1LIB (6)										
With complex function	82	18	58	70	80	49	163	55	32	30
Without complex functions	69	15	48	57	66	38	135	44	26	25
•SYS1.SORTLIB	36	14	45	53	62	36	128	41	24	22
•SYS1.TELCMLIB										
for BTAM	1	1	3	3	4	2	8	3	2	2
for QTAM	11	4	9	12	12	9	27	11	7	6
for RJE	6	4	13	15	17	10	37	10	6	6
for TCAM	30	19	61	71	85	48	179	54	32	29
for CRJE	6	5	17	19	24	13	54	13	8	8

Notes:

1. Number of 256-byte records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter of the DD statement in the publication IBM System/360 Operating System: Job Control Language.) The number of directory records that can be contained on a track is as follows:
   - IBM 2301 Drum Storage - 45
   - IBM 2302 Disk Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2321 Data Cell - 5
   - IBM 2305-1 Drum Storage - 26
   - IBM 2305-2 Drum Storage - 28
   - IBM 3330 Disk Storage - 16
2. These estimates are with a specification of LBMAINT=E.
3. If two FORTRAN IV compilers are desired (i.e., G and H) in the same system, the larger library (G or H) should be requested during system generation.
4. The libraries with the error message facility are identical and the libraries without the error message facility are identical; therefore, if both compilers with identical libraries are present, space is required for only one library.
5. The Graphic Programming Services for FORTRAN IV may be used with the G, and/or H compiler. Add the storage requirement for GSP to the storage requirement for the FORTRAN IV library selected.
6. If GSP=INCLUDE is specified at system generation increase the track requirement by 1.

Figure 79. Auxiliary Storage Requirements for the Subroutine Libraries

The Rollout Data Set (SYS1.ROLLOUT)

The rollout data set, used only with MVT and M65MP, must be large enough to contain the dynamic main storage area. This area is the maximum amount of storage that could be rolled out at any one time. The space allocated for this data set must be contiguous and the block size is 1024.

The Data Set for Checkpoint/Restart

The checkpoint data set may be on any direct access device or any magnetic tape drive supported by BSAM and BPAM. The size of the checkpoint data set is determined by the user. The following information can be used as a guideline in determining the size of this data set.

Figure 80 contains the size and number of records written when a checkpoint is taken. The number of tracks or the amount of tape occupied by the checkpoint data set can be determined by applying the number of records and their sizes against either the track capacities of the direct access device or the recording density and type for the magnetic tape device.

Description	Size (in bytes)	Number of Records Required	
		With MFT	With MVT
CHR (checkpoint header record)	400	1	1
DSDR (data set descriptor record)	400	N/2 (1)	N/2 (1)
CIR (core image record)	B	A/B	A/B
SUR (supervisor record)	200	1	C/170

Where:
- N = the number of data sets defined in the job step
- A = the amount of storage required by the user-written program
- B = the blocksize of the checkpoint data set. If specified by the user, the blocksize must be equal to or greater than 600; if the default is to be used, the blocksize is equal to 32,760 for magnetic tape or track capacity for the direct access device used.
- C = the amount of storage required in the system queue area by the user-written program.

Note:
1. Add one record for the first generation data set and a second record for each additional 4 generation data sets. Also, add one record for each data set that requires 6 to 20 volumes and one record for each additional 15 volumes. That is, if the data set requires 35 volumes, add 2 records; if 50 volumes are required, add 3 records, and so on.

Figure 80. Auxiliary Storage Requirement for the Data Set for Checkpoint/Restart

The Accounting Data Set (SYS1.ACCT)

This data set can be used with any configuration. The user determines how much space is to be allocated to the data set and what accounting information is to be stored in the data set.

The SMF Data Set (SYS1.MAN)

This data set can reside on tape or on direct access. If it resides on direct access, a primary data set (SYS1.MANX) and an alternate data set (SYS1.MANY) are required. The size of the data set depends on the length of the records written onto it. For example, the size required for the data set would be 48,473 bytes, if you had a total of 12 jobs per hour for four hours with each job having:

- 4 DD statements per job step plus,
- 2 items of accounting information with 5 bytes per item plus,
- 3 steps per job.

(For a detailed explanation of how this number was calculated see the publication, IBM System/360 Operating System: SMF Guide.)

The Core Image Dump Data Set (SYS1.DUMP)

This data set can reside on tape or direct access. If it resides on direct access, the number of tracks allocated for the data set must be large enough to contain all of main storage. Use the following chart to determine the number of tracks required:

STORAGE SIZE / DEVICE	128K	256K	512K
IBM 2301 Drum Storage	9	17	31
IBM 2302 Disk Storage	33	67	129
IBM 2303 Drum Storage	33	67	129
IBM 2311 Disk Storage	43	86	171
IBM 2314 Disk Storage	22	43	86
IBM 2305-1 Drum Storage	17	33	65
IBM 2305- Drum Storage	12	24	47
IBM 3330 Disk Storage	13	26	52

The TCAM Message Queues Data Set

If you use TCAM, you can queue messages on three secondary storage devices: the IBM 2311 Disk Storage Drive, the IBM 2314 Direct Access Storage Facility, and the IBM 3330 Disk Storage. The number of records that can be written per track on each of these devices can be estimated by the following formulas:

Number of records per 2311 track = 1/(.00035 KEYLEN)

Number of records per 2314 track = 1/(.00070 KEYLEN)

Number of records per 3330 track = 13165/(199+KEYLEN)

Where: KEYLEN = the value specified on the KEYLEN operand of the INTRO macro instruction.

The message queues data set must begin on a cylinder boundary and it can have multiple extents on multiple volumes. The data section of each record will be 6 bytes long and the key section (message) will be the length specified on the KEYLEN operand. Figures 81 and 82 contain examples of the number of records per track for each of the two devices.

Records per track	10	10	11	11	12	12	13	13	14	14	15	15	16
Value of KEYLEN	255	239	238	212	211	189	188	169	168	153	152	138	137
Records per track	16	17	17	18	18	19	19	20	20	21	21	22	22
Value of KEYLEN	125	124	114	113	103	102	94	93	85	84	77	76	71
Records per track	23	23	24	24	25	25	26	26	27	27	28	28	29
Value of KEYLEN	70	64	63	58	57	53	52	48	47	43	42	39	38

Figure 81. 2311 Track Capacity for TCAM Disk Message Queues Data Set

Records per track	17	17	18	18	19	19	20	20	21	21
Value of KEYLEN	255	248	247	227	226	209	208	193	192	178
Records per track	23	24	24	25	25	26	26	27	27	28
Value of KEYLEN	164	163	151	150	135	134	128	127	117	116
Records per track	30	30	31	31	32	32	33	33	34	34
Value of KEYLEN	99	91	90	84	83	76	75	70	69	63
Records per track	36	37	37	38	38	39	39	40	40	41
Value of KEYLEN	52	51	46	45	41	40	36	35	32	31

Figure 82. 2314 Track Capacity for TCAM Disk Message Queues Data Set

The TCAM Checkpoint Data Set

For the IBM 2311 Disk Storage Drive the size in bytes of the Checkpoint Data Set is given by the formula

S=(61+1.05L1)+1.26AL2+N(61+1.05L3)+(M+3)(61+1.05L4)

For the IBM 2314 Direct Access Storage Facility the size in bytes of the Checkpoint Data Set is given by the formula

S=(101+1.05L1)+1.39AL2+N(101+1.05I3)+(M+3)(101+1.05L4)

For the IBM 3330 disk storage device the size in bytes of the Checkpoint Data Set is given by the formula

S=(135+L1)+N(135+L3)+(M+3)(135+L4)

In these formulas,

L1 = the length of a control record=30+5A

L2 = the length of an environment record=22+B+C+4D+5E+ $(21F_1+21F_2+...+21F)+(G(H_1+H_2+...+H_1))$

If L2 is less than 300 bytes; it is rounded up to 300.

L3 = the length of an incident record=12+K

L4 = the length of a checkpoint request record=17+21F+J

where

A is the value coded in the CPRCDS-" operand of the INTRO macro.

B is the total number of bytes of data located in all option fields assigned to stations, lines, or application programs.

C is equal to the sum of the number of single entries in the Terminal Table plus the number of group entries in the Terminal Table.

D is equal to the number of single, group and process entries in the Terminal Table whose destination queues are maintained on disk.

E is equal to the number of destination queues maintained on disk for single, group, and process entries in the Terminal Table.

F is equal to the number of priority levels specified for each destination (assume one priority level for each destination queue defined by a PROCESS macro, and one for each destination queue defined by a TERMINAL macro having no "LEVEL=" operand).

G is equal to 1 if "I" is specified in the "STARTUP=" operand of the INTRO macro; otherwise, G is equal to 0.

H is equal to the length of an Invitation List (a formula for determining this length is given in the discussion of the LCOPY macro).

I is equal to the number of lines having Invitation Lists (not counting output-only lines).

J is the length, in bytes, of the maximum number of option fields assigned to any one entry in the Terminal Table.

K is equal to J if J is greater than 32; otherwise K is equal to 32.

M is equal to the value coded for the "CKREQS=" operand of the INTRO macro.

N is equal to the number of incident checkpoint records desired (N should be between 1 and 255).

Space Requirements for TSO Swap Data Set

The total swap data set space required is the sum, for each TSO user region of (R/A1)*(U + 2) * A2

where
R is the size of the region
A1 is the size of a swap allocation unit in bytes (see below)
A2 is the size a swap allocation unit in tracks (see below)
U is the expected upper bound on the number of users normally logged on in the region.

Since a variation of the number of users logged on to a region is to be expected, it might be advantageous to provide overflow space on some lower speed device unless the time sharing parameters are so structured that the expected upper bound will not be exceeded.

SWAP Device	Swap Allocation Unit Sizes Allocatin Unit(A2)	Sizes(A1)
2301	1 track	18K
2303	4 tracks	18K
2314	10 tracks	64K
2305-1	4 tracks	44
2305-2	4 tracks	52
3330	3 tracks	36

Space Requirements for TSO User Attribute Data Set

Directory (blocks) = N * A/4
Space (tracks)=N * A/S

where
N = the number of TSO users authorized to use the system.
A = the average number of member blocks per user.
S = the number of blocks on a track and is equal to:

R/B

where
R = the number of bytes of data on a track.
B= 24C + 12 CD + 12 CDE + 88X + 24Y + 44

where
C is the number of passwords the user has
D is the average number of account numbers per password
E is the average number of procedure names per account
X is the number of account numbers unique to this user
Y is the number of procedure names unique to this user

Space Requirements for TSO Broadcast Data Set

Space (track) = (1 + M + B + M/25 + U/12) /K

where
M is the maximum number of messages sent to non logged on users as "mail"
B is the maximum number of "notices" placed in the data set by the operator
U is the maximum number of users authorized to use the TSO system
K is the number of 129 byte keyed records on a track

2301	2302	2303	2311	2314	2305-1	2305-2	3330
64	22	17	16	25	19	35	40

The Command Library (SYS1.CMDLIB)

The amount of auxiliary storage required by the command library is the sum of the track requirements from Figure 83 plus the amount of space required for directory records.

	No of Directory Records(1)	Number of Tracks Required								
		2301 Drum	2302 Drum	2303 Drum	2311 Disk	2314 Disk	2321	2305-1 Drum	2305-2 Drum	3330 Disk
LIBMAINT=E	27	39	139	155	194	103	419	95	62	61
LIBMAINT=F	27	35	150	157	227	105	418	79	57	58

Note:
1. Number of 256-byte directory records to be allocated for a directory when new partitioned data set is being defined. (See the description of the SPACE parameter in the publication IBM System/360 Operating System: Job Control Language Reference) The number of directory records that can be contained on a track is as follows:

   - IBM 2301 Drum Storage - 45
   - IBM 2302 Drum Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2305-1 Drum Storage - 16
   - IBM 2305-2 Drum Storage - 26
   - IBM 3330 Disk Storage - 28

Figure 83. Auxiliary Storage Requirements for SYS1.CMDLIB

The Help Library (SYS1.HELP)

The amount of auxiliary storage required by the help library is the sum of the track requirements from Figure 84 plus the amount of space required for directory records.

	No. of Directory Records	Number of Tracks Required							
		2301 Drum	2302 Drum	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
Unblocked	5	32	87	116	120	76	105	56	49
Blocked	5	15	68	68	73	39	24	20	29

Note:

1. Number of 256-byte directory records to be allocated for a directory when a new partitioned data set is being defined. (See the description of the SPACE parameter in the publication IBM System/360 Operating System: Job Control Language Reference) The number of directory records that can be contained on a track is as follows:

   - IBM 2301 Drum Storage - 45
   - IBM 2302 Drum Storage - 14
   - IBM 2303 Drum Storage - 12
   - IBM 2311 Disk Storage - 10
   - IBM 2314 Disk Storage - 17
   - IBM 2305-1 Drum Storage - 16
   - IBM 2305-2 Drum Storage - 26
   - IBM 3330 Disk Storage - 28

2. The blocking factor for all devices except the IBM 2311 and the IBM 2321 is equal to 3360 bytes per block; the blocking factor for the IBM 2311 is equal to 3600 bytes per block; and the blocking factor for the IBM 2321 is equal to 2000 bytes per block.

Figure 84. Auxiliary Storage Requirements for SYS1.HELP

Space Requirements for the Display Control Module Library (SYS1.DCMLIB)

The amount of space required to contain the Display Control Modules and program function key (PFK) areas is determined by the following formula.

Tracks=(1464A+3464B+4736C+120D)/bytes per track

Where:

A = number of 2260 consoles
B = number of Mod 85/165 console
C = number of 2250 consoles
D = number of programs function keys.

Work Space Requirements

Work space requirements for IBM-supplied programs depend on either the number of source cards or the amount of main storage available to the program, or both. These estimates are for typical source programs and vary considerably, according to the type and combination of statements in the program being processed. The following list shows where to find the work space requirements for those IBM-supplied programs that need work space:

- Linkage Editor E work space requirements are in Figure 85A.
- Linkage Editor F work space requirements are in Figure 85B.
- ALGOL work space requirements are in Figure 86.
- RJE work space requirements are in Figure 87.
- Assembler F work space requirements are in Figure 88.
- FORTRAN IV H work space requirements are in Figure 89.
- COBOL E work space requirements are in Figure 90.
- American National Standard COBOL work space requirements are in Figure 91.
- RPG E work space requirements are in Figure 92.
- FORTRAN IV E work space requirements are in Figure 93.
- PL/I F shared library storage requirements are in Figure 94.
- PL/I F work space requirements are in Figure 95.
- GJP and SGJP work space requirements are in Figure 96.

Device	Number of Tracks Required			
	15K E Level Linkage Editor Operating in		18K E Level Linkage Editor Operating in	
	15K	18K	18K	20K
2301 Drum	4*	12*	4*	7*
2302 Disk	16*	48*	16*	28*
2303 Drum	16*	48*	16*	28*
2311 Disk	26	70	26	42
2314 Disk	13*	35*	13*	21*
2321 Data Cell	58*	167*	58*	100*

Note: These estimates assume the maximum size programs are processed by the linkage editor.

Figure 85A. Work Space for the Linkage Editor E

Size of Program	Number of Tracks Required							
	2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305 Drum	3330 Disk
10K	2	14	4	5	3	11	2	2
50K	8	18	18	22	14	55	9	10
100K	16	35	35	44	27	110	18	19

Note: These estimates assume that the record length used is the largest record size supported for the device. The record lengths used are as follows:

- IBM 2301, record length is 18K
- IBM 2302, record length is 4K
- IBM 2303, record length is 4K
- IBM 2311, record length is 3K
- IBM 2314, record length is 6K
- IBM 2321, record length is 1K
- IBM 2305, record length is 13K
- IBM 3330, record length is 12K

In general, the amount of work space for a program can be estimated by the following formula:

$$\text{Number of tracks} = \frac{\text{size of program}}{\text{record length}} + .10 \text{ of size}$$

Figure 85B. Work Space for Linkage Editor F (SYSUT1)

Data Set	Number of Source Cards	Number of Tracks Required								
		2301 Drum	2301 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
SYSUT1	150	1	2	2	2	1	5	1	1	1
	500	1	4	4	5	3	15			
	1000	2	8	8	10	5	30	3	3	3
SYSUT2	150	1	2	2	2	1	5	1	1	1
	500	1	4	4	5	3	15	2	2	2
	1000	2	8	8	10	5	30	3	3	3
SYSUT3	150	1	1	1	2	1	2	1	1	1
	500	1	2	2	3	1	5	1	1	1
	1000	1	4	4	5	2	10	2	2	2

Note: The primary quantity specified in the SPACE parameter of the DD statements for SYSUT1, SYSUT2, and SYSUT3 must be large enough to contain the entire data set. The use of a secondary quantity for any of these data sets will increase the need for main storage by 40 percent.

Figure 86. Work Space for ALGOL

Data Set	2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
	Allow ONE TRACK on each device for EACH MULTIPLE of:							
SYS1.IHKBRDSL	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
SYS1.IHKESTB No. of Jobs	130	57	37	42	58	31	67	82
SYS1.IHKJEDTE No. of Jobs	88	30	24	22	36	26	50	56
SYS1.IHKMSGSI	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
SYS1.IHKTDRTB No. of Terminals	98	35	26	27	35	28	54	62
SYS1.IHKTXTTE	3 (2)	7 (2)	9 (2)	9 (2)	6 (2)	3 (2)	3 (2)	3 (2)
SYS1.IHKUDRTB No. of Users	135	62	38	46	62	32	69	86

Notes:
1. Allow one track for this data set in any RJE installation.
2. Allow this many tracks for this data set in any RJE installation.

Figure 87. Work Space for Remote Job Entry

Data Set	Number of Source Cards	Assembler F Operating In	Number of Tracks Required								
			2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
SYSUT1	150	44K	2	6	6	8	5	14	3	3	3
		100K	2	8	8	8	8	15	3	3	3
		200K	2	8	8	8	8	15	3	3	3
	500	44K	4	15	15	20	11	35	6	6	6
		100K	5	19	19	20	19	37	6	6	6
		200K	5	19	19	20	19	37	6	6	6
	1000	44K	7	29	29	38	29	67	10	10	11
		100K	9	34	34	37	34	68	10	10	11
		200K	9	34	34	37	34	68	10	10	11
SYSUT2	150	44K	2	6	6	7	6	13	2	2	3
		100K	2	7	7	7	7	13	2	2	3
		200K	2	7	7	7	7	13	2	2	3
	500	44K	4	14	14	18	14	32	5	5	5
		100K	5	17	17	18	17	33	5	5	6
		200K	5	17	17	18	17	33	5	5	6
	1000	44K	7	26	26	34	26	60	9	9	10
		100K	8	30	30	33	30	60	9	9	10
		200K	8	30	30	33	30	60	9	9	10
SYSUT3	150	44K	1	3	3	3	3	6	1	1	1
		100K	1	3	3	3	3	6	1	1	1
		200K	1	3	3	3	3	6	1	1	1
	500	44K	1	4	4	5	4	9	2	2	2
		100K	2	5	5	5	5	10	2	2	2
		200K	2	5	5	5	5	10	2	2	2
	1000	44K	2	6	6	8	6	14	3	2	3
		100K	2	8	8	8	8	15	3	3	3
		200K	2	8	8	8	8	15	3	3	3

Note: These estimates are based on the assumption that no macro instructions are used in the source program. The storage required for SYSUT3 increases when macro instructions are used and is approximately equal to the storage required for SYSUT1 for a 1000 card program.

Figure 88. Work Space for Assembler F

Data Set	Number of Source Cards	Number of Tracks Required							
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
SYSUT1 (EDIT option)	150	2	5	8	8	5	14	4	3	3
	500	7	15	20	20	16	35	8	7	8
	1000	10	28	40	40	32	70	16	13	15
SYSUT2 (XREF option)	150	1*	1*	1*	2*	1*	N/A	1*	1*	2*
	500	1*	2*	4*	4*	2*	N/A	2*	2*	2*
	1000	1*	4*	8*	8*	4*	N/A	3*	3*	3*

Figure 89. Work Space for FORTRAN IV H

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	1	2	3	3	2	6
	500	2	8	9	11	6	20
	1000	4	16	18	23	12	42
SYSUT2	150	1	5	6	7	3	13
	500	4	16	17	23	12	42
	1000	9	33	35	45	24	82
SYSUT3	150	2	5	7	7	4	13
	500	5	17	18	23	12	42
	1000	9	33	35	46	24	84

Figure 90. Work Space for COBOL E

Data Set	Number of Source Cards	Number of Tracks Required								
		2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305-1 Drum	2305-2 Drum	3330 Disk
SYSUT1	1042	1	2	2	3	1	4	1	1	1
	1784	8	26	9	36	18	63	9	8	11
SYSUT2	1042	3	10	11	14	5	24	3	3	3
	1784	11	37	41	51	22	88	11	10	13
SYSUT3	1042	1	2	2	3	1	4	1	1	1
	1784	6	19	22	27	12	48	6	5	7
SYSUT4	1042	1	3	3	4	2	6	1	1	2
	1784	3	9	10	12	6	21	3	3	4

Note: These estimates are for American National Standard COBOL operating in 86K bytes of core storage, with a buffer size of 2768 bytes. The XREF and TRUNC option were specified.

Figure 91. Work Space for American National Standard COBOL

Data Set	Number of Source Cards	Number of Tracks Required					
		IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1	150	1	3	4	3	3	7
	500	2	8	10	10	7	21
	1000	4	16	20	20	13	42
SYSUT2	150	1	3	4	3	3	4
	500	2	8	10	10	7	12
	1000	4	16	20	20	13	24
SYSUT3	150	1	2	3	3	2	5
	500	2	7	9	8	7	16
	1000	4	13	18	15	13	32

Figure 92. Work Space for RPG E

Data Set	Number of Source Cards	Size Option (3)	Block Size	Number of Tracks Required (1)					
				IBM 2301 Drum Storage	IBM 2302 Disk Storage	IBM 2303 Drum Storage	IBM 2311 Disk Storage	IBM 2314 Disk Storage	IBM 2321 Data Cell
SYSUT1 and SYSUT2 (2) with the SPACE Option (3)	150	15K	104	1*	2*	3*	3	2*	6*
		44K	1704	1*	2*	2*	2	2*	4*
		86K	1704	1*	2*	2*	2	2*	4*
		200K	1704	1*	2*	2*	2	2*	4*
	500	15K	104	3*	7*	9*	10	6*	20*
		44K	1704	2*	6*	6*	6	4*	12*
		86K	1704	2*	6*	6*	6	4*	12*
		200K	1704	2*	6*	6*	6	4*	12*
	1000	15K	104	5*	14*	17*	19	11*	39*
		44K	1704	3*	12*	12*	12	8*	24*
		86K	1704	3*	12*	12*	12	8*	24*
		200K	1704	3*	12*	12*	12	8*	24*
SYSUT1 and SYSUT2 (2) with the PRFRM Option (3)	150	19K	96	1*	3*	3*	3	2*	6*
		48K	1696	1*	2*	2*	2	1*	3*
		90K	1696	1*	1*	2*	1	1*	2*
		204K	1696	0*	0*	0*	0	0*	0*
	500	19K	96	3*	7*	9*	10	6*	19*
		48K	1696	1*	6*	6*	6	4*	11*
		90K	1696	1*	5*	5*	5	4*	10*
		204K	1696	0*	0*	0*	0	0*	0*
	1000	19K	96	5*	14*	18*	19	12*	38*
		48K	1696	3*	12*	12*	12	8*	23*
		90K	1696	2*	11*	11*	11	8*	22*
		204K	1696	0*	0*	0*	0	0*	0*

Notes:
1. These estimates assume that 40 bytes of intermediate text are generated for each source card image on each utility data set.
2. If the ADJUST compiler option is specified, the estimates for SYSUT2 are twice those given for SPACE compile, regardless of whether SPACE or PRFRM is specified.
3. For detailed information on the compiler options, see the publication IBM System/360 Operating System: FORTRAN IV E Programmer's Guide, GC28-6503.

Figure 93. Work Space for FORTRAN IV E

PARAMETER	Sub-parameter		Sub-parameter		Sub-parameter		Sub-parameter	
If MODES=	TASK	The storage requirement is	NOTK	The storage requirement is	REAL	The storage requirement is	CMPX	The storage requirement is
And ARRAY=	N.A		N.A		BASIC	2000 bytes	BASIC	2500 bytes
	N.A		N.A		LEAF	2500 bytes	LEAF	3200 bytes
CONVS=	N.A		N.A		BASIC	3900 bytes	BASIC	4400 bytes
	*BIT	2700 bytes	*BIT	2700 bytes	*BIT	2700 bytes	*BIT	2700 bytes
	*CHAR	3900 bytes	*CHAR	3900 bytes	*CHAR	3900 bytes	*CHAR	3900 bytes
	*EDIT	4300 bytes	*EDIT	4300 bytes	*EDIT	4300 bytes	*EDIT	4300 bytes
	*OPT1	5000 bytes	*OPT1	5000 bytes	*OPT1	5000 bytes	*OPT1	5000 bytes
	*PICT	7900 bytes	*PICT	7900 bytes	*PICT	7900 bytes	*PICT	7900 bytes
	*STERL	4400 bytes	*STERL	4400 bytes	*STERL	4400 bytes	*STERL	4400 bytes
MATHS=	N.A.		N.A.		BASIC	1800 bytes	BASIC	4300 bytes
	N.A.		N.A.		LONG	2700 bytes	LONG	5500 bytes
	N.A.		N.A.		SHORT	3800 bytes	SHORT	4800 bytes
RECIO=	BASIC	2400 bytes	BASIC	1700 bytes	N.A.		N.A.	
	WAIT	1300 bytes	WAIT	1100 bytes	N.A.		N.A.	
STORG=	*ERR	1300 bytes	*ERR	1300 bytes	*ERR	1300 bytes	*ERR	1300 bytes
	*LISTP	2700 bytes	*LISTP	2700 bytes	*LISTP	2700 bytes	*LISTP	2700 bytes
STRGS=	*BIT	3200 bytes	*BIT	3200 bytes	*BIT	3200 bytes	*BIT	3200 bytes
	*CHAR	1800 bytes	*CHAR	1800 bytes	*CHAR	1800 bytes	*CHAR	1800 bytes
	*STR	2700 bytes	*STR	2700 bytes	*STR	2700 bytes	*STR	2700 bytes
STRIO=	DATA	5300 BYTES	DATA	5300 bytes	N.A		N.A	
	EDIT	3200 bytes	EDIT	3100 bytes	N.A		N.A	
	LIST	5300 bytes	LIST	5200 bytes	N.A		N.A	

- All shared libraries contain basic storage management routines. If you specify MODES=TASK, the basic storage requirement is 7100. If you specify MODES=NOTK, the storage requirement is 5100 bytes.
- To use this figure; locate your subparameters, in the proper column, and add the storage requirements.
- Subparameters marked with an * can be specified for any MODES= condition and should be added only once.
- If you specify a combination of subparameters, add the storage requirements individually.
- Storage is required, on SYS1.LINKLIB, for the modules selected with this option. Convert the storage required into tracks by using the following conversion factors:

Device	Conversion factor
IBM 2301 Drum Storage Device	6 x 10^{-5} tracks/byte
IBM 2302 Disk Storage Device	26 x 10^{-5} tracks/byte
IBM 2303 Drum Storage Device	30 x 10^{-5} tracks/byte
IBM 2311 Disk Storage Device	35 x 10^{-5} tracks/byte
IBM 2314 Disk Storage Device	18 x 10^{-5} tracks/byte
IBM 2305 Drum	12 x 10^{-5} tracks/byte
IBM 3330 Drum	10 x 10^{-5} tracks/byte

EXAMPLE: If the PL1LIB macro shared library feature is specified as

```
MODES=(TASK,REAL),CONVS=(BASIC,BIT,CHAR),STRGS=BIT

the storage requirement is  7100   (basic requirement)
                           +3900
                           +2700
                           +3900
                           +3200
                            20,800 bytes   20,800 bytes (35x10-5 tracks/bytes) = 8
                          Tracks on a 2311
```

Figure 94. Storage Requirements for Options Specified in the PL1IIB Macro for the Shared Library Feature

Data Set	Number of source Cards	PL/I F Operating In	Number of Tracks Required							
			2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2321 Data Cell	2305 Drum	3330 Disk
SYSUT1 without the EXTDIC option	150	44K	2	6	6	8	4	22*	3	3
		100K	0	0	0	0	0	0*	0	0
		200K	0	0	0	0	0	0*	0	0
	500	44K	8	23	23	31	16	92*	11	10
		100K	5	9	9	18	9	27*	6	6
		200K	0	0	0	0	0	0*	0	0
	1000	44K	15	48	48	64	32	192*	22	20
		100K	10	33	33	48	24	102*	16	15
		200K	5	12	12	15	8	27*	6	6
SYSUT1 with the EXTDIC	150	44K	2	6	6	8	4	24	3	3
		100K	0	0	0	0	0	0	0	0
		200K	0	0	0	0	0	0	0	0
	500	44K	8	23	23	31	16	99	11	10
		100K	6	10	10	22	11	33	8	8
		200K	0	0	0	0	0	0	0	0
	1000	44K	18	65	65	74	37	202	25	24
		100K	12	55	55	64	32	111	22	21
		200K	5	18	18	20	10	28	7	7
SYSUT3 with or without the EXTDIC option	150	44K	5	12*	17*	20	10*	25*	12	10
		100K	3	8*	12*	14	7*	20*	8	7
		200K	3	8*	12*	14	7*	20*	8	7
	500	44K	13	40*	45*	50	29*	84*	35	30
		100K	9	29*	36*	38	23*	67*	27	25
		200K	9	29*	36*	38	23*	67*	27	25
	1000	44K	26	60*	90*	97	58*	168*	55	50
		100K	18	45*	72*	76	45*	134*	42	40
		200K	18	45	72*	76	45*	134*	42	40

Note: These estimates are based on the assumptions that the input is 80-character records and that there is no increase for the macro processor.

Figure 95. Work Space for PL/I F

Figure 96 contains suggested work space requirements for each of the four or five data sets that are required for each display unit using GJP or SGJP. The notes included in the figure describe how many records each data set can contain, using the suggested work space requirements. If any of these data sets must contain more records, increase the track requirements accordingly.

Data Set Data Set	Number of Tracks Required							
	2301 Drum	2302 Disk	2303 Drum	2311 Disk	2314 Disk	2305-1 Drum	2305-2 Drum	3330 Disk
SYS1.DIAnnn (1)								
primary	1	4	4	5	3	4	3	2
secondary	1	4	4	5	3	4	3	2
SYS1.JCLnnn (2)								
primary	1	4	4	5	3	3	2	2
secondary	1	4	4	5	3	3	2	2
SYS1.EXTnnn (3)								
primary	1	4	4	5	3	3	2	2
secondary	1	4	4	5	3	3	2	2
SYS1.EXTnnnA (4)								
primary	1	4	4	5	3	3	2	2
secondary	1	4	4	5	3	3	2	2
SYS1.DISnnn (5)								
primary	10	40	40	50	30	40	30	20
secondary	2	8	8	10	6	8	6	4

Where: nnn = the address of the display unit to be used

Notes:

1. The diary data set contains a history of all operations performed during a session. Each record contains 120 bytes; each operation frame can result in 1 to 4 records. The suggested primary track requirement can contain up to 95 diary records.
2. The JCL data set contains generated JCL records for a single job. Each record contains 80 bytes; each operation frame associated with job definition can result in 1 to 4 records. The suggested primary track requirement can contain up to 125 JCL records. The JCL data set can also contain system message block (SMB) records, which are placed in the data set after a foreground job is completed. Each record contains 176 bytes; each generated JCL record (other than system input data) will result in an average of 3 to 4 SMB records. The suggested primary track halve this requirement) requirement can contain up to 75 SMB records.
3. The extract data set contains the information entered on an operation frame for the current job. Each record contains 372 bytes; each operation frame results in 1 record. The suggested primary track requirement can contain up to 40 records.
4. The alternate extract data set has the same format as the extract data set.
5. The display data set contains Sysout records for a data set from a user's job. Each record contains 3300 bytes and holds 25 Sysout records. The suggested primary track requirement can contain up to 1250 Sysout records (GJP only).

Figure 96. Work Space for GJP or SGJP

Appendix A Contents

Appendix A: Reentrant Load Modules. Type 3 and 4 SVC Routines and Error Recovery Procedures

This appendix lists the modules and SVC routines that may be resident in the fixed area of storage. The name and size of each module and routine is given, along with the library in which it is located. This list is divided into five sections:

- Those modules that are always loaded into the link pack area with MVT.
- Those reenterable load modules from the link library that may be resident in the link pack area with MVT.
- Those access method modules that may be resident with any configuration.
- Those type 3 and 4 SVC routine modules that may be resident with any configuration.
- Error recovery procedures that may be resident with any configuration.

Modules Always Loaded into the Link Pack Area with MVT

The following list contains those job scheduler modules from the link library that are always loaded into the link pack area when an MVT system is initialized:

Module Name	Function	Size
IEFSD102	MVT Initiator, Replace Region Interface	696
IEFSD105	MVT Initiator, Wait for Work in the Input Queue	248
IEFSD263	MVT Initiator, ATTACH	1528
IEFQINTZ	MVT Queue Management, Get Region for Queue	96
IEFDSOLP	Wait for a STOP or MODIFY DSO command	96
IEEPRTN	Free Region for START and MOUNT	218
IEERGN	Alias for IEEPRTN	
IEEPALTR	Queue Alter, Get Region	530
IEEPPRES	Get Region for PRESRES Routine	112
IEFVME	ASB GET/FREE Interpretation Region	288
IEEPRWI2	GET Region for START and MOUNT	682
*IEEVGPSD	Display User/Send-Get Region	400
*IKJEFF44	Wait Routine Background Reader	208
*IKJEAT01	Initialize TSC Region	120

*Included if TSO is selected during system generation.

The following list contains the BSAM and QSAM modules from the SVC library that are always loaded into the MVT link pack area.

Module Name	Function	Size
IGG019AA	Simple GET Locate Fixed	160
IGG019AB	Simple GET Locate variable	168
IGG019AI	Simple PUT Locate fixed	128
IGG019AK	Simple PUT Move Fixed	240
IGG019AJ	Simple PUT Locate Variable	304
IGG019AQ	GET Error Routine	336
IGG019AR	PUT Error Routine	248
IGG019BA	READ/WRITE All Devices	424
IGG019BB	CHECK All Devices	296
IGG019CC	Schedules I/O for tape, DA-IN, CDRDR, PTRDR	504
IGG019CD	SK F STD - Fit on Track ?	644
IGG019CE	PRNTR - PCH, End of block	144
IGG019CF	PRNTR - PCH, ASA Char to Command Code	280
IGG019CH	CK for multiple extent in DEB (Appendage)	128
IGG019CI	Length CK for F Blocked Records (Appendage)	552
IGG019CJ	Read Length CK for V Tape Records (Appendage)	536
IGG019CL	PRNTR Test Channel 9,12 (Appendage)	72

Note: Some of these modules are part of the standard RAM list. The space required for these modules should be subtracted from the area required for the standard list.

Modules That may be Resident in the Link Pack Area in MVT

The following list contains reenterable load modules from the link library (except where noted) that may be loaded into the link pack area with MVT. To avoid the duplicate loading into either the Link Pack Area or dynamic main storage of modules already resident in the Link Pack Area, the ADD utility control statement must show all the ALIAS names of the load module being placed in the Link Pack Area. (For more information IBM System/360 Operating System: MVT Guide.)

Note: Attributes of a load module will determine which subpool it may be loaded into. Therefore, certain load modules that are re-entrant are not marked re-entrant.

Initiator/Terminator Modules

IEFSD061	Step Termination	46,416
IEFSD104	Alias for IEFSD061	
IEFSD065	Alias for IEFSD061	
IEFW42SD	Alias for IEFSD061	
IEFV4221	Alias for IEFSD061	
*IEFSD062	Step Start	9,088
*DEVNAMET	Device Name Table (see Job Step Initiation in MVT)	Variable
*DEVMASKT	Device Mask Table (see Job Step Initiation in MVT)	Variable

*These modules may be included in the link pack area even though they are not marked reentrant.

Queue Manager Modules

IEFQDELE	
IEFQMDQ2	3448
IEFQMSSS	

Reader/Interpreter Modules

*IEFVHA	Reader control routine	35,112
*IEFVHCB	Alias for IEFVHA	
*IEFVHREP	Alias for IEFVHA	
*IEFVHF	Alias for IEFVHA	
*IEFMVTJA	Job statement processing	6200
*IEFVJA	Alias for IEFMVTJA	
*IEFVHI	Initialization	4512
*IEFVINA	Instream procedures	5152
*IEFIRC		
*IEFMVTHR		1464
*IEFHRFK2	Alias for IEFMVTHR	
*IEFVHN		1664
*IEZDCODE		208

*These module names must be added to the BLDL list when establishing modules for the link pack area. (See the MFT Guide and the MVT Guide).

ASB Reader Modules

IEFVMA	Initialization	1600
IEFVMB	Input Stream processor	8166
IEFVMC	Command Processor	730
IEFVMD	Termination	2444
IEFVMF	Interpreter Control	11,054

Restart Reader Modules

IEFRSTRT	Issues SVC 52	8
IEFVRR1	Dequeue by Jobname Interface	2104
IEFVRR2	Table Merge Routine	2976
IEFVRR3	Reinterpretation Delete/Enqueue Routine	3200
IEFVRRC	Reinterpretation Control Routine	4368
IEFRCLN1	Linkage Reinterpretation	120
IEFRCLN2	Linkage Reinterpretation	120

Loader Modules

IEWLDRGO	Loader Control/Interface	472
LOADR	Alias for IEWLDRGO	
IEWLOADR	Loader Processing	14,104
IEWLOAD	Alias for IEQLOADR	

Output Writer Modules

IEFSD070	Data Set Writer Attach	808
IEFSD078	Writer Control	544
IEFSD080	Writer Control	7192
IEFSD085	SYSOUT Data Set Control	3736
IEFSD086	SYSOUT Message Handler	3820
IEFSD087	SYSOUT Data Set Writer	3136
IEFSD094		4080
IEFQMNQ2		1096
IEFSDXXX	Variable Spanned Records	1128
IEFSDXYZ	Command Changing of Writer Output	592
IEFSDTTE	3211 Printer Support	2096

Graphics Cancel Key Option Modules

IFFCAN01	Cancel Key Option - Routine 1	2504
IFFCAN02	Cancel Key Option - Routine 2	2640
IFFCAN03	Cancel Key Option - Routine 3	44

SMF Module

IFASMFDP	Dump Program For SMF Data Set on Direct Access	1920

Graphics Modules (Problem Oriented Routines)

IFFANA	Express Attention Handling	704
ANLZ	Alias for IFFANA	
IFFPAAST	Store Graphic Orders	416
GSTOR	Alias for IFFPAAST	
IFFPBAPR	Graphic Character Print	1216
GCPRNT	Alias for IFFPBAPR	
IFFPCAAR	Circular Arc	2512
GARC	Alias for IFFPCAAR	
IFFPDAPL	Scale and Plot	3504
GSPLOT	Alias for IFFPDAPL	
IFFPEAGR	Cartesian Grid	1432
GCGRID	Alias for IFFPEAGR	
IFFPFAVA	Circular Arc With Vectors	3024
GVARC	Alias for IFFPFAVA	
IFFPGAVP	Scale and Plot with Vectors	2944
GSVPLT	Alias for IFFPGAVP	
IFFPHALA	Grid Labeling	1848
GLABEL	Alias for IFFPHALA	
IFFPIAPG	Polar Grid	4224
GPGRID	Alias for IFFPIAPG	
IFFPJAPV	Polar Grid with Vectors	3704
GPGVRD	Alias for IFFPJAPV	
IFFPKADG	Graphic Data Plotting	4264
GSDPLT	Alias for IFFPKADG	
IFFPLARE	Light Pen Tracking	1048
PENTRK	Alias for IFFPLARE	
IFFPPASG	Off-screen/off-grid option	816
GOFFSAG	Alias for IEFPPASG	

Graphics Modules (FORTRAN IV, and PL/1 F Graphic Subroutine Package)

Note: Control section names appear in parentheses after the function; alias names are so indicated.

IFFAAA02	Terminate Graphic Subroutine Package (TMGSP)	208
IFFAAA03	Initialize Graphic Device (INDEV)	1552
IFFAAA04	Terminate Graphic Device (TMDEV)	456
IFFAAA05	Initialize Graphic Data Set (INGDS) Note: For each graphic data set initialized by this call, add 2•(graphic-data-output-area-length+100). Also, for each graphic data set that has one or more keyed or correlated elements or sequences, add $550 \bullet \frac{\text{(no. of elements)}}{40}$. If this division results in a remainder, add an additional 550 bytes.	1080
IFFAAA06	Terminate Graphic Data Set (TMGDS)	488
IFFACA00	Create Attention Level (CRATL)	800
IFFACA01	End Attention Levels (ENATL)	784
IFFACA02	Enable Attention Sources (ENATN)	920
IFFACA03	Disable Attention Sources (DSATN)	696
IFFACA04	Modify Position of Attention Level (MPATL)	1176
IFFACA05	Modify Light Pen or End-Order-Sequence Attention Information (MLPEO)	560
IFFACA06	Set Light Pen Attentions (SLPAT)	304
IFFACA07	Modify Status of Programmed Function Indicator Lights (MLITS)	872
IFFACA08	Request Attention Information (RQATN)	3080

IFFACA13	Sound Audible Alarm (SALRM)	176
IFFACA50	Specify Link-Load Status (SPEC)	504
IFFADA01	Read Data (GSPRD)	1852
IFFADA02	Remove Cursor (RCURS)	832
IFFADA03	Insert Cursor (ICURS)	1084
IFFAEA01	Set Data Mode (SDATM)	720
IFFAEA02	Set Graphic Mode (SGRAM)	184
IFFAEA03	Set Data Limits (SDATL)	224
IFFAEA04	Set Graphic Data Set Limits (SGDSL)	1008
IFFAEA06	Set Scissoring Option (SSCIS)	176
IFFAEA07	Set Character Mode (SCHAM)	160
IFFAFA01	Plot Lines/Plot Points (PLINE/PPNT)	2072
IFFAFA16	Alias for IFFAF01	
IFFAFA02	Plot Line Segment(s) (PSGMT)	2728
IFFAFA03	Plot Text (PTEXT)	2504
IFFAFA04	Set Beam at Absolute Position/Move Beam to Position (STPOS/MVPOS)	1576
IFFAFA17	Alias for IFFAFA04	
IFFAFA05	Begin a Sequence of Elements/Begin a Buffer Subroutine (BGSEQ/BGSUB)	704
IFFAFA18	Alias for IFFAFA05	
IFFAFA06	End a Sequence of Elements (ENSEQ)	336
IFFAFA07	End a Buffer Subroutine (ENSUB)	656
IFFAFA08	Link to a Buffer Subroutine (LKSUB)	1056
IFFAFA09	Place in Include Status/Place in Omit Status (INCL/OMIT)	848
IFFAFA10	Alias for IFFAFA09	
IFFAFA11	Execute (EXEC)	848
IFFAFA12	Reset a Graphic Data Set (RESET)	1672
IFFAFA13	Indicate Beam Position (IDPOS)	560
IFFAFA14	Force a Set Mode Order (FSMOD)	112
IFFAFA15	Set End-Order-Sequence Order (STEOS)	1176
IFFAFA19	Order Graphic Data Sets (ORGDS)	720
IFFAGA01	Locate Position of Light Pen (LOCPN)	904
IFFAGA02	Begin Light Pen Tracking (BGTRK)	968
IFFAGA03	Read Current Location of Tracking Symbol (RDTRK)	400
IFFAGA04	End Light Pen Tracking (ENTRK)	200
IFFAGA05	Define Strokes (DFSTR)	592
IFFAGA06	Plot Strokes (PLSTR)	2904
IFFAGA07	Generate Graphic Orders (ORGEN)	2712
IFFAGA08	Convert Coordinates (CNVRT)	920
IFFAHA01	Flow Control Management	1520
IFFAHA02	Buffer Management	1224
IFFAHA03	Key Table Management	528
IFFAHA04	Data Generator	1424
IFFAHA05	Data Store	2464
IFFAHA06	Scaling	608
IFFAHA15	Alias for IFFAHA06	
IFFAHA07	Scissoring	1672
IFFAHA09	Cancel Key	240
IFFAHA11	Director, Part 2	968
IFFAHA13	Update1/Update2	1120
IFFAHA14	Alias for IFFAHA13	
IFFAJA01	Test Return Code (ITRC)	320
IFFAJA02	Test Integer Beam Position/Test Real Beam Position (ITBP/ITRP)	552
IFFAJA03	Alias for IFFAJA02	
IFFAJA04	Test Status (ITST)	328

1130/360 Data Transmission Modules

IKDGTCLT	Return Status of Communication Line to User	376
IKDGTEND	Logically Disconnect Communication Support	848
IKDGTIRB	Determine BTAM Procedure to be Requested	2432
IKDGTNIT	Establish Initial Communication Contact	912
IKDRDWRT	Request BTAM Procedure	1128

PL/I F Library Modules

IHECLSA	Close files (this module is required only for the execution of programs compiled and link edited under PL/I Versions 1, 2, 3).	1096
IHECLTA	Close files	1632
IHECLTB	Alias for IHECLTA	
IHECTTA	Multitasking close files	2112
IHECTTB	Alias for IHECTTA	
IHEERDA	Data Processing error messages	720
IHEEREA	I/O error messages	1840
IHEERIA	Error messages	896
IHEERNA	Error messages (this module is only required for the execution of programs compiled and link edited under PL/I Versions 1 and 2).	4504
IHEEROA	Error messages	856
IHEERPA	Error messages	1272
IHEERSA	SNAP	936
IHEERSB	Alias for IHEERSA	
IHEERTA	Multitasking error messages	880
IHEESMA	To print SNAP and system action messages	1776
IHEESMB	Alias for IHEESMA	
IHEESSA	To print SNAP and system action messages	2152
IHEESSB	Alias for IHEESSA	
IHEITBA	BSAM interface	4032
IHEITCA	BSAM interface	2832
IHEITDA	QISAM interface	2464
IHEITEA	BISAM interface	1896
IHEITFA	BDAM interface	1960
IHEITGA	QSAM interface	1288
IHEITHA	BISAM interface	2896
IHEITJA	BDAM interface	2904
IHEITKA	QSAM Interface Spanned Input	752
IHEITLA	QSAM Interface Spanned Output	536
IHEOPNA	Open files	984
IHEOPOA	Open files	2288
IHEOPPA	Open files	2104
IHEOPQA	Open files	1592
IHEOPZA	Open files	1064
IHETEXA	Task ABEND message	1800
IHETOMA	Write to operator	552
IHETOMB	Alias for IHETOMA	
IHETOMC	Alias for IHETOMA	
IHETOMD	Alias for IHETOMA	
IHETOME	Alias for IHETOMA	
IHEZZAA	ABDUMP	1424
IHEZZBA	ABDUMP	1872
IHEZZCA	ABDUMP	3256
IHEZZFA	ABDUMP	1760

TCAM Modules	Function	Size
IEDQEC	PUT Scheduler	1616
IEDQEW	GET Scheduler	2328
IEDQEZ	GET Scheduler	24
IEDQNG	Checkpoint (CHECKPT macro)	272
IEDQNH	Checkpoint (TCHNG macro)	256
IEDQNJ	Checkpoint (Operator Control)	250
IEDQNK	Checkpoint (Environment)	912
IEDQNM	Checkpoint (CKREQ macro)	456
IEDQNO	Checkpoint	248
IEDQNP	Checkpoint	656
IEDQNQ	Checkpoint	800
IEDQNR	Checkpoint	272
IEDQNS	Checkpoint	208
IEDQNX	Operator Awareness Message Router	580

Fortran Syntax Checker Modules

IPDSNEXC	Checking and Error Message Setup	10,752
IPDTEE	Description of FORTRAN E	2304
IPDAGH	Description of FORTRAN G/H	5632

PL/I Syntax Checker Modules

IKM001	Syntax Checker Module of 20K Version	17,408
IKM21	Transient load Modules for 20K Version	4096
IKM22	Transient Load Modules for 20K Version	4096
IKM23	Transient Load Modules for 20K Version	4096
IKM002	Syntax Checker Module of 27K Version	28,672
IKM003	Syntax Checker Module of 16K Version	17,408

Miscellaneous Modules

IEWSZOVR	Asynchronous Overlay Supervisor	992
IECBBFB1	Build Buffers	96
IECQBFG1	Get Pool	224
IEAXDS00	Decimal Stimulation Routine for Model 91	3236
IEEVSIPL	SYS1.BRODCAST.TIOT Initialization	96
IEESD563	Queue search setup routine	1680
IEESD564	Queue search routine	1730
IEESD583	Queue search return routine	980
IEESD584	D Q/D N message setup routine	480

Access Method Modules

The following list contains the access method modules that may be made resident in any configuration when the resident reenterable load module option is selected. All of these modules are on the SVC library. Those module names followed by -SL are the modules loaded when the IBM-supplied standard list IEAIGG00 is used. Names in parentheses are aliases.

SEQUENTIAL ACCESS METHOD MODULES

Modules Common to BSAM and QSAM

Module	Function	Size
IGG019AX	User Totaling Save Routine	120
IGG019B0	Build buffer cntrl block & buffer pools	328
IGG019CA-SL	Stacker Select Card Reader	160
IGG019CB-SL	Space or Skip - QSAM, BSAM	168
IGG019CC-SL	Schedules I/O for Tape, DA-IN,CDRDR,PTRDR	504
IGG019CD-SL	Schedules I/O for DA	644
IGG019CE-SL	PRNTR-PCH, End of Block (SAM)	144
IGG019CF-SL	PRNTR-PCH, ASA Char to Command Code	280
IGG019CG	Update QSAM/BSAM SII Appendage	272
IGG019CH-SL	CK for multiple extent in DEB (Appendage)	128
IGG019CI-SL	Length CK for F Blocked Records (Appendage)	552
IGG019CJ-SL	Read Length CK for V Tape Records (Appendage)	536
IGG019CK-SL	Checks Delimiter Characters (Appendage)	144
IGG019CL-SL	PRNTR Test Chan 9, 12 (Appendage)	72
IGG019CM	Translate table TELE TYPE	848
IGG019CN	Translate table ASCII	568
IGG019CO	Translate table BURROUGHS	568
IGG019CP	Translate table FRIDEN	848
IGG019CQ	Translate table IBM PTTC/8	848
IGG019CR	Translate table NCR	848
IGG019CS	WLR Appendage P. T. Rdr.	32
IGG019CT	BSAM End-of-Block Routine	56
IGG019CU	C.E, AB.E. PCI (Input/OUTPUT) Appendage	1600
IGG019CV	EOB DA Output, PCI	984
IGG019CW	EOB Tape In/Out DA Input PCI	624
IGG019CX	EOB Printer/Punch PCI	208
IGG019CY	EOB ASA Char. Printer/PUNCH PCI	368
IGG019CZ	APPND End of Extent PCI	224
IGG019C0-SL	Channel end U-Format	148
IGG019C1	TRK OV ASYNCH ERR. RTN	392
IGG019C2	EOB TRK OV.	1098
IGG019C3	TRK OV ABNE APPENDAGE	344
IGG019EI	C.E., A.B.E. appendiage bypass DOS CHKPT records U,F,FB	410
IGG019EJ	C.E., A.B.E. appendage bypass DOS CHKPT records V,VB	424
IGG019BM	Update BSAM EOE Appendage	144
IGG019EK	RPS SIO Channel and abnormal end appendage	450
IGG019FN	SIO for search direct	120
IGG019TC	Schedules I/O for Tape - User Totaling Facility	256
IGG019TD	SK F Std - Fit on Tape? - User Totaling Facility	632
IGG019TV	EOB DA Output, PCI - User Totaling Facility	1008
IGG019TW	EOB Tape Input/Output PCI - User Totaling Facility	440
IGG019T2	EOB TRK OV - User Totaling Facility	1056
IGG019C4	End of Extent, Search Direct	148
IGG019FP	Channel End for Search Direct	320

BSAM Modules

Module	Function	Size
IGG019BA-SL	READ/WRITE all devices	424
IGG019BB-SL	CHECK all devices	296
IGG019BC-SL	NOTE/POINT Disk	328
IGG019BD-SL	NOTE/POINT Tape	368
IGG019BE-SL	Control Tape	496
IGG019BF	Read Translate	552
IGG019BG	Paper Tape Check	264
IGG019BH	Update BSAM R/W	312
IGG019BI	Update BSAM Check	120
IGG019BK	NOTE/POINT Rt. D.A. PCI/T.O./UPDATE	440
IGG019BL	NOTE/POINT Rt. Tape PCI	272

QSAM Modules (Simple Buffering)

Module	Function	Size
IGG019AA-SL	Simple GET Locate Fixed	160
IGG019AB-SL	Simple GET Locate Variable	168
IGG019AC-SL	Simple GET Move Fixed	288
IGG019AD-SL	Simple GET Move Variable	264
IGG019AE	Update QSAM GET	488
IGG019AF	Update QSAM Synch.	712
IGG019AG-SL	GET Move Fixed with CNTRL	152
IGG019AI-SL	Simple PUT Locate Fixed	144
IGG019AJ-SL	Simple PUT Locate Variable	304
IGG019AK-SL	Simple PUT Move Fixed	232
IGG019AL-SL	Simple PUT Move Variable	368
IGG019AM-SL	Simple Backward Locate Fixed	160
IGG019AN-SL	Simple Backward Move Fixed	280
IGG019AQ-SL	GET Error Routine	336
IGG019AR-SL	PUT Error Routine	248
IGG019AT	GET Translate	792
IGG019AV-SL	Simple PUT Locate Dummy	128
IGG019BN	Update/Locate Var Length Rcd Exten	1987
IGG019BO	Get/Loc Var Length Rcd Exten	622
IGG019BP	Put/Loc Var Length Rcd Exten	968
IGG019BQ	Update GET Var Spanned	925
IGG019FB	Simple GET Locate Variable Spanned	248
IGG019FD	Simple GET Move Variable Spanned	472
IGG019FF	Simple GET Data Variable Spanned	488
IGG019FG	Simple PUT Data Variable Spanned	584
IGG019FJ	Simple PUT Locate Variable Spanned	288
IGG019FL	Simple PUT Move Variable Spanned	568

QSAM Modules (Exchange Buffering)

Module	Function	Size
IGG019EA	EXC. LOC. GET BLKD	144
IGG019EB	EXC. LOC. GET UNBLKD	104
IGG019EC	EXC. SUBS GET UNBLKD	88
IGG019ED	EXC. SUBS GET BLKD	184
IGG019EE	EXC. PUT, PUTX UNBLKD	352
IGG019EF	EXC. PUT, PUTX BLKD	312

BSAM/QSAM Extended Error Recovery for 3211

IGG019FR	Appendage	90
IGG019FS	Error Retry	1024

BSAM/QSAM Optical Reader Modules (1285/1287/1288)

IGG019VA	GET Locate Mode, Fixed Records - QSAM	312
IGG019VB	GET Locate Mode, Variable Records - QSAM	408
IGG019VC	GET Move Mode, Fixed Records - QSAM	376
IGG019VD	GET Move Mode, Variable Records - QSAM	456
IGG019VE	SYNCH Module - QSAM	880
IGG019VF	READ Module - BSAM	136
IGG019VG	CHECK Module - BSAM	818
IGG019VH	CNTRL Module - BSAM/QSAM	864
IGG019VI	RDLNE Module - QSAM	232
IGG019VJ	DSPLY Module - BSAM	472
IGG019VK	RESCN Module - BSAM	592
IGG0197A	OPEN Stage II (OCR) - BSAM/QSAM	1024
IGG0197B	OPEN Stage III (OCR) - BSAM/QSAM	1024

BSAM 1419/1275 Modules

IGG019V1	READ	174
IGG019V2	EOB	336
IGG019V3	CHECK	416
IGG019V4	CONTROL	440
IGG019V5	Appendages	3504
IGG0197C	OPEN Stage II	1024
IGG0197D	OPEN Stage III	1024
IGG00201D	CLOSE Module	1024

BSAM/QSAM TSO Interface Modules

IGG01QTX	CHECK	80
IGG019TY	NOTE/POINT	8
IGG019TZ	CONTROL	24
IGG019T3	GET	392
IGG019T4	PUT	232
IGG019T5	READ/WRITE	520
IGG019T6	GET/PUT	520
IGG019T7	READ	432
IGG019T8	WRITE	184
IGG0196S	TSO Open Executor	1024

BSAM/QSAM Modules (3505/3525)

IGG0197L	Open Stage I	1024
IGG0197M	Open Stage I	1024
IGG0197N	Open Stage II	1024
IGG0197P	Open Stage II	1024
IGG0197Q	Open Stage II	1024
IGG0201R	CLOSE	1024
IGG0201P	CLOSE	1024
IGG019FK	EOB - Punch with DPI	350
IGG019FQ	EOB - 3525 Print	900
IGG019FU	EOB - 3525 Interpret	250
IGG019FA	CNTRL - 3525 Printer Control	350
IGG019C6	Appendage - 3525 Associated Data Set	186

Module	Function	NON-PRS Size	RPS Size
IGG019DA	WRITE FORMAT 'F', LOAD MODE	784	
IGG019DB	WRITE FORMAT V, U, LOAD MODE	856	
IGG019DC	CHECK ROUTINE, LOAD MODE	216	
IGG019DD	WRITE FORMAT F, LOAD MODE, TRK. OV.	1224	
IGG019KA	FOUNDATION MODULE	1544	
IGG019KC	RELATIVE TRACK	272	
IGG019KE	RELATIVE BLOCK	296	
IGG019KF	CONVERT RELATIVE BLOCK	696	
IGG019KG	BLOCK FEEDBACK	184	
IGG019KH	CONVERT TO RELATIVE BLOCK	240	
IGG019KI	READ/WRITE by BLOCK KEY	152	
IGG019KK	READ/WRITE by BLOCK ID	328	
IGG019KM	WRITE ADD FORMAT U or V	712	
IGG019KO	WRITE ADD FORMAT F	312	
IGG019KQ	WRITE VERIFY	248	352
IGG019KU	CHANNEL END APPENDAGE	232	
IGG019KW	KEY EXTENDED SEARCH	336	328
IGG019KY	SELF FORMAT EXTENDED SEARCH	192	
IGG019LA	PRE-FORMAT EXTENDED SEARCH	216	216
IGG019LC	END OF EXTENT APPENDAGE	168	
IGG019LE	DYNAMIC BUFFERING	320	
IGG019LG	READ EXCLUSIVE	1032	
IGG019LI	CHECK MODULE	240	
IGG019KR	READ/WRITE for Spanned Records	704	664
IGG019KN	WRITE ADD for Spanned Records	1392	
IGG019KJ	Foundation Module for Spanned Records	3496	3496
IGG019KL	Dynamic Buffering for Spanned Records	350	
IGG019BR	CREATE BDAM VAR SPANNED (WRITE)	1960	
IGG019BS	CREATE BDAM VAR SPANNED (CHECK)	390	
IGG019BT	CREATE BDAM VAR SPANNED CHAN. END APPENDAGE	174	
IGG019BU	READ BDAM VAR SPANNED	160	
IGG019BV	READ BDAM VAR SPANNED	354	
IGG0199L	CREATE BDAM VAR SPANNED	1024	

Note: The following module relationships exist when any one of the BDAM modules mentioned below is loaded with the link pack area:

A) If IGG019KA is resident, the following modules must also be resident; IGG019KE, IGG019KC, IGG019KQ, IGG019KI, IGG019KK, IGG019KF (any of these, with the exception of IGG019KI, may be resident without requiring other modules to be).
B) If IGG019KI is resident, IGG019KW must also be resident; the reverse is not true.
C) If IGG019KJ is resident, the following modules must also be resident; IGG019KC, IGG019KQ, IGG019KR, IGG019KK (any of these, with the exception of IGG019KR, may be resident without requiring other modules to be).
D) If IGG019KR is resident, IGG019KW must also be resident; the reverse is not true.
E) If IGG019KO is resident, IGG019LA must also be resident; the reverse is not true.
F) If IGG019KN is resident, IGG019KY must also be resident; the reverse is not true.
G) If IGG019KM is resident, IGG019KY must also be resident; the reverse is not true.

BISAM Modules

Module	Function	Size
IGG019G0	COMB, WRITE KN APPENDAGE FS	2288
IGG019G1	COMB, WRITE KN APPENDAGE FSWC	2408
IGG019G2	COMB, WRITE KN APPENDAGE FU	2200
IGG019G3	COMB, WRITE KN APPENDAGE FUWC	2432
IGG019G4	COMB, WRITE KN APPENDAGE BS	2848
IGG019G5	COMB, WRITE KN APPENDAGE BSWC	2938
IGG019G6	COMB, WRITE KN APPENDAGE BU	3304
IGG019G7	COMB, WRITE KN APPENDAGE BUWC	3752
IGG019G8	COMB, READ, WRITE K APPENDAGE (NO WC)	1304
IGG019G9	COMB, READ, WRITE K APPENDAGE (WC)	1568
IGG019GL	WKN, NO, WC	2432
IGG019GM	WKN, WC	2656
IGG019GN	COMB, NO, WC	3728
IGG019GO	COMB, WC	4104
IGG019GV	WRITE KN ASYNCHRONOUS (WC)	2256
IGG019GW	COMBINED ASYNCHRONOUS (WC)	3104
IGG019GX	READ, WRITE K ASYNCHRONOUS	992
IGG019GY	WRITE KN ASYNCHRONOUS (NO WC)	2232
IGG019GZ	COMBINED ASYNCHRONOUS (NO WC)	3144
IGG019H3	COMBINED PMT (VLR)	2180
IGG019H7	READ, WRITE K PMT (VLR)	1468
IGG019HP	CHANNEL PROGRAM WRITE KN (VLR)	1272
IGG019I9	READ, WRITE K APPENDAGE (VLR)	1686
IGG019IM	WRITE KN APPENDAGE (VLR)	2336
IGG019IN	WRITE KN APPENDAGE (VLR)	4068
IGG019IO	COMB, WRITE KN APPENDAGE (VLR)	3912
IGG019IX	READ, WRITE K ASYNCHRONOUS (VLR)	1100
IGG019IY	WRITE KN ASYNCHRONOUS (VLR)	3624
IGG019IZ	COMBINED ASYNCHRONOUS (VLR)	4278
IGG019J0	COMBINED PMT NLSD=0	1648
IGG019J3	COMBINED PMT NLSD≠0	2064
IGG019J6	READ, WRITE K PMT NLSD=0	1256
IGG019J7	READ, WRITE K PMT NLSD≠0	1464
IGG019JC	CHECK	144
IGG019JH	SIO APPENDAGE FOR RPS DEVICES	3349
IGG019JI	DYNAMIC BUFFER	732
IGG019JJ	CHANNEL PROGRAM NLSD=2+	216
IGG019JK	CHANNEL PROGRAM NLSD=1	96
IGG019JL	CHANNEL PROGRAM READ, WRITE K (NO WC)	648
IGG019JM	CHANNEL PROGRAM READ, WRITE K (WC)	544
IGG019JN	CHANNEL PROGRAM WRITE KN FS	952
IGG019JO	CHANNEL PROGRAM WRITE KN BS	872
IGG019JP	CHANNEL PROGRAM WRITE KN FSWC	1248
IGG019JQ	CHANNEL PROGRAM WRITE KN BSWC	1244
IGG019JR	CHANNEL PROGRAM WRITE KN FU	912
IGG019JS	CHANNEL PROGRAM WRITE KN BU	928
IGG019JT	CHANNEL PROGRAM WRITE KN FUWC	1224
IGG019JU	CHANNEL PROGRAM WRITE KN BUWC	1224
IGG019JV	READ, WRITE K NPMT	212
IGG019JW	WRITE KN NPMT	192
IGG019JX	WRITE KN PMT	640

QISAM Modules (Load Mode)

Module	Function	Size
IGG019GA	PUT (NO WC)	4408
IGG019GB	PUT (WC)	4496
IGG019GC	PUT APPENDAGE (NO WC)	1778
IGG019GD	PUT APPENDAGE (WC)	2158
IGG019GE	CHANNEL PROGRAMS (NO WC)	624
IGG019GF	CHANNEL PROGRAMS (WC)	736
IGG019GG	SIO APPENDAGE FOR RPS DEVICES	1280
IGG019IA	PUT (NO WC VLR)	4360
IGG019IB	PUT (WC VLR)	4468
IGG019IE	CHANNEL PROGRAMS (NO WC VLR)	568
IGG019IF	CHANNEL PROGRAMS (WC VLR)	664
IGG019I1	PUT W/O WRITE CHK-FULL TRACK INDEX WRITE	4096
IGG019I2	PUT W/O WRITE CHK-FULL TRACK INDEX WRITE	4096

QISAM Modules (Scan Mode)

IGG019HA	SIO APPENDAGE FOR RPS DEVICES	1008
IGG019HB	GET PUTX, RELSE, ESETL, SETL B	3672
IGG019HD	SETL K, SETL KC	1392
IGG019HF	SETL I	656
IGG019HG	GET APPENDAGE AND ASYNCHRONOUS	808
IGG019HH	PUTX APPENDAGE (NO WC)	376
IGG019HI	PUTX APPENDAGE (WC)	880
IGG019HJ	SETL I APPENDAGE	72
IGG019HK	SETL K, SETL KC APPENDAGE	672
IGG019HL	CHANNEL PROGRAMS	648
IGG019HN	GET, PUTX, RELSE, ESETL, SETL B (VLR)	3808

TELECOMMUNICATIONS MODULES

BTAM Modules

Module	Function	
IGG019LP	Start I/O Page Fix Routine	
IGG019MA	Read/Write Channel Program Generator	3354
IGG019MB	Channel End/Abnormal End Appendage	5284
IGG019MC	Program Controlled Interrupt Appendage	1104
IGG019MD	IBM 1050 Data Communications System on a non-switched network	248
IGG019ME	IBM 1050 Data Communications System on a non-switched network with Auto Poll	232
IGG019MF	IBM 1050 Data Communications System on a switched network	344
IGG019MI	IBM 1060 Data Communications System	216
IGG019MJ	IBM 1030 Data Collection System	248
IGG019MK	IBM 1030 Data Collection System with Auto Poll	248
IGG019ML	AT&T 83B3 Selective Calling Stations	168
IGG019MN	Western Union Plan 115A Outstations	160
IGG019MP	AT&T Model 33/35 Teletypwriter Exchange Terminal on a switched network (using eight bit Data Interchange Code)	200
IGG019MR	Online Test Control Module	2882
IGG019MS	Request/Release Buffer Routine	440
IGG019MT	IBM 2740 Communications Terminal	160
IGG019MU	IBM 2740 Communications Terminal on a switched network	200
IGG019MV	IBM 2740 Communications Terminal with transmit control and checking on a switched network	304
IGG019MW	IBM 2740 Communications Terminal with transmit control on a switched network	216
IGG019MX	IBM 2740 Communications Terminal with checking on a switched network	304
IGG019MY	IBM 2740 Communications Terminal with station control and checking	240
IGG019MZ	IBM 2740 Communications Terminal with station control	160
IGG019M0	IBM 2740 Communications Terminal with checking	288
IGG019M1	IBM 2740 Communications Terminal with station control, checking, and Auto Poll	240
IGG019M2	IBM 2740 Communications Terminal with station control and Auto Poll	160
IGG019M3	IBM 2260 Display Unit (attached as a remote terminal with a 2701 Data Adapter Unit)	328
IGG019M4	IBM 1060 Data Communications System with Auto Poll	224
IGG119M5	IBM BSC Terminal on a nonswitched point-to-point network	296
IGG419M6	IBM BSC Terminal on a switched network	424
IGG419PA	Channel End/Abnormal End Appendage	432
IGG019PA	Channel End/Abnormal End Appendage	455
IGG019PB	World Trade Telegraph Terminals	176
IGG019PC	IBM BSC Terminal on a nonswitched multipoint network	328
IGG019PD	WTTA Channel End Appendage	1008
IGG019PE	IBM 2741 Communications Terminal	128
IGG019PF	IBM 2741 Communications Terminal on a switched network	160
IGG019PG	Second-Level Attention Routine (for Local 3270)	455

IGG019PH	Local 3270 I/O Module	135
IGG019PI	Local Online Test Control	480
IGG019PK	2741 Break routine	78
IGG019PL	IBM 2740 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit)	296
IGG019PM	IBM 2760 Communications Terminal with checking and OIU (IBM 2760 Optical Image Unit) on a switched network	376
IGG019PN	IBM 1050 Non-switched Device I/O Module	224
IGG019PO	IBM 1050 Switched Device I/O Module	312
IGG019PP	IBM 2740X Checking	224
IGG019PQ	IBM 2740X Dial with Checking	272

*If this module is made resident in a system with more than one BTAM user, then all I/O device modules must be made resident.

QTAM Modules

Module	Function	Size
IGG019NJ	IBM 2740 Communications Terminal	104
IGG019NK	IBM 2740 Communications Terminal on a Switched network	176
IGG019NL	IBM 2740 Communications Terminal with transmit control and checking on a switched network	288
IGG019NM	IBM 2740 Communications Terminal with transmit control on a switched network	192
IGG019NN	IBM 2740 Communications Terminal with checking on a switched network	248
IGG019NO	IBM 2740 Communications Terminal with station control and checking	224
IGG019NP	IBM 2740 Communications Terminal with station control	144
IGG019NQ	IBM 2740 Communications Terminal with checking	192
IGG019NR	IBM 2260 Display Unit (remote)	280
IGG019NS	AT&T Model 33/35 Teletypewriter Exchange Terminal on a switched network (using 8-bit data Interchange Code)	192
IGG019NT	Western Union Plan 115A Outstations	144
IGG019NU	AT&T 83B3 Selective Calling Stations	152
IGG019NV	IBM 1030 Data Collection System	224
IGG019NW	IBM 1060 Data Communications System	192
IGG019NX	IBM 1050 Data Communications System on a switched network	312
IGG019NY	IBM 1050 Data Communications System on a non-switched network	200
IGG019NZ	Read/Write Channel Program Generator	1088
IGG019N1	IBM 1050 Data Communications System on a non-switched network with Auto Poll	216
IGG019N2	IBM 1060 Data Communications System with Auto Poll	200
IGG019N3	IBM 1030 Data Collection System with Auto Poll	224
IGG019N8	IBM 2740 Communications Terminal with station control, checking, and Auto Poll	224
IGG019N9	IBM 2740 Communications Terminal with station control and Auto Poll	144
IGG019QA	World Trade Telegraph Terminals	152
IGG019QB	WTTA Line End Appendage	1248

GRAPHICS ACCESS METHOD MODULES

Module	Function	Size
IGG019OA	Input/Output Control Routine	2952
IGG019OB	Channel End Appendage	368
IGG019OE	Attention Routing Routine	2120
IGG019OJ	Entry Interface Routine	192
IGG019OK	Attention Inquiry Routine	1232

TELECOMMUNICATIONS ACCESS METHODS

TCAM Modules

Module	Function	Size
IGG019EW	3270 Local Special Characters Table	
IGG019Q0	I/O Interrupt Trace Routine	568
IGG019Q1	2260 Local Scheduler	376
IGG019Q2	Line Appendage for Binary-synchronous Devices	8170
IGG019Q3	Line Appendage for Start/Stop Devices	5504
IGG019Q4	Line Appendage for 1050	2960
IGG019Q5	Line Appendage for a QTAM Compatible System	4270
IGG019Q6	Send Scheduler for leased lines and no TSO	1113
IGG019Q7	Send Scheduler with no TSO	1321
IGG019Q8	Checkpoint Continuation Restart Subroutine	596
IGG019Q9	Concentrator Send Scheduler	1367
IGG019RA	Checkpoint Appendage	100
IGG019RB	Dispatcher Without Subtask Trace	528
IGG019RC	Disk Message Queues Routine	1529
IGG019RD	Buffered Terminal Scheduler	2148
IGG019RE	Common Buffer Send Scheduler	316
IGG019RF	EXCP Driver (Single CPB)	993
IGG019RG	GET/READ Routine	3054
IGG019RH	QTAM Compatable GET Routine	2160
IGG019RI	PUT/WRITE Routine	1072
IGG019RJ	QTAM Compatable PUT Routine	496
IGG019RK	Disk End Appendage (Single CPB)	350
IGG019RL	CHECK Routine	340
IGG019RM	POINT Routine	524
IGG019RN	PCI Appendage	1144
IGG019RO	Dispatcher with Subtask Trace	640
IGG019RP	Disk Reusability/Copy Routine	4096
IGG019RQ	Post Pending Routine	128
IGG019RR	Special Characters Table for	96
IGG019RS	Special Characters Table for 2260 Remote	80
IGG019RT	Special Characters Table for 83B3, 115A	80
IGG019RU	Special Characters Table for TWX	80
IGG019RW	Special Characters Table for World Trade	96
IGG019R0	Line Appendage for all Types of Lines	9470
IGG019R1	Dial Line Scheduler	1010
IGG019R2	Disk Appendage	560
IGG019R3	Leased Line Scheduler	612
IGG019R4	Send Scheduler	1272
IGG019R5	Attention Handler for 2260 Local	320
IGG019R6	Start-up Message Routine	1116
IGG019R7	EBCDIC Special Characters Table	128
IGG019R8	ASCI Special Characters Table	128
IGG019R9	6BIT Special Characters Table	128

Type 3 and 4 SVC Routines

The following list contains those routines that may be resident when the resident type 3 and 4 SVC routine option is selected. All of these routines are on the SVC library. Those module names followed by -SL are the modules loaded when the IBM-supplied standard list IEARSV00 is used.

ABEND - SVC13 (MFT only)

IGC0001C	Normal termination processing	896
IGC0101C	ABEND processing	410
IGC0201C	ABEND processing	984
IGC0301C	ABEND processing	876
IGC0401C	ABEND processing	784
IGC0501C	ABEND processing (without subtasking)	480
IGC0501C	ABEND processing (with subtasking)	976
IGC0601C	ABEND processing	920
IGC0701C	ABEND processing	831
IGC0801C	ABEND processing	712
IGC0901C	ABEND processing	688
IGC0A01C	ABEND processing	976
IGC0B01C	ABEND processing (without MCS)	912
IGC0B01C	ABEND processing (with MCS)	978
IGC0C01C	ABEND processing (with subtasking)	600
IGC0D01C	ABEND processing (with subtasking)	320
IGC0E01C	ABEND processing (with subtasking)	320
IGC0F01C	ABEND processing	920
IGC0G01C	ABEND processing	884
IGC0H01C	ABEND processing	544
IGC0J01C	ABEND processing	684
IGC0M01C	ABEND processing	310

ABEND - SVC13 (MVT Only)

IGC0001C	ABEND interfacing	900
IGC0101C	Initializes purges	875
IGC0301C	Recursion router	675
IGC0401C	Message purge	750
IGC0501C	Purges queues for RORI	375
IGC0701C	ABDUMP related hooks	600
IGC0801C	Open ABEND dump dataset	800
IGC0901C	Takes snap dumps of abending tree	550
IGC0B01C	Closes data sets	700
IGC0C01C	Core allocation	475
IGC0D01C	Subsystem interfaces and purges	775
IGC0F01C	PRBs CDE purge	825
IGC0G01C	Supervisor purges	600

ABEND SVC13 (DAR - MFT, MVT)

IGC0L01C	Gives core image dump	625
IGC0M01C	Handles tasks in must-complete status	525
IGC0N01C	Reinstates select system tasks	750
IGC0P01C	Sets tasks permanently non-dispatchable	325
IGC02D1C	Writes core image dump (MFT)	932
IGC03D1C	Reinstate system tasks (MFT)	361
IGC04D1C	Set failing task permanently non dispatchable if sec. DAR recursion	928
IGC05D1C	Set failing task permanently non dispatchable	158

ABDUMP - SVC51 (MFT)

IGC0005A	SVC Processing	960
IGC0105A	ABDUMP Processing	1024
IGC0205A	ABDUMP Processing	1024
IGC0305A	ABDUMP Processing	968
IGC0405A	ABDUMP Processing	856
IGC0505A	ABDUMP Processing	928
IGC0605A	ABDUMP processing	496
IGC0A05A	ABDUMP Processing	1694
IGC0B05A	ABDUMP Processing	632
IGC0C05A	ABDUMP Processing	416
IGC0D05A	ABDUMP Processing	744
IGC0E05A	ABDUMP Processing	992
IGC0F05A	ABDUMP Processing	312
IGC0G05A	TCAM ABDUMP processing	840
IGC0H05A	TCAM ABDUMP processing	795
IGC0I05A	TCAM ABDUMP processing	488
IGC0J05A	TCAM ABDUMP processing	892
IGC0K05A	TCAM ABDUMP processing	972
IGC0L05A	ABDUMP processing	992
IGC0M05A	ABDUMP processing	556
IGC0N05A	Format and print line group DCB's and LCB's (TSO)	31A
IGC0P05A	Format and print BTU TRACE and PLCB's (TSO)	2EA

ABDUMP - SVC51 (MVT Only)

IGC0005A	Dump to DASD	975
IGC0105A	Outputs TCB, RBs, LLEs	860
IGC0205A	Outputs CD entries	1000
IGC0305A	Formats MSS information	960
IGC0405A	Outputs QCB & IRB traces	848
IGC0505A	Formatted savearea output	885
IGC0605A	Outputs nucleus, regs	770
IGC0705A	Outputs programs on RBQ an old list	590
IGC0805A	Outputs users gotten core	600
IGC0A05A	Common routines used by other modules (resident load)	1760
IGC0B05A	Format MP PSA	536
IGC0C05A	Outputs heading code; comp code and PSW	416
IGC0D05A	Formats & prints AVT & TNT (TCAM)	743
IGC0E05A	Format & print terminal names from terminal table (TSO)	853
IGC0F05A	Format & print TCAM destination QCBs (TSO)	520
IGC0G05A	Format & print TCAM DCBs and LCBs (TSO)	888
IGC0H05A	Formats TSO control blocks (TSO)	662
IGC0I05A	Formats TSO control blocks (TSO)	400
IGC0J05A	Outputs GTF trace table (non MP)	732
IGC0K05A	Outputs GTF trace table (MP)	878
IGC0L05A	ABDUMP initialization	860
IGC0M05A	Formats GTF control or records	600
IGC0N05A	Outputs supervisor trace table	409
IGC0P05A	Outputs supervisor trace table (MP)	479
IGC0R05A	Format and print line group DCB's and LCB's (TSO)	398
IGC0S05A	Format and print BTU TRACE and PLCB's (TSO)	3EA
IGC0Z05A	Dump to tape	850

ASCII - SVC103 (MFT, MVT)

IGC0010C	ASCII-EBCDIC/ASCII Translate	640

MGCR - SVC34 (MFT and MVT Only)

IGC0003D	Base Module	432
IGC1203D	Reply Processor	1024
IGC0303D	Chain Manipulator	768
IGC0403D	Control Phase	972
IGC0503D	Error Phase	1024
IGC0603D	SET Command Processor - Part I	640
IGC8603	SET Command Processor - Part II	863
IGC0703D	MODIFY/STOP Command Processor	992
IGC0803D	Command Processor	460
IGC0903D	Set Time of Day Processor	488
IGC1103D	VARY/UNLOAD Command Processor	1024
IGC1303D	TCAM Command Scheduler	352
IGC1403D	HALT END OF DAY Processor	1000
IGC1503D	Command Scheduling	576
IGC3103D	Immediate command processor VARY/UNLOAD	58
IGC3303D	Syntax scanner for ONLINE, OFFLINE, and console	592
IGC3503D	Display Command Router Routine (MFT and MVT)	756
IGC3603D	M6KMP Vary command pre-processor	914
IGC0006H	Statistics update -SVC68	1024
IGC4203D	Vary Unit Field Scan (MCS)	672
IGC4303D	VARY MSTCONS (MCS)	357
IGC4403D	Vary Keyword Scan (MCS)	917
IGC4503D	Periodic STOP Processor	752
IGC3703D	MVT CANCEL Processor	832
IGG2103D	Error Message Writer	782
IGC4603D	VARY ONLINE/OFFLINE of Console (MCS)	820
IGC4703D	Process VARY HARDCPY Commands (MCS)	542
IGC4803D	Message for Status of Varied Console (MCS)	928
IGC4903D	Process VARY CONSOLE Command (MCS)	554
IGC1203D	Reply Processor Routine (MCS)	952
IGC1B03D	Reply Message Routine (MCS)	355
IGC3803D	Start Command Processing (MVT only)	376
IGC4103D	Hardcopy Message Module	736
IGC5503D	MCS/TSO Periodic Stop Command	400
IGC5803D	Display User/Send Router Routine	200
IGC1603D	Log/Writelog Processor	820
IGC2303D	SMF Processor	960
IGC3203D	VARY Router	384
IGC5403D	Command Translator	640
IGC5703D	VARY Hardcopy Processor	550
IGC5103D	STAE Exit Routine - First Load	912
IGC5203D	STAE Exit Routine - Second Load	376
IGC5303D	STAE Exit Routine - Message Module	688
IGC6503D	NS SET Command Handler	960
IGC5503D	MCS/TSO Periodic Stop Command Processor	440
IGC5603D	Control and MSGRT message MOD 1	1024
IGC5903D	Control and MSGRT message MOD 2	
IGC6303D	MSGRT command processor load 1	
IGC6403D	MSGRT command processor load 2	
IGC6703D	Control command processor load 1	
IGC6803D	Control command processor load 2	
IGC6903D	Control command processor load 5	
IGC7503D	Route verification load 1	
IGC7603D	Route verification load 2	
IGC7703D	Control command processor load 4	
IGC7803D	Control command processor load 3	1024
IGC5803D	Display User/Send Router Module	200
IGC7903D	Message Module	1024
IGC8503D	Display SQA Routine	340

Operator Communications - SVC72 (MFT and MVT Only)

IGC0007B	Router Module	328
IGC1I07B	Open Card Reader as Console	1008
IGC2I07B	Open Printer as Console	840
IGC0I07B	Open 1052 Console	833
IGC1107B	Input From Card Reader Console	664
IGC2107B	Output to Printer Console	840
IGC0107B	Input/Output to 1052 Console	1024
IGCXL07B	Console Switch Handler	688
IGC3I07B	OPEN/CLOSE Routine (MCS)	985
IGCXL07B	Console Switch Routine (MCS)	970
IGCXM07B	Console Switch Routine (MCS)	880
IGCXN07B	Console Switch Routine (MCS)	928
IGCXV07B	Console Switch Routine (MCS)	728
IGC0007B	Link to Communications Task Routines (MCS)	266
IGC2107B	Unit Record Output Processor - BSAM (MCS)	409
IGC1107B	Unit Record Input Processor - BSAM (MCS)	265
IGC0107B	1052 Processor Module (MCS)	186
IGC0907B	Message Buffer Writer (MCS)	132
IGC5107B	Router module load 1	1024
IGC5207B	Write WTO messages load 1	
IGC5307B	Splits WTO messages	
IGC5407B	Handles CANCEL and command entry	
IGC5607B	Processes deletion of messages	
IGC5707B	Handles DOM	
IGC5807B	Processes deletion of messages	
IGC5907B	Removes messages	
IGC5A07B	Sets K S options	
IGC5C07B	Handles asynchronous errors	
IGC5D07B	Message module 1	
IGC5E07B	Message module 2	
IGC5F07B	Handles light pen and cursor interrupts	
IGC5G07B	OPEN/CLOSE	
IGC5H07B	MOD 85 I/O	
IGC5J07B	Roll mode	
IGC5K07B	Timer interpretor	
IGC5P07B	2250 I/O load 1	
IGC5Q07B	2250 I/O load 2	
IGC5R07B	2260 I/O load 1	
IGC5U07B	3277 I/O Routine 1	1024
IGC5V07B	3277 I/O Routine 2	1024
IGC5W07B	3284/3286 Processor	1024
IGC5Z07B	Router module load 2	
IGC6107B	Transient DCM handler load 1	
IGC6207B	Write WTO messages load 2	
IGC6A07B	PFK handler 1	
IGC6B07B	PFK handler 2	
IGC6D07B	Message module 3	
IGC6G07B	Cleans up after device status change	
IGC6L07B	Status display handler 1	
IGC6M07B	Status display handler 2	
IGC6N07B	Status display handler 3	
IGC6O07B	Status display handler 4	
IGC6P07B	Status display handler 5	
IGC6Q07B	Status display handler 6	
IGC6R07B	2260 I/O load 2	
IGC6T07B	Status display handler 7	
IGC6Z07B	Transient DCM handler load 2	

SYS1.LOGREC Recorder - SVC76

IGC0007F	SVC 76 1st load - SYS1.LOGREC recorder	972
IGC0107F	SVC 76 3rd load - IPL-EOD module	616
IGC0207F	SVC 76 4th load - Message module	424
IGC0307F	SVC 76 2nd load-Statistics update module	852

Graphics

IGC0007A	Buffer Management (SVC71)	904
IGC0107A	Buffer Management (SVC71)	912
IGC0207A	Buffer Management (SVC71)	840
IGC0007C	SPAR (SVC73)	752
IGC0107C	SPAR (SVC73)	392
IGC0007D	DAR (SVC74)	792
IGC0107D	DAR (SVC74)	608
IGC0007E	ATTNINQ (SVC75)	632

OPEN - SVC19

IGC0001I-SL	Initial Load - Load 1	1024
IFG0190P	ABEND Interpretation and Recovery Initialization Function	1024
(IFG0200P)		
(IFG0230P)		
(IFG0550P)		
IFG0190R	Display DSNAME WTO Function	1024
(IFG0200R)		
(IFG0550R)		
IFG0193A-SL	OPEN Initial Volume Serial Function	1024
IFG0193B	Open Tape Initial Function	1024
IFG0193C	Open Tape Label Editor Function	1024
(OMODVOL1)		
IFG0193D	Open Tape Destroy Label Function	1024
IFG0193E	Open Tape Create Label Function	1024
IFG0194A	Open Direct Access Volume Verification Function	1024
IFG0194C	Open Direct Access Volume Verification Function	1024
IFG0194D	Open Tape Volume Reference Function	1024
IFG0194E-SL	Open Direct Access Unit Selection Function Open Direct Access Read DSCB Function	1024
IFG0194F	Open Tape Mount Verification Function	1024
IFG0194G	Open Tape Volume Mounting Function	1024
IFG0194H	Open Tape Volume Verification Function	1024
IFG0194I	Open Tape Final Common Function	1024
IFG0194J (IGG0190A)	Open Tape Label Editor Interface Function	1024
IFG0195A-SL	Open Direct Access Read DSCB Function	1024
IFG0195B	Open Tape Standard Label Positioning Function	1024
IFG0195C	Open Tape No Label Positioning Function	1024
IFG0195D (IGG0190B)	Open Tape Nonstandard Label Input Interface Function	1024
IFG0195E	Open Direct Access DISP=MOD Error Recovery Function	1024
IFG0195G	Open Direct Access Expiration Date Error Function	1024
IFG0195H	Open Tape Standard Label INPUT/MOD Header Label I Function	1024
IFG0195J-SL	Open Direct Access Read DSCB to JFCB Merge Function	1024
IFG0195K	Open Tape Standard Label INPUT/MOD Header Label 2 Function	1024
IFG0195M	Open Direct Access BPAM Concatenation Function	1024
IFG0195N	Open Tape Standard Label Input User Label Function	1024
IFG0195O	Open Direct Access Parallel Mounting Function	1024
IFG0195P	Open Direct Access Parallel Mounting Function	1024
IFG0195T	Open Security Initialization Function	1024
IFG0195U	Open Security Search Function	1024
IFG0195V	Open Security TSO Password Function	1024

IFG0196J-SL	Open Merge JFCB to DCB Function	1024
IFG196K	Open Merge JFCB to DCB Function	1024
IFG0196L-SL	Open Merge DCB Exit Function	1024
IFG0196M-SL	Open Merge DCB to JFCB Function	1024
IFG0196N	Open Tape Standard Label Output Security Function	1024
IFG0196O	Open Tape Nonstandard Label Output	
(IGG0190R)	Interface Function	1024
IFG0196Q	Open Tape Standard Label Date	
	Protection Function	1024
IFG0196T	Open Tape Standard Label Rewrite Volume Label	1024
	Function	
IFG0196U	Open Tape Standard Label Output User Label Function	1024
IFG0196V-SL	Open Access Method Executor Determination Function	1024
IFG0196W-SL	Open Access Method Executor Return	1024
(IGG0190S)	Function	
IFG0196X	Open Final EXCP Appendage Function	1024
IFG0198N-SL	Open Final SYSOUT LIMIT Function	1024
IFG0199B	ABEND Interpretation and Recovery	1024
	Write-to-Programmer	
(IFG0209B)	Function	
(IFG0239B)		
(IFG0559B)		
IFG0199D	ABEND Interpretation and Recovery ABEND Trace	1024
(IFG0209D)	Function	
(IFG0239D)		
(IFG0559D)		
IFG0199E	ABEND Interpretation and Recovery	
(IFG0209E)	ABEND Exit Function	1024
(IFG0239E)		
(IFG0559E)		
IFG0199R	Optional Module Trace Initialization/Termination	1024
(IFG0209R)	Function	
(IFG0239R)		
(IFG0559R)		
IFG019TR	Optional Module Trace Trace Function	1024
(IFG020TR)		
(IFG023TR)		
(IFG055TR)		
IGC0002B-SL	Open Initial Function (OPEN and OPEN TYPE=J)	680
IGG0196M	Problem Determination Initialization Function	1024
READPSWD	Open Security Read Password (READPSWD) Function	920
SECLOADA	Open Security Scratch - Rename Interface Function	902

TCAM Operator Control Modules

IGC0010D	Operator Control Control Module Load-0	888
IGC0110D	Operator Control Control Module Load-1	1001
IGC0310D	Operator Control Message Module Load-1	846
IGC0410D	Operator Control Message Module-Load 2	978
IGC0510D	Operator Control Message Module-Load 3	649
IGC0610D	Incident Checkpoint Request Interface	244
IGC0710D	Output Writer and On-line Test Interface	1013
IGC0810D	Operator Control Message Module-Load 4	624
IGC0910D	Operator Control Message-Load 5	635
IGCD010D	SCAN/MAP/DISPATCH Display Function Routine	914
IGCD110D	Copy Operator Control Terminal Routine	989
IGCD210D	Copy QCB Information Routine	682
IGCD310D	Copy Invitation List Entry Routine	843
IGCD410D	Copy Held Terminals Routine	432
IGCD510D	Copy Terminal Information Routine	804
IGCD610D	Copy Line Information Routine	376
IGCD710D	Copy Invitation List Routine	255
IGCD810D	Display Options Routine	882
IGCD910D	Copy LCB Information Routine	774
IGCH010D	Stop Terminal Transmission Routine	597

IGCI010D	ICHNG Deactivate Routine	714
IGCI110D	ICHNG Move/Active Routine	734
IGCMA10D	SCAN/MAP/DISPATCH Modify Function Routine 1	855
IGCM010D	SCAN/MAP/DISPATCH Modify Function Routine 2	956
IGCM110D	Modify Successful Message Routine	873
IGCM210D	Modify Poll Routine	448
IECM410D	Change Interval Type Routine	540
IGCM510D	Modify Intense Routine	557
IGCM610D	Alter Trace Status Routine	364
IGCM710D	Change Control Terminal Routine	248
IGCM810D	Modify Options Routine	967
IGCM910D	Debug Service Aid Router	698
IGCR010D	Resume Terminal Transmission Routine	601
IGCV010D	SCAN/MAP/DISPATCH Vary Function Routine	852
IGCV110D	Stop Line Routine	922
IGCV310D	Start Line Routine	633
IGCV410D	Start Terminal Routine	1018
IGCZ010D	MCP Closedown Processing Routine 1	342
IGCZ110D	MCP Closedown Processing Routine 2	972

OPEN Executors for TCAM

IGG01930	Disk Open	1024
IGG01931	Disk Open	1024
IGG01933	Open error handler	1024
IGG01934	Disk Open	1024
IGG01935	Line Open	1024
IGG01936	Line Open	1024
IGG01937	Line Open	1024
IGG01938	Line Open	1024
IGG01939	Line Open	1024
IGG01940	Line Open	1024
IGG01941	Checkpoint Open	1024
IGG01942	Checkpoint Open	1024
IGG01943	Checkpoint Open	1024
IGG01944	Checkpoint Open	1024
IGG01945	Checkpoint Open	1024
IGG01946	Message Processing Queues Open	1024
IGG01947	Message Processing Queues Open	1024
IGG01948	Line Open	1024
IGG01949	Checkpoint Open	1024

OPEN Executors for SAM

IGG0191A-SL	DEB Construction - Load 1	1024
IGG0196A-SL	DEB Construction - Load 2	1024
IGG0191B-SL	Main Executor - Load 1	1024
IGG0196B-SL	Main Executor - Load 2	1024
IGG0191C	Dummy Executor	1024
IGG0191D-SL	First Load Direct Access Executor	1024
IGG0191E	Input Exchange Buffering Executor	1024
IGG0191F	Output Exchange Buffering Executor	1024
IGG0191H	Record Overflow Executor	1024
IGG0191I	Buffer Construction Executor	1024
IGG0191J	Direct Access IN/OUT and OUT/IN	1024
IGG0191K	Direct Access Executor PCI	1024
IGG0191N	DEB construction for Direct Access Devices	1024
IGG0191P	Update Executor	1024
IGG0191Q	Tape/Unit Record Executor	1024
IGG0191R	TAPE, Disk IN/OUT Executor	1024
IGG0191S	Record Overflow Executor	1024
IGG0191T	UCS Load Determination	1024
IGG0191U	UCS Image Retrieval	1024
IGG0191V	UCS Load	1024

IGG0197U	UCS Verification	1024
IGG0197E	FCB Retrieval	1024
IGG0197F	FCB Load and Verification	1024
IGG01915	Load Executor for Variable Length Records	1024
IGG0191W	SAM Stage 2 Executor	1024
IGG0191X	SAM Stage 2 Executor	1024
IGG0191Y	Executor for User Totaling	1024
IGG0191Z	SAM Stage 2 Executor	1024
IGG0196P	SAM Stage 2 Executor	1024
IGG0199K	SAM Stage 2 Executor	1024
IGG01993	SAM Stage 2 Executor	1024
IGG01911-SL	IOB and Buffer Construction	1024
IGG01991	Load Executor for Variable Length Records	1024
IGG01916	Load Executor for Variable Length Records	1024
IGG01992	Load Executor for Variable Length Records	1024
IGG01910-SL	Load Executor	1024
IGG01917-SL	Load Executor	1024
IGG01912	Update Load Executor - Paper Tape	1024
IGG01918	Update Load Executor - Paper Tape	1024
IGG01913	Load Executor PCI/T.O	1024
IGG01919	Load Executor PCI/T.O	1024
IGG01914	Exchange Buffering Load Executor	1024
IGG01990	Exchange Buffering Load Executor	1024

OPEN Executors for BDAM

IGG0193A	Open Executor No. 1	1024
IGG0193C	Open Executor No. 2	1024
IGG0193E	Open Executor No. 3	1024
IGG0191L	Create BDAM Data Set	1024
IGG0191M	BSAM Load Mode, Record Overflow	1024
IGG0193F	Obtain/Format Buffer Area	1024
IGG0193G	Loads Required BDAM Modules	1024

OPEN Executors for ISAM

IGG0192A	Build DEB	1024
IGG0192B	Buffers	1024
IGG0192C	Buffers add work area initialization	1024
IGG01920	Validate fields in format 2 DSCB	1024
IGG01922	Validate fields in format 2 DSCB	1024

OPEN Executors for BISAM Only

IGG0192H	Move From DSCB, Get Work Area	1024
IGG0192I	Load PMT, CP1 or CP2	1024
IGG0192J	Load Appendage, Asynchronous	1024
IGG0192K	Load NPMT, Dynamic Buffering CP4-CP7	1024
IGG0192L	Load WRITE KN NPMT, Channel Programs	1024
IGG0192M	Set-up WRITE KN Channel Programs	1024
IGG0192N	Set-up WRITE KN Channel Programs	1024
IGG0192O	Set-up WRITE KN Channel Programs	1024
IGG0192P	Read HIGH-level Index	1024
IGG0192Q	Set-up WRITE KN Channel Programs	1024
IGG0192W	Move from DSCB to DCB work area (VLR)	1024
IGG0192X	Set-up WRITE KN Channel Programs (VLR)	1024
IGG0192Z	SET-UP WRITE KN Channel Programs (VLR)	1024
IGG01950	Validate Fields in Format 2 DSCB (VLR)	1024

OPEN Executors for QISAM Only

IGG0192D	Calculations	1024
IGG0192E	Calculations	1024
IGG0192F	Calculations	1024
IGG0192G	Calculations	1024
IGG0192R	Load, Set-up CP18 (No Write Validity Check)	1024
IGG0192S	Set-up, CP19, Pre-format	1024
IGG0192T	Set-up, CP20, CP21 (No Write Validity Check)	1024
IGG0192U	Load, Set-up CP18 (Write Validity Check)	1024
IGG0192V	Set-up CP20, CP21 (Write Validity Check)	1024
IGG01921	Set Up Load Mode Work Area	1024
IGG01923	Load (Scan Mode) (VLR)	1024
IGG01924	Set-up Channel Programs (VLR)	1024
IGG01928	Load (Scan Mode)	1024
IGG01929	Set-up Channel Programs	1024
IGG0195D	Resume Load Initialization	1024
IGG0195T	Full Track Index Write Initialization	1024
IGG0195U	Full track with Resume Load Initializaiton	1024
IGG0196D	Resume Load Initialization - Set Up CP 31	1024
IGG0195G	Resume Load Initialization	1024
IGG0196G	Resume Load Initialization	1024

OPEN Executors for Graphics

IGG0193Y	Open Executor - Load 1	1024
IGG0193Z	Open Executor - Load 2	1024
IGG0193L	Open Executor - Load 3	1024

OPEN Executors for BTAM

IGG0193M	Open Executor - Load 1	1024
IGG0193Q	Open Executor - Load 2	1024
IGG0193S	Open Executor - Load 3	1024
IGG0194N	Open Executor - Load 4	1024
IGG0194P	Open Executor (for Local 3270)	1024
IGG0194Q	Open Executor (for Local 3270)	1024

OPEN Executors for QTAM

IGG0193N	Open Line Group - Load 1	1024
IGG0193O	Open Direct Access Message Queues-Load 1	1024
IGG0193P	Open Message-Process Queue	1024
IGG0193R	Open Line Group - Load 2	1024
IGG0193T	Open Line Group - Load 3	1024
IGG0193U	Open Direct Access Message Queue - Load 2	1024
IGG0193V	Open Checkpoint Data Set	1024
IGG0194A	Open Line Group - Load 4	1024

CLOSE - SVC20

IGC0002_-SL[1]	Initial Load	1024
IFG0200P	ABEND Interpretation and Recovery Initialization	1024
(IGG0206M)	Function	
IFG0200V-SL	Close Initialization Function	1024
IFG0200W-SL	Close Unit Record/Teleprocessing Function	1024
IFG0200Y-SL	Close Unit Record/Teleprocessing Function	1024
(IGG0200F)		
(IGG0200G)		
IFG0200Z	Close Tape Standard Trailer Label Function	1024
IFG0201R	Close Direct Access Input User Labels Function	1024
IFG0202A	Close Tape Standard User Label Function	1024

---

[1]Punch a 12-0 multipunch.

IFG0202B	Close Tape Nonstandard Label Function	1024
(IFG0232Y)		
(IGG0200B)		
IFG0202C	Close Direct Access Input User Labels Function	1024
IFG0202D	Close Direct Access Output User Labels Function	1024
IFG0202E-SL	Close Direct Access Write File Mark Function	1024
IFG0202F	Close Tape Volume Disposition Function	1024
IFG0202G	Close Tape Volume Disposition Function	1024
IFG0202H	Close SMF Data Set SMF Record Builder Function	1024
(IFG0553B)		
IFG0202I	Close SMF Data Set SMF Record Builder Function	1024
IFG0202J-SL	Close Final SMF Interface Function	1024
IFG0202K-SL	Close Final Restore System Function	1024
IFG0202L-SL	Close Final Termination Function	1024

CLOSE-TCAM

IGG02030	Disk Close	1024
IGG02035	Line Close	1024
IGG02036	Checkpoint Close	1024
IGG02041	Checkpoint Close	1024
IGG02046	Message Processing Queues Open	1024
IGG02047	Message Processing Queues Close	1024

CLOSE Executors

IGG0201A	SAM - Close Executor for Non-Direct Access Devices	1024
IGG0201B	SAM	1024
IGG0201X	SAM - CLOSE Executors for non-DA devices	1024
IGG0201Z-SL	SAM/PAM - Close Executor for Direct Access Devices	1024
IGG0202I	QISAM - Flush Buffers, Indices	1024
IGG0202J	QISAM - Write EOF	1024
IGG0202K	QISAM - Calculate for Padding	1024
IGG0202L	QISAM - Pad Track Index	1024
IGG0202M	QISAM - Pad High-Level Indices	1024
IGG02029	ISAM	1024
IGG0202D	ISAM - Free Work Area	1024
IGG0202A	ISAM - Purge, Free Buffers	1024
IGG0203A	BDAM	1024
IGG0203M	BTAM - Close Executor	1024
IGG0203N	QTAM - Close Line Group	1024
IGG0203O	QTAM - Close Direct Access Message Queues	1024
IGG0203P	QTAM - Close Message-Process Queue	1024
IGG0203R	QTAM - Close General Closedown	1024
IGG0203Y	Graphics	1024
IGG0203X	Graphics	1024
IGG0201Y-SL	Release Work Areas and Buffers (D.A.)	1024

TCLOSE - SVC23

IGC0002C	Initial Load	1024
IFG0230P	ABEND Interpretation and Recovery Initialization Function	1024
IFG0232D	TCLOSE Direct Access Input Function	1024
IFG0232G	TCLOSE Tape Standard Trailer Label Function	1024
IFG0232J	TCLOSE Direct Access Output Trailer Label Function	1024
IFG0232M	TCLOSE Tape Standard Trailer Label Function	1024
IFG0232S	TCLOSE Tape Volume Positioning Function	1024
IFG0232Z	TCLOSE Final Function	1024

End of Volume - SVC55

IFG0550P	ABEND Interpretation and Recovery Initialization Function	1024
IFG0551B-SL	EOV SYNAD Executor Function	1024
IFG0551D	EOV SYNAD Executor Function	1024
IFG0551F	EOV Initial Read JFCB Function	1024
IFG0551H	EOV Initial Work Area Initialization Function	1024
IFG0551J	EOV Initial String Determination Function	1024
IFG0551L (IGG0551A)	EOV Access Method Executor Function	1024
IFG0551N (IGG0551B)	EOV Access Method Executor Function	1024
IFG0551P	EOV Tape Output Trailer Label Function	1024
IFG0551R	EOV Tape Output Trailer Label Function (EOV2)	1024
IFG0551T (IGG0550F)	EOV Tape Output Volume Disposition Function	1024
IFG0551V	EOV Tape Output New Volume Function	1024
IFG0551X (IGG0550P)	EOV Tape Output Label Verification Function	1024
IFG0551Z	EOV Tape Output Label Verification Function	1024
IFG0552B	EOV Tape Output Label Rewrite Function (VOL1)	1024
IFG0552D	EOV Tape Output Label Rewrite Function (HDR1)	1024
IFG0552F	EOV Tape Output Label Rewrite Function (HDR1, UHL)	1024
IFG0552H	EOV Tape Output Exit Function	1024
IFG0552J (EMODVOL1)	EOV Tape Output Label Destroy (EMODVOL1) Function	1024
IFG0552L	EOV Tape Output Label Create Function	1024
IFG0552N (IGG0550H)	EOV Tape Output Error Recovery and Nonstandard Label Function	1024
IFG0552P	EOV Tape Output WTO Function	1024
IFG0552R (IGG0550B)	EOV Tape Input Standard Trailer Label Function	1024
IFG0552T	EOV Tape Input Standard Trailer Label Function	1024
IFG0552V	EOV Tape Input Volume Positioning Function	1024
IFG0552X	EOV End-of-Data Function	1024
IFG0552Z	EOV Tape Input New Volume Mounting Function	1024
IFG0553D	EOV Tape Input New Volume Mounting Function	1024
IFG0553F	EOV Tape Input Standard Header Label Function	1024
IFG0553H (IGG0550D)	EOV Tape Input Next Volume Mounting Function	1024
IFG0553P	EOV Direct Access Input Initial Function	1024
IFG0553R	EOV Direct Access Input Mount Function	1024
IFG0553T	EOV Direct Access Input Mount Function	1024
IFG0553V	EOV Direct Access Input Mount Ahead Function	1024
IFG0553X	EOV Direct Access Input DEB Function	1024
IFG0553Z	EOV Direct Access Input Exit Function	1024
IFG0554B	EOV Direct Access Input FEOV Repositioning Function	1024
IFG0554D	EOV Direct Access Input FEOV Repositioning Function	1024
IFG0554J	EOV Direct Access Message Function	1024
IFG0554L (IFG0195F)	EOV Direct Access Input User Header/Trailer Label Function	1024
IFG0554N	EOV 2321 and Direct Access Output FEOV Function	
IFG0554P (IGG0550K)	EOV Direct Access Output Get Space Current Volume Function	1024
IFG0554R (IGG0552K)	EOV Direct Access IBM 2321 Get Space Current Volume Function	1024
IFG0554T (IGG0550S)	EOV Direct Access Output B37 Abend Function	1024
IFG0554V	EOV Direct Access Output Next Volume Mount Function	1024
IFG0554X	EOV Direct Access Output IBM 2321 Next Volume Mount Function	1024
IFG0554Z	EOV Direct Access Output Volume Disposition Function	1024

IFG0555B	EOV Direct Access Output User Trailer Label Interface Function	1024
IFG0555D	EOV Direct Access Output JFCB Update Function	1024
IFG0555F	EOV Direct Access Output Read DSCB Function	1024
IFG0555H	EOV Direct Access Output Construct DEB Function	1024
IFG0555J (IFG0196P)	Open Merge Direct Access Output User Header Label Function	1024
IGC0003A	FEOV Executor Function	1024
IGC0005E-SL	EOV Executor Function	1024

DADSM Functions

IGC0003B	Allocate - Initialization Entry Point	1024
IGG0325A	Allocate - Duplicate F1 DSCB Search	1024
IGG0325B	Allocate - Space Request Calculation	1024
IGG0325C	Allocate - Absolute Track Processing	1024
IGG0325K	Allocate - User Label Extent Allocation	1024
IGG0325D	Allocate - Available-Space Search	1024
IGG0325E	Allocate - F1/F3 Build of non-split-cylinder requests	1024
IGG0325L	Allocate - Split-cylinder Processing (Non-drum device)	1024
IGG0325F	Allocate - F6 DSCB Creating and Updating	1024
IGG0325J	Allocate - Split-cylinder Processing (drum device)	1024
IGG0325S	Allocate - Suballocation: Find F1 DSCB, Build extents	1024
IGG0325M	Allocate - Suballocation: Complete F1 DSCBs	1024
IGG0325G	Allocate - F5 DSCB Updating	1024
IGG0325H	Allocate - F4 DSCB Updating and Error Handling	1024
IGG032I1	ISAM Allocate - Validity Checking	1024
IGG032I2	ISAM Allocate - Available-Space Search	1024
IGG032I3	ISAM Allocate - Build F1, F2, and F3 DSCBs	1024
IGG032I4	ISAM Allocate - Update an existing F1 DSCB	1024
IGG032I5	ISAM Allocate - Embedded Index Processing	1024
IGG032I6	ISAM Allocate - F5 DSCB Updating	1024
IGG032I7	ISAM Allocate - F4 DSCB Updating and Error Handling	1024
IGG032I8	ISAM Allocate - Multivolume Data Set Initialization	1024
IGG0325Z	DOS VTOC Conversion - Initialization	1024
IGG0325P	DOS VTOC Conversion - Non-split-cylinder Data Set Processing	1024
IGG0325R	DOS VTOC Conversion - Multiple F5 and F6 DSCB Processing	1024
IGG0325Q	DOS VTOC Conversion - Split-cylinder Data Set Processing	1024
IGG0325U	DOS VTOC Conversion - Build F6 DSCBs	1024
IGG0325V	DOS VTOC Conversion - Check for F6 Extent Overlap	1024
IGG0325W	DOS VTOC Conversion - F6 DSCB Conversion	1024
IGG0325T	DOS VTOC Conversion - F5 DSCB Conversion, F4 DSCB Updating	1024
IGG0553A	Extend - Initialization	1024
IGG0553F	Extend - DOS VTOC Conversion Interface Module	1024
IGG0553G	Extend - Space Request Calculation	1024
IGG0553B	Extend - Available-Space Search	1024
IGG0553C	Extend - F1/F3 DSCB Build/Update	1024
IGG0553D	Extend - F5 DSCB Updating	1024
IGG0553E	Extend - F4 DSCB Updating, Error Handling	1024
IGC0002I	Scratch - Initialization	1024
IGG0290E	Scratch - Mount Message Building	1024
IGG0290F	Scratch - Volume Mounting and Verification	1024
IGG0290A	Scratch - Find F1 DSCB, Password-protection Interface	1024
IGG0299A	Scratch - DSCB Removal	1024
IGG020D0	Partial Release - Write Back F1 DSCB	1024
IGG0290B	Scratch - F6 DSCB Updating for split-cylinder data sets	1024

IGG0290C	Scratch - F5 DSCB Updating	1024
IGG0290D	Scratch - F4 DSCB Updating, SMF Record Type 17 processing	1024
IGG020P1	Partial Release - Initialization and F1 DSCB Updating	1024
IGG020P2	Parital Release - F3 DSCB Updating	1024
IGG020D1	Partial Release - F5 DSCB Updating	1024
IGG020P3	Partial Release - F4 DSCB Updating	1024
IGC00030	Rename - Initialization	1024
IGG03002	Rename - Volume Mounting and Verification	1024
IGG03001	Rename - F1 DSCB Renaming, Password-protection Interface	1024
IGG03003	Rename - SMF Record Type 18 Processing	1024
IGC0002G	Obtain	1024
IGC0007H	LSPACE - Initialization and Input Validation	1024
IGC0107H	LSPACE - Available-Space Totaling, SMF Record Type 19 and Message Processing	1024
IGC0009H	Protect - Initialization	1024
IGC0109H	Protect - Request Processing	1024
IGC0209H	Protect - DSCB Updating	1024

Catalog Management Functions

IGC0002F	Initialization & 1st Load of Locate	1024
IGG0CLC1	Relative GDG & Alias	1024
IGG0CLC2	Second Load of Locate	1024
IGG0CLC3	Update Initialization & Entry Building	1024
IGG0CLC4	Entry Building	1024
IGG0CLC5	First Load of Update	1024
IGG0CLC6	Second Load of Update	1024
IGG0CLC7	Third Load of Update & Cleanup	1024
IGC0002H	Open & Extend Catalog Data Sets	1024
IGG0CLF2	Format BPAM & Catalog Data Sets	1024

Restart - SVC 52

IGG0005B	SMB Reader (used by MFT & MVT)	656
IGC0105B	Initialization	608
IGC0205B	Builds Channel Program/Positions Checkpoint Data Set	576
IGC0505B	Restores Problem Program Core and Rebuilds System Information (MFT)	888
IGC0505B	Restores Problem Program Core and Rebuilds System Information - MVT	880
IGC0603B	Rebuilds System Information (MFT)	288
IGC0605B	Rebuilds System Information - MVT	1008
IGC0705B	Rebuilds System Information - MVT	880
IGC0805B	Rebuilds Information - MVT Only System	720
IGC0905B	Rebuilds System Information - MVT	1024
IGC0G05B	JFCB Processor - Table Build	416
IGC0H05B	Dummy Data Set Processors	920
IGC0I05B	JFCB Processor - Table Completion	472
IGC0K05B	Mount/Verification Processor - Non-Direct Access	1024
IGC0L05B	SYSIN/SYSOUT Processor - Non-Direct Access	1024
IGC0M05B	Mount/Verification Processor - Direct Access	1024
IGC0N05B	SYSIN/SYSOUT Processor 1 - Direct Access	1024
IGC0P05B	Positioning - Non-Direct Access	686
IGC0S05B	Repositioning in Parallel	1024
IGC0W05B	ISAM Data Set Processing	824
IGC0Q05B	SYSIN/SYSOUT Processor 2 - Direct Access	392
IGC0R05B	Positioning - Direct Access	1088
IGC0T05B	Access Method Processor/Restores I/O	584
IGC0V05B	Restart Exit Routine	496
IGC0U05B	Positioning of DOS tapes	788

STAE - SVC 60

IGC0006_[1]	Create or modify a STAE Environment	720
IGC00060	STAE Service Routine	725
IGC0R01C	Validity checking and I/O purge	550
IGC0S01C	Schedules user STAE exit routine	700
IGC0T01C	Frees work area, routes for retry	525
IGC0U01C	Close data sets. WTOR purge	950
IGC0V01C	Dequeue I/O requests for ISAM, BTAM, QTAM	950
IGC0W01C	Schedules user's retry routine	900
IGC01S1C	Schedule STAE Exit Routine and Test Retry Option (MFT)	864
IGC02S1C	Data Set Closing (MFT)	640
IGC03S1C	Schedule STAE Retry Routine (MFT)	584
IGC04S1C	Data Set Closing for ISAM, BTAM and QTAM (MFT)	608

CHKPT - SVC 63

IGC0006C	Initialization	968
IGC0206C	Builds CHR	688
IGC0506C	Quiesces I/O	1024
IGC0A06C	Writes CHR on Checkpoint Data Set	352
IGC0D06C	Writes DSDRs on Checkpoint Data Set	1024
IGC0F06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	488
IGC0G06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	944
IGC0H06C	Writes CIRs and SURs on Checkpoint Data Set - MVT	1004
IGC0N06C	Restores I/O	1024
IGC0Q06C	Clean Up	768
IGC0S06C	Issues Console Message	572

BTAM - SVC 66

IGC0006F	Online Test Control (Start-Stop)	1024
IGC0106F	1030 Terminal Test	936
IGC0206F	1050 Terminal Test	912
IGC0306F	1060 Terminal Test	1024
IGC0406F	2740 Terminal Test	952
IGC0506F	2848/2260 Terminal Test	912
IGC0606F	2848/2260 Terminal Test	488
IGC0706F	BSC (USASCII/TRANSCODE) Test Module	784
IGC0806F	BSC (EBCDIC) Test Module	944
IGC0906F	2741 Correspondence Code Terminal Test	858
IGC0A06F	2741 PTTC Code Terminal Test	858
IGC0B06F	2760 Terminal Test	396
IGC0C06F	2740C Online Test Module	920
IGC0D06F	BSC Test Control Module	1024
IGC0E06F	EBCDIC Test Module (for 3270)	1024
IGC0F06F	EBCDIC Test Module (for 3270)	1024
IGC1006F	ASCII Test Module (for Remote 3270)	1024
IGC1106F	ASCII Test Module (for Remote 3270)	1024
IGC1206F	Online Test Control (for Local 3270)	1024
IGC1306F	EBCDIC Test Module (for 3270)	1024
IGC1406F	EBCDIC Test Module (for 3270)	1024

SETPRT - SVC 81

IGC0008A	UCS Load Determination	1024
IGG08101	UCS Image Retrieval	1024
IGG08103	FCB Retrieval	1024
IGG08104	FCB Load and Verification	1024
IGG08102	UCS Load and Verification	1024

TGET/TPUT - SVC 93

IGC0009C	First Load of TGET	1024
IGG09301	TPUT	1024
IGG09302	TPUT with TJID	1024
IGG09303	Wait Remove Routine	1024

Terminal Status - SVC 94

IGC0009D	Initialization and TCLEARQ	1024
IGG09404	STBREAK	1024
IGG09405	STCOM	1024
IGG09406	STTIMEOU	1024
IGG09407	STCC	1024
IGG09408	STATTN	1024
IGG09409	STAUTOLN	1024
IGG09400	TCAM ABEND	1024
IGG0940A	STSIZE	1024
IGG0940B	GTSIZE	1024
IGG0940C	STAUTOCP	1024
IGG0940D	STAUTOPT	1024
IGG0940E	RTAUTOPT	1024
IGG0940F	TSO ABEND	1024
IGG0940G	STCLEAR	1024

IEHATLAS + ATLAS (SVC 86)

IGC0008F		1024
IGG0860A		1024
IGG0860B		1024
IGG0860C		1024
IGG0860D		1024
IGG086AE		1024

Miscellaneous SVC Routines

IGC0004H	Shared DASD Logical and Physical Reservation Control	608
IGC0005F	Shared DASD Logical Reservation Control	792
IGC0001F-SL	Purge (SVC 16)	992
IGC0101F	Purge (SVC16 - Second Load - First of Two Possible)	1009
IGC0201F	Purge (SVC16 - Second Load - Second of Two Possible)	996
IGC0001G	Restore	272
IGC0002A	BPAM Store Routine (SVC21)	1024
IGC0002B	OPEN-JFCB in Storage (SVC22)	1024
IGC0002E	D.A. Track Balance (SVC25)	872
IGC0003A	SAM FEOV Executor (SVC31)	1024
IGC0003E	WTO/WTOR (SVC35)	1024
IGC0005C	RELEX (SVC53)	184
IGC0005G	FREEDBUF (SVC57)	72
IGC0006D	Read JFCB	1024
IGC0006I	Backspace (SVC69)	1000
IGC0008C	SMF WTM (SVC83) Buffer Control	832
IGC0108C	SMF Data Set	1094
IGC0208C	SMF Data Set Verification	854
IGC0008G	SVC 87 - Delete Operator Messages (MCS)	220
IGC0004D	CHAP (SVC 44) MFT with Subtasking only	744
IGC0006B	DETACH (SVC 62) MFT with Subtasking only	424
*IGC0004[1]	EXTRACT (SVC 40) - MFT without subtasking	92
*IGC0004[1]	EXTRACT (SVC 40) - MFT with subtasking	432
*IGC0004B	ATTACH (SVC 42) - MFT without subtasking	610
*IGC0004B	ATTACH (SVC 42) - MFT with subtasking	1024
IGC0006G	SYNADAF (SVC 68) Initial Load	1024
IGC0106H	SYNAD Routine CSW Status and CCB Post Routine for SAM, DAM, and EXCP	712
IGC0206H	SYNAD Routine for BISAM	775

IGC0306H	SYNAD Routine for QISAM	584
IGC0406H	SYNAD Routine for QISAM, BTAM, QTAM, and GAM	960
IGC0506H	Formats Synad Message for EXCP	288
IGC0606H	Formats Synad Message for Optical Character Readers	1024
IGC0009A	Volume Statistics Recording Routine	928
IGC0706H	Synad Routine Unit Check Analysis	704
IGC10110	Display C, K load 1 (SVC 110)	1024
IGC11110	Display C, K load 2 (SVC 110)	1024
IGC12110	Display C, K load 3 (SVC 110)	1024
IGC20110	Display U syntax check (SVC 110)	1024
IGC21110	Display U UCB scan (SVC 110)	1024
IGC22110	Display U data cell and exit (SVC 110)	1024
IGC23110	Display U UCB find and write (SVC 110)	1024
IGC40110	Display PFK (SVC 110)	1024
IGC0603E	Multiple-line WTO load 1 (SVC 35)	1024
IGC0703E	Multiple-line WTO load 2 (SVC 35)	1024
IGC0803E	Multiple-line WTO load 3 (SVC 35)	1024
IGC0903E	Multiple-line WTO load 4 (MVT only) (SVC 35)	1024

---

* These modules can also be made permanently resident by specifying them in the SUPRVSOR macro during system generation.
[1]Punch a 12-0 multipunch.

Error Recovery Procedures

The following list contains those procedures that may be resident when the resident error recovery procedure option is selected. All of these routines are on the SVC library.

Unit Record Device Error Routines

IGE0011B	1285 ERP	920
IGE0011C	1287 ERP	904
IGE0011D	1288 ERP	904

Error Routines Common to All Devices

IGE0025C	Write-to-Operator Load 1	720
IGE0125C	Write-to-Operator Load 2	432
IGE0225C	Write-to-Operator Load 3	1024
IGE0325C	Write-to-operator Load 4	950
IGE0425C*	Write-to-operator Load 5	968

*Loaded for 3330 and 2305 devices only.

IGE0025D	Statistics Update	832
IGE0025E	I/O Purge	344
IGE0025F	Outboard Recorder (OBR)	344
IGE0125F	Outboard and Channel Check Recorder	976

TCAM Routines

IGE0004G	Start-Stop Control Module	992
IGE0104G	Read/Write Unit Check (except Time-Out)	800
IGE0204G	Non-operational Control Unit, Start-Stop Unit-Exception and Start-Stop Unit Check with Time-Out	
IGE0304G	Unit Check for Non-read, Non-write and Non-Poll CCWs	320
IGE0404G	Auto Poll and Read Response to Poll Unit Check and Unit Exception	308
IGE0504G	Error Post and CCW Return	916
IGE0604G	Unit Check and Unit Exception for Audio and 2260 Local Devices	288
IGE0804G	Start-Stop Channel Check	740
IGE0904G	Terminal Statistics Recording	172
IGE0004H	BSC Control Module	944
IGE0104H	BSC Equipment Check, Lost Data, Intervention Required, and Unit Exception	816
IGE0204H	BSC Data Check, Overrun and Command Reject	840
IGE0404H	BSC CCW Return Module	1024
IGE0504H	BSC Error Post Module	688
IGE0804H	BSC Channel Check	88
IGE0904H	OBR/SDR Interface for TPER Recording	732

Error Routines for 3211

IGE0000F	ERP LOAD1	1024
IGE0100F	ERP LOAD2	1024

Error Routine for 3270

IGE0010E	3270 ERP	1024
IGE0110E	3270 ERP	1024

BTAM Error Recovery

IGE0004A	Start/Stop ERP Control	544
IGE0004B	Start/Stop ERP Data Check	408
IGE0004C	BSC ERP Control	1024
IGE0104A	Start/Stop ERP Data Check	536
IGE0104B	Start/Stop ERP Diagnostic Write/Read	328
IGE0104C	BSC ERP Data Check	376
IGE0204A	Start/Stop ERP Timeout	552
IGE0204B	ERP Line Error Recording	408
IGE0204C	BSC ERP Error Post	960
IGE0304A	Start/Stop Intervention Required	560
IGE0304B	Start/Stop ERP Unit Exception	696
IGE0304C	BSC ERP Intervention Required	360
IGE0404A	Start/Stop ERP Lost Data	400
IGE0404B	Start/Stop ERP Read Skip Write Break	512
IGE0404C	BSC ERP Timeout	768
IGE0504A	Start/Stop ERP Post	656
IGE0504B	Start/Stop ERP Overrun	416
IGE0504C	BSC ERP Special Return	944
IGE0604A	Start/Stop ERP Bus Out Error Check	312
IGE0604B	ERP Intervention Required Message Writer	248
IGE0604C	BSC ERP Lost Data	432
IGE0704A	Start/Stop ERP Read Skip Write Break	416
IGE0704B	Remote 3270 Error Post	1024
IGE0704C	BSC ERP Bus Out & Overrun	408
IGE0804A	Start/Stop ERP Status Check	176
IGE0804B	ERP Channel Check Interface Control Check	592
IGE0804C	BSC ERP Equipment Check & Command Reject	488
IGE0904A	Start/Stop ERP Control	248
IGE0904C	BSC ERP Unit Exception	980

Appendix B Contents

Appendix B: Reentrant Load Modules That can be Made Resident in the Time Sharing Link Pack Area

This appendix lists the modules that may be resident in the time sharing link pack area. The name, size, and function of each module is given, along with the library in which it is located. This list is divided into two major sections:

- Those modules located on SYS1.LINKLIB that can be made resident in the time sharing link pack area.
- Those modules located on SYS1.CMDLIB that can be made resident in the time sharing link pack area.

It is recommended that modules marked with an * be placed in the time sharing link pack area.

Modules on SYS1.LINKLIB That can be Made Resident in the Time Sharing Link Pack Area

TSO Command System Modules (TMP)

IKJEFT01	TMP Initialization	2080
*IKJEFT02	TMP Mainline	5888

LOGON/LOGOFF Scheduler Modules

IKJEFLE	Phase I Prompter	5848
IKJEFLGM	LOGON Messages	3040
IKJEFLF	System Initiated LOGOFF	320
IKJEFLB	Job Scheduling Task Router	1400
IKJEFLK	POST Invocation Initiator Exit	320
IKJEFLG	LOGON Asynchronous	2440
IKJEFLC	Phase I Prompting Monitor	3808
IKJEFLL	LOGOFF Processor	3016
IKJEFLJ	Pre-invocation Initiator	2384
IKJEFLA	Initialization	1384
IKJEFLI	LOGON Installation Exit Support	3858
IKJEFLPA	TOD and DATE Text Preparation	616

Service Routine Modules

IKJPARS	Parse Service Routine	11,505
IKJPARS2	Parse Service Routine	7,832
*IKJSCAN	Command Scan Service Routine	1352
IKJEFD00	Dynamic Allocation Interface Service Routine	11,856

Command Processor Modules

*IKJEFT25	TIME Command Processor	672
IKJEFF51	CANCEL/STATUS Command Processor	1776
IKJEFF53	CANCEL/STATUS Command Processor	320
IKJEFF58	CANCEL/STATUS Command Processor	200
IKJEFF59	CANCEL/STATUS Command Processor	408
IKJEFF61	OUTPUT - Queue Control	3336
IKJEFF65	OUTPUT - Default Class Table	32
IKJEFF02	SUBMIT	1440

Modules on SYS1.CMDLIB That can be Made be Resident in the Time Sharing Link Pack Area

Service Routine Modules

IKJEHDEF	Default Service Routine	3416
IKJDFLT	Alias for IKJEHDEF	
IKJEHCIR	Catalog Information Service Routine	736

Command Processor Modules

LOGOFF	LOGOFF	160
TERMINAL	TERMINAL	3336
PROFILE	PROFILE	2096
IKJEFF60	OUTPUT	10,816
IKJEFF67	OUTPUT - Message Processor	5792
LINK	LINK - Initial Module	50
LOADG	LOADGO - Initial Module	50
IKJLKL01	LINK/LOADGO Processing Module	12,512
IKJLKL02	LINK/LOADGO Control Module	704
ACCOUNT	ACCOUNT	5800
IKJEFA10	ACCOUNT - ADD Subcommand Processor	18,624
IKJEFA20	ACCOUNT - CHANGE Subcommand Processor	21,512
IKJEFA30	ACCOUNT - DELETE Subcommand Processor	14,672
IKJEFA40	ACCOUNT - LIST Subcommand Processor	11,672
OPERATOR	OPERATOR	6976
LISTBC	LISTBC	5152
SEND	SEND	9576
IKJEES40	SEND/ACCOUNT Interface	6656
HELP	HELP	6432
IKJEFE11	WHEN	3328
CANCEL/STATUS	CANCEL/STATUS	4232
CANCEL		136
SUB	SUBMIT	4592
IKJEFF04	SUBMIT	9184
IKJEFF10	SUBMIT	8
IKJEFF16	SUBMIT	1216
EXEC	EXEC	13,096
IKJEFE04	EXEC	4688
RUN	RUN	6016
CALL	CALL	3288
ALLOCATE	ALLOCATE	6528
ATTRIB	ATTRIB	4314
IKJEBEAA	EDIT - access method routines	5064
IKJEBEBO	EDIT - BOTTOM subcommand processor	208
IKJEBECG	EDIT - CHANGE subcommand processor, second load	4064
IKJEBECH	EDIT - CHANGE subcommand processor, first load	3424

IKJEBECI	EDIT - Command invoker service routine	2504
IKJEBECN	EDIT - CHANGE subcommand processor, third load	2512
IKJEBECO	EDIT - Initial copy service routine	1784
IKJEBEDA	EDIT - Data set allocation/unallocation service routine	1200
IKJEBEDE	EDIT - DELETE subcommand processor	1872
IKJEBEDO	EDIT - DOWN subcommand processor	904
IKJEBEEN	EDIT - END subcommand processor	1088
IKJEBEEX	EDIT - Access method termination routine	472
IKJEBEFA	EDIT - Final copy service routine	976
IKJEBEFI	EDIT - FIND subcommand processor	2216
IKJEBEFO	EDIT - FORMAT Subcommand processor	2536
IKJEBEHE	EDIT - HELP subcommand processor	112
IKJEBEIM	EDIT - INPUT subcommand processor, second load	3464
IKJEBEIN	EDIT - initialization routine	7744
IKJEBEIP	EDIT - INPUT subcommand processor, first load	1840
IKJEBEIS	EDIT - INSERT subcommand processor	1712
IKJEBELE	EDIT - Line edit service routine	2592
IKJEBELI	EDIT - Line number insert/replace/delete subcommand processor	1840
IKJEBELT	EDIT - LIST subcommand processor	1488
IKJEBEMA	EDIT - main control routine	3744
IKJEBEME	EDIT - MERGE subcommand processor	2448
IKJEBEMR	EDIT - Re-translate service routine	584
IKJEBEMS	EDIT - Message selection service routine	680
IKJEBEM1	EDIT - Message module, #1	1016
IKJEBEM2	EDIT - Message module, #2	1688
IKJEBEM3	EDIT - Message module, #3	1008
IKJEBEM4	EDIT - Message module, #4	1048
IKJEBEM5	EDIT - Message module, #5	880
IKJEBEM6	EDIT - Message module, #6	928
IKJEBEM7	EDIT - Message module, #7	1136
IKJEBEPR	EDIT - PROFILE subcommand processor	1416
IKJEBEPS	EDIT - Processor table search routine	1840
IKJEBERE	EDIT - RENUM subcommand processor	3616
IKJEBERU	EDIT - RUN subcommand processor	2744
IKJEBESA	EDIT - SAVE subcommand processor	6112
IKJEBESC	EDIT - SCAN subcommand processor, first load	2280
IKJEBESN	EDIT - SCAN subcommand processor, second load	3360
IKJEBETA	EDIT - TABSET subcommand processor	1432
IKJEBETO	EDIT - TOP subcommand processor	360
IKJEBEUI	EDIT - Access method initialization routine	1552
IKJEBEUP	EDIT - UP subcommand processor	896
IKJEBEUT	EDIT - Access method interface routine	464
IKJEBEVE	EDIT - VERIFY subcommand processor	368

TEST	TEST - Initialization	9272
IKJEGMNL	TEST - Mainline Routines	21,424
IKJEGSYM	TEST - Resolve Symbolic Addresses	5872
IKJEGPCH	TEST - Subcommand Initialization	2760
IKJEGASN	TEST - Subcommand Initialization	2776
IKJEGAT	TEST - AT Subcommand	4400
IKJEGATD	TEST - AT Subcommand	1000
IKJEGDCB	TEST - LISTDCB Subcommand	3768
IKJEGDEB	TEST - LISTDEB Subcommand	3696
IKJEGEQU	TEST - EQUATE and DROP Subcommands	3376
IKJEGGO	TEST - GO, RUN, and CALL Subcommands	2088
IKJEGLDF	TEST - LOAD, DELETE, GETMAIN, and FREEMAIN Subcommands	4784
IKJEGLST	TEST - LIST Subcommand Initialization	4152
IKJEGLSA	TEST - LIST Subcommand	3848
IKJEGMAP	TEST - LISTMAP Subcommand	2000
IKJEGOFF	TEST - OFF Subcommand	3928
IKJEGPSW	TEST - LISTPSW Subcommand	1728

IKJEGQFY	TEST - QUALIFY Subcommand	3320
IKJEGTCB	TEST - LISTTCB Subcommand	3992
IKJEGWHR	TEST - WHERE Subcommand	3384

Utility Routine Modules

IKJEHDS1	LISTDS Utility Routines	8112
LISTDS	Alias for IKJEHDS1	
IKJEHCT1	LISTCAT Utility Routines	7944
LISTCAT	Alias for IKJEHCT1	
IKJEHAL1	LISTALC Utility Rouines	5056
LISTALC	Alias for IKJEHAL1	
IKJEHPRO	PROTECT Utility Routines	4560
PROTECT	Alias for IKJEHPRO	
IKJEHDEL	DELETE Utility Routines	6368
DELETE	Alias for IKJEHDEL	
IKJEHREN	RENAME Utility Routines	8368
RENAME	Alias for IKJEHREN	

Modules that are Always Made Resident in the Time Sharing Link Pack Area

*IKJEAD02	Driver	4672
*IKJEAD03	Driver MODIFY Processor	608
IKJEAL00	System Initiated Logoff	320
IKJEAT03	TSC Main Control	30,316
IKJEAI00	Alias for IKJEAT03	
IKJEAI01	Alias for IKJEAT03	
IKJEAI02	Alias for IKJEAT03	
IKJEAI03	Alias for IKJEAT03	
IKJEAR00	Alias for IKJEAT03	
IKJEAR01	Alias for IKJEAT03	
IKJEAT04	Alias for IKJEAT03	
IKJEAT05	Alias for IKJEAT03	
IKJEAT06	Alias for IKJEAT03	
IKJEAT07	Alias for IKJEAT03	
IKJEAT08	Alias for IKJEAT03	
IKJEAT09	Alias for IKJEAT01	
IKJEFLM	TSO Exit from IEFSD263	136
IKJEFLS	STAE Exit and Retry Routine for Scheduling Task	1576
IKJEFLS1	Alias for IKJEFLS	
IKJEFLS2	Alias for IKJEFLS	
IKJEFLS3	Alias for IKJEFLS	
IKJGGQT0	QTIP Main Control	8112
IKJGGQT1	Alias for IKJGGQT0	
IKJPTGT	I/O Service Routines (PUTLINE/GETLINE)	6064
IKJGETL	Alias for IKJPTGT	
IKJPUTL	Alias for IKJPTGT	
IKJSTCK	Alias for IKJPTGT	

*These modules may be replaced by an installation written driver. If they are, loads 02 and 03 of the new driver will be made resident in the time sharing link pack area.

Index

Indexes to systems reference library manuals are consolidated in the publication IBM System/360 Operating System: Systems Reference Library Master Index, Order No. GC28-6644. For additional information about any subject listed below, refer to other publications listed for the same subject in the Master Index.

IBM System/360 Operating System:
Storage Estimates

GC28-6551-16

READER'S COMMENT FORM

Your views about this publication may help improve its usefulness; this form will be sent to the author's department for appropriate action. Using this form to request system assistance or additional publications will delay response, however. *For more direct handling of such requests, please contact your IBM representative or the IBM Branch Office serving your locality.*

Possible topics for comment are:

Clarity Accuracy Completeness Organization Index Figures Examples Legibility

What is your occupation? _____
Number of latest Technical Newsletter (if any) concerning this publication: _____
Please indicate in the space below if you wish a reply.

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A. (Elsewhere, an IBM office or representative will be happy to forward your comments.

Cut or Fold Along Line

Cut or Fold Along Line

Your comments, please . . .

This manual is part of a library that serves as a reference source for system analysts, programmers, and operators of IBM systems. Your comments on the other side of this form will be carefully reviewed by the persons responsible for writing and publishing this material. All comments and suggestions become the property of IBM.

Fold Fold

First Class
Permit 81
Poughkeepsie
New York

Business Reply Mail
No postage stamp necessary if mailed in the U.S.A.

Postage will be paid by:

International Business Machines Corporation
Department D58, Building 706-2
PO Box 390
Poughkeepsie, New York 12602

Fold Fold

IBM

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, New York 10604
(U.S.A. only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)

System/360 OS Storage Estimates (S360-20) Printed in U.S.A. GC28-6551-16

System/360 OS Storage Estimates (S360-20) Printed in U.S.A. GC28-6551-16

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, New York 10604
(U.S.A. only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)