

SYSTEM DESCRIPTION

DMF II

Edition B



SYSTEM TEN COMPUTER BY **SINGER**

SINGER
BUSINESS MACHINES

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DMF II

Edition B



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SINGER
BUSINESS MACHINES

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DMF II SYSTEM DESCRIPTION

The System Ten computer is designed to provide multiprogramming capabilities for user application programs. Data is processed by interactive techniques rather than by traditional batch processing techniques.

OVERVIEW OF DMF II

The Disc Management Facility (DMF) is the software operating system for disc-based System Ten computers. However, multi-partition (or multi-program) switching functions are accomplished by the System Ten computer rather than by traditional executive software programs. The most recent development in DMF is designated as DMF II. The basic concepts of DMF II are shown in Figure 1.

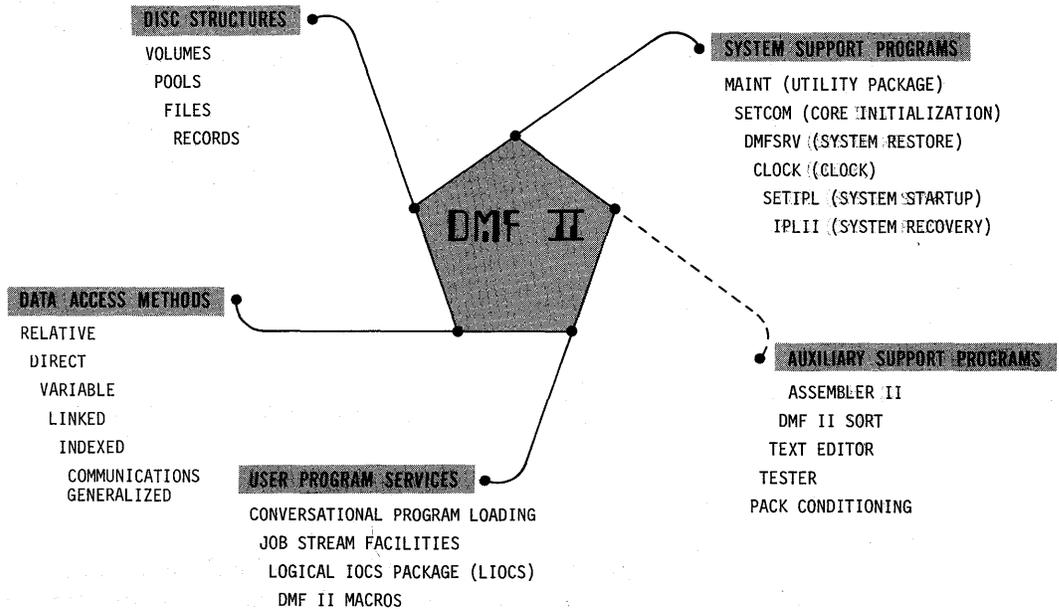


Figure 1. Basic Concepts of DMF II

Significant features of DMF II include unique user program services and special support programs. The user program services constitute a supervisor function which performs program loading, input/output control system (IOCS) functions and librarian functions. The supervisor function for DMF II is supplemented by system support programs and by auxiliary support programs. The auxiliary support programs are designed to function independently, as well as in the DMF II environment. Individual user application programs may be written to make maximum use of DMF II services.

Program loading is accomplished by operator interactions (conversationally) or by job stream facilities. The sequence of programs in a given run is also controlled by the job stream facilities.

The librarian functions involve a method for organizing and structuring program and data files and a system of directories for cataloging and locating the program and data files.

A logical input/output control system (LIOCS) is provided for logical access to records in data files and for simultaneous access of system resources using contention control. DMF II provides a group of macros which simplify writing programs. The macros define LIOCS files, link the files to LIOCS routines and supply definitions for fields (such as index registers and dates).

The support programs are used for generation and maintenance of DMF II disc systems, for writing, assembling, compiling and testing user written programs and for sorting data files into specified sequences.

FEATURES FOR USER PROGRAMS

The following DMF II features are significant for user application programs:

- Contention Control

DMF II programs and routines simultaneously access system resources through a feature called contention control. By using this feature, files can be shared between two or more programs running simultaneously and records can be added and updated by all the programs. Contention control is included automatically in all support programs, and can be included in the LIOCS routines.

- Interchangeable Volumes

Interchangeable disc volumes can be mounted on any available disc drive, and the DMF II automatic volume-search routines will locate the volume. If a required volume is not mounted, instructions will be directed to the operator that identify the volume and ask that the volume be mounted. Any number of interchangeable volumes can be defined for a DMF II disc system.

- Tailored LIOCS Routines

The LIOCS routines can be tailored to include various access methods and other options. Several different versions of LIOCS can be generated, if desired, each containing the facilities required for a specific set of application programs.

- Job Stream Files

User application programs can be structured into application systems by the use of a job stream file. Each job stream file contains a proper sequence of control statements to load the programs and command statements. DMF II support and user application programs can be executed from job stream files.

- Error Detection and Handling

Input/output error detection and handling is provided in all DMF II support programs and in DMF II LIOCS. Error retries are routinely attempted, and many errors are corrected automatically. When an error cannot be corrected or bypassed, status is set and control is always returned to the user program or to the operator. Descriptive error messages or status codes are provided.

- Service Routines

Service routines are provided to user programs for locating and loading program files that are on the system residence (SYSRES) volume. Assembler language overlays can be written and used, and snapshot core dumps can be made during program debugging.

- Data Files

Data files can be accessed or established by using the system support program MAINT or from user-written programs using LIOCS.

- Control Files

Control files can be used to complete the final definition of data files. Thus, the physical attributes of a file can be determined at program execution time when the LIOCS OPEN routine references the control file.

- Data Access Methods

The general access methods available in DMF II are basic sequential, mixed sequential, and keyed. The specific access methods are designated as follows: relative access, direct access, variable sequential access, linked sequential access, magnetic tape access and communications. When writing a program, the user may choose one of these access methods for each data file to be used in the program.

- Operation of DMF I Programs on DMF II

Most existing programs that use DMF I common-resident LIOCS and unmodified file control blocks can be run in DMF II without change. The DMF II LIOCS OPEN routine automatically converts the DMF I file control block to a DMF II file control block.

DMF II PROGRAMS AND MACROS

The overall concept for DMF II includes selection and use of a variety of programs and macros.

System Programs

- Loading Program

The initial program for loading DMF II is the conversational loader (C_LOAD). Both DMF II support programs and user written programs may be loaded either through operator interactions (conversationally) or through a job stream file (automatically from disc).

- Disc System Generation Program

The DMF service program (DMFSRV) is used to build a basic DMF II disc system on a disc pack. The DMFSRV program and the image of the DMF II disc system are both recorded on a magnetic tape by the MAINT BACKUP command.

- LIOCS System-Generation Macro

The LIOCS system-generation macro (C_LIOCS) is used to generate one or more versions of DMF II LIOCS. Each version is tailored to include access methods and features as specified by the user. The desired versions of DMF II LIOCS are generated, loaded into common core, and referenced by LIOCS operational macro calls from user written programs.

- Core Initialization

The core initialization program (SETCOM) is used to prepare a System Ten computer for running jobs under the DMF II system. The program is used at the start of each working period. The current data fields in common core (such as the date) are initialized, and the desired version of DMF II LIOCS is loaded into common core. Various user and system fields in common core may be displayed on operator request as part of a daily job run log or for debugging.

- Utility Package

The MAINT program is the primary utility package supplied with the DMF II system. The commands and functions of the MAINT program are listed for reader convenience in Table 1.

- CLOCK Program

The CLOCK program runs in a digital clock partition and maintains the time-of-day fields in common core.

- System Startup Program

The system startup program (SETIPL) is a card-resident program which establishes a system resident volume, if disc drive 0 is not operable.

- System Recovery Program

The system recovery program (IPLII) is a disc-resident or a card-resident program and is used to reload the initial program load (IPL) sectors on a SYSRES volume.

Table 1. Commands for MAINT Program

Command	Function
ASSIGN	(1) Establish the configuration of each partition in the system (2) Start or cancel jobs in other partitions (3) Temporarily or permanently assign a physical device to a logical device for a partition (4) Establish or remove other DMF II systems running on the same System Ten computer
BACKUP	Prepare a backup copy on a magnetic tape of a DMF II system, volume, pool or file (both individually and in logical combinations)
COPY	Copy a volume, pool or file from one DMF II system to another
CREATE	Organize a consecutive area on a disc volume into a pool that can contain data files
DELETE	Delete a file or pool (thus freeing the space for use by other files or pools)
DISPLAY	Print the contents of a DMF II system, volume, pool or file on a line printer or at a workstation
FILE	Catalog or update a data file and (optionally) write data into the file
INDEX	Create an index pointer file containing keys to a linked sequential data file (The keys will allow user-written programs to access data records by key through LIOCS calls.)
INIT	Initialize a disc pack as a DMF II interchangeable volume
LINK	Establish references to data pools on other volumes
MOVE	Copy a pool or file within a DMF II system
PAUSE	Issue messages and temporarily interrupt a MAINT command stream in a USE file or a job stream file
PUNCH	Copy a file into punched cards
REMOVE	Remove references to data pools on other volumes
RENAME	Change the name of a pool or file
RESTORE	Restore all or part of the contents of a backup tape
SELECT	Identify the elements desired in a BACKUP or a RESTORE run
TYPE	Issue messages from USE file or from job stream file between MAINT commands
UNLOCK	Unlock contention locks that might have been left locked because of program abort or error
USE	Provide MAINT command access from a disc file

DMF II Macros

The DMF II macros, used to simplify the coding of user written applications programs, are as follows:

- DEFINE Macro

The DEFINE macro supplies predefined names for frequently-used system fields in partition and common core. These names may be referenced by the user program, and include such fields as the index registers, dates and user program switches.

- FCB Macro

The FCB macro builds the file control block for a data file that will be accessed by the program, using DMF II LIOCS.

- SETFCB macro

The SETFCB macro provides the user with the means to alter the contents of the file control block.

- EXIT Macro

The EXIT macro terminates a program normally and returns control to the conversational loader.

- LIOCS Macros

The LIOCS operational macros are used to open, access and close data files through the appropriate file control blocks. The LIOCS macros and functions are listed in Table 2.

- Special DMF II Macros

For more advanced uses of DMF II, special groups of macros have the following functions: (1) to be used in conjunction with job stream file, (2) to access the mailbox in DMF II standard common, (3) to allocate and free areas of reserved common core, (4) to provide programming services, such as locating files, loading programs, locking records and dumping core, and (5) to define the fields in DMF tables and labels.

Auxiliary Support Programs

- Pack Conditioning Program

The pack conditioning program is used when a new disc pack is obtained. An unconditioned disc pack cannot be accessed by normal programs. To make the disc pack compatible with DMF II, the PKCOND program records the track identification on every sector. The PKCOND program is executed only one time for each disc pack.

Table 2. LIOCS MACROS

Macro	Function
BOF	Reposition the file control block so that the next access to the file will be the first record in the file
CLOSE	Finalize the state of the file and release the file from processing by the program
DELETE	Remove the current linked-sequential record from the data file
DELETD	Mark the direct-access record pointed to by the key field as logically deleted
DELETR	Mark the current relative-access or direct-access record as logically deleted
EOF	Reposition the file control block at the last record (or sector) in the file
GET	Read the next record in the data file
GETUP	Read the next record in the data file, and mark the record to prevent another program (running at the same time) from modifying the record until the program that issued the GETUP (1) updates the record, (2) makes another access to the data file or (3) goes to end-of-job
INSRT	Insert a record in a <u>linked-sequential file between the preceding record and the current record</u>
OPEN	Locate the data file and initialize the file control block
PUT	Write the next record in the data file
QEOF	Position the file control block after the last sector in the file
READ	Read a record (pointed to by the key field) in a direct-access file or in an indexed linked-sequential file
READUP	Read a record in a direct-access file or in an indexed linked-sequential file pointed to by the key field, and mark the record so that no other program (running at the same time) will modify the record until the program that issued the READUP (1) updates the record, (2) makes another access to the data file or (3) goes to end-of-job
UPDATE	Rewrite the current record
WRITE	Write the record (pointed to by the key field) in a direct-access file or in an indexed-sequential file
WRTEOF	Mark an end-of-file location

- Assembler Program

The Assembler II program is used to assemble user written programs and to tailor a desired version of DMF II LIOCS.

- DMF II Sort Program

The DMF II Sort program is used to sort data files into specified sequences.

- Tester Program

The Tester program is used to test and debug computer programs.

- Text Editor Program

The Text Editor program is used to edit source language programs.

CORE STRUCTURES

Common Core

- Core locations 0 to 299 are used exclusively by the hardware operating system for System Ten computer tables.
- Core locations 300 to 999 are used for DMF II standard common fields and include such data as the date, the user program switches and the common core mailbox. The common core mailbox is a 415-position buffer, which can be used for passing data between programs that are running concurrently. Macros are provided for user access of the common core mailbox in the DMF II standard common area. Programs written in RPG II can also access the common core mailbox.
- Core locations above 999 are available for DMF II LIOCS and for user tables, programs, and buffer areas.

Two DMF II macros, CALOC and CFREE, allow user programs to obtain areas in common core. To load LIOCS and to allocate user areas in common core, the common core reservations are established by the SETCOM program.

Partition Core

- Core locations 0 to 299 are used by the software operating system. This core area contains a number of fields that are shared with the user program, such as index registers, program loader and core dump entry points. Other fields provide partition and system information including the logical device assignments, error-restart addresses, and an error-code storage area.
- Core locations 300 to 339 are used for the control block for job stream macros. This control block is loaded by the conversational loader at the beginning of each program, unless the user program overlays this area. This control block is also set up by the macros from the job stream facilities (EXIT,

CANCEL and JWAIT macros). The other job stream macros require that this control block be intact. The LIOCS OPEN and CLOSE transients overlay this core area.

- Core locations 300 to 999 are used by the conversational loader between executions of the user program and by the LIOCS OPEN and CLOSE routines during user program executions. This core area is available to the user before execution of any OPEN routine and after execution of a CLOSE routine; however, core memory will not be saved or restored when the OPEN or CLOSE routines are executed.
- Core locations above 999 are available for user programs.

DISC STRUCTURES

Physical Organization

The physical access mechanism of a typical disc drive is shown in Figure 2. Each disc surface is divided into 200 or 400 concentric circular tracks with 50 sectors per track. The recording surfaces of tracks which can be accessed without moving the access arms constitute a cylinder.

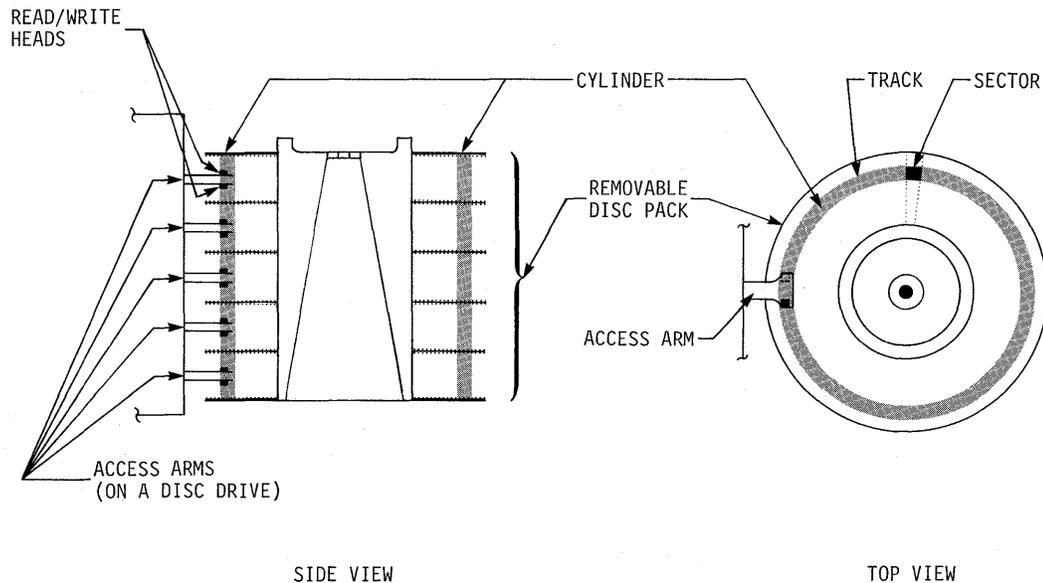


Figure 2. Disc Pack and Physical Access Mechanism for Singer Model 40 Disc Drive

The Singer disc drives record on interchangeable disc packs. The characteristics of each model are described in Table 3.

Table 3. Characteristics of Singer Disc Drives

Disc Drive Model Number	Disc Pack Model Number	Number of Track Recording Surfaces	Number of Cylinders	Number of Sectors Per Disc Pack	Number of Characters of Total Storage Capacity
40	41	10	200	100,000	10,000,000
42*	41A	4	200	40,000	4,000,000
	41B	4	200	40,000	4,000,000
44**	41C	20	400	400,000	40,000,000

* Singer Model 42 Disc Drive is designed to operate with a split disc pack consisting of an upper disc pack (41A) and a lower disc pack (41B).

** Access to a Singer Model 44 Disc Drive is similar to accessing to four Model 40 Disc Drives.

Logical Organization

Data in the DMF II disc structure is organized in volumes on disc packs. Within each volume, contiguous sectors are grouped into pools. Within each pool, the sectors are grouped into one or more files. Within each file, the sectors are grouped into data records.

Volumes

Each DMF II disc system consists of one or more related volumes. The first volume is the SYSRES volume for the system and all other volumes are interchangeable volumes.

A volume can be organized in surface mode or in cylinder mode. Volumes on all Singer disc drives can be used in surface-addressing mode. Volumes on Singer Model 40 and Model 44 Disc Drives can be used in cylinder-addressing mode. In the cylinder-addressing mode, five times as much contiguous data can be accessed without moving the disc access arms. Volumes are created for access by either the surface mode or the cylinder mode, but not by mixed modes. Each volume has a volume label that identifies the type and mode of the data, and the type of disc pack.

Each volume has a pool directory which contains a pool label for each pool on the volume. The SYSRES volume pool directory also contains a volume pointer to all pools on interchangeable volumes within the system. The volume pointer identifies the volume where the pool is located. The volume pointer can point to a volume from another DMF II disc system, thus allowing program and data files to be accessed across system boundaries.

The SYSRES volume, in addition to the volume pointer and pool directory, contains the initial program load (IPL) routine. The IPL routine allows the DMF II conversational loader to be "bootstrapped" into core from a console (workstation or display).

Pools and Files

Two basic types of pools in the DMF II disc system are relative and linked sequential. The relative pool is a contiguous group of sectors, each of which is accessed by adding an increment to a base address. A relative pool contains only one file. The linked-sequential pool is a contiguous group of sectors, each of which contains a pointer (link) to another sector. A linked-sequential pool can contain more than one file.

In general, relative pools are most useful for data files and linked sequential pools are most useful for program files. A combination of pool types may be needed for the design of specific application systems. Applications for pools and files under DMF II are presented in Table 4.

Blocks and Records

Depending on the access method under DMF II, records can be blocked or unblocked and can be fixed or variable in length. The capabilities of DMF II LIOCS are summarized in Table 5.

Some auxiliary support programs for DMF II do not support records or blocks longer than 1,000 characters; thus data files containing records and blocks longer than 1,000 should be identified and used only in situations where these auxiliary support programs will not be involved.

Directory Structures

DMF directories consist of pool labels or file labels. Both the pool directory and the file directory are used to locate a given file. Volume pointers in the SYSRES volume pool directory catalogue point ultimately to pool labels of pools on other volumes. The pool label points to the root of the file directory for the pool. The file directory is a structure of file labels in a given pool. The file label points to the first data record of the file.

Table 4. Summary of File Types and Access Methods

(a) RELATIVE POOLS

FILE TYPE	FILE FORMAT	ACCESS TECHNIQUES	APPLICATIONS
RELATIVE FILES	RELATIVE FILES CONTAIN FIXED-LENGTH RECORDS WHICH MAY BE BLOCKED. EACH RECORD IS IDENTIFIED BY A RELATIVE RECORD NUMBER WHICH INDICATES DISTANCE FROM THE BEGINNING OF THE FILE. EACH RECORD MAY INCLUDE A RECORD STATUS CHARACTER WHICH INDICATES IF THE RECORD IS IN USE, DELETED OR AVAILABLE. ONLY ONE RELATIVE FILE MAY BE STORED IN A POOL.	RECORDS MAY BE ACCESSED SERIALLY BY USING A SERIES OF GET OR PUT MACRO CALLS OR RANDOMLY BY SPECIFYING THE RELATIVE RECORD NUMBER OF THE DESIRED RECORD.	A SERIAL TRANSACTIONS FILE PROVIDES THE FASTEST MEANS OF STORING DATA. RECORDS CAN BE SORTED IF NECESSARY FOR SUBSEQUENT PROCESSING. A SMALL RELATIVE FILE MAY BE USED AS WORK SPACE TO HOLD DATA ITEMS OR TABLES WHICH DO NOT FIT IN CORE MEMORY. A HOTEL COULD USE A RELATIVE FILE TO ACCESS RECORDS BOTH SERIALLY AND RANDOMLY, WHERE THE ROOM NUMBER IS USED AS A RELATIVE RECORD NUMBER.
DIRECT FILES	DIRECT FILES ARE RECORDED IN THE SAME FORMAT AS RELATIVE FILES, EXCEPT THAT RECORDS ARE STORED RANDOMLY BY KEY. A KEY TRANSFORMATION ALGORITHM IS USED TO DEVELOP A RELATIVE RECORD NUMBER FOR EACH KEY AND TO PROVIDE ALTERNATE (OVERFLOW) VALUES WHEN DIFFERENT KEYS TRANSFORM TO THE SAME RECORD NUMBER. OVERFLOW STORAGE IS WITHIN THE FILE RATHER THAN IN A SEPARATE AREA. A USER KEY TRANSFORMATION SCHEME MAY BE INCORPORATED IF DESIRED. THE FILE SHOULD CONTAIN EXTRA RECORD SPACE TO OPTIMIZE OVERFLOW PROCESSING.	DIRECT ACCESS IS USED WHEN A FILE MUST BE ACCESSED RANDOMLY. DIRECT ACCESS MINIMIZES THE TIME REQUIRED TO STORE OR RETRIEVE A GIVEN RECORD. THE USER SUPPLIES A KEY WITH HIS MACRO CALL, AND LIOCS PERFORMS THE KEY TRANSFORMATION AND OVERFLOW PROCESSING. DIRECT FILES MAY ALSO BE ACCESSED SERIALLY, ALTHOUGH RECORDS ARE NOT RETRIEVED IN KEY SEQUENCE.	INVENTORY FILES ARE USUALLY ACCESSED RANDOMLY WHEN ACCESS TIME IS AN IMPORTANT FACTOR. RECORDS MAY BE ADDED OR DELETED AT ANY TIME. THE FILE MAY ALSO BE READ SERIALLY FOR SORTING AND/OR PRODUCING SUMMARY REPORTS.
VARIABLE FILES	VARIABLE SEQUENTIAL FILES ARE ALWAYS STORED IN BLOCKED FORMAT. EACH BLOCK BEGINS WITH A BLOCK LENGTH, AND EACH RECORD BEGINS WITH A RECORD LENGTH.	VARIABLE FILES ARE USUALLY ACCESSED SERIALLY. RECORDS ARE RETRIEVED IN THE SAME ORDER AS THEY WERE STORED. A LIMITED RANDOM ACCESS CAN BE MADE BECAUSE THE RELATIVE SECTOR NUMBER FOR THE CURRENT BLOCK IS AVAILABLE TO THE USER AND MAY BE SAVED AND RESTORED FOR RANDOM ACCESS TO A GIVEN BLOCK AT A LATER TIME.	VARIABLE FILES ARE APPROPRIATE FOR ANY TRANSACTION FILE IN WHICH THE AMOUNT OF INFORMATION TO BE STORED VARIES. AN EXAMPLE OF SUCH A FILE IS AN ORDER FILE IN WHICH THE LENGTH OF EACH RECORD IS DEPENDENT ON THE NUMBER OF LINE ITEMS PER ORDER.

(b) LINKED POOLS

FILE TYPE	FILE FORMAT	ACCESS TECHNIQUES	APPLICATIONS
LINKED-SEQUENTIAL FILES	LINKED SEQUENTIAL FILES ARE BUILT IN LINKED POOLS BY CHAINING TOGETHER SECTORS FROM THE POOL FREE SECTOR LIST. A POOL MAY CONTAIN ANY NUMBER OF FILES. EACH SECTOR CONTAINS UP TO 94 CHARACTERS OF DATA AND A SIX-CHARACTER LINKAGE. RECORDS OF ANY SIZE ARE SUPPORTED; RECORDS ARE FIXED-LENGTH AND ARE USUALLY NOT BLOCKED, BECAUSE BLOCKING OF LINKED RECORDS IS NOT SUPPORTED BY LIOCS.	EXCEPT WHEN INDEXED, LINKED FILES ARE PROCESSED SERIALLY. OPERATIONS ARE PROVIDED TO POSITION THE USER PROGRAM AT THE BEGINNING OR END OF THE FILE. A RECORD MAY BE INSERTED BETWEEN TWO RECORDS AT ANY POINT IN THE FILE. DELETION OF A RECORD IS ACCOMPLISHED BY REMOVING THE SECTORS FOR THE RECORD FROM THE FILE CHAIN AND BY RETURNING THESE SECTORS TO THE POOL FREE SECTOR LIST.	LINKED FILES ARE USED FOR DATA FILES WHICH ARE DYNAMIC, SUCH AS FILES WHICH ARE MAINTAINED IN SEQUENCE BY INSERTING RECORDS. THE FACILITY TO ALLOW MULTIPLE FILES IN A LINKED POOL ALLOWS SEVERAL FILES TO SHARE A LIST OF FREE SPACE. THIS SHARING REDUCES DISC SPACE OVERHEAD WHEN SEVERAL DYNAMIC FILES ARE STORED ON THE SAME SYSTEM.
INDEXED LINKED-SEQUENTIAL FILES	RANDOM ACCESS TO A LINKED SEQUENTIAL FILE MAY BE ACCOMPLISHED USING AN INDEX FILE WHICH IS SEPARATE FROM THE DATA FILE. THE INDEX FILE PROVIDES A DIRECTORY STRUCTURE FOR RECORD KEYS IN THE DATA FILE. EACH INDEX ENTRY CONTAINS A POINTER TO THE LOCATION OF THE CORRESPONDING KEY IN THE DATA FILE. IF THE DATA FILE IS IN SEQUENCE BY THE KEY USED FOR INDEXING, IT IS NOT NECESSARY TO INDEX EVERY RECORD. ANY NUMBER OF INDEXES CAN BE BUILT FOR A GIVEN DATA FILE. INDEXES ARE BUILT USING THE MAINT SYSTEM SUPPORT PROGRAM.	THE USER OPENS AN INDEXED FILE THROUGH ITS INDEX, AND MAY ACCESS THE FILE BOTH RANDOMLY (THROUGH THE INDEX) AND SERIALLY (USING LINKED SEQUENTIAL OPERATIONS). TO ACCESS THE FILE RANDOMLY, THE USER PROVIDES A KEY; LIOCS SEARCHES THE INDEX AND, IF NECESSARY, SEARCHES PART OF THE DATA FILE TO FIND THE DESIRED RECORD, OR A PLACE TO INSERT A NEW RECORD.	INDEXED LINKED SEQUENTIAL FILES ARE ESPECIALLY USEFUL WHEN IT IS NECESSARY TO ACCESS A FILE RANDOMLY WHILE MAINTAINING THE RECORDS IN KEY SEQUENCE FOR SERIAL PROCESSING. THIS IS ALSO THE ONLY DMF II ACCESS METHOD WHICH ALLOWS RANDOM ACCESS TO A FILE BY MORE THAN ONE KEY. A COMMON APPLICATION OF THIS ACCESS METHOD IS IN OPEN-ORDER PROCESSING, WHERE ORDER ITEMS ARE INSERTED IN ORDER NUMBER SEQUENCE, USING THE INDEX FOR RAPID PLACEMENT OF NEW ITEMS AND RANDOM RETRIEVAL OF OUTSTANDING ITEMS. RANDOM ACCESS USING AN INDEX FILE IS SLOWER THAN A SIMILAR KEYED ACCESS USING THE DIRECT ACCESS METHOD.
DOUBLE LINKED-SEQUENTIAL FILES	DOUBLE LINKED FILES ARE LINKED SEQUENTIAL FILES CONTAINING BOTH FORWARD AND BACKWARD LINKAGES. RECORDS ARE FIXED LENGTH AND MAY NOT BE BLOCKED; ALL RECORDS ARE 80 CHARACTERS LONG.	DOUBLE LINKED FILES ARE NORMALLY ACCESSED ONLY BY THE TEXT EDITOR, WHICH USES THE DOUBLE LINKAGES TO MOVE IN BOTH DIRECTIONS WHILE EDITING PROGRAM FILES. DOUBLE LINKED FILES ARE NOT NORMALLY ACCESSED BY LIOCS, BUT MAY BE ACCESSED IN A READ-ONLY MANNER.	DOUBLE LINKED FILES ARE USED FOR PROGRAM SOURCE FILES, JOB STREAM FILES, CONTROL FILES AND ALL OTHER CARD-IMAGE FILES WHICH ARE MAINTAINED BY THE TEXT EDITOR.

(c) NON-DISC MEDIA

FILE TYPE	FILE FORMAT	ACCESS TECHNIQUES	APPLICATIONS
MAGNETIC TAPE	RECORDS MAY BE FIXED OR VARIABLE LENGTH (BLOCKED OR UNBLOCKED) OR UNDEFINED. STANDARD LABEL PROCESSING, USER LABEL OPTIONS AND UNLABELED TAPES ARE SUPPORTED.	MAGNETIC TAPE FILES ARE ALWAYS ACCESSED SERIALLY, USING A SERIES OF GET OR PUT MACRO CALLS. CONTROL OPERATIONS ARE PROVIDED FOR SUCH FUNCTIONS AS BACKSPACING OR REWINDING TAPE. A CONTROL FILE ON DISC MAY BE USED TO SPECIFY LABEL PROCESSING OPTIONS.	MAGNETIC TAPE FILES ARE USED TO LOG TRANSACTIONS FOR BACKUP PURPOSES AND TO TRANSFER DATA FILES TO OTHER COMPUTER SYSTEMS.
COMMUNICATIONS	RECORDS ARE FIXED-FORMAT AND MAY NOT BE BLOCKED. THE LENGTH OF THE RECORD INPUT IS PROVIDED WITH EACH READ.	ACCESS IS SERIAL, USING GET OR PUT MACRO CALLS. CONTROL OPTIONS ARE PROVIDED FOR FORMS CONTROL, ETC. BASIC ERROR RECOVERY IS PROVIDED BY LIOCS.	USED TO PROCESS DATA FROM OR TO REMOTE PERIPHERAL DEVICES, SUCH AS CRTS AND PROVIDES DEVICE-INDEPENDENT I/O.

Table 5. Summary of Access Methods Under DMF II

Item Handled or Applicable Technique	Type of Access Method						
	Relative	Direct	Variable Sequential	Linked Sequential	Indexed Linked Sequential	Magnetic Tape	Communications
FILE FORMAT CAPABILITIES							
Fixed length records	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variable length records	No	No	Yes	No	No	Yes	No
Undefined records	No	No	No	No	No	Yes	Yes
Blocked records	Yes	Yes	Yes	No*	No	Yes	No
Minimum record length	10	10	10	10	10	16	1
Maximum block length	9800	9800	9800	9300	9300	9999	9999
Records can be in sequence	Yes	No	Yes	Yes	Yes	Yes	Yes
More than one file per pool	No	No	No	Yes	Yes	Not Applicable	Not Applicable
LIOCS ACCESS CAPABILITIES							
Normal accessing method	Serial or Random	Random	Serial	Serial	Random	Serial	Serial
Access by key	No	Yes	No	No	Yes	No	No
Access by record number	Yes	Yes	No	No	No	No	No
Start from other than first record	Yes	Yes	No	No	Yes	No	No
Insertion of records	No	No	No	Yes	Yes	No	No
Deletion of records	Yes	Yes	No	Yes	No	No	No

*MAINT supports blocked records.

DMF II SYSTEM CONFIGURATIONS

Building a DMF II System

At least one SYSRES volume is necessary for each DMF II system. A SYSRES volume may be built by one of the following methods:

- The system restore program (DMFSRV) is used to build a SYSRES volume from a backup tape created by the BACKUP command (in the MAINT program). The restored system is bootstrapped and the RESTORE command (in the MAINT program) is used to restore the balance of the volume from the tape. One disc drive and one magnetic tape drive are required when using this method.
- ✓ • The COPY command (in the MAINT program) is used to build a SYSRES volume from an existing SYSRES volume. Two Singer disc drives (or one Model 42 Disc Drive) are required when using this method.

Interchangeable volumes are built by one of the following methods:

- The INIT command (in the MAINT program) is used to initialize the volume.

After initialization, the MAINT commands (RESTORE and COPY) can be used to copy pools and files to this new volume, and the MAINT commands (LINK, CREATE and FILE) can be used to build new pools and files.

- Any existing interchangeable volume in another DMF II system can be added to the new DMF II system by linking pools to the SYSRES pool directory with the LINK command in the MAINT program.

Minimum Hardware Requirements

- One Singer Model 20 or Model 21 Processor*
- A multiterminal input/output channel (MTIOC) partition with 10K core memory
- Common core storage (10K)
- A conversational device for operator communication, such as a workstation or video display
- One disc drive

*Some features of DMF II require a Model 21 Processor.

Optional Peripheral Devices

- Additional disc drives to increase on-line storage capacity
- MTIOC partitions for support programs
- A digital clock partition to provide time-of-day
- A communications partition using the Synchronous Communications Adapter (SCA)
- A communications partition using the Asynchronous Communications Adapter (ACA)
- A communications partition using the Asynchronous Terminal Adapter (ATA)
- A modular data input/output channel for attaching Job Information Stations (JIS) - Singer Model 100
- Card readers to retrieve information from punched cards
- Card punches to store information on punched cards
- Magnetic tape drives to store and retrieve information on magnetic tape
- Line printers to provide printed output
- Video displays to provide visual interactive input/output
- Workstations to provide printed interactive input/output

Basic Configuration

The simplest flexible configuration for a DMF II system contains a Singer Model 42 Disc Drive with the lower disc pack for the SYSRES volume and the upper disc pack for an interchangeable volume. The SYSRES volume contains the DMF II system software base in a linked pool (SYSPOL). The SYSRES volume would include MAINT, SORT, LIOCS, SETCOM, user-written programs, a work pool for SORT, and user data pools. The interchangeable volume contains program and data pools for user applications. If new applications are developed, interchangeable volumes are added with the data pools for the new applications.

A separate DMF II system can be built to develop and test new programs during off-hours, using various auxiliary support programs such as Tester, Text Editor and Assembler II.

Additional volumes can be created as backup volumes. Each backup volume can be initialized as a mini-SYSRES volume with a small SYSPOL which contains only the MAINT utility package. DMF II can be loaded by an initial program load (IPL) from the backup volume, and the desired interchangeable volume can be rebuilt. The SYSRES volume can be copied intact to a backup volume. This backup volume is used as the IPL volume to restore SYSRES.

A sample configuration for DMF II is shown in Figure 3.

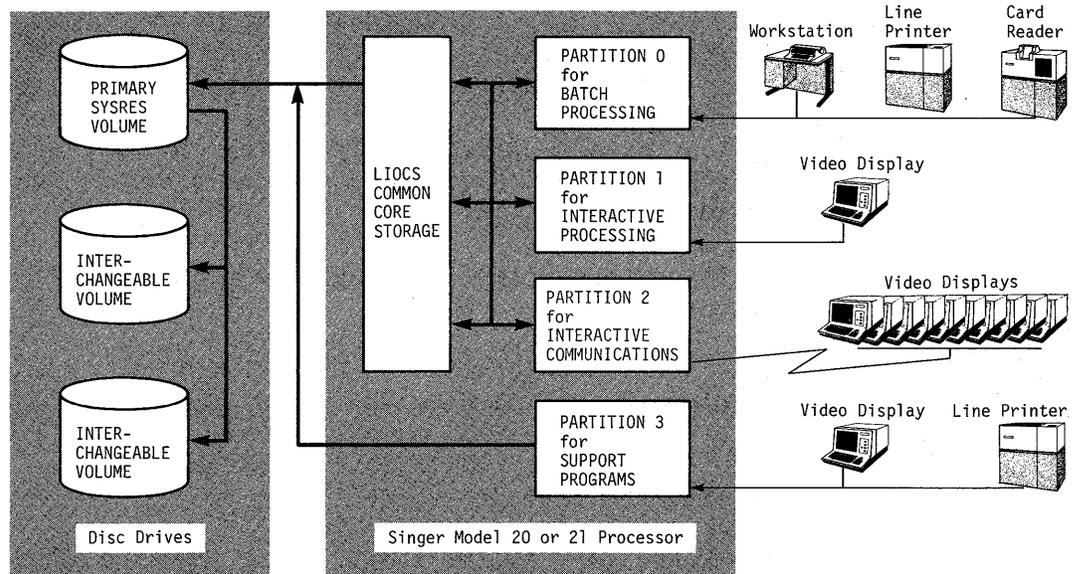


Figure 3. Sample Configuration for DMF II

A DMF II system, similar to the Model 42 system, can be configured with two Singer Model 40 Disc Drives. This configuration provides greater programming flexibility and convenience because of the use of separate disc drives and because all disc packs are the same type. Configurations with either the Model 40 or Model 42 disc drives can be expanded by using additional disc drives. Types of disc drives may be mixed under DMF II. When using several disc drives, independent DMF II systems can be run simultaneously on a single System Ten computer. Each independent DMF II system has one individual SYSRES volume. The SYSRES volume mounted on the IPL drive is designated as the primary SYSRES. All job loading requests are passed through the primary SYSRES and directed to the secondary SYSRES volumes.

With some hardware configurations, devices other than disc must be used to provide backup capability. A system with one Model 40 or Model 44 disc drive could have magnetic tape drives or communications partitions for backup of critical files. An alternate configuration involves the use of a System Ten computer at a nearby location, where the backup operations for the user files can be performed. This configuration is less flexible than the use of magnetic tape drive or communications partitions for backup.

MULTI-PARTITION OPERATION

The DMF II system provides facilities to control access to shared data files. Programs may be run in multiple partitions and may access common data that is stored on disc. These access facilities are supported in user programs by using DMF II LIOCS. System support programs and auxiliary support programs can be used with these access facilities.

Multi-partition operation is controlled under DMF II by the use of the following types of locks:

- System lock is maintained in DMF II standard common, and is set when volume or pool labels are being altered.
- Volume lock is set while initializing the volume and while reorganizing the pool directory.
- Pool locks may be for long-term or short-term use. The long-term lock is set for work pool access, for exclusive access to direct and relative access files, and for noncontention use of a linked sequential pool. The short-term pool lock is set when allocating sectors to a linked sequential file.
- File lock is set when exclusive use of the file is desired. This exclusive use is specified by the Assembler II, Text Editor or user program which uses DMF II LIOCS.
- Drive lock is maintained in DMF II standard common, and consists of a lock for each disc drive on the system. Drive lock is set when altering a linked-sequential file label. Drive lock is also set by DMF II LIOCS, when a multisector record is accessed, to prevent moving of the disc arm by another partition while accessing a single logical record.
- Record lock is maintained in DMF II standard common, and consists of the record protection table. Record locks are set and cleared by DMF II LIOCS when the user requests the locking of a record with a GETUP or READUP macro. Record locks may also

be set and cleared by the ENQUE and DEQUE macros. Record locks protect against simultaneous update of a record by more than one partition. The LIOCS support of record lock is a LIOCS generation option.

APPLICABLE DOCUMENTS

- Assembler II Reference Manual, Edition B (Singer Publication No. 44-B151-401-01)
- System Ten Programmers Reference Booklet (Singer Publication No. 40-101R)
- Disc Pack Conditioning Program Reference Manual (Singer Publication No. 40-355)
- DMF II System Installation Reference Manual, Edition B (Singer Publication No. 44-B800-701-01)
- DMF II Programmer's Reference Manual, Edition B (Singer Publication No. 44-B800-401-01)
- DMF II System Support Programs Reference Manual, Edition B (Singer Publication No. 44-B800-702-01)
- DMF II Message Manual, Edition B (Singer Publication No. 44-B800-601-01)
- DMF II Sort Reference Manual (Singer Publication No. 44-B324-401-00)
- Text Editor Reference Manual, Edition C (Singer Publication No. 44-B325-801-02)
- Tester Reference Manual, Edition B (Singer Publication No. 44-B400-401-01)

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