RTE FILE MANAGER
HP 2300E
HP 9600E/F Option Y01

The File Manager is an optional software module (option Y01) of HP Real Time Executive (RTE) Systems. It provides for convenient, orderly storage and fast, easy accessing of programs and data kept on the moving-head and/or fixed-head disc memory unit(s) of the RTE system. Because it simplifies storage and access, the RTE File Manager Package (FMP) saves you time in all phases of system operation, from processing of programs through the collection and analysis of data.

Many single-processor or distributed real-time systems are developed to include a very large number of programs and data records. The File Manager organizes all user-defined storage for these records into named files and provides access to these files through operator commands entered at the system console, or in response to program calls. At the same time, the file manager provides safeguards which can be used to assure that no program interferes destructively with the files used by another program. To meet the challenge of file management in the multiprogramming environment of the RTE, the File Manager Package provides a very complete set of file management tools whose use can greatly enhance overall system performance and value.

MULTIPROGRAMMING AND FILE INTEGRITY

Of key importance in a multiprogramming RTE system is avoidance of file conflicts. The RTE File Manager provides a variety of options that permit file access and file security to be optimized, file-by-file, to satisfy system requirements. Up to seven different programs can have the same file open simultaneously, or a file may be opened exclusively to just one program. Simple, easy-to-use security codes let you restrict your files to designated programs and users and to control the nature of their access (read only or read and write). Alternatively, it is also possible to leave access to files unrestricted.

SECURITY

Often the security of the filing system is just as important as its integrity. Data in certain files may be of a confidential nature, necessitating restriction of read, as well as write, access. It may be necessary to assure that data in other files comes from only one source, so only that source can be given write access to those files. The same security codes that can be used to safeguard file integrity also form the basis of a file security scheme that can be as comprehensive as you want to make it.

COMMUNICATION WITH NAMED FILES

The File Manager provides for calling programs and data files by name. This spares you the inconvenience and additional time involved in dealing with the details of track and sector addressing.

REMOTE TERMINAL ACCESS TO FILES

The File Manager is fully compatible with HP distributed systems software that coordinates information transfer in distributed systems. Working through this software, remote terminals can read programs or data from, or write into files administered by the file manager. In this application, the file security coding provisions of the option Y01 File Manager will be particularly valuable in establishing and maintaining a clear organization of the data base on the central system disc.

TYPES OF FILES

An important indication of the scope and versatility of the RTE File Manager is the following list of the different types of files which it handles.

Type Zero Files are non-disc files which can be established for control of peripheral devices through the File Manager, using File Manager commands.

Type One Files are 128-word record length, random-access files. Transfers may access any number of 128-word records. Because transfers to or from type one files are direct, this type of file has the fastest transfer rate. Any file may be opened as a type one file.

Type Two Files are user-selected record length, random-access files. Each transfer is one record long. Transfers are slower than with type one files because they go through a packing buffer.

Type Three, Four, and Five Files are random record length, sequential-access, extendable files, which are packed on the disc. These files differ according to use, as follows:

    a. Type Three Files are usable for data as well as for programs.

    b. Type Four Files are used for source programs.

    c. Type Five Files are used for relocatable programs.

Type Six Files are created by the Save Program (SP) command and are used for disc-resident, executable programs.

Types Seven and Above are random-length, sequential-access, extendable files, which are packed on the disc. The definitions of these are as follows:

    a. Type Seven Files are used for absolute binary code.

    b. File Types with numbers higher than Seven may be defined by the user to distinguish them from the other types of files.

OPERATIONAL FLEXIBILITY

The File Manager responds to a powerful set of operator's commands, which the user can enter from the system console (Table 1). It also provides an access structure that gives program control of file management without the need for operator intervention. To meet changing conditions of system use, on-line changes can be made to such parameters as file names.

A set of precision tools for file access is provided, tools that enable the user to apply creativity in establishing a file system indexed for rapid access; tools worthy of the experienced software systems analyst. The File Manager is open-ended so that the user can start with a simple system and later, with more experience, can evolve a system capable of handling a major data base.

Table 1
File Manager Commands and Calls

Operator Commands	Program Calls ▲	Purpose
MC		Notifies FMP that a cartridge has been mounted
IN		INitializes a disc
LL		Changes assignment of List Logical Unit
LO		Changes assignment of Log Output device
CR	CREAT	CReates a file; does not store data
ST		STores a file; creates a new file
SA		Creates a file and SAves the logical source or load-and-go tracks
MS		Moves a Source file to the logical source tracks
MR		Moves a Relocatable binary file to the load-and-go tracks
SP		Saves an RTE system Program; creates a type six file
RP		Restores a saved Program
DU		DUmps a file; does not create a file
TR		TRansfers input control to another file or to a logical unit
	APOSN	Positions a file to a known record address
	OPEN	Opens a desired file
	FCONT	Sends RTE control request to type zero file
	READF	Transfers one record from file to user buffer
	WRITE	Transfers one record from user buffer to file
	POSNF	Directs next READF/WRITF to a specified record
	RWNDF	Resets file to first record; if type zero file, a rewind request is generated
RN	NAMF	ReNames specified file
	FSTAT	Returns 125 words of Disc Directory
	LOCF	Returns file status, including position of record pointer
	CLOSE	Closes a file
PU	PURGE	PUrges file and directory entry
CL		Cartridge directory Listing
CO		COpies all files on one disc to another disc
LI		LIsts file contents
DL		File Directory Listing
PK		PacKs one or all mounted discs
DC		Requests FMP to logically Disconnect the Cartridge from the system
??		Causes File Manager to type out full error message, explaining error code
SV		Change error printout SeVerity code
EX		Turns off File Manager

▲ Callable from FORTRAN, ALGOL, or HP Assembly language.

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EASY TO USE AND POWERFUL

In the design of the File Manager, great attention was paid to default conditions. This has resulted in calling sequences and commands that are simple and easily employed by the first-time user or the user who has standard requirements. At the same time, the more advanced user can override virtually all of the defaults, giving him complete control over all aspects of the File Manager's operations.

PROGRAM DEVELOPMENT

File Manager Operator Commands facilitate handling of programs through all stages of their conversion from written statements to full operational status. (See example in Figure 1.) Program calls to the File Manager's library of subroutines provide new ways to maximize system capability. The File Manager's flexible input/output to peripheral devices even makes system regeneration easier. For example, it is easy to build a master set of programs on magnetic tape, from which selection can be made for generation of new systems.

Command	Description
*ON,FMGR	Turns on File Manager (to read in and list new source program file).
:ST,5,LIN1	Reads program from paper tape into a program file named LIN1, created by ST.
:LI,LIN1	Lists LIN1 to prepare for editing it.
:MS,LIN1	Moves LIN1 to the Logical Source tracks of the system for the System Editor.
FMGR 015 LS IS ON LU2 TRACK NN	Reply from File Manager indicates logical source pointer.
EX SEND FMGR	Terminates File Manager. Reply to EX command.
*ON,EDIT,1,2,2	Turns on System Editor.
/EDIT: ENTER EDIT FILE	Editor requests edit file.
* * *	Operator enters edit changes.
/EDIT: TRACKS IN NEW FILE /EDIT: NN,XX /EDIT: END OF EDIT RUN	Editor signifies completion of edit run.
*LS,NN,XX	Operator sets Logical Source pointer to the new source file.
*ON,FMGR	Turns on File Manager (to save edited source file).
:SA,LS,LIN2	Saves edited version of LIN1 as LIN2.
:PU,LIN1	Purges the pre-edit version of LIN2.
EX SEND FMGR	Terminates File Manager. Reply to EX command.
*LG,2	RTE System command that allocates two Load-and-Go tracks (for compilation).
*ON,FTN4,2,99	Turns on FORTRAN IV compilation of LIN2.
SEND FTN	Compilation completed.
*ON,FMGR	Turns on File Manager (to save relocatable program just compiled).
:SA,LG,LIN3	Saves relocatable binary program in file LIN3; LIN3 can now be executed as a background disc-resident program.

HOUSEKEEPING AND FILE INTEGRITY

The File Manager will purge files on request* and will repack files on any designated disc, or all files on all on-line discs. An important aspect of such operations which has been dealt with carefully in the File Manager is file integrity. File repacking operations are hazardous on some file management systems, but the option Y01 RTE File Manager protects files during repack so a system shut-down at any critical point in the repacking process could result in failed access to no more than one file. The File Manager also provides the mechanism needed to request and dump to mag tape, a procedure often employed by users who desire the additional security of permanent off-line files, or who need to keep historical records of data on a lower-cost storage medium.

INFORMATION FOR THE USER

The File Manager will list, on request, a cartridge directory, a file directory, and designated files.* Easy access to listings makes the files easy to work with. In addition, the File Manager provides status information and error messages to guide the user.

PERIPHERAL DEVICE CONTROL

A special feature of the option Y01 File Manager, and one offering real convenience to the user, is peripheral device control by means of file manager commands. This is established by a Type Zero File directory entry for the magnetic tape unit, photoreader, punch, line printer, or other peripheral device that is to be controlled in that manner. After this directory entry has been established, the device can be controlled by the file commands *Open, Close, Read, Write,* etc. One important benefit of peripheral control via the file manager is that a program can obtain undivided access to a peripheral in the multiprogramming environment. For example, a program can issue an exclusive open to a type zero file that is designated as a line printer, locking out other cooperating programs until a needed listing is completed. File Manager Operator Commands such as *Store* and *Dump* let you pull a selected file from a magnetic tape unit to core or disc, and then return it, with control over positioning, format, and end-of-file marks. An unusual degree of control is provided, extending even to the specification of mag tape format or Software Input/Output (SIO) format in transfers to or from magnetic tape.

When given the appropriate security code.

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HARDWARE REQUIREMENTS AND ORGANIZATION

Any set of system hardware that is supporting the current version of RTE can support the File Manager Package. Any mass storage arrangement supported now, or in the past, for RTE is acceptable to the File Manager. This includes combinations of fixed and moving-head discs. Most of today's systems use the HP 12960A Cartridge Disc Subsystem, which has one fixed and one removable cartridge. Up to four system drives can be supported on one RTE system, and peripheral and auxiliary discs and off-line storage can extend total capacity. Up to 31 discs can be active at a given time under File Management.

File Management can be laid out to include any contiguous subset of discs in an RTE system. The flexibility of this arrangement leaves to the user's discretion the stipulation of tracks for the file package to suite the application.

ORGANIZED MODULARLY

The File Management Package (FMP) consists of three modules plus communication elements in each user program that works with files.

1. FMGR is a segmented, background disc resident program that handles operator commands and certain system tasks.

2. An FMP Subroutine Library contains file management subroutines that are used in creating, opening, closing, reading, writing, purging, and listing files. These subroutines are called by user's programs. (Within the RTE framework, they are type six or seven library subroutines.)

3. D.RTR is a foreground disc resident (or core resident) program that manages all directories, responding to the needs of FMGR and the functional subroutines for directory modifications.

4. Communications elements external to the File Manager are Data Control Blocks. A Data Control Block is a 144-word segment of a user program, which is active while a file is open and is freed when the file is closed.

CORE REQUIREMENTS

The File Manager is designed to operate in an RTE System with a minimum 16K of core memory. FMGR operates within the same 5K background area that is required for the HP Real–Time Assembler or either of the Real-Time FORTRAN compilers. D.RTR uses a few words more than 1K of disc- or core-resident memory. ID segments use about 200 words more.

FILE MANAGER PACKAGE SUMMARY

The Option Y01 File Manager includes the following software and documentation:

1. RTE File Manager (FMGR)	29033-60001 (3 tapes)
2. RTE File Manager, FMGR Library	29033-60002 (1 tape)
3. File Management Package Listings, excluding FMGR	29033-91001-1 through -91005-1
4. Real-Time Executive File Manager System, Operating and Programming Manual	29033-98000

ORDERING INFORMATION

The option Y01 RTE File Manager may be ordered through your local Hewlett-Packard Field Sales Office under the same terms and conditions as other Real Time Executive software. Your HP systems sales engineer will provide information on price, delivery, and the terms and conditions under which this RTE Software module is supplied.

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