SPERRY UNIVAC
COMPUTER SYSTEMS

PUBLICATIONS REVISION

Operating System/4 (OS/4)

Software Conventions

Programmer Reference

UP-7945 Rev. 3

The SPERRY UNIVAC® Operating System/4 (OS/4) Library Memo announces the release and availability of "SPERRY UNIVAC Operating System/4 (OS/4) Software Conventions Programmer Reference", UP-7945 Rev. 3. This is a Standard Library Item (SLI).

This revision incorporates the following information into the manual:

- Addition of new program (UTJAC job accounting utility) to disk volume label checking (Section 3)
- Addition of information to disk SYSPOOL space management (Section 5)
- Clarification in file control block storage limitations (Section 6)
- Minor deletion in system error communication information (Section 7)
- Incorporation of information from Publications Change Notice 6 (UP-8240.6).

Destruction Notice: This revision supersedes and replaces "SPERRY UNIVAC Operating System/4 (OS/4) Software Conventions Programmer Reference" UP-7945 Rev. 2, released on Library Memo dated November, 1975. Also destroyed is Updating Package A, UP-7945 Rev. 2-A, released on Library Memo dated January, 1977. Please destroy all copies of UP-7945 Rev. 2, UP-7945 Rev. 2–A and their Library Memos.

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1. Introduction

This manual describes various conventions relating to the system processors, such as the assembler, linkage editor, or librarian, that comprise the SPERRY UNIVAC Operating System/4 (OS/4). The conventions described are disc volume and tape label checking, stacking output modules, disc scratch space management, and software error communication.

A basic knowledge of the OS/4 would be helpful in the use of this manual. In particular, knowledge of the following manuals is recommended:

Job control manual, UP-7793 (current version)

Utility and service routines manual, UP-7713 (current version)

Tape librarian manual, UP-7667 (current version)

Supervisor manual for 9400/9480 systems, UP-7689 (current version)

Supervisor manual for 90/60,70 systems, UP-7934 (current version)

Operations handbook for 9400/9480 systems, UP-7871 (current version) or operations handbook for 90/60,70 systems, UP-7937 (current version).

In this manual, information applying specifically to the SPERRY UNIVAC 9400 System tape operating system (TOS) and the tape language processors should be disregarded for OS/4 program utilization for SPERRY UNIVAC 90/60 and 90/70 Systems.

2. Tape Label Processing

2.1. GENERAL

The software programs in the SPERRY UNIVAC Operating System/4 (OS/4) utilize tapes with standard labels. These tapes are prepped with the magnetic tape preparation routine (UTPREP). See utility and service routines manual, UP-7713 (current version) for details on tape prepping and dummy label handling. Prepping affords the user additional volume security when processing tape files.

For the user not requiring this security, tape volumes need not be prepped and may have nonstandard labels. These tape volumes may be defined for this type of processing by including an OPTION NOVOL statement in the control stream. The processing is also conditional on the inclusion of a VOL statement, which determines if dummy tape labels (VOL1 and HDR1) are to be generated. The OS/4 programs supporting this level of tape label processing are:

- Tape patch routine
- Tape and disc librarian
- Tape and disc report program generators
- Tape and disc COBOL
- Tape FORTRAN
- Tape and disc linkage editors
- Tape and disc assemblers*
- UNIVAC 9400/IBM 360 Compatible disc and tape assemblers

  For these assemblers, the OPTION NOVOL statement must be specified when SCR2 is specified as the file name for the source input tape.

- Disc/tape assembler
- Disc module patch routine
- Disc-to-tape utility routine
- Tape-to-disc utility routine

  For these routines, the OPTION NOVOL statement must be specified when processing multivolume files.

- General copy and restore utility routine
- Independent sort/merge utility

The basic assemblers (BASM, BDASM) do not perform standard label processing.

The label processor checks the volume serial number if the OPTION NOVOL statement is not specified, as well as checking the file identification, creation date, and expiration date fields, if specified, on the LBL statement. The OPTION NOVOL statement does not suppress label checking for standard label tape files processed by OS/4 data management. For a discussion of magnetic tape standard label processing, refer to the data management manual, UP-7629 (current version).

2.2. DESCRIPTION OF PROCESSING

The following paragraphs describe the action taken depending on conditions such as the types of tapes and whether or not OPTION NOVOL or VOL statements are specified in the control stream.

2.2.1. Types of Tapes

An output tape is one with the write enable ring inserted, thus allowing the tape to be written on as well as read. An input tape may be read only and is defined by the *filename option in the LFD job control statement.

The various output tapes referred to in this section are defined as follows:

- Prepped tape — A tape that has been processed by the magnetic tape preparation routine (UTPREP).
- Pseudoprepped tape — Scratch and OBJFIL, LDMFIL, or library tapes for which dummy VOL1 and HDR1 labels were generated.
- Used tape — Any tape that has been written on, in any format.
- Blank tape — A tape that has never been written on or has been bulk erased.

All input tapes must have a VOL1 label or a BOOT record as the first block; these labels are always preserved.

2.2.2. OPTION NOVOL Included

If the OPTION NOVOL statement is included in the control stream, nonstandard tape labels and formats can be processed. The user can process dummy tape labels on scratch and OBJFIL, LDMFIL, or library tapes and can process BOOT and IPL records containing a volume serial number of SYSRES. When a VOL statement is also included in the control stream, existing tape labels are preserved, if they conform to either prepped or pseudoprepped format. The specific method of processing depends on the type of output tape.

For prepped tapes, if a VOL statement is included in the control stream and if a VOL1 label or BOOT record is read, the tape labels are preserved; otherwise, dummy VOL1 and HDR1 labels are generated.

For pseudoprepped tapes, a VOL statement should not be included so that dummy VOL1 and HDR1 labels are generated. However, if suitable VOL and LBL statements are included, existing dummy tape labels are preserved if the presence of a VOL1 label is confirmed upon reading.

For blank output tapes, it is recommended that a VOL statement not be included; dummy VOL1 and HDR1 labels will thus be generated. If a VOL statement is included, a check is made of the first block for a VOL1 label. This results in either a data check error or a tape runaway. The console message indicating tape I/O errors requires a U response so that the dummy VOL1 and HDR1 labels may be generated.

If the VOL statement is omitted, dummy VOL1 and HDR1 labels are generated for all types of output tapes.

If the VOL statement is required for one job step but is not required in a subsequent job step, the files must be allocated on a job step basis (e.g., // DVC n,,STEP). Otherwise, the desired result may not be achieved.

Regardless of the type of tape or the type of label information on the tape, no attempt is made to check the volume serial number or any file label information.

Multivolume files created by the system disc dump and restore routine (UTDCTP) are restricted to using only the OPTION NOVOL statement.

2.2.3. OPTION NOVOL Not Included

If the OPTION NOVOL statement is not included in the control stream, tapes are expected to have standard labels and to be prepped in standard format. These tapes may be secured by using either UTPREP or the output of a previous librarian or language processor run. In this latter case, VOL and LBL statements should not be specified.

The types of output tapes that may be used are the prepped and the pseudoprepped. Used and blank tapes should not be used as output tapes.

All tapes must have a VOL1 label or a BOOT record as the first block and an HDR1 label or IPL record as the second block.

For a prepped output tape, if the VOL and LBL statements are included, the volume serial number and file label information, respectively, are checked; otherwise, they are ignored.

Tape labels on all tapes are preserved whether or not a VOL statement is included.

2.2.3.1. Verification of Expiration Date

When the OPTION NOVOL statement is not included in the control stream, the output tapes must have standard labels and formats. If the HDR1 record is missing or in error, the following console message is displayed:

UAM1 did HDR1 ERROR R, U, I

Verification of the expiration date in the HDR1 label is accomplished by comparing it to the date field in the job preamble.

The use of the relative expiration date (Rdddd) and VCHECK on the LBL statement is not supported by the OS/4 software listed in 2.1. Only the data management label processing function supports these functions.

The date field in the job preamble can be set in two ways:

1. The operator keys in the Julian date (yyddd) posted in the system information block. When a job is initiated, job control moves this field to the job preamble.

2. If job control encounters a SET DATE statement in the control stream, the date from this statement is stored in the job preamble, overlaying any previous date stored in the job preamble.

If the Julian date is not keyed in and the SET DATE statement is not included, the date in the job preamble remains blank. When this blank field is compared with the expiration date in the HDR1 label of a prepped output tape, the result is the following console message:

UAM2 did UNEXPIRED FILE R, U, I

This message also appears when a valid preamble date is less than the expiration date in the HDR1 label.

If the message reply is I and no LBL statement is included in the control stream, the expiration and creation date fields in the new HDR1 label are taken from the preamble and set to blank. Subsequent use of this output tape as an input tape results in an error when the blank fields are compared with the creation date in the file control block. Therefore, it is advisable to set the date to avoid such errors.

The HDR1 label is regenerated for output tapes from the expiration and creation dates in the LBL job control statement. If the LBL statement is omitted, the preamble date is used.

2.2.3.2. Library Tapes

Library tapes may be structured in either of two ways:

1. The system library structure begins with a bootstrap (BOOT) record followed by an initial program load (IPL) record.

2. The user library structure begins with a VOL1 label followed by a HDR1 label.

Input or output library tapes in either type of structure can be processed when the OPTION NOVOL statement is not included in the control stream.

If the BOOT record on an output tape in system library structure contains a volume serial number, the volume serial number is checked and processed. If the BOOT record on either an input or output tape in system library structure contains the character string SYSRES as the volume serial number, no further checking is done. The tape is then processed. If no volume serial number is provided, the tape librarian creates a bootstrap record with a volume serial number of SYSRES.

For system library formatted tapes (BOOT/IPL), a valid volume serial number is generated on the output (BOOT) tape by prepping the LIBOUT tape and including a correct VOL statement for that file. If there is a mismatch between the tape volume serial number and the VOL statement volume serial number while running under the OPTION NOVOL statement, a bootstrap record with a volume serial number of SYSRES is created by the tape librarian.

The system library tape format produced by the tape librarian (IPL option on the LIB statement) of the SPERRY UNIVAC 90/60,70 System differs from the BOOT SYSRES or BOOT volume serial number formats of the SPERRY UNIVAC 9400/9480 System.

In the 90/60,70 the volume serial number field within the BOOT record is occupied by a channel command word. Since this field never contains a valid volume serial number, no volume serial number processing is performed by the system. Indicate this to the system as follows:

- Without automatic volume recognition, checking a BOOT tape for volume serial number is avoided by using an OPTION NOVOL statement or by omitting the VOL statement.

- With automatic volume recognition, if a VOL statement is included in the control stream, the OPTION NOVOL statement also must be used. In addition, the volume serial number parameter in the SET IO command also must be entered to achieve the correct tape assignment when the VOL statement is processed. The SET IO command is required to overlay the channel command word, which is posted into the PUB, with the correct volume serial number.

Input and output tapes in the user library structure are checked as follows:

- If a VOL statement is not included in the control stream, the VOL1 label is not checked for a volume serial number.
- If an LBL statement is not included for an input tape, the file identification and creation date are not checked.
- If an LBL statement is not included for an output tape but the Julian date is specified by a SET DATE command, the expiration and creation dates in the Julian date field of the job preamble are stored in the HDR1 label.

2.2.3.3. Special Notes

The first block read on an input library or OBJFIL tape positioned at load point must be a VOL1 label or a BOOT record; otherwise, a file definition error results. If the VOL1 label or BOOT record is present, the tape is positioned properly after the tape mark.

All output tapes are checked for a write enable ring before any initial processing is done. If a ring is not present, the following error message is printed:

UAM3 did NOT WRITE ENABLED R, U

If a magnetic tape unit is accessed when it is not in a ready state, the following console message is displayed:

UAM3 did NOT READY R, U

If the message reply is R, the tape is again tested. If the reply is U, the job step terminates.

If the OPTION NOVOL statement is not included in the control stream and a VOL statement is included in the file definition, the tape is rewound and job control checks the volume serial number. Therefore, the files on which the processors are stacking their output should not be defined redundantly. The LFD OBJFIL statement should be included for the first job step only.

When operating under the OPTION NOVOL statement, the presence of a VOL statement determines that the labels are to be preserved, whenever possible, on output tapes. If a VOL statement is desired in one job step and not in a subsequent step (using the same logical unit number), the files must be allocated on a step basis (e.g., //DVC n,, STEP); otherwise, the desired result may not be achieved.

2.3. SUMMARY

- OPTION NOVOL Statement Included

Conditions		Action Taken				
Tapes	VOL Statement	VolsnChecked	LBL Checked	Tape Labels Preserved	Dummy Tape Labels Generated	VOL1 Label Read
Output: Prepped	Yes	No	No	Yes	No	Yes
	No	No	No	No	Yes	No
Pseudoprepped	Yes, plus LBL statement	No	No	Yes	No	Yes
	No (1)	No	No	No	Yes	No
Used	N.A.	No	No	No	Yes	No
Blank	N.A.	No	No	No	Yes	No
Input: All (2)	No, and no LBL statement	No	No	Yes	No	Yes

NOTES:

(1) It is recommended that VOL and LBL statements not be used. If used, the action indicated is taken.

(2) All input tapes must have VOL1 label or BOOT record as first block.

- OPTION NOVOL Statement Not Included

Conditions		Action Taken				
Tapes	VOL/LBL Statements	VolsnChecked	LBL Checked	Tape Labels Preserved	Dummy Tape Labels Generated	VOL1 Label Read
Output: Prepped	Yes	Yes	Yes	Yes	No	Yes
	No	No	No	Yes	No	Yes
Pseudoprepped	No	No	No	Yes	No	Yes
Used	Not acceptable					
Blank						
Input: All (1)	Yes	Yes	Yes	Yes	No	Yes
	No	No	No	Yes	No	Yes

NOTE:

(1) All input tapes must have VOL1 label or BOOT record as first block.

3. Disc Volume Label Checking

Disc volume labels are processed by the following SPERRY UNIVAC Operating System/4 (OS/4) programs:

Disc assembler

Disc/tape assembler

UNIVAC 9400/IBM 360 Compatible Disc Assembler

Disc FORTRAN

Disc librarian

Disc linkage editor

Disc module patch routine

Disc RPG

Extended COBOL

UTJAS job accounting utility

During initial processing of a disc library file, a basic level of disc label verification is necessary in order to retrieve a library file. This basic level of support includes volume serial number verification and the file identification requirement.

If specified on the LBL statement, the file serial number and the creation date fields are also checked.

NOTE:

Duplicate volume serial numbers for disc volumes are not allowed in the system concurrently.

4. Stacking Output Modules

4.1. GENERAL

The output from all language processors and the linkage editor is stacked whether on tape or disc and whether the output is an object module or a load module. The modules are stacked on tape in sequence, as produced.

4.2. TAPE SYSTEM

All language processors write object modules as output on the logical tape file named OBJFIL. The assembler may also produce load modules as output. The linkage editor writes load modules as output on either the logical tape file named OBJFIL or LDMFIL. After an object module or load module is output, the tape is left positioned at the end of the second tape mark.

A subsequent processor run determines whether the OBJFIL is at load point. If at load point, the processor overwrites the tape with scratch information. Then the object file is created and the tape is left positioned after the second tape mark. If OBJFIL is not at load point, scratch information is written beyond the object modules on the tape. Then the tape is positioned backwards over the scratch information and the tape mark, and the object file is written following any previous object code. If SCR3 is defined to the assembler, SCR3 is used for scratch processing rather than OBJFIL.

If the linkage editor obtains input from OBJFIL, it ensures that the file is positioned past the end sentinel, leaving OBJFIL in the same position as if a processor had been run.

The tape should be rewound at end-of-job time. If either of these files is positioned at load point prior to writing a scratch file or when producing a final output, previous modules on these tapes will be overwritten. The same result may occur if a file is redundantly defined (i.e., LFD statement) in a later job step, or if the OPTION NOVOL statement is specified in earlier job steps and is omitted in a later job step.

The FM,2 option may be specified with the MTC job control statement or operator command to position OBJFIL or LDMFIL forward over previously compiled or linked modules to preserve stacked output.

The format of OBJFIL or LDMFIL containing data (object or load modules) is:

VOL1

HDR1

tape mark

{ object module 1 / load module 1 }

{ object module 2 / load module 2 }

.

.

.

{ object module n / load module n }

tape mark

end sentinel

OBJFIL may contain load modules produced by the assembler. LDMFIL contains only load modules.

4.3. DISC SYSTEM

All language processors and the linkage editor write module output on the disc in a logical file named SYSPOOL. A temporary file is established within SYSPOOL which is known as the module complex library (MCL). The MCL is established automatically by the first language processor or linkage editor job step in a job. Subsequent processor or linkage editor job steps within a job automatically stack module output in the MCL. All data within SYSPOOL (including the MCL) exists only during the running of a job and is released at job termination time. Therefore, to preserve a module, it must be moved to a more permanent storage area on disc or may optionally be stored on tape.

4.3.1. Disc Stacked Output

Prior to job termination, all module output in the MCL is moved to a permanent library file on disc by means of the disc librarian. The control statements to accomplish this operation are included in the control stream as an additional job step following the execution of the language processor or the linkage editor.

4.3.2. Tape Stacked Output

The facility also exists in the disc system to preserve modules in the MCL by writing them to tape through the use of the OUT=(T) option of the PARAM statement. This level of support is provided by the disc assembler, disc linkage editor, and disc RPG.

The output modules are stacked on tape in a manner similar to that described for a tape system (4.2). The tape is initially generated with the appropriate header labels and left positioned beyond the second tape mark. The processors using this facility then backfile over the tape mark, write object code on the tape, and leave the tape positioned beyond the second tape mark for the next processor. The tape may be positioned manually through the use of the MTC job control statement or operator command (4.2).

5. Disc SYSPOOL Space Management

5.1. GENERAL

Module output generated by language processors and the linkage editor is written on disc in a logical file named SYSPOOL. Initial space allocation for SYSPOOL is done by the disc mapping program (disc mapping manual, UP-7833 (current version)). The space allocated to SYSPOOL is used by the processors and linkage editor for temporary scratch space and for the module complex library (MCL).

If a job using SYSPOOL does not return control to job control so that the job may be terminated in an orderly manner, the SYSPOOL area being used by this job must be remapped by means of the disc mapping program (DACMAP). When job control displays the message JT01, the SYSPOOL allocation is reclaimed by the system, and the SYSPOOL area does not require remapping. An abnormal termination also produces the JT01 message, and the SYSPOOL area does not require remapping.

5.2. SIZE DETERMINATION FACTORS

Factors in determining the permanent size of the disc MCL for all processors and of the disc scratch space when using disc RPG, disc FORTRAN, and extended COBOL have been provided. MCL contains the object output of the language processors and the linkage editor and space is allocated during the first job step of a language processor or linkage editor job step. The size factor, to be effective, must be specified for that step.

The size factor is a 1-byte field generated through the system generation procedure. It is comprised of two 4-bit multipliers; the first multiplier is used for scratch files, and the second multiplier is used for the MCL. If positional parameter 5 (SYSGEN) of the SIB macro instruction is not specified, the default factor of X'11' is generated. The multipliers are stored in the system information block in the location specified as SB$COBOP.

The multiplicative factor in the SIB macro instruction may be overridden for a given job or job step by including an OPTION statement with the following parameters:

//△OPTION△ [{MCL / SCR}],n [, {SCR / MCL},n]

where:

SCR
Specifies that the following parameter is the multiplicative factor for the SCRATCH file allocation in SYSPOOL used by the disc processors (FORTRAN, COBOL, RPG). This parameter is not used by the disc/tape and disc assemblers.

MCL

Specifies that the following parameter is the multiplicative factor for the MCL file allocation in SYSPOOL used by the disc processors (FORTRAN, COBOL, assembler, RPG) and the disc linkage editor.

n

Is the designated multiplicative factor. It must be a decimal number from 1 through 15.

After the space for the MCL has been allocated, the assembler utilizes all the remaining SYSPOOL cylinders for scratch space. The linkage editor requests the same amount of scratch space as allocated to the MCL; to increase the scratch space, the MCL multiplicative factor must be specified. The MCL multiplier is applied to the standard MCL disc request (five cylinders for the UNIVAC 8411 Disc Subsystem or two cylinders for the UNIVAC 8414 Disc Subsystem). For example, if the first language processor to request MCL space encountered a multiplier of 3, the size of the MCL would be 15 cylinders (8411 disc) or 6 cylinders (8414 disc). This facility may be used to overcome MCL overflow and for scratch file overflow. A multiplicative factor of 3 may be obtained by an OPTION MCL,3,SCR,1 statement or an SIB multiplier of X'13'.

The MCL parameter specification must be present in the control stream before the first processor using MCL is executed; otherwise, the system default factor established at system generation time is used. This option is job-oriented and should not be specified more than once.

The SCR parameter specification is job-step-oriented and may be respecified for each step of a job. The specified factor remains in effect until superseded by a subsequent OPTION SCR statement. This factor is not reset to the system default value for each job step.

If additional SYSPOOL volumes are available and can be assigned, disc language processors will allocate scratch files more efficiently. Two, three, or four distinct SYSPOOL volumes may be utilized to spread out the work files. Decreased disc arm movement results from alleviating the conflicts occurring when accessing work files which reside on disc volumes with other work files. The net result is faster compilations. Additional SYSPOOL volumes (more than two) may be defined for the following disc language processors: FORTRAN (DFOR), RPG (DRPG), and extended COBOL (COBOL).

If elements placed in the MCL library by the different processors are to be used in later job steps, then once SYSPOOL is allocated to specific devices for a job, it must not be reallocated via job control or deallocated by the FREE statement or FREE macro instruction.

A SYSOOL file that is to be allocated on an 8424/8425 disc volume is restricted to any 220 cylinders of the first 256 cylinders of that volume in a non-standard, multijobbing system. In an extended, multi-jobbing system, it is restricted to any 210 cylinders of the first 256 cylinders of the volume.

A single SYSPOOL volume satisfies the work file requirements for the disc language processors (excluding the basic processors such as BDASM, BDFOR, etc.). This feature may be activated through use of the supervisor SIB macro instruction (SSP parameter).

The disc linkage editor can run unconditionally with one SYSPOOL volume.

The disc and disc/tape assemblers utilize a maximum of two SYSPOOL volumes.

The disc sort work files (DM01, DM02,,,DM0n) must be assigned to separate SYSPOOL volumes.

The SYSPOOL space available to any given job may be limited via the DACMAP LIM statement. For a discussion of this system feature, refer to the disc mapping program manual, UP-7833 (current version).

6. File Control Block Storage Limitations

For each file defined in the control stream by an LFD statement, a file control block of 141 bytes is generated. The file control block contains information from VOL and LBL statements, as well as the device assignments for the file. The information must be available to data management during open, close, and end-of-volume procedures and, therefore, should not be destroyed by those programs using data management functions.

In a tape operating system, the file control blocks are stored in high order main storage. This must be taken into consideration when space requirements are being calculated for a program. In a disc operating system, the file control blocks are stored on the SYSRES disc in the system pool of temporary storage (SYSPOOL).

For additional information on file control blocks, see the job control manual, UP-7793 (current version).

7. System Error Communication

7.1. GENERAL

The user programmer switch indicator (UPSI) is the last byte of the 12-byte communication region in the job preamble. The two most significant bits of the UPSI byte are used to communicate error conditions to the user. The user can test the setting of these two bits by means of the SKIP job control statements and thus control the execution of job control statements based on error conditions that arise during the execution of certain software programs.

The UPSI byte is cleared by job control at job initialization. The user can set or reset any of the eight bits in the UPSI by means of the SET UPSI statement. The user tests the setting of these bits with the SKIP statement. See the job control manual, UP-7793 (current version) for an explanation of the SKIP and SET UPSI statements.

The following software programs set the UPSI bits:

Tape and disc assemblers (ASM, DASM)

Disc/tape assembler (DTASM)

UNIVAC 9400/IBM 360 Compatible Tape and Disc Assemblers (ASMC, DASMC)

Tape and disc linkage editor (LINK, DLINK)

Tape and disc librarian (LIBS, LIBUPS, DAPS)

Tape and disc COBOL (COBOLB, COBOL)

Tape and disc FORTRAN (FOR, DFOR)

Tape and disc RPG (RPG, DRPG)

Disc module patch routine (UTDPCH)

Tape patch routine (UTTPCH)

General copy and restore utility routine (UTGCRS)

Independent sort/merge utility (SORT)

The system software saves the initial contents of the UPSI byte. If there are no errors, the initial setting of the UPSI byte is restored.

7.1.1. Bit 0, UPSI Byte

The most significant bit of the UPSI byte (bit 0 or X'80' bit) is set by a processor if the output module is not completely produced. In general, errors that cause bit 0 to be set are:

1. Any external condition that results in aborting a software program prior to normal completion (e.g., I/O errors that are unrecoverable).

2. Any program controlled abort which occurs prior to normal completion (e.g., error in PARAM statements, internal processing errors, or file control block not defined for a required file).

In addition, the software programs set bit 0 for the following specific errors:

- Assembler

  Failure to generate an output module (e.g., early termination due to an I/O failure).

- RPG

  Error notes 000, 040, 080, 098, 209, 210, 212, 222, 227, and 238. (See report program generator manual, UP-7707 (current version) for an explanation of these error notes.)

- FORTRAN

  All CSECT overflow messages and the message TOO MANY EXTERNAL SYMBOL ID's.

- COBOL

  Any abnormal termination, the inability of the compiler to produce a complete or correct object module, and console messages CC01, CC02, CC03, CC07, CC08, CC09, CC10, CC11, CC12, CC13, CC14, CC15, CC17, CC27, and CC28.

- Linkage Editor

  Fatal I/O errors or incomplete file definition.

- Disc/Tape Librarian

  Block number errors encountered on LIBIN/LIBOUT (LIBS) or LIBIN (DAPS), or all disc files (LIB1,...,LIB5) closed because of I/O errors.

- Tape Patch

  Fatal I/O error encountered.

- General Copy and Restore Utility Routine

  Fatal I/O error encountered, resulting in output of incomplete file.

- Independent Sort/Merge Utility

  Any fatal error detected during initialization or during sort.

7.1.2. Bit 1, UPSI Byte

Bit 1 or X'40' bit of the UPSI byte is set by a processor if the output module is not produced or if an error occurs that prohibits normal execution of the program. The software programs also set bit 1 for the following specific errors:

- Assembler

  Any nonacademic error message. (See assembler manual, UP-7935 (current version).)

- RPG

  Error notes other than those listed for bit 0 of the UPSI byte (7.1.1).

- FORTRAN

  Any diagnostic message.

- COBOL

  Any compiler diagnostic message, except those with severity codes of P or C.

- Linkage Editor

  Any diagnostic message (error or warning).

- Disc/Tape Librarian

  Any error detected during a library update.

- Tape Patch Routine

  Any diagnostic problems that result in ignoring a control statement.

- Disc Module Patch Routine

  Fatal I/O errors, incomplete file definition, block count error.

- Disc Space Management Routine

  Any attempt to scratch a nonexistent file when the CONT parameter is specified in the SCRATCH control statement. ←

- General Copy and Restore Utility Routine

  Any diagnostic message.

- Independent Sort/Merge Utility

  Any diagnostic message.

7.1.3. Bit 2, UPSI Byte

Errors that cause this bit to be set are:

- COBOL

  Any compiler diagnostic message with a severity code of C.

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