SOFTWARE ●PERATING PROCEDURES

GENERATING DOS-M

PREREQUISITE SOP MODULES:

Software Input/Output System Configuration (5951-1374)

REFERENCE MANUALS:

Moving-Head Disc Operating System (02116-91779)

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GENERATING DOS-M

The Moving-Head Disc Operating System (DOS-M) is a disc-based software system for the batch processing of user jobs and the maintenence of disc files. DOS-M must be generated into usable form on the disc before user jobs can be processed. This SOP module consists of several procedures and an appendix. The procedures should normally be followed in order although each is self-contained.

PROCEDURE 1
USING DSGEN TO CREATE DOS-M

DSGEN (the DOS-M Generator) is a stand-alone program that generates a system to fit the user's core memory size, I/O equipment, and programming needs. The relocatable program modules of DOS-M (in paper tape, magnetic tape, or disc) are input to DSGEN. Output from DSGEN is a configured system disc on any active subchannel of the disc controller.

To accomplish this, DSGEN requests certain information from the user. DSGEN then accepts the relocatable program modules to be included in the system, determines where they belong in core or on the disc, relocates them into absolute format, and stores them on the disc. DSGEN also creates I/O tables by identifying each I/O device and its associated driver routine, and establishing procedures for interrupt processing on each channel.

DSGEN is an absolute program, loaded into core by the Basic Binary Loader (BBL). Since DSGEN is independent of the DOS-M which it generates, the I/O operations of DSGEN require SIO Drivers.

Using other standard Hewlett-Packard software, the user can create a magnetic tape file of the relocatable program modules to speed up the program loading phase of system generation. (See *PREPARE TAPE SYSTEM*, 02116-91751.) Alternatively, the modules can be stored in relocatable form on the disc for even more convenient system generation.

DSGEN operates on the same minimum configuration as that required for DOS-M.

Operating Instructions

The operation of DSGEN involves four phases:

1. INITIALIZATION PHASE. DSGEN requests specifications for the DOS-M, including description of available disc space, memory, time base

generator channel, system generation code, computer identification, system and user disc subchannel, and program input devices.

- PARAMETER INPUT PHASE. Parameters to change EXEC modules or drivers from disc to core-resident may be entered. The programs' NAM records are already set for a minimum core system except that DVRØØ should be changed to disc-resident. DISCM, $EX3Ø, (if EFMP used), DVR31 (moving-head disc driver) and DVRØ5 (teleprinter driver) must be core-resident.

- DISC LOADING PHASE. DSGEN requests a specification of the base page linkage, and begins loading programs onto the disc. Systems programs (i.e., the modules of DOS-M) are loaded first, after which DSGEN requests information for the equipment table, device reference table (logical unit table), and interrupt table and proceeds to load the rest of the programs onto the disc.

To execute DSGEN and configure DOS-M, follow these steps:

- Turn on all equipment, and unprotect the disc.
- Configure DSGEN with the SIO Teleprinter Driver and the tape reader and magnetic tape reader and magnetic tape drivers (if desired). Load the configured DSGEN through the tape reader using the Basic Binary Loader. DSGEN must be loaded *before* the magnetic tape driver; otherwise an ERR01 *error* occurs.
- Start DSGEN at location $1ØØ_8$. DSGEN begins the initialization phase.

See the SOFTWARE INPUT/OUTPUT SYSTEM CONFIGURATION Module (5951-1374) of the *SOFTWARE OPERATING PROCEDURES* manual.

INITIALIZATION PHASE

During the initialization phase, DSGEN requests information necessary to begin generating the DOS-M. After each question is printed, the operator responds by giving the required information terminated by a *return linefeed*. The

following responses are typical. (The operator responses are only examples, actual responses should be appropriate to the particular system being generated.)

Initialization Phase 3

1. DSGEN requests a decimal system generation code. This code is written in the label field of the system disc for identification.....SYS GEN CODE?

   Operator responds.....79

2. DSGEN requests the octal channel number (select code) of the disc controller.....SYS DISC CHNL?

   Operator responds with the high priority (low number) channel.....10

3. DSGEN requests the number of sectors per physical track on the disc. This is half the number of sectors per logical or software track.....# SECTORS/TRACK?

   Operator responds with 12 for the 2870 disc or
   23 for the 2883.....12
   or 24 for the 7900 disc.....
   or 24 for the 7900/7901 disc.

4. DSGEN requests the number of tracks (decimal) on the system disc.....SYS DISC SIZE?

   Operator responds with a decimal number less than or equal to 200. (A response of 200 leaves three tracks as spares. A response less than 200 leaves extra tracks as spares.).....200

5. DSGEN requests the number of drives on the system.....# DRIVES?

   Operator responds with 1 or 2 (2883 disc) or between 1 and 4 inclusive (2870 disc)....3

6. DSGEN requests the decimal number of the first track on the system disc which is available to DOS-M.....FIRST SYSTEM TRACK?

   Operator responds.....*Ø*

7. DSGEN requests the decimal number of the first sector available to DOS-M.....FIRST SYSTEM SECTOR?

   Operator responds. (The system area cannot begin before track 0, sector 3).....*3*

8. DSGEN requests the subchannel number of the system disc.....SYS DISC SUBCHNL?

   Operator responds with a number between 0 and 7.....*Ø*

   On a 7901 Disc, only odd-numbered subchannels are available.

9. DSGEN requests the subchannel number of the user disc. (This may be the same as the system disc.).....USER DISC SUBCHNL?

   Operator responds with a number between 0 and 7. (System efficiency increases if the user disc is on a different drive from the system disc.).....*2*

10. DSGEN requests the I/O channel (select code) of the Time Base Generator.....TIME BASE GEN CHNL?

    Operator responds with an octal number or Ø if the time base is not present.....*Ø*

11. DSGEN asks whether the computer is a 2114 or not...IS 2114?

    Operator responds with YES or NO.....*YES*

12. DSGEN requests the last word of available core memory in octal.....LWA MEM?

    Operator responds.....*17677*

13. DSGEN asks whether :SS directives are to be allowed in the system.....ALLOW :SS?

    Operator responds either YES or NO.....*YES*

14. DSGEN requests the type of first input unit for relocatable program modules.....PRGM INPT?

    Operator responds with PT (for paper tape), TY (for teleprinter), DF (for disc file), or MT (for magnetic tape; see PTS manual, 02116-91751).....*PT*

15. If the previous answer is DF and an SIO Magnetic Tape Driver is not present, DSGEN requests the sub-channel number of the disc containing the relocatable program modules.....INPUT DISC SUBCHNL?

    Operator responds with the appropriate subchannel number. The subchannel must contain a disc (prepared by a pre-existing DOS-M) whose user area contains only relocatable modules of DOS-M. By specifying PT to the next question (LIBR INPT?) the operator can include programs from the paper tape reader in addition to those on the disc file.....*3*

16. DSGEN requests the type of optional input unit for relocatable program modules.....LIBR INPT?

    Operator responds with PT, TY, DF or MT.....*PT*

    NOTE: Any type of program can be entered through the Program Input Unit or the Library Input Unit.

17. DSGEN requests the type of input unit for the parameters, input phase.....PRAM INPT?

    Operator responds with PT or TY.....TY

When DSGEN finishes the initialization phase, the computer halts.

PROGRAM INPUT PHASE

During the program input phase, DSGEN accepts relocatable programs from the Program Input Unit and Library Input Unit specified during the initialization phase. The operator selects the input device by setting switch register bits Ø-1 ($ØØ_2$ for the Program Input Unit, or $1Ø_2$ for the Library Input Unit), and places the programs in the input device. Main programs must enter prior to their segments. DISCM should be the first module loaded.

The suggested order of tape input is:

DOS-M CORE-RESIDENT SYSTEM (DISCM)
DOS-M I/O DRIVERS (DVRØ5, DVRØ1,...ETC)
DOS-M EXEC MODULES ($EXØ1...)
EFMP EXEC MODULES (IF DESIRED-$EX3Ø...)
DOS-M JOB PROCESSOR/FILE MANAGER (JOBPR)
DOS-M RELOCATING LOADER (LOADR)
DOS-M ASSEMBLER (MAIN CONTROL, SEGMENTD, SEGMENT1,....)
DOS-M FORTRAN (MAIN CONTROL, PASS 1,...)
DOS-M EFMP UTIL (IF $EX3Ø... AND FORTRAN IV LIBRARY ARE INCLUDED)
RTE/DOS ALGOL
RTE/DOS FORTRAN IV LIBRARY OR RTE/DOS BASIC FORMATTER
RTE/DOS RELOCATABLE PROGRAM LIBRARY (EAU OR NON-EAU)

Any relocatable user programs to be made a permanent part of DOS-M.

NOTE: If the FORTRAN IV Library is to be included in an 8K system, certain rules must be followed:

1. *The system must be generated without any compilers or an assembler.*
2. *A magnetic tape SIO driver cannot be used with DSGEN.*
3. *The compilers and assembler must be loaded into the system during operation (using the Loader).*

Load the first input module and start the computer executing. When entering paper tape, the message "*EOT" is printed whenever an end-of-tape occurs. The computer halts. Program input can be switched back and forth between the input units by varying the switch register bits between $ØØ_2$ and $1Ø_2$ before starting the computer.

To terminate the program input phase, the user must set switch register bits to $Ø1_2$, and start the computer. If there are no undefined externals, this message is printed on the system teleprinter:

NO UNDEF EXTS

If there are undefined externals, the following message is printed:

UNDEF EXTS

The externals are listed one per line and the computer halts. External references are satisfied by loading more programs. The user must set switch register bits to $ØØ_2$ (for Program Input Unit) or $1Ø_2$ (for the Library Input Unit) and start the computer executing. If the externals are to be left unsatisfied, set the switch register bits to $Ø1_2$ and start the computer executing.

NOTE: $EX3Ø through $EX33 (the EFMP EXEC modules) are not listed when missing.

PARAMETER INPUT PHASE

During the parameter input phase, the operator can change some modules from disc to core-resident. (If an I/O driver is changed from disc-resident (type 4) to core-resident (type Ø), the associated EQT entry must include the R parameter.) Since DVRØØ is a DOS driver, it is distributed as a core-resident driver; it should be changed to disc-resident if DVRØ5 is included in DOS-M. Any unnecessary I/O drivers must be eliminated at this time. DVRØ5, DVR31, DISCM, and $EX3Ø are distributed as core-resident modules; they must not be changed to disc-resident.

Each parameter record is of this general form:

name,type

where *name* is the name of the program

type is the program type code;

Ø - System core-resident

1 - System disc-resident EXEC modules

3 - User disc-resident main

4 - Disc-resident I/O driver

5 - User segment

6,7 - Library

EXEC modules and drivers that are often used may be changed from disc to core-resident. The functions of the EXEC modules are:

Module Name	Called by User EXEC Request Codes	Function
$EXØ1	16	Disc Work Tracks Status.
$EXØ2	17	Disc Work Tracks Limits.
$EXØ3	6	Program Completion.
$EXØ4	7	Program Suspension and associated messages.
$EXØ5	8,1Ø	Program Main or Segment Search (Note: $EXØ5 calls $EX1Ø)
$EXØ6	18	User File Name Search
$EXØ7	11	Current Time Processor
$EXØ8	4 (RT)	Real Time Disc Allocation
$EXØ9		:EQ Processor
$EX1Ø	8,1Ø	Load and Execute Main Program or Segment (Note: See also $EXØ5)
$EX11	14,15	System File Name Search (Note: Used for File Read/Write)
$EX12		System Startup
$EX13		Error Message Processor
$EX14		:UP, :DN, :LU Processor
$EX15		Abort and Post Mortem Dump
$EX16		:GO Parameter Processor
$EX17	23	:UD Processor

Module Name	Called by User EXEC Request Codes	Function
$EX18	1,2,3 14,15	I/O Initiation Processor (Note: See also $EX11)
$EX19		:IN Processor
$EX2Ø		Disc Parity Processor

Functions of EFMP EXEC Modules

$EX3Ø	-	Always core-resident (common routines and values).
$EX31	-	DEFINE, CREATE, DESTROY, OPEN, CLOSE
$EX32	-	READ, WRITE, RESET, STATUS, CHANGE
$EX33	-	COPY, REPACK

When EXEC modules are made core-resident, certain associated subroutines must also be changed to be core-resident. Several EXEC modules use $ADDR:

$EXØ1
$EXØ2
$EXØ6
$EXØ7
$EXØ8

The following EXEC modules use $LBL:

$EX17
$EX19

The following EXEC modules use $SRCH:

$EXØ5
$EXØ6
$EX11

These EXEC modules use ASCII:

$EXØ4
$EXØ9
$EX13
$EX14
$EX15

To end the parameter input phase and continue on to the disc loading phase, the operator enters "/E" instead of a parameter record.

DISC LOADING PHASE

DSGEN asks two questions before entering DISC LOADING PHASE.

1. DSGEN requests the estimated number of system linkages required in base page.....# SYSTEM LINKS?

   Operator responds with a decimal number. (The more modules that are core-resident the more links are needed, 13Ø should be the minimum response.).....*13Ø*

2. DSGEN requests the estimated number of user linkages required in base page.....# USER LINKS?

   Operator responds with a decimal number. (Since the loader requires approximately 32Ø linkages, 32Ø should be the minimum number entered.).....*32Ø*

NOTE: If the system requires more linkages than you have assigned, it takes them away from the user link area. If the total of the two responses overflows base page (>677$_{10}$), the questions are repeated. If DOS-M does not need all the system links it adds them to the user links.

Figure DOSM-1 shows the relative location of the various core areas. Loading of the absolute, resident supervisor begins after the establishment of the user and system linkage areas. As each program is loaded, DSGEN prints a memory map giving the starting locations and, if switch register bit 15 is on, the entry points for all main programs and subroutines. (Subroutines are indented two spaces, and entry point addresses are preceded by an asterisk.)

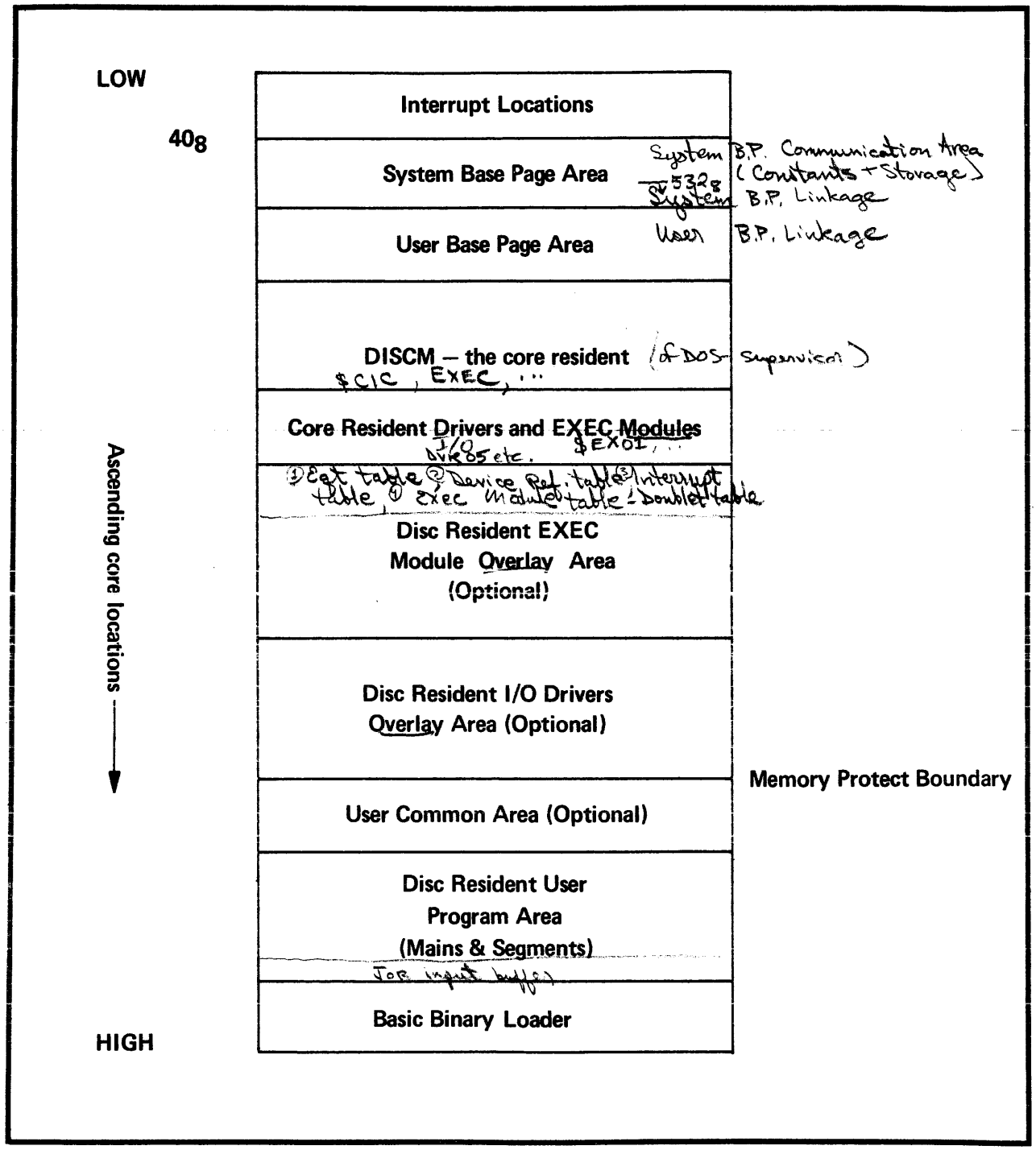

Figure DOSM-1. Core Allocations in DOS-M

Input/Output Tables

Next, DSGEN generates the three I/O tables: equipment table, device reference table (logical unit table), and the interrupt table.

3. DSGEN requests the equipment table entries.....EQUIPMENT TABLE ENTRY?

Operator responds with a series of one line EQT entries, which are assigned EQT numbers sequentially from one as they are entered. The EQT entry relates the EQT number to an I/O channel and driver, in this format.....*n1,DVRnn [,D] [,R][,U]*

where *n1* is the I/O channel (select code) (lower number if multi-board),
DVRnn is the driver name (*nn* is the equipment type code).
D, if present, means DMA channel required,
R, if present, means driver is core-resident (must be type 0)
U, if the physical subchannel number.

Operator terminates the equipment table entries by typing...../E

Here is a sample Equipment Table:

```
* EQUIPMENT TABLE ENTRY
10,DVR31,D,R      (EQT entry #1 = disc)
12,DVR23,D        (EQT entry #2 = magnetic tape)
14,DVR05,R        (EQT entry #3 = special teleprinter)
15,DVR01          (EQT entry #4 = photoreader)
16,DVR02          (EQT entry #5 = tape punch)
17,DVR12          (EQT entry #6 = line printer)
/E                (End of table)
```

4. DSGEN requests the logical unit assignments for
the device reference table.....DEVICE REFERENCE TABLE?

For each logical unit number, DSGEN prints.....*n*=EQT#?

Operator responds with an EQT entry number (*m*)
appropriate to the standard definition of *n*.
Numbers above 6 may be assigned any EQT entry
desired.....*m*

Operator terminates entry by typing...../E

Here is a sample Device Reference Table:

```
* DEVICE REFERENCE TABLE

1     = EQT #?   (System teleprinter on channel 14, EQT #3)
3
 2    = EQT #?   (Disc on channel 10, EQT #1)
1
 3    = EQT #?   (Disc on channel 10 EQT #1 -- reserved for system use)
1
 4    = EQT #?   (Standard punch unit on channel 16, EQT #5)
5
 5    = EQT #?   (Standard input unit on channel 15, EQT #4)
4
 6    = EQT #?   (Standard list unit on channel 17, EQT #6)
6
 7    = EQT #?   (Standard unit definable by user)
2
 8    = EQT #?   (End of table)
/E
```

NOTE: The number of responses given here determines the number of logical units allowed in the system. To allow unassigned logical units for the user, respond with a Ø to as many questions as units are desired.

5. DSGEN requests the interrupt table entries.....INTERRUPT TABLE

   Operator responds with an entry for each I/O location which may interrupt, in ascending order, and in this format.....*n1, n2*

where *n1* is the octal channel number (high number -- lower priority -- for two board interfaces) between 10_8 and 37_8 inclusive (must be entered in ascending order), and

n2 is a decimal EQT entry number.

Operator terminates entry by typing...../E

Here is a sample Interrupt Table:

```
* INTERRUPT TABLE
11,1          (Channel 11 linked to EQT #1)
13,2          (Channel 13 linked to EQT #2)
14,3          (Channel 14 linked to EQT #3)
15,4          (Channel 15 linked to EQT #4)
16,5          (Channel 16 linked to EQT #5)
17,6          (Channel 17 linked to EQT #6)
/E            (End of table)
```

NOTE: The EQT numbers need not appear in numerical order. This order is determined by refereing back to the Equipment Table. The octal channel numbers, however, must be in ascending sequence.

Following the completion of the I/O tables, DSGEN loads the disc-resident executive modules (if any), and the disc-resident I/O drivers (if any).

6. DSGEN reports the last address plus 1 of the supervisor.....LWA SYS xxxxx

7. DSGEN requests the first word address of the user program area.....FWA USER?

   Operator responds with an octal address greater than or equal to *xxxxx*. In an 8K computer, this response must be less than or equal to $73\emptyset\emptyset_8$ (This option is provided so that user programs can start on a page boundary, if desired).....*nnnnn*

   DSGEN proceeds to load all user main programs and segments onto the disc with memory map listings as described for system programs.

8. When system generation is complete, DSGEN prints...*SYSTEM STORED ON DISC

9. Protect the disc. DOS-M may now be bootstrapped into memory (procedure 4).

Restart

During any of the phases the operator can restart that phase if any error occurs by restarting DSGEN at location 100_8.

TYPICAL SYSTEM GENERATION

The following is a listing from the generation of a 16K DOS-M (using the HP 2870 Disc Drive) with the relocatable programs modules coming from a disc file.

```
SYS GEN CODE?
ØØØØ

SYS DISC CHNL?
14

# SECTORS/TRACK?
12
```

```
SYS DISC SIZE?
200

# DRIVES?
1

FIRST SYSTEM TRACK?
0
FIRST SYSTEM SECTOR?
3

SYS DISC SUBCHNL?
0

USER DISC SUBCHNL?
0

TIME BASE GEN CHNL?
0

IS 2114?
NO

LWA MEM?
37677

ALLOW :SS?
YE

PRGM INPT?
DF
INPUT DISC SUBCHNL?
1

LIBR INPT?
PT

PRAM INPT?
TY

*EOT
*EOT
*EOT
*EOT

NO UNDEF EXTS

ENTER PROG PARAMETERS
$EX05,0
$EX06,0
$EX11,0
$EX18,0
$SRCH,0
$ADDR,0
```

# of tracks

none allowed

(switch reg 00)
disc

(switch reg 10)
paper tape

initialization phase

program input phase
Some additional modules were entered via paper tape.

to input various programs
Press run w/ switch reg set
to 0 - input from prgm inpt (DF in this ex.)
10 input from libr inpt (PT in this ex.)
01 - terminate

core resident

parameter input phase

```
DVR00,4          (disc resident I/O drivers)
/E

# SYSTEM LINKS?
149

# USER LINKS?
528

SYSTEM
DISCM       02000   > 2173
$EX05       04173   >  205
$EX06       04400   >   37
$EX11       04437   >  164
$EX18       04623   >  460
$ADDR       05303   >   15
$SRCH       05320   >  300
DVR05       05620   >  245
DVR31       06065   >  517

* EQUIPEMNT TABLE ENTRY
                    I/O channel-I/O slot
006604  11,DVR00                17 wds/entry x 6 = 146₈ wds
        13,DVR01
        14,DVR31,D,R
        16,DVR02
        17,DVR05,R  (driver core resident)
        22,DVR23,D  (DMA channel required)
        /E

006752  * DEVICE REFERENCE TABLE
                    1 wd/entry x 8 entries = 10₈ wds
         1 = EQT #?
        5
         2 = EQT #?
        3
         3 = EQT #?
        3
         4 = EQT #?
        4
         5 = EQT #?
        2
         6 = EQT #?
        1
         7 = EQT #?
        0
         8 = EQT #?
        6
         9 = EQT #?
        /E
```

$6762

* INTERRUPT TABLE — actual table created:

14_{10} mem. locs. = 16_8 loc.

11,1	1st loc $6	0	15	addr. of EQT entry	3
13,2	7 (DMA)	0	16	" " " "	4
15,3	10	0	17	" " " "	5
16,4	11	addr. of EQT entry 1	20	0	
17,5	12	0	21	0	
23,6	13	addr. of EQT entry 2	22	0	
/E	14	0	23	addr of EQT entry 6	

07000 Exec module table

40 2 wds/disc resident exec module (16 disc resident exec modules) $2 \times 16 = 32_{10} = 40_8$

EXEC SUPERVISOR MODULES - disc resident

07040 — starting loc. of disc resident exec module - overlay area

$EX01	07040	
$EX02	07040	
$EX03	07040	
$EX04	07040	315
ASCII	07355	
$EX07	07040	
$EX08	07040	
$EX09	07040	261
ASCII	07321	
$EX10	07040	
$EX12	07040	
$EX13	07040	356
ASCII	07416	
$EX14	07040	341
ASCII	07401	
$EX15	07040	300
ASCII	07340	
$EX16	07040	
$EX17	07040	367
$LBL	07427	73
$EX19	07040	
$LBL	04616	
$EX20	07040	
(ASCII		

7040 + 462 = 7522

largest exec module here is $EX17 w/sub $LBL: $367_8 + 73_8 = 462_8$ loc.

I/O DRIVER MODULES - disc resident

DVR01	07522 — start of disc resident I/O driver overlay area
DVR02	07522
DVR23	07522
DVR00	07522

LWA SYS 10336 — last addr + 1 of supervisor

$10335 - 7522 = 613 = DVR23$

FWA USER? — 1st wd of user prog. area.
11000

USER SYSTEM PROGRAMS

LOADR	11000
JOBPR	11000
ASMB	11000
ASMBD	16120
ASMB1	16120
ASMB2	16120
ASMB3	16120
ASMB4	16120
ASMB5	16120
ALGOL	11000
.EAU.	23275
%WRIT	23345
SREAD	24043
DUMRX	24576
.OPSY	24662
ALGL1	24722
FTN	11000
FTN01	12127
SREAD	20241
.OPSY	20774
DUMRX	21034
FTN02	12127
FTN03	12127
FTN04	12127
%WRIT	16515
FADSB	17213
.OPSY	17371
.FLUN	17431
.PACK	17452
DUMRX	17566
.ZRLB	17652
.EAU.	17713

```
FTN4        11000

F4.1        26636

F4.2        26636

* SYSTEM STORED ON DISC
```

PROCEDURE 2
USING DSGEN TO FORMAT DISCS

Before a fresh disc cartridge or pack can be used as a disc in DOS-M, it must be formatted by DSGEN. System discs are formatted during system generation, but user discs must be formatted by running DSGEN again in a special mode. Formatting a disc involves assigning it a system generation code, reading every sector, clearing any existing user or system directory, etc. The result is a unlabeled user disc ready for use in DOS-M.

Operating Instructions

1. Turn on all equipment.

2. Unprotect the disc controller.

3. Load a configured DSGEN using the Basic Binary Loader (BBL).

4. Set up a starting address at location 100_8.

5. Set switch register bit 15 equal to 1.

6. Start the computer executing.

7. DSGEN asks for a decimal number to be written on the disc label. This number is used for identification.....SYS GEN CODE?

   Operator responds with a decimal number.....79

8. DSGEN requests the octal select code of the disc controller.....SYS DISC CHANNEL?

   Operator responds with an octal number 10

9. DSGEN asks the number of sectors per hardware track on the disc (this is half the number of sectors on a software track).....# SECTORS/TRACK

   Operator responds with 12 for the 2870 disc or 23 for the 2883 disc.....*12*

10. DSGEN requests the subchannel number (0 to 7) of the user disc to be formatted.....USER DISC SUBCHANNEL?

    Operator responds with a number between 0 and 7 inclusive.....*3*

11. DSGEN requests that the disc be unprotected (if it is still unprotected)
    .....TURN ON DISC PROTECT OVERRIDE - PRESS RUN

    Operator unprotects the disc and starts the computer executing.

12. DSGEN carries out formatting on the specified subchannel and halts with a code of 102007_8.

13. This procedure should be repeated for each proposed user disc.

    Operator can start the computer to format a new disc (switch 15 must still be equal to 1). DSGEN repeats from .....USER DISC SUBCHANNEL?

    Operator can set switch 15 equal to 0 and start the computer to proceed to system generation.

PROCEDURE 3

CONFIGURING THE DOS-M BOOTSTRAP

Once DOS-M has been generated onto a disc, it is initiated into operating status using the DOS-M Bootstrap (Procedure 4). The Bootstrap, however, must be configured before being used.

Operating Instructions

1. Turn on all equipment.

2. Load and configure the SIO Punch or Teleprinter Driver.
   Using photoreader - put ~~to~~ bootstrap tape in - holes to back
   hit POWER, LOAD, READ
3. Load the Bootstrap with the Basic Binary Loader.
   Set P reg to address of loader = 37700_8 for 16K memory > 77700_8 for 32K, hit EXT preset INT preset LOADER enable & RUN
4. Set up the Bootstrap configuration starting address at location 2_8.

5. Set switch register bits 5 through 0 equal to the octal select code of the disc controller (low number, high priority channel).

5a. Set switch register bit 15 on to punch a configured Bootstrap. Set switch register bit 15 off to configure the Bootstrap in core only.

6. Start the computer executing.

7. The Bootstrap punches out a configured copy of itself and halts. For another copy, simply start the computer executing again.

PROCEDURE 4

INITIATING DOS-M WITH THE BOOTSTRAP

When DOS-M has been generated onto the disc, it is loaded into core and initiated by using a small stand-alone program called the DOS-M Bootstrap. Once DOS-M has been loaded and initiated, it is ready to process user tasks.

Operating Instructions

1. Turn on all equipment.

2. Configure a DOS-M Bootstrap (Procedure 3).

3. Load the configured Bootstrap into core using Basic Binary Loader.

4. Set up the starting address of the Bootstrap at location 100_8.

5. Set switch register bits 2 through 0 equal to the octal subchannel of the system disc. (If this subchannel differs from that established at system generation time, the new subchannel overrides the old.)

   0 for fixed disk (system)
   1 for removable disk (data pack)

6. Start the computer executing.
   hit EXT, INT, RUN

7. When DOS-M has been loaded into core, it prints the following message:

   INPUT :DATE, XXXXXXXXXX (No time base generator)

   or

   INPUT :DATE, XXXXXXXXXX,H,M (Time base present)

   see p 2-49 DOS-M manual

8. All other directives are ignored until a valid DATE directive is entered.* Immediately following the DATE directive, the only valid directives are TRACKS, BATCH, TYPE, and JOB. All others are ignored until a JOB directive is entered.

*Valid date directive; to get DOS-M started type
:DA, any string of ten char. except commas
e.g. :DA, 3/23/73

attention symbol: "@"

APPENDIX

ERROR HALTS AND MESSAGES

During the creation and operation of DOS-M error conditions may occur. These are signalled to the user either by halting the computer with a specific halt code or by printing a error message.

ERROR CONDITIONS DURING EXECUTION OF DSGEN

Both halts and messages can occur in DSGEN.

ERROR HALTS

Halt Code	Cause	Recovery Action
102000	Follows an irrecoverable error message.	Irrecoverable.
	Generator unable to find $STRT in DISCM. DISCM is probably missing.	Not recoverable.
102002	Follows ERRØ2.	See ERRØ2 in error messages.
102003	Follows ERRØ3	See ERRØ3 in error messages.
102004	Follows ERRØ4.	See ERRØ4 in error messages.
102007	Normal halt. Disc initialization of subchannel has completed.	Start the computer executing to initialize another subchannel or to generate a system.
102022	Disc error after ten attempts. Disc address in A, disc status in B	Start execution to retry ten more times. When preceded by ERR12 continues to next track.

Halt Code	Cause	Recovery Action
102032	Disc not ready or disc should be unprotected. Disc address in A and disc status in B.	Ready or unprotect the disc. Start the computer executing.
102077	Normal halt. Ready to receive another program tape.	Continue generation. Enter next tape and start the computer executing.
102000	If DSGEN is above 10000_8, an impossible condition has occurred.	Either a hardware/software failure has occurred or DSGEN has overflowed its work area because the system was too large.

ERROR MESSAGES

The following messages may be printed on the terminal during execution of DSGEN:

Message	Meaning	Action
Messages During Initialization and Input Phase		
ERRØ1	Invalid response to initialization request.	Request is repeated. Enter valid reply.
ERRØ2	Checksum error on program input.	Computer halts; to try again, reposition tape to beginning of record and start the computer.
ERRØ3	Record out of sequence.	Same as ERRØ2.
ERRØ4	Illegal record type.	Same as ERRØ2. If input is from disc, error is irrecoverable (remove source file from disc).
ERRØ5 *name*	Duplicate entry point.	Revise program by reloading the entry points (the current entry point replaces the previous entry point).

Message	Meaning	Action
ERRØ6	Invalid base page length in BCS-produced rel. tape (must be zero).	Base page area is ignored, but memory protect error will occur if program is executed.
ERRØ7	Program name or entry point table overflow of available memory.	Irrecoverable error. Revise or delete programs.
ERRØ8 *name*	Duplicate program name.	The current program replaces the previous program.
Messages During the Parameter Phase		
ERRØ9	Parameter name error (no such program).	Enter valid parameter statement.
ERR1Ø	Parameter type error.	Same as ERRØ9.
General Messages		
ERR11	System Directory Track overflow	Irrecoverable. Regenerate system and reduce the value for the response to the FIRST SYSTEM SECTOR? message.
ERR12	Disc error during disc initialization.	Start the computer executing to bypass the faulty tracks.
ERR13	User segment precedes user main program.	Irrecoverable.
ERR14	Absolute code overlays relocatable code in the disc scratch area.	Irrecoverable. Regenerate the system and select one of the following two options: 1) Reduce the number of programs being loaded; or 2) load the library after all other programs are loaded. If that is not successful, increase the size of the system disc and/or lower the starting track/sector of the system.

Message	Meaning	Action
ERR15	More than 63 subprograms called by a main program.	Revise main program (subsequent calls to subprograms are ignored).
ERR16	Base page linkage overflow.	Diagnostic printed for each word required. Revise order and composition of program loading to reduce linkage requirements.
ERR17	Current disc address exceeds number of available tracks.	Irrecoverable error.
ERR18	Memory overflow (absolute code exceeds LWA memory).	Diagnostic printed for each word required (absolute code is generated beyond LWA). Revise program.
ERR19	Program overlay (current word of absolute code has identical location to previous).	Current word is ignored (the address is printed).
ERR2Ø	Binary DBL record overflow of internal table.	Records overlay previous DBL records (diagnostic printed for each overflow record). Revise program.
ERR21	Module containing entry point $CIC not loaded.	Irrecoverable error.
ERR22	Read parity/decode disc error. A-register bits 8-14 show track number; bits Ø-7 show sector number.	After ten attempts to read or write the disc sector, the computer halts. To try ten more times, start the computer executing.
ERR23	EQT not entered for disc-resident I/O module.	Restart at $1ØØ_8$.

Messages During I/O Table Entry

ERR24	Invalid channel number.	Enter valid EQT statement.
ERR25	Invalid driver name or no driver entry points.	Same as ERR24.

Message	Meaning	Action
ERR26	Invalid or duplicate D,R,U operands.	Same as ERR24.
ERR27	Invalid logical unit no.	Enter valid DRT statement.
ERR28	Invalid channel number.	Enter valid INT statement.
ERR29	Channel number decreasing.	Same as ERR28.
ERR31	Invalid EQT number.	Same as ERR28.
ERR35	Base page interrupt locations overflow into linkage area.	Restart Disc Loading Phase.
ERR36	Invalid number of characters in final operand.	Same as ERR28.

ERROR CONDITIONS DURING USE OF DOS-M BOOTSTRAP

The following halts can occur during use of DOS-M Bootstrap:

Halt Code	Cause	Recovery Action
102011	Disc error status is in the A-register. If A-register contains Ø, then subchannel did not contain a system.	Check that the device is ready and then call maintenance.
102031	Same as above.	Occurs during execution of disc-resident part of Bootstrap. Check that that disc is ready then call maintenance.

ERROR CONDITIONS DURING OPERATION OF DOS-M

Both halts and messages can occur during execution of DOS-M. The halts that can occur include:

Halt Code	Location	Cause	Recovery Action
102002	location 2_8	Possible memory wrap-around when memory protect is not present.	Program error. Bootstrap DOS-M from the disc and correct the program.
102003	location 3_8		

Halt Code	Location	Cause	Recovery Action
102004	DISCM	Power has gone up or down with powerfail option present.	Bootstrap DOS-M from disc and restart.
102011	$EX20	Disc parity error. Halt occurs after a message is printed giving location of error.	Unprotect the disc and start the computer executing. DOS-M assigns next spare track.
102031	DVR31	Trying to write on disc cylinder that is flagged "protected" without first unprotecting the disc.	Starting the computer executing to exit DVR31 with no action taken.
102077	$EX20	Follows message telling operator to protect the disc after spare track assignment.	Protect the disc and start the computer executing. DOS-M aborts the job that was running.

NOTE: The sub-systems of DOS-M also print out error messages. The error messages for FORTRAN, ALGOL, and Assembler are documented in a separate module of the SOFTWARE OPERATING PROCEDURES. The messages generated by UTIL (the Extended File Management Package Utility program) are covered in the DOS-M manual.

ERROR MESSAGES

During the operation of DOS-M certain messages may be printed on the system terminal. These messages may be error reports or simply informative; they are generated by various parts of DOS-M. The messages are listed alphabetically including where they originated, what they mean, and what response, if any, the operator must make. Messages that begin with a variable name or a non-alphabetic character are listed by the first non-variable, alphabetic character.

Message	Source	Description
BAD CONTROL STATE.	JOBPR	Directive just entered is not acceptable in DOS-M. Enter correct directive on system teleprinter.
BEGIN 'DEBUG' OPERATION	DEBUG	Any legal DEBUG operations may now be entered. Enter any legal DEBUG operations.
CHECKSUM ERROR	JOBPR	Checksum error in INPUT to :ST,R,file, LU directive. Correct tape.
CW *nnnnn*	DISCM	In a READ/WRITE EXEC call at *nnnnn*,buffer extends beyond memory bounds. Correct program.
DEVICE #*nn* DOWN	JOBPR	EQT # *nn* is unavailable (down). Use the :UP,*nn* directive to make the device available (UP). (Then use the :GO directive if needed.)
DICTIONARY OVERFLOW	JOBPR	No room is left for entries in the user file dictionary. Put file on another disc or remove some of the files.
??? DISC	DISCM	Informs user that disc is not recognizable by DOS-M. Must be labeled or unlabeled with :IN, or formatted with DSGEN, before using in DOS-M.
DISC GEN CODE *nnnn* NOT SYS GEN CODE *nnnn* ERR POSS	DISCM	Informs the user that the disc being requested was initialized (labeled) by a system with a different system Generation Code. Generation code on disc may be updated by labeling or unlabeling using :IN.
DISC NOT ON SYSTEM	DISCM	No disc pack with the currently requested label can be found on the system. Mount disc pack with correct label or ready drive containing disc.
DONE?	JOBPR	Thirty feed frames (paper tape) or an end-of-file (magnetic tape) have occurred during input. Enter YES for end of input; NO for more input.
??? LABEL *xxxxxx* DOS LABEL *xxxxxx* TSB LABEL *xxxxxx*	DISCM	Attempting to label (or unlabel) an already labeled disc pack. Enter YES to relabel the disc pack or NO to drop the request to relabel the disc pack.

Message	Source	Description
DUPLICATE FILE NAME	JOBPR	Doubly defined file name found in a STORE directive (other than STORE,P), or an EDIT directive with a new file name; or on DD,U. Remove file or rename file.
$END ALGOL	ALGOL	End of ALGOL compilation. No response required.
$END ASMB	ASMB	Assembly as completed. No response required.
$END ASMB CS	ASMB	Assembly has ended because of an error in the assembler control statement. Correct the control statement.
$END ASMB NPRG	ASMB	Assembly has terminated because no JFILE was found when required. Define the file using a JFILE directive.
$END ASMB PASS	ASMB	Another pass of the source program through the input device is required. Printed on the system after Pass 1. Replace the program in the input device and type: :GO.
$END ASMB XEND	ASMB	Assembly stops. An EOF occurred in the source program before an END statement. Add an END statement to the program.
END FILE	JOBPR	During an EDIT, (1) the master file ended before completion of editing or (2) a double occurred in column 1 and 2 of a source statement.
$END FTN	FTN	Compilation has completed. No response required.
END JOB *xxxx* [RUN = *xxxx* MIN. *xx.x* SEC EXEC = *xxxx* MIN. *xx.x* SEC]	JOBPR	End of current job. Total job time and execution time of the job are printed on the system teleprinter and standard list device if a time-base generator is present.
ENTER FILE NAME(S) OR /E	LOADR	Enter list of relocatable program files. To terminate list of file names type "/E".
ENTRY ERROR	DEBUG	DEBUG operation entered was illegal. Correct entry.

Message	Source	Description
EQT *xx* CH *xx* DVR*xx* D R U*x* S*x*	JOB	Equipment table entry printed by the directive :EQ. No action required.
EXTRA PARAMETERS	JOBPR	More than 15 parameters in a directive. Excess parameters are not processed.
FI *nnnnn*	DISCM	In a FILE READ/WRITE EXEC call; (1) the file requested at *nnnnn* cannot be found. If *nnnnn* is not present, enter the file. (2) the length of the buffer requested at *nnnnn* extends beyond the end at the file. Correct the buffer length. Either case causes calling program to abort.
HPAL	ALGOL	Control statement error. Correct control statement.
IB *nnnnn*	DISCM	Illegal buffer address in EXEC call at location *nnnnn*. Program is aborted. Correct buffer program address.
IE *nnnnn*	DISCM	If a colon occurs in the first column of input entered through the batch device during a program execution, the program is aborted, control is given to the JOBPR and the input is processed as a directive. *nnnnn* is the memory location of the input request.
IGNORED	DISCM	Input from system teleprinter during program execution cannot be processed. Correct input.
*IGNORED	JOBPR	All directives following EJOB and before next JOB except BATCH, TYPE, TRACKS and OFF are ignored. Enter acceptable directive.
file ILLEGAL	JOBPR	On a source file LIST directive, the requested file was not a source file. Retype LIST directive using source file. A file name begins with a non-alphabetic character. Rename the file.
ILLEGAL DIGIT	JOBPR	In a decimal number, character is other than Ø-9. Enter correct decimal number. In an octal number, digit is other than Ø-7. Enter correct octal number.
ILLEGAL LUN	JOBPR	Logical unit requested is equal to zero, greater than the number of logical units in the system, not the correct type (i.e., input type for output device), etc. Enter a correct logical unit.

Message	Source	Description
ILLEGAL PROGRAM RUN LIMITS	DISCM	Attempt to run a user main or segment whose user area limits or base page limits will not fit within the limits of the current system. Recreate user mains or segments on current system using LOADR.
ILLEGAL PROGRAM TYPE	JOBPR	Program requested in a RUN or PROG is not legal. Enter correct name.
INPUT ERROR	DISCM	Equipment table entry number or logical unit number in EQ, LU, UP or DN is illegal. Enter correct equipment table or logical unit entry number.
INPUT :DATE, XXXXXXXXXX[,H,M,]	DISCM	When system is initiated from the disc, DOS-M requires a DATE directive. The "HM" is ignored in DOS-M if a Time Base Generator is not in the system. Enter a DATE directive.
I/O ERR ET EQT #*mm*	DISCM	End-of-tape on device #*mm*. EQT #*mm* is unavailable. To make the device available (up), use the UP,*n* directive.
I/O ERR NR EQT #*mm*	DISCM	The device #*mm* is not ready. To make the device available (up), use the UP,*n* directive.
I/O ERR PE EQT *mm*	DISCM	Parity error on device #*mm* returns to program return address with A set to status, B set to Ø. Call maintenance.
IT *nnnnn*	DISCM	Illegal disc track or sector address in EXEC call from location *nnnnn*. Program is aborted. Correct the track or sector address in EXEC call.
I/O ERR {PE / NR} USER DISC	DISCM	A parity error or device not ready occurred when attempting to assign a user disc. Disc may not be formatted; format it with DSGEN.
I/O ERR {PE / NR} USER DISC	DISCM	Disc error in completion section of DVR31. Retry previous operation.
JBIN OVF	FTN, ASMB	Overflow of job binary area during assembly or compilation. Reduce size of job or purge user files.
JOB ABORTED!	JOBPR	Correct problem and start new job.

Message	Source	Description
JOB *xxxxx ddddddddd* [TIME = *xxxx* MIN. *xx.x* SECS EXEC = *xxxx* MIN. *xx.x* SEC.]	JOBPR	Message printed at the beginning of each job. The time information is deleted in DOS-M if a Time Base Generator is not included in the system. Start job.
LØ1	LOADER	Checksum error on tape.
LØ2		Illegal record.
LØ3		Memory overflow.
LØ4		Base page overflow.
LØ5		Symbol table overflow.
LØ6		Duplicate main or segment name (may be caused by attempting to run the loader twice in one job).
LØ7		Duplicate entry point.
LØ8		No main or segment transfer address.
LØ9		Record out of sequence.
L1Ø		Insufficient directory work area, or user area space.
L11		Program name table overflow.
L12		User file specified cannot be found.
L13		Program name duplication.
L14		Non-zero base page length.
L15		Segment occurred before main.
L16		Program overlay (illegal ORG).
L17		Illegal library record.
LBL = *111111*	DISCM	Disc subchannel referenced is labeled *111111*. If attempting to change user disc subchannel, enter UD with correct label.

Message	Source	Description
LIMIT ERROR	JOBPR	In a directive, source statement numbers are out of order (EDIT), dump limits are incompatible (PDUMP, ADUMP), sector numbers are illegal (DUMP), or beginning source statement number is greater than final statement number (EDIT). Correct directive and re-enter.
xxxx LINES	JOBPR	Total number of statements stored by a STORE,S directive. No response required.
****LIST END****	JOBPR	Terminates list of source statements generated by a LIST directive. No response required.
LN *nnnnn*	DISCM	Logical unit requested by an EXEC call at *nnnnn* is unassigned. Program is aborted. Reassign logical unit.
LOADR COMPLETE	LOADR	Loading has completed. No responses required.
LOADR SUSP	LOADR	Loader has suspended (usually at EOT). Type :GO,*n* to restart the Loader with proper parameter value.
LOADR TERMINATED	LOADR	Loader has terminated because of an error. Check input.
LOAD TAPE	LOADR	In conjunction with LOADR SUSP, this message requests that next relocatable tape be loaded before GO. Load the next relocatable tape and enter :GO to read next tape or :GO,1 to indicate that all tapes are read in.
LU *nnnnn*	DISCM	Illegal logical unit in EXEC call at *nnnnn*. Program is aborted. Enter correct logical unit number.
LU*xx* EQT*xx*	JOBPR	Logical unit table entry; EQT #*xx* assigned to LU#*xx*. No response required.
LUN UNASSIGNED	JOBPR	Logical unit requested in a directive is unassigned. Assign logical unit number requested in the directive.
xxxxx MISSING	DISCM	Segment *xxxxx* requested by an EXEC call is not in system or user directory. Job is aborted. Correct job.

Message	Source	Description
MISSING PARAMETER	JOBPR	A parameter is missing in a directive. Retype the directive correctly.
MP *nnnnn*	DISCM	Memory protect violation at location *nnnnn*. Program is aborted. Correct the program.
NAME *IGNORED	JOBPR	Illegal JOB *name*; non-alphabetic first character. Retype correct job name.
NEXT AVAIL TRACK=*tt* BAD=*n*	JOBPR	In TRACK directive, *tt* = first track beyond end of current user area; *n* = number of bad tracks. "BAD=*n*" returned only if bad tracks do exist. *tt* = "NONE" if no tracks are available.
NO BIN END	JOBPR	No END record detected when storing a relocatable binary program.
NO PROGRAMS LOADED	LOADR	No programs were loaded by the LOADR. Loading terminates.
NO SOURCE	JOBPR	No source statements following a /R or /I in an EDIT directive. Enter source statements after the /R or /I.
NO SOURCE	ALGOL	Source file from disc not pre-set.
NUMBER OVERFLO	JOBPR	An integer is too large.
OR *nnnnn*	DISCM	I/O operation requested by EXEC call at *nnnnn* is rejected. Program is aborted. Check program.
OVERFLOW JBIN	JOBPR	There is not enough room in the JBIN for storing the relocatable binary output from the assembler or compilers.
PARAMETER ILLEGAL	JOBPR	A parameter of a directive is illegal. Re-enter directive.
PARITY ERROR SC=*m*,TRK=*ttt*,SCTR=*sss*	JOBPR	Parity error during disc read or write. Call maintenance.
PAUSE *xxxx*	LIBR (Formatter)	Program has temporarily suspended itself. *xxxx* is an octal number. Restart program using the GO directive.

Message	Source	Description
RE-ENTER STATEMENT ON TTY	JOBPR	Follows most error messages that do not cause abort. Type in the correct statement.
RQ *nnnnn*	DISCM	Illegal request code in EXEC call at *nnnnn*. Program is aborted. Correct the program.
SPARE TRK OVERFLOW	JOBPR	Defective cylinder detected and no spare tracks available for reassignment.
STOP *xxxxx nnnnn*	LIBR	Program *xxxxx* has terminated at location *nnnnn*.
SUBCHAN = *n*	DISCM/ JOBPR	Given in response to :UD information request or when :SS makes new subchannel assignment. No response required.
xxxxx SUSP	DISCM	Program *xxxxx* suspended by EXEC call or PAUSE directive. Restart program using the GO directive.
TAPE END	JOBPR	EOT flag set on magnetic tape or paper tape device during output via JOBPR directives :DUMP and :LIST or output of a JOB or EJOB statement. If a magnetic tape, it is rewound with standby, if paper tape a trailer is punched. The JOBPR will then pause to allow new tape to be set up. Mount a new magnetic tape. Enter :GO to continue the output.
TM *nnnnn*	DISCM	Maximum execution time exceeded. The program is currently at *nnnnn* and is aborted. Increase execution time.
#TRACKS UNAVAILABLE	DISCM	There are not enough work tracks for the compiler. Purge disc of unnecessary files.
TRAC # TOO BIG	JOBPR	Track requested is higher than last available disc track (track may be in JBIN area). Redefine the track request or purge files or use different disc.
TSB DISC	DISCM	Informs user that the user disc was labeled by a non-DOS-M system. May be made DOS-M disc by labeling or unlabeling with :IN.
TURN{ON / OFF} DISC PROTECT OVERRIDE SWITCH	DISCM	Unprotect [ON] or protect [OFF] the disc.

Message	Source	Description
UD *nnnnn*	DISCM	Unable to find user disc requested by EXEC call at *nnnnn*. Mount required disc and type :GO; or terminate program with :AB or :OF.
UNLBL	DISCM	User disc specified in UD is unlabeled. If trying to change user disc assignment, enter UD,*[,*n*].
file name UNDEFINED	JOBPR	Undefined file name in PURGE, LIST, RUN, STORE or DD,U,*file*. Retype correct file name on the system teleprinter.
UNDEFINED EXTS	LOADR	Undefined external references exist in programs Loaded. The external references are listed one per line. To load additional programs from paper tape type :GO,Ø[,*n*].
WRONG INPUT	JOBPR	Relocatable binary input furnished for a source file request or vice-versa. Put in a correct input.
name: nn xx	ERRØ	Library routine error code, where *name* is the name of the user's program; *nn* is the routine identifier, and *xx* is the error type.
@	JOBPR/ DISCM	Directives may be entered. Enter desired directive.
*	DISCM	Operator attention directives may be entered. Enter desired directive.