SH20-1671-0

Installed User Program

Assembler-H/CMS Interface Program Description/Operations Manual

Program Number 5796-PEJ

This manual is designed to be used by Assembler-H/CMS Interface users in conjunction with existing Assembler H documentation. It describes the HASM command, and contains information on the features unique to Assembler-H/CMS Interface. The HASM command as described herein is used to invoke Assembler H under control of the conversational Monitor System (CMS), a component of IBM Virtual Machine Facility/370 (VM/370). The HASM command thus makes available, to the CMS user, the extensions to assembler language and improved assembly performance provided by Assembler H relative to preceding CMS assemblers.

This manual also contains the information needed by system support personnel to install and maintain the Assembler-H/CMS Interface program.

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TABLE OF CONTENTS

1.0 INTRODUCTION

This manual is designed to be used in conjunction with existing Assembler H documentation. It describes the HASM command, and contains information on the features unique to the Assembler H/CMS Interface program.

The HASM command as described herein is used to invoke Assembler H under control of the Conversational Monitor System (CMS), a component of IBM Virtual Machine Facility/370 (VM/370). The HASM command thus makes available, to the CMS user, the extensions to assembler language and improved assembly performance provided by Assembler H relative to preceding CMS assemblers.

This manual also contains the information needed by system support personnel to install, maintain, and modify the Assembler H/CMS Interface program.

2.0 SYSTEM OVERVIEW

2.1 DESCRIPTION

In order to install Assembler H for use in a CMS environment, the user must have both the Assembler H/CMS Interface IUP distribution tape and the Assembler H Program Product (PP) distribution tape. The programs and CMS exec procedures distributed as part of the IUP make possible the installation and execution of Assembler H under the control of CMS.

During the installation process, the files from the IUP tape and the object modules, macro definitions and sample program from the PP tape are loaded. A CMS exec procedure is then used to generate the CMS modules needed to execute the assembler.

After installation of Assembler H has been completed, the HASM command can be used to invoke Assembler H to assemble user specified files. Assembler processing and output are controlled by the options specified in the HASM command.

2.2 TERMINOLOGY

Throughout the remainder of this manual, the following terms will be used:

- IUP refers to all programs and files that are provided as part of the Assembler H/CMS Interface Installed User Program distribution material, Program No. 5796-PEJ.

- PP refers to all programs and files that are provided as part of the OS Assembler H Program Product distribution material, Program No. 5734-AS1 (basic material only).

- HASM, unless otherwise qualified, refers to all programs and files that collectively provide the ability to install and execute Assembler H under CMS.

2.3 SYSTEM CONFIGURATION

The minimum system configuration requirements for installation of HASM are satisfied by the VM/370 minimum configuration. The minimum requirements for subsequent use of HASM are satisfied by the CMS minimum configuration. Refer to the publication IBM Virtual Machine Facility/370: Planning and System Generation Guide, Order No. GC20-1801, for details.

2.4 PROGRAMMING SYSTEMS

An operational VM/370 system serves as the base for HASM installation and subsequent use. In addition, the user must have available the IUP tape and the PP tape. The following is a list of the IBM programs required to install, operate and/or maintain HASM:

- Virtual Machine Facility/370, Program No. 5749-010, Release 2, Modification Level 0 (an operational CMS system is required by this IUP)
- OS Assembler H PP, Program No. 5734-AS1, Version 5 (only the basic distribution material is required)
- Assembler H/CMS Interface IUP, Program No. 5796-PEJ

3.0 PROGRAM DESCRIPTIONS

The programs which are part of HASM are of two general types: those used during the installation process and those used during an assembly initiated by the HASM command. The purpose of each file loaded or created during the installation process is described in Section 4, Installation Instructions. The HASM command, and all files processed or created by it, is described in Section 5, Operations Instructions.

The Assembler H/CMS Interface IUP is composed of a number of CMS exec procedures and programs. The programs are written in assembler language and in some cases use language features available with Assembler H. The CMS exec procedure HASMLOAD and the program HASMLOAD are used to load the Assembler H tape. The CMS exec procedures HASMGEND and HASMGMOD, and the programs HASMOPCO, IEV61, IEVCMS, and IEVAUX are needed for generation of the assembler modules. HASMOPCO, IEV61, and IEVAUX do not contain executable code. This section describes the way in which the IUP establishes the interface between Assembler H and CMS. The information given is intended to be used in conjunction with listings of the CMS exec procedures and programs.

3.1 USE OF THE ASSEMBLER H DISTRIBUTION TAPE

The loading of the Assembler H distribution tape is done using the HASMLOAD EXEC. The EXEC first determines that IEV61 TEXT does not exist on any currently accessed disk. This is necessary so that the initial generation of the assembler modules will be correct. Next, a FILEDEF command is issued for TAP1 (virtual tape address 181) using ddname IEVIN. This ddname is used by the HASMLOAD program to read the Assembler H PID tape. The HASMLOAD program (which exists as HASMLOAD TEXT) is then invoked by the EXEC.

The HASMLOAD program is used to load the Assembler H object modules, macro library, and sample program from the PID tape. Correct operation of the program requires that the tape be structured in a particular way. The Assembler H Version 5 PID tape served as the basis for the design of HASMLOAD, and correct operation with tapes containing earlier versions was not investigated. Successful operation of the program writes the following files on the A-disk: IEV10 TEXT, IEV20 TEXT, IEV80 TEXT, IEV90 TEXT, IEV50 TEXT, IEV60 TEXT, IEV00 TEXT, HASMMAC COPY, IEV501 TEXT, IEV502 TEXT, IEV503 TEXT, and IEVSAMP ASSEMBLE.

After execution of the HASMLOAD program, the HASMLOAD EXEC copies IEV50 TEXT as IEV500 TEXT (IEV500 TEXT is the Assemblr H object module for the universal instruction set). The other IEVnn TEXT files are placed in HASMGLIB TXTLIB and the TEXT files are erased. The HASMMAC COPY file is placed in HASMMAC MACLIB and the COPY file is erased.

HASMLOAD EXEC next invokes the HASMGEND EXEC using the INSTALL option. This results in the generation of a usable set of assembler modules for use in the next phase of the installation. Upon return from HASMGEND, control is returned to CMS.

3.2 GENERATION OF THE HASM MODULE FILES

The HASMGEND EXEC is used to generate the Assembler H/CMS interface routine HASM MODULE as well as the assembler modules themselves. In the process of doing this, a number of assemblies will be done. During a full re-generation, the following steps are performed by HASMGEND:

1. Places the user created file HASMOPT COPY (described in Section 4) in HASMOPT MACLIB. Issues the command GLOBAL TXTLIB HASMGLIB (contains Assembler H object modules). Issues the command GLOBAL MACLIB HASMMAC HASMOPT CMSLIB OSMACRO (specifies macro libraries needed for assemblies).

2. Assembles the file IEV61. This assembly produces IEV61 TEXT and is the Assembler H module which contains default options and ddnames to be used by the assembler. IEV61 TEXT becomes part of IEV60 MODULE.

3. Issues a STATE command to see if IEV50LOP TEXT exists on any accessed disk. If so, this file will be used as the op-code table when generating IEV50 MODULE. This step provides a means for an installation to include its own local op-code table rather than one of those supplied as part of the Assembler H Program Product.

4. If IEV50LOP TEXT does not exist, the file HASMOPCO is assembled. This is done only to determine which instruction set was selected by the installation, and results in a return code between 250 and 253 inclusive. After subtracting a constant 250 from this return code, a single digit from 0 to 3 results. This digit is concatenated to the name IEV50, forming, for example, IEV500. This procedure determines the filename of the TEXT file that will be used as the op-code table.

5. Assembles the files IEVCMS and IEVAUX to produce the TEXT files and listings.

6. Using IEVCMS TEXT and IEVAUX TEXT, genmod IEVHA MODULE. This module will be re-generated later and given the name HASM MODULE. It is generated at this time because it is needed in generating a correct assembler module 'overlay' type structure.

7. Using the sub-exec HASMGMOD, the following files, all with filetype MODULE, are generated: IEV00, IEV10, IEV20, IEV50, IEV60, IEV80, and IEV90. These modules form a prestructured overlay that conforms to that depicted in 'Figure 2. Main Storage Usage', in the publication OS Assembler H Logic, Order No. LY26-3760. The methods used in creating such an overlay structure are described in the section entitled 'Overlay Structures' in the publication IBM Virtual Machine Facility/370: System Programmer's Guide, Order No. GC20-1807. Notice that the modules are generated in a 'bottom up' manner and then generated again in a 'top down' manner. This is done so that a given MODULE will have a module map containing only its own symbols. All of the modules have module maps at this point so that the CMS ZAP command can be used, if desired, to refer to external names contained in the modules.

8. Using IEVCMS TEXT and IEVAUX TEXT, after prompting for the mode letter to be used in a GENDIRT command, HASM MODULE A2 is created.

9. The file HASMGEN MAP is created from the MAP files created by HASMGMOD EXEC during module generation. The extra MAP files are then erased.

10. If the ZAP option was specified in the HASMGEND command, a ZAP command will be issued specifying that file 'HASMZAP ZAP' contains ZAP command input. This provides a method of applying Assembler H PTF fixes distributed as input to the OS service routine IMASPZAP.

11. If the MAP option was specified in the HASMGEND command, control is returned to CMS at this point. Otherwise, the assembler modules will be LOADMODed and GENMODed once again, this time specifying the NOMAP option in the GENMOD commands. Control is then returned to CMS.

3.3 EXECUTION LOGIC

For a description of the execution logic of the HASM command processor, system support personnel should consult the source listing for module IEVCMS (produced by HASMGEND EXEC). This listing, which is heavily commented, is prefaced by a description of the overall operation of the module. For information describing the execution logic of the Assembler H Program Product, refer to the publication OS Assembler H Logic, Order No. LY26-3760. Program listings for Assembler H modules may be obtained on microfiche using Order No. LCB6-3772.

4.0 INSTALLATION INSTRUCTIONS

4.1 IUP DISTRIBUTION TAPE

The IUP distribution tape, in the recording density and format requested by the recipient, contains one file in CMS TAPE DUMP format. The CMS files contained on this tape are those necessary to process the PP tape in a CMS (rather than OS) environment at installation time, and to interface the assembler with CMS at execution time.

4.2 INSTALLATION VIRTUAL MACHINE

In addition to a correctly operating VM/370 system, HASM requires the following for installation:

a. A virtual machine with storage size of at least 396K with CMS available.

b. A CMS formatted minidisk with at least ten available cylinders of 3330 disk space (or equivalent) to serve as the installation disk. This same minidisk can be used for future maintainence and/or modification activity.

The installation process creates a number of CMS files of filetype MODULE. These MODULE files make up the minimum set of files that must be available at assembly time for correct operation of the HASM command. If it is decided to copy these modules to another minidisk after installation is complete, approximately one cylinder of 3330 disk space (or equivalent) is required.

4.3 LOADING THE IUP DISTRIBUTION TAPE

a. Mount the IUP distribution tape (5796-PEJ) on a tape unit and ATTACH that unit to the virtual machine using virtual address 181. The installation disk should be ACCESSed as the A-disk in read/write mode.

b. Issue the CMS command TAPE LOAD. Upon successful completion of this command, the following files will have been loaded on the installation disk:

HASMLOAD	ASSEMBLE	- source code and object text for the
HASMLOAD	TEXT	program used to process the PP tape
IEVAUX	ASSEMBLE	- source code and object text for the
IEVAUX	TEXT	HASM auxiliary directory
IEVCMS	ASSEMBLE	- source code and object text for the
IEVCMS	TEXT	HASM command processor
HASMOPCO	ASSEMBLE	- assembled during installation to select instruction set
IEV61	ASSEMBLE	- assembled during installation to include specified default options
HASMOPT	COPY	- - - contains macro instructions which specify default options and values
HASMGEND	EXEC	- - - builds (rebuilds) all HASM modules
HASMGMOD	EXEC	- - - sub-exec used by HASMGEND
HASMLOAD	EXEC	- - - controls processing of the PP tape
HASMSEP	MAP	- - - used in construction of HASMGEN MAP

c. The IUP tape may now be rewound and unloaded.

4.4 LOADING THE PP DISTRIBUTION TAPE

a. Mount the PP distribution tape (5734-AS1) on a tape unit attached as virtual address 181 (if the tape unit from the previous step is used, ensure that the recording density of the PP tape is compatible with the tape unit in use).

b. Issue the CMS command HASMLOAD. Upon successful completion of this EXEC procedure, the following files will exist in addition to those listed previously:

```
HASMMAC  MACLIB - - PP macro definitions
HASMGLIB TXTLIB - - PP object modules
IEV500   TEXT - - - PP universal opcode table
IEV501   TEXT - - - PP scientific opcode table
IEV502   TEXT - - - PP commercial opcode table
IEV503   TEXT - - - PP standard opcode table
IEVSAMP  ASSEMBLE - PP sample program
IEV50    TEXT - - - HASM opcode table installed
HASM     MODULE - - HASM command module
IEV00    MODULE - - HASM assembler module
IEV10    MODULE - - HASM assembler module
IEV20    MODULE - - HASM assembler module
IEV50    MODULE - - HASM assembler module
IEV60    MODULE - - HASM assembler module
IEV80    MODULE - - HASM assembler module
IEV90    MODULE - - HASM assembler module
HASMGEN  MAP  - - - HASM module map
```

It should be noted that in addition to loading certain modules from the PP tape, HASMLOAD EXEC also invokes the HASMGEND EXEC to build a working HASM processor. This is necessary for subsequent installation processing.

c. The tape unit attached as virtual device 181 may now be DETACHed.

4.5 ESTABLISHING INSTALLATION DEFAULT OPTIONS

At this point in the installation process, all necessary files have been loaded from the IUP and PP tapes and a working HASM processor has been generated. You may now specify, if desired, new values for any assembler default option or ddname. You may also select any one of the available instruction sets (standard, scientific, commercial, or universal).

To specify the desired values, you use macro calls. One of the files loaded on the installation disk was HASMOPT COPY. This file, as distributed, contains one macro call and specifies NODECK and OBJECT as assembler default options. As distributed,

HASMOPT COPY contains the following:

```
OPTIONS  DEFAULT=(NODECK,OBJECT)
```

It is suggested that at least these two default options always be specified during installation so that object modules created by HASM commands will be handled as expected.

The CMS editor can be used to change the OPTIONS macro supplied, and to create additional macro calls in the HASMOPT COPY file. The macros that are valid are OPTIONS, DDNAMES, and OPCODES. The functions performed by each of these macros and the operands used with each are fully described in the publication OS Assembler H System Information, Order No. SC26-3768, under the heading 'Installation Procedure - Phase One'. Only the three macros named above should be coded in HASMOPT COPY. The GENPARM macro and the END statement described in the referenced publication have already been supplied elsewhere and need not be supplied by the user.

4.6 THE HASMGEND EXEC

The HASMGEND EXEC is used to generate all HASM modules. The exec recognizes three user supplied parameters. They are MAP, ZAP, and REDIRT. The MAP and ZAP parameters are described in this section. The REDIRT parameter is described in the following section.

a. The MAP parameter specifies that the HASM modules generated are to have CMS module maps. If this parameter is not specified, the MODULE files will be GENMODed using the NOMAP option.

b. The ZAP parameter specifies that a file named HASMZAP ZAP, containing CMS ZAP command control statements, is to be applied against the HASM modules during the generation process. In conjunction with the file HASMGEN MAP, described in the next section, this parameter facilitates the application of OS SUPERZAP PTF fixes to the assembler modules. The CMS ZAP command is described in the publication IBM Virtual Machine Facility/370: System Programmer's Guide, Order No. GC20-1807.

4.7 FINAL STEPS IN THE INSTALLATION PROCEDURE

The HASMGEND EXEC is used to complete the installation procedure. It generates all HASM modules, and also produces a file named HASMGEN MAP which lists all module entry point names and their associated storage addresses.

a. Issue the CMS command HASMGEND, also specifying the MAP and/or ZAP parameters if desired. Upon successful completion of this EXEC procedure, the following files will exist on the installation disk in addition to those listed previously:

   HASMOPT MACLIB - - contains HASMOPT copy file
   IEV61 TEXT - - - contains Assembler H defaults

   In addition, three assembly listings will be printed offline. These listings are of modules IEV61, IEVCMS, and IEVAUX.

b. During execution of HASMGEND, the following questions are asked:

   DO YOU WISH TO USE AN AUXILIARY DIRECTORY (RESPOND YES OR NO)

   A response of NO will cause the assembler modules to be given a filemode of 'A2' after they they have been generated. A response of YES will cause the filemode to be 'A1' and will also cause the following question to be asked:

   ENTER THE MODE LETTER THAT WILL BE USED TO ACCESS THE DISK CONTAINING THE H-ASSEMBLER MODULES, OR ENTER A NULL LINE TO DEFAULT THE MODE LETTER TO 'S'

   The mode letter entered is used in a CMS GENDIRT command during the generation of HASM MODULE. Refer to the publication IBM Virtual Machine Facility/370: System Programmer's Guide, Order No. GC20-1807, under the heading 'AUXILIARY DIRECTORIES', for a discussion of this subject.

Unless you desire to copy the HASM modules to another minidisk, the installation is complete. If you do wish to make HASM available on another minidisk, you need copy only the following MODULE files:

```
HASM   MODULE
IEV00  MODULE
IEV10  MODULE
IEV20  MODULE
IEV50  MODULE
IEV60  MODULE
IEV80  MODULE
IEV90  MODULE
```

Also, if these modules are copied to another minidisk, you should be aware that HASM MODULE may need to be re-GENDIRTed (unless you are not using an auxiliary directory). This operation is facilitated by the command HASMGEND REDIRT. The REDIRT parameter indicates that HASM MODULE is to be regenerated. If REDIRT is specified, the ZAP parameter should not be specified and the MAP parameter may be specified if desired. For example, assume that it is desired to install the HASM modules on the CMS system disk. Assume also that the system disk and HASM installation disk have virtual addresses 190 and 250 respectively, and that 190 is linked in read/write mode. The following sequence of commands might be used to accomplish the desired results:

```
ACCESS 190 A
ACCESS 250 B/R
COPYFILE * MODULE B = = A (OLDD TYPE
HASMGEND REDIRT
```

The COPYFILE command is used to copy the eight MODULE files to the A-disk (190). The HASMGEND command, specifying the REDIRT parameter, will type the message ENTER THE MODE LETTER THAT WILL BE USED..., and will then GENDIRT and GENMOD only HASM MODULE. The other seven modules remain unchanged.

If you responded NO to the DO YOU WISH TO USE AN AUXILIARY DIRECTORY question previously described, then you should NOT issue the HASMGEND REDIRT command. You may stop after the COPYFILE command in the above example.

4.8 MODULE REGENERATION CONSIDERATIONS

Should it become necessary to regenerate the HASM modules, this can normally be accomplished without recourse to the installation tapes if the files created during initial installation are available. To change an assembler option, for example, you could ACCESS the installation disk as the read/write A-disk, EDIT the change into HASMOPT COPY, and issue the command HASMGEND. The same general procedure can be used to incorporate local program modifications. The information contained in the section 'Final Steps in the Installation Procedure' will, in general, remain applicable.

4.9 SUMMARY OF STEPS TO INSTALL HASM

a. Access the installation disk as the read/write A-disk

b. Attach a suitable tape drive as virtual address 181

c. Mount the IUP tape on virtual unit 181

d. Issue the CMS command: TAPE LOAD

e. Issue the CMS command: TAPE RUN

f. Mount the Assembler H PP tape on virtual unit 181

g. Issue the CMS command: HASMLOAD

h. Issue the CP command: DETACH 181

i. If desired, EDIT the file HASMOPT COPY to specify installation defaults

j. Issue the CMS command: HASMGEND

k. If desired, copy the HASM modules to another minidisk

5.0 OPERATIONS INSTRUCTIONS

5.1 REFERENCE DOCUMENTATION

The HASM command is used in basically the same way as the CMS ASSEMBLE command. Some command options are different, reflecting differences between the VM/370 assembler and Assembler H. As mentioned in the introduction, this manual is intended to be used in conjunction with existing Assembler H documentation. These manuals, in turn, are intended to be used in conjunction with existing OS/VS-DOS/VS-VM/370 Assembler documentation. For your convenience, a list of these manuals, along with their order numbers, is given below.

- OS/VS, DOS/VS, and VM/370 Assembler Language, GC33-4010
- OS/VS and VM/370 Assembler Programmer's Guide, GC33-4021
- IBM Virtual Machine Facility/370: Command Language Guide for General Users, GC20-1804
- OS Assembler H General Information Manual, GC26-3756
- OS Assembler H Language, GC26-3771
- OS Assembler H Programmer's Guide, SC26-3759
- OS Assembler H Messages, SC26-3770

5.2 HASM COMMAND

5.2.1 COMMAND OPTIONS

HASM offers a number of optional facilities. For example, you can suppress printing of your assembly listing or parts of the listing, and you can specify whether you want an object deck or an object module. You select the options by including appropriate keywords in the HASM command that invokes the assembler. There are three types of options:

- Simple pairs of keywords: a positive form (such as OBJECT) that requests a facility, and an alternative negative form (such as NOOBJECT) that rejects that facility.

- Keywords that permit you to assign a value to a function (such as LINECOUN(50)).

- HASM command processor options (such as PRINT) which are not passed to Assembler H but are used to control certain aspects of the assembly process. Such options are referred to in later sections as "CMS options", to distinguish them from Assembler H options.

Each of these options has a standard or default value which is used for the assembly if you do not specify an alternative value. The default values are discussed in the following section, 'Command Defaults'.

The HASM command processor combines all the assembler options into a string of characters with a comma separating each option. This string is passed to the assembler when it is invoked. If "n" options are specified (n>1), then "n-1" commas are inserted. The total number of characters in the assembler options plus the number of inserted commas must not be greater than 100. The CMS options are not included in this count. You may specify the options in any order. If contradictory options are used (for example, LIST and NOLIST), the rightmost option (in this case, NOLIST) is used.

The command options are described in section 5.2.3

5.2.2 COMMAND DEFAULTS

If you do not code a given option in the HASM command, a default option will be assumed. The following default options are included when HASM is shipped by IBM:

NODECK, OBJECT, LIST, XREF(FULL), NORENT, NOTEST, NOBATCH, ALIGN, ESD, RLD, LINECOUN(55), FLAG(0), SYSPARM(), DISK, NUMBER, NOSTMT, TERMINAL(0)

However, these may <u>not</u> be the default options in effect at your installation. The defaults could have been respecified when HASM was installed. For example, RENT could be made the default in place of NORENT. Also, a default option can be specified during installation so that you cannot override it. Similar considerations apply to the assembler ddnames for which the HASM command processor issues FILEDEFs. In the description of the HASM command, the options and ddnames specified as being "default values" are those included when HASM is shipped by IBM.

You should determine what default values are in effect at your installation and whether there are any you cannot override.

5.2.3 COMMAND FORMAT

The HASM command is used to invoke Assembler H to assemble the specified file. HASM processing and output are controlled by the options selected. The format of the HASM command follows. Default values are underscored.

```
+---------+
|         |
| HASM    |  [fn] [ (options...[)]]
|         |
|         |  listing control options:
|         |
|         |  +-------+  +-----------+  +--------+  +-------------+
|         |  |ESD    |  |FLAG (0)   |  |LIST    |  |LINECOUN (55)|
|         |  |NOESD  |  |FLAG (nnn) |  |NOLIST  |  |LINECOUN (nn)|
|         |  +-------+  +-----------+  +--------+  +-------------+
|         |
|         |  +-------+  +------------+  +--------+
|         |  |RLD    |  |XREF (FULL) |  |DISK    |
|         |  |NORLD  |  |XREF (SHORT)|  |PRINT   |
|         |  +-------+  |NOXREF      |  |NOPRINT |
|         |             +------------+  +--------+
|         |
|         |  object module control options:
|         |
|         |  +-------+  +----------+  +--------+
|         |  |DECK   |  |OBJECT    |  |TEST    |
|         |  |NODECK |  |NOOBJECT  |  |NOTEST  |
|         |  +-------+  +----------+  +--------+
|         |
|         |  SYSTERM options:
|         |
|         |  +--------+  +--------+  +-------------+
|         |  |NUMBER  |  |STMT    |  |TERMINAL (0) |
|         |  |NONUMBER|  |NOSTMT  |  |TERMINAL (n) |
|         |  +--------+  +--------+  |NOTERM       |
|         |                          +-------------+
|         |
|         |  other options:
|         |
|         |  +-------+  +---------+  +-------+  +-----------------+
|         |  |ALIGN  |  |BATCH    |  |RENT   |  |SYSPARM ()       |
|         |  |NOALIGN|  |NOBATCH  |  |NORENT |  |SYSPARM (string) |
|         |  +-------+  +---------+  +-------+  |SYSPARM (?)      |
|         |                                     +-----------------+
+---------+
```

fn -- is the filename of the source file to be assembled. The file specified must consist of fixed-length, 80 character records. If a user issued FILEDEF for SYSIN is active, and if the FILEDEF specified DISK, the filename may be omitted. If the user FILEDEF specified TAPn or READER, a "dummy" filename must be supplied and is used to name the TEXT and LISTING files. If no user FILEDEF for SYSIN is active, the source file must exist on an ACCESSed disk and must have a filetype of ASSEMBLE.

ESD -- The assembler produces the External Symbol Dictionary as part of the listing.

FLAG(nnn) -- Error diagnostic messages below severity code nnn will not appear in the listing nor on the SYSTERM device. Diagnostic messages can have severity codes of 0, 4, 8, 12, 16, or 20 (0 is the least severe). MNOTEs can have a severity code of 0 through 255.

For example, FLAG(8) will suppress messages for severity codes 0 through 7.

LIST -- An assembler listing is produced. Note that the NOLIST option overrides the ESD, RLD, XREF, DISK, and PRINT options. In addition, no diagnostic information will be written on the SYSTERM device.

LINECOUN(nn) -- The number of lines to be printed between headings in the listing is the number nn. The permissible range is 1 to 99 lines.

RLD -- The assembler produces the Relocation Dictionary as part of the listing.

XREF(FULL) -- The assembler listing will contain a cross reference table of all symbols used in the assembly. This includes symbols that are defined but never referenced. The assembler listing will also contain a cross reference table of literals used in the assembly.

XREF(SHORT) -- The assembler listing will contain a cross reference table of all symbols that are referenced in the assembly. Any symbols defined but not referenced are not included in the table. The assembler listing will also contain a cross reference table of literals used in the assembly.

DISK | DI -- This CMS option writes the LISTING file on a virtual disk.

PRINT | PR -- This CMS option writes the LISTING file on the printer. The LISTING file is not written on disk.

NOPRINT | NOPR -- This CMS option suppresses the writing of the

LISTING file. Any assembler diagnostic messages will still be written on the SYSTERM device.

DECK -- The object module is placed on the SYSPUNCH device.

OBJECT — The object module is placed on the SYSLIN device.

Note: The OBJECT and DECK options are independent of each other. Both or neither can be specified. The output on SYSLIN and SYSPUNCH is identical except that SYSLIN is closed with a disposition of LEAVE and SYSPUNCH is closed with a disposition of REREAD.

TEST -- The object module contains the special source symbol table (SYM cards).

NUMBER | NUM -- This CMS option writes the line number field (columns 73-80 of the input records) on the SYSTERM device for statements for which diagnostic information is produced.

NONUMBER | NONUM -- This CMS option suppresses the NUMBER option.

STMT -- This CMS option writes the statement number assigned by the assembler on the SYSTERM device for those statements for which diagnostic information is produced.

NOSTMT -- This CMS option suppresses the STMT option.

TERMINAL(n) | TERM(n) -- This CMS option provides the ability to stop diagnostic information of a given severity from being written on the SYSTERM device. The value of n is a decimal number between 0 and 7. The value of n can be thought of as a 3 bit binary number, and it is this 3 bit "mask" that serves as the diagnostic message filter. Consider the 3 bits to be labeled b0, b1, b2 from left to right. Then, the following apply:

b0 = 1 suppress 'ERROR' diagnostics
b1 = 1 suppress 'WARNING' diagnostics
b2 = 1 suppress 'MNOTE' diagnostics

For example, TERM(4) will suppress ERRORs, and TERM(5) will suppress ERRORs and MNOTEs.

NOTERM -- This CMS option suppresses the writing of all diagnostic information on the SYSTERM device. NOTERM has the same effect as the option TERMINAL(7).

ALIGN — The assembler does not suppress the alignment error diagnostic message. All alignment errors are diagnosed.

NOALIGN -- The assembler suppresses the diagnostic message

"IEV033 ALIGNMENT ERROR" if fixed point, floating-point, or logical data referenced by an instruction operand is not aligned on the proper boundary. The message will be produced, however, for references to instructions that are not aligned on the proper (halfword) boundary or for data boundary violations for privileged instructions such as LPSW. DC, DS, DXD, or CXD constants, usually causing alignment, are not aligned.

BATCH -- The assembler will do multiple (batch) assemblies under the control of a single HASM command. The source decks must be placed together in one file. The TEXT file produced will contain multiple object decks. The LISTING file produced will contain multiple listings.

RENT -- The assembler checks for possible coding violations of program reenterability.

SYSPARM(string) -- 'string' is the value of the system variable symbol &SYSPARM. The assembler uses &SYSPARM as a read-only SETC variable. If no value is specified for the SYSPARM option, &SYSPARM will be a null (empty) character string.

In the CMS environment, 'string' cannot be longer than 8 characters. If you wish to enter a string of more that 8 characters, use the SYSPARM(?) format. Using this form, you will be prompted at your terminal with the message:

ENTER SYSPARM:

A terminal read is than issued so that the SYSPARM value can be entered. It is also necessary to use the SYSPARM(?) form to enter parentheses and/or imbedded blanks in 'string'.

5.2.4 COMMAND DIAGNOSTIC MESSAGES

For information on the diagnostic messages output by Assembler H, refer to the publication OS Assembler H Messages, Order No. SC26-3770. In addition to the messages which may be issued by the assembler, there are messages which may be issued directly by the HASM command processor. The following is a list of the message codes, message texts, and return codes which may occur.

IEVCMS010E FILENAME OMITTED AND DDNAME 'SYSIN' IS UNDEFINED. (rc = 24)

IEVCMS011E FILENAME OMITTED AND FILEDEF 'SYSIN' IS NOT FOR DISK. (rc = 24)

IEVCMS002E FILE 'fn ft fm' NOT FOUND. (rc = 28)

IEVCMS003E INVALID OPTION 'option'. (rc = 24)

```
IEVCMS004E   IMPROPERLY FORMED OPTION 'option'.  (rc = 24)
IEVCMS006E   NO READ/WRITE DISK ACCESSED.  (rc = 36)
IEVCMS007E   FILE 'fn ft fm' DOES NOT CONTAIN FIXED
             LENGTH 80 CHARACTER RECORDS.  (rc = 32)
IEVCMS038E   FILEID CONFLICT FOR DDNAME 'SYSIN'.  (rc = 40)
IEVCMS052E   OPTIONS SPECIFIED EXCEED 100
             CHARACTERS.  (rc = 24)
IEVCMS070E   INVALID PARAMETER 'parm'.  (rc = 24)
IEVCMS075E   DEVICE 'device' INVALID FOR INPUT.  (rc = 40)
IEVCMS074E   ERROR action AUXILIARY DIRECTORY.  (rc = 40)
```

IEVCMS038E is issued if a user FILEDEF SYSIN DISK fn... is active, a filename is specified in the HASM command, but the two filenames do not match.

IEVCMS074E is issued if an error occurs SETTING or RESETTING the auxiliary directory (insertion/deletion from the FST chain).

5.3 OVERRIDING HASM FILE DEFAULTS

When you issue the HASM command, there are default FILEDEF commands issued for assembler datasets. You may wish to override these with explicit FILEDEF commands. The ddnames used are:

```
SYSIN     - input to the assembler
SYSLIB    - macro/COPY library
SYSUT1    - utility work file
SYSPUNCH  - object module output
SYSLIN    - object module output
SYSPRINT  - listing output
SYSTERM   - diagnostic output (SYSTERM applies
            to CMS environment only)
```

The default FILEDEF commands issued by HASM for these ddnames are:

```
FILEDEF SYSIN DISK fn ASSEMBLE * (RECFM FB LRECL 80 BLOCK 3200
FILEDEF SYSLIB DISK CMSLIB MACLIB * (RECFM FB LRECL 80 BLOCK 3200
FILEDEF SYSUT1 DISK fn SYSUT1 m4 (BLOCK 4000
FILEDEF SYSPUNCH PUNCH
FILEDEF SYSLIN DISK fn TEXT m1
FILEDEF SYSPRINT DISK fn LISTING m1 (RECFM FB BLOCK 121
FILEDEF SYSTERM TERMINAL
```

In the filedefs for SYSUT1, SYSLIN, and SYSPRINT, the filemodes 'm4' and 'm1' are established dynamically by the HASM command processor as follows:

In the filedef for SYSUT1, the filemode 'm4' is set to use the read/write disk with the most available space. For example, if

three read/write disks were accessed as the A, B, and D disks, if the D disk had the most available space then 'm4' would be set to 'D4' for use during the assembly.

In the filedefs for SYSLIN and SYSPRINT, if the assembler source file (SYSIN input) is NOT on disk or is on a read/only disk, the filemode 'm1' is set to 'A1'. If the source file is on a read/write disk, the mode letter 'm' is set to the mode of that read/write disk. For example, if the source file were on a read/write B disk, the filemode 'm1' would be set to 'B1'.

A FILEDEF command, issued for any of the above ddnames prior to invoking the assembler, overrides the default FILEDEF issued by the HASM command processor. Assume that there is an assembler source file in card deck form which you wish to assemble. If you have this card deck available to your CMS card reader, you could issue an overriding FILEDEF command prior to assembling, that is, FILEDEF SYSIN READER. Now you can invoke the assembler as follows:

```
HASM SAMPLE (options . . .
```

The name SAMPLE is used by HASM as the filename for any TEXT or LISTING file produced by the assembler. An existing TEXT or LISTING file on your read/write A-disk would be erased by the HASM command processor.

Similarly, if you have a tape containing an assembler input file which you wish to assemble, you could issue the following commands:

```
FILEDEF SYSIN TAPn (RECFM F LRECL 80 BLOCK 80
```

or, if the file were blocked 80x800, you could specify BLOCK 800 in the preceding FILEDEF. In either case, the FILEDEF would be followed by the command HASM SAMPLE (options . . .

You can read OS datasets as CMS files by defining those datasets with the FILEDEF command. For example:

```
FILEDEF SYSIN DISK OSDS ASSEMBLE fm
                  DSN OS DATASET (options . . .
HASM (options . . .
```

It is also possible to assemble a member of an OS PDS by using the MEMBER parameter of the FILEDEF command.

The same techniques used in these examples can be applied to other ddnames. Care should be taken that any attributes specified for a file conform to the assembler expected attributes for the device.

The SYSTERM DCB specifies RECFM=FA,LRECL=121,BLKSIZE=121. Information concerning the attributes used for other assembler files can be found in the publication OS Assembler H Programmer's Guide, Order No. SC26-3759.

6.0 SAMPLE PROBLEM

One of the files loaded on the installation disk when HASM is installed is named IEVSAMP ASSEMBLE. This file may by used as input to the assembler to test the correctness of the installation procedure. With the installation disk ACCESSed as the read/write A-disk, issue the command:

HASM IEVSAMP (options you choose . . .

e.g. HASM IEVSAMP (PRINT XREF(SHORT))

If your assembly results in the creation of IEVSAMP TEXT and/or IEVSAMP LISTING on the installation disk, you may wish to ERASE these two files after you have completed your validation procedures.

For a more complete discussion of the sample program, and for information on the results expected from an assembly of the sample program, refer to Appendix A of the publication OS Assembler H Programmer's Guide, Order No. SC26-3759.

7.0 MODIFICATION AIDS

Modules IEVCMS ans IEVAUX are of fixed size in the sense that each module contains unused space at its end. This is accomplished by using an ORG statement (in the ASSEMBLE file) at the end of each of these modules. IEVCMS module size is X'1C00' bytes, and IEVAUX module size is X'400' bytes. The unused space is provided so that code may be added to or deleted from either module without affecting the overall size of HASM MODULE. This means that HASM MODULE may be re-generated without affecting the load points of the Assembler H modules.

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