

# OPERATING MANUAL CHANGES

## MANUAL IDENTIFICATION

**Model Number:** 64000  
**Manual Title:** Emul/Anal 6809/6809E  
**Part Number:** 64214-90903  
**Date Printed:** September 1982

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections.

Make all appropriate software or hardware related changes indicated in the table below.

Software		Hardware	Make Manual Changes
Model - Rev.	Date	Serial Prefix or Number	
SUDS	Oct. 1, '82		1,2
System Software Update	Feb. 1, '83		1,2,3

### ▲ NEW ITEM

#### CHANGE 1

Section 2,

Page 2-3

Replace:

Fig. 2-1 on page 2-3.

#### CHANGE 2

Section 4

Page 4-11

Change: make changes as shown below

Entry	Range	Type	Blocks
1	2000H - 3FFFH	RAM/EMUL	000 - 007
2	E000H - FFFFH	ROM/EMUL	000 - 007

The effect is that emulation memory blocks 000 and 007 can be accessed either as 2000H thru 3FFFH or as 0E000H thru 0FFFFH. Locations 2000H and 0E000H refer to the same physical location. The designation of ROM or RAM is not significant other than to show the flexibility of this technique.

### NOTE

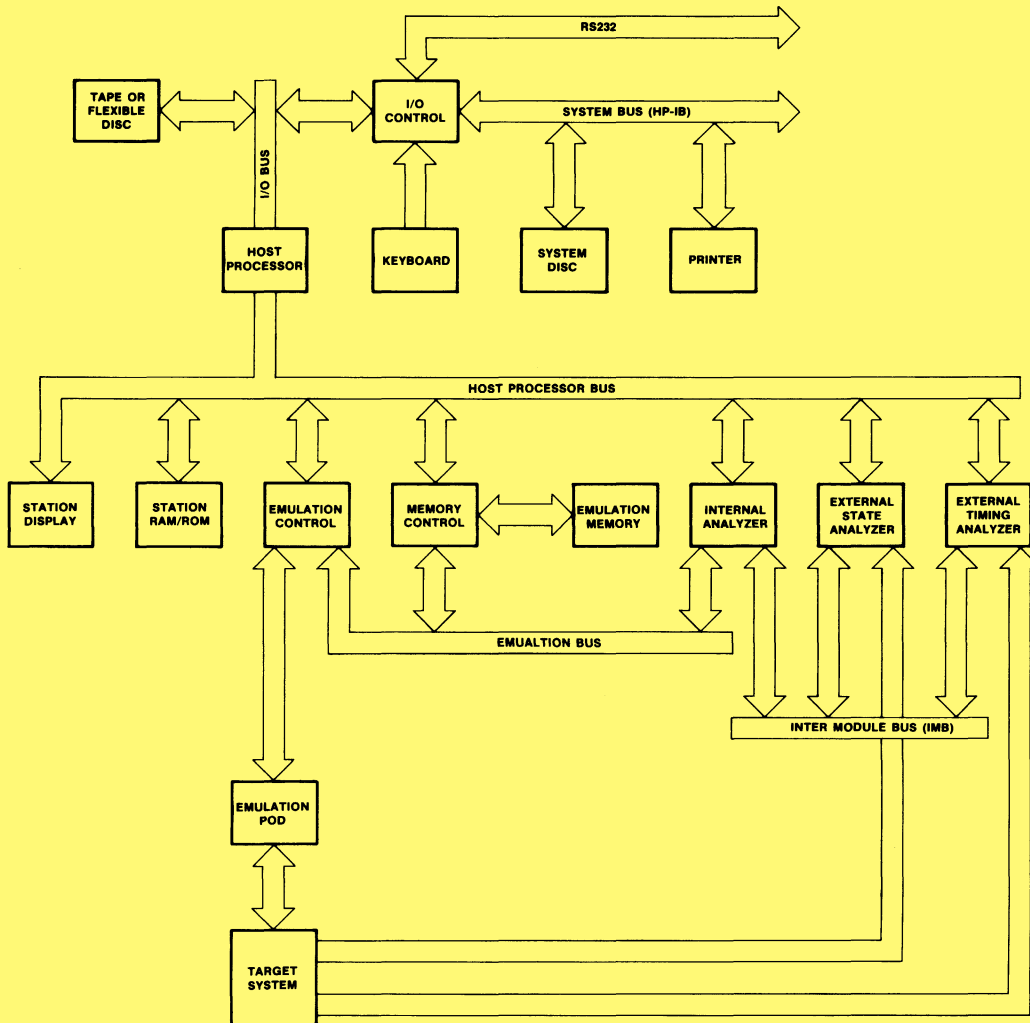
Manual change supplements are revised to keep manuals as current and as accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

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Printed in U.S.A.



**Figure 2-1. 64000 Logic Development System Simplified Functional Block Diagram**

The architecture of the multi-module system, illustrated in figure 2-1, allows monitoring of the emulation processor without interfering with its operation. In addition, because the emulation bus is independent from the host processor bus, it is possible for emulation to continue while the development station is used for other purposes.

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### ▲CHANGE 3

Chapter 8,

Pages 8-81 thru 8-85,

Delete: all references under paragraph titled: "Linker Symbols File (File Type 13)".

Add: the following paragraphs describing "Linker Symbols File (File Type 13)".

### Linker Symbol File (File Type 13)

The Linker Symbol File is generated anytime program modules are linked together. It consists of the following four types of records (see figure 8-29):

- **TYPE 1 RECORD** - Microprocessor Configuration Record (one per file).
- **TYPE 2 RECORD** - Global Symbols Records.
- **TYPE 3 RECORD** - Program Names Records.
- **TYPE 4 RECORD** - Memory Space Allocation (RANGE).

Each of the above listed records is described below.

**TYPE 1 RECORD** (see figure 8-30). The first record in the Linker Symbol File is always a TYPE 1 record. It is similar to the NAME record in relocatable files and is required for the linker to configure itself for the correct microprocessor. The record is only used when a link\_sym file is the first file given as a response to the linker question "Object files?". This is a fixed-length record containing 26 words and is configured as follows:

- a. Record identification (ID) word - The record ID word is always the first word in the record. It is also the first word in the Linker Symbol File and contains the number "1". This number identifies the record as the microprocessor configuration record. (The "1" is used internally and should not be confused with the file type number which is "13".
- b. Pad words 1 through 15 - These words are inserted so that word positions 16 through 23 in this name record contains the same information as do corresponding word positions in the name records of the relocatable files.

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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

- c. Name and user ID word block - A fixed length 8-word block (words 16 through 23) that contains the microprocessor configuration file name in standard file name format, i.e., I68000:HP. The MSB of word 16 contains the following information:

bits 15-13: indicates the number of 16-bit words-1 in the file name.

bits 12-11: indicates the number of 16-bit words in the userid.

bits 10-8 : "don't care" conditions.

- d. Address size - This word (word 24) is required for emulation and state analysis. It defines the number of 16-bit words required to specify an address for the target processor. The LSB of this word indicates the address size (1 = one word addresses (16 bits); 2 = two-word addresses (32 bits)). The MSB of this word, hishift (see figure 8-30), is used to convert 32-bit logical addresses (segment, offset) to physical addresses. This is accomplished by putting the segment in the MS 16 bits of a 32-bit register, shift right the number of bits indicated in hishift, then do a 32-bit add to offset.
- e. Checksum - The checksum word (word 25) contains the arithmetic sum of the binary values of the preceding 25 words in this record.

**TYPE 2 RECORD** (see figure 8-31). The Linker Symbol File may contain multiple Global Symbol Records (TYPE 2). The first Global Symbol Record follows the Microprocessor Configuration Record and all subsequent Global Symbol Records are contiguous. These records are copied from the linker's symbol table at the conclusion of pass 1.

A Global Symbols Record contains the global symbols and the relocated address values (symbol values) generated when the program modules are linked. Each record may consist of up to 128 16-bit words (0-127 words) structured as follows (see figure 8-32):

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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

- a. Record identification (ID) word - The record ID is always the first word in each record and contains the number "2". (The "2" is used internally and is not to be confused with the file type number which is "13".)
- b. Global symbol definition blocks - A global symbol definition block consists of the symbol word(s) and the value word(s) which are described in more detail in this paragraph.
- c. Checksum word - The checksum word must be the last word in each record. If the record is completely full, then the checksum word will be the 128th word (word #127).

Symbol word(s) - The ASCII character, or characters, are contained in this word (or words). From one to fifteen ASCII characters may be defined. To specify a single-character symbol, only one symbol word is required. To specify either 14 or 15 ASCII characters, the maximum of eight words is required. (Symbols longer than 15 characters are truncated as 15 characters.)

First symbol word - The first word in every symbol definition block is structured the same. The least significant eight bits (7 through 0) contain the first ASCII character in the symbol. The most significant eight bits (15 through 8) always contains the following information (see figure 8-32):

- a. Global Symbol Length (GSL) - Bits 15, 14, and 13 specify the number of symbol words-1 in this block. For example, if the global symbol consists of two ASCII characters, which require two symbol words, GSL is equal to 1. (The second byte in the second word will contain an ASCII blank, i.e., code 20H.)
- b. Bits 12, 11, and 10 - "don't care" conditions.

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### ▲CHANGE 3 (Cont'd)

Chapter 8,

Pages 8-81 thru 8-85,

Add:

- c. Memory Relocation (Relo) - Bits 9 and 8 specify how the symbol may be relocated as follows:

Bit 9	Bit 8	Storage Type
0	0	ABS (Absolute)
0	1	PROG area
1	0	DATA area
1	1	COMN area

Additional symbol words - The second through the eighth symbol words may each contain up to two ASCII characters. However, if in the last symbol word, only one byte is required to define the last symbol character, then the least significant byte in that word must contain an ASCII blank (code 20H). That is the two bytes in each symbol word must contain meaningful data, even in the last word.

The symbol words must be packed. Only the words actually required to specify the symbols are to be used. Thus, if five symbol words required to define a symbol, then only five symbol words must be used.

Symbol value word(s) - Immediately following the last symbol word may be either one or two value words, depending upon the size of the target processor addressable memory. This word (or words) specifies the address assigned to the symbol by either the assembler (if ABS-absolute) or by the linker. If the address can be contained in one 16-bit word, then only one word is to be used. Two 16-bit words are used only if they are both required. When two words are used, the first word contains the least significant 16 bits and the second word contains the most significant bits of the symbol address.

All global symbol definition blocks within the Linker Symbol File must be structured as defined above.

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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

**TYPE 3 RECORDS** (see figure 8-33). The Linker Symbol File may contain multiple Program Names Records. The first Program Names Record follows the last Global Symbols Record. All succeeding Program Names Records are contiguous.

The names of type 3 records are not maintained in any internal structure. Program names have an implicit ordinal number value from 0 to N. It should be noted that if a link\_sym file is given as an input to the linker, the resulting link\_sym file does not contain the program names from the inputted link\_sym file.

Type 3 records contain all source program names and their relocation addresses. The primary purpose of these records is to provide relocation addresses for the symbols in asm\_sym files.

Program names are not the same as file names. The most common example of this is with libraries. Program names come from the Program Description Records within Relocatable Files (File Type 3 - see figure 8-39). The name in the relocatable record (see figure 8-40) is the name of the source file that produced the relocatable file. The program name will be the same as the relocatable file name as long as the relocatable file has not been renamed or copied to a library.

For example, if two separate source file programs are assembled/compiled, the result will be two separate relocatable files with each having the file name of the source program as follows:

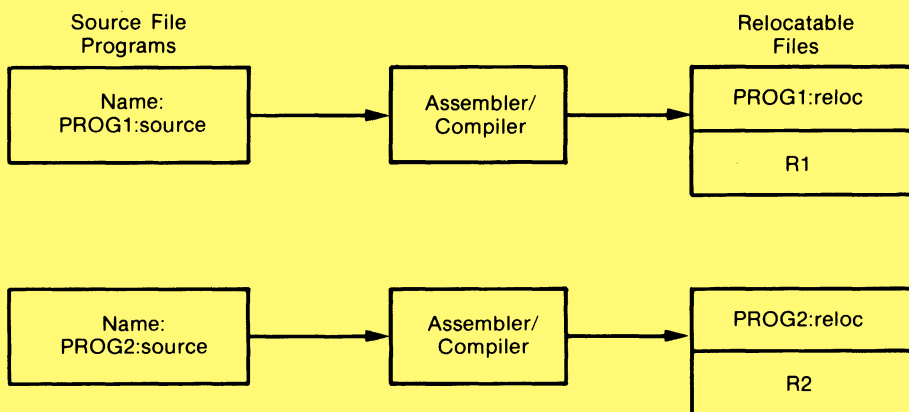
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## MANUAL IDENTIFICATION

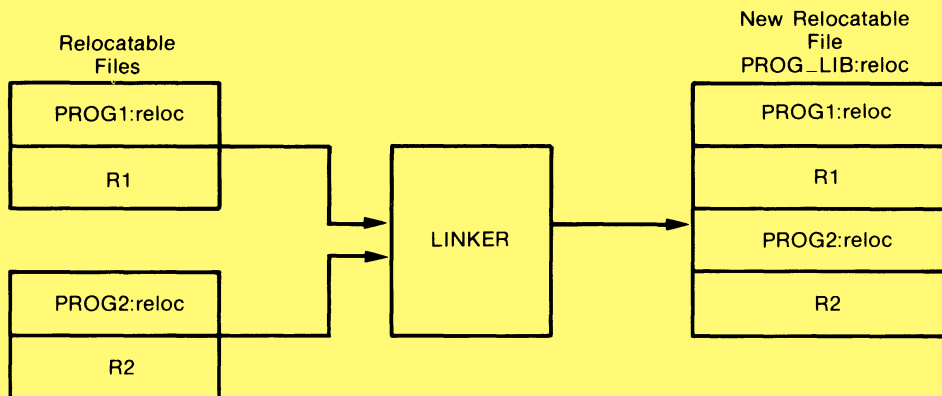
**Model Number:** 64000  
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**Part Number:** 64214-90903  
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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:



If the two relocatable files are linked together to form a library, for example, a new relocatable file would be built under a new file name as follows:



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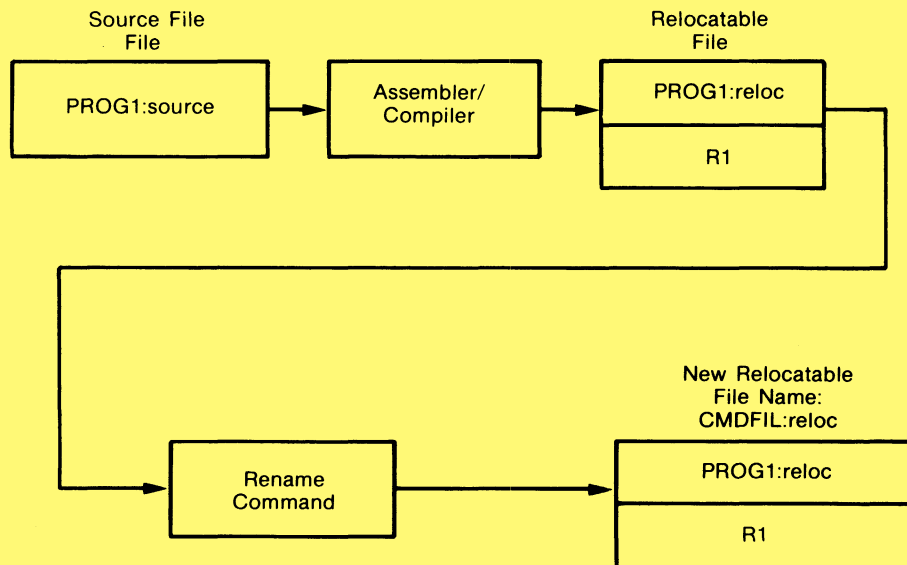
Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

The linker output listing for the above would be:

```
PROG_LIB:ID  
PROG1:ID  
PROG2:ID
```

Note the two original source file names are indented, indicating multiple relocatables in PROG\_LIB:ID file.

Using the 64000 system "rename" command will also result in a relocatable file having a different name than the source file program as follows:



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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

The linker output listing for the above would be:

```
CMDFIL:ID  
PROG1:ID
```

A Program Names Record contains the names of the source file programs, the corresponding user ID's and the load addresses generated when the program modules are linked. Each record may consist of up to 128 sixteen-bit words (words 0-127) structured as follows:

- a. One Record Identification (ID) Word.
- b. Multiple Program Name and Addresses Definition Blocks (fixed length blocks of 14 words each).
- c. One checksum word.

Record identification (ID) word - The ID word is always the first word in each record and contains the number "3". (The "3" is used internally and is not to be confused with the file type number which is "13".)

Program name and addresses definition block - This is a fixed length block consisting of 14 sixteen-bit words allocated as follows (see figure 8-34):

- a. Eight words reserved for the program name and users ID.
- b. Six words reserved for the linker load addresses.

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### ▲CHANGE 3 (Cont'd)

Chapter 8,  
Pages 8-81 thru 8-85,  
Add:

Program name and user ID words - The formatting and packing of these words are done in the same way as described for the Microprocessor Configuration Record (TYPE 1), Name and ID word Block.

Load address words - These words contain the load addresses assigned by the linker. If an address is not assigned to a particular area, the address words contain zeros (0000H). The MS 16-bit address word will be used only if required by the target microprocessor's addressable memory space.

Checksum word - The checksum word must be the last word in each record. If the record is completely full, the the checksum word will be in the 128th word (word #127).

The checksum word contains the arithmetic sum of the binary values of the preceding words in the record.

**TYPE 4 RECORDS** (see figure 8-34A). Type 4 records follow type 3 records and contain a list of memory spaces used by the relocatable files. Each block contains file, program name, and relocation information plus the lower and upper bounds of the piece of memory used. Blocks are sorted on lower bound from smallest to largest.

Records contain from 1 to 9 fixed length blocks with each block containing 14 words. A block may not cross a record boundary.

Pages 8-97 thru 8-104,  
Replace: with pages 8-97 thru 8-104 attached.

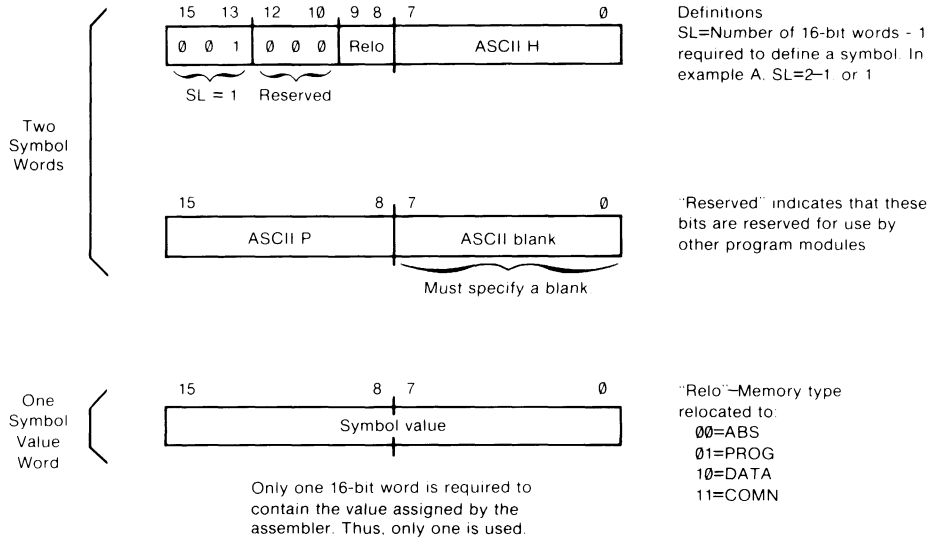
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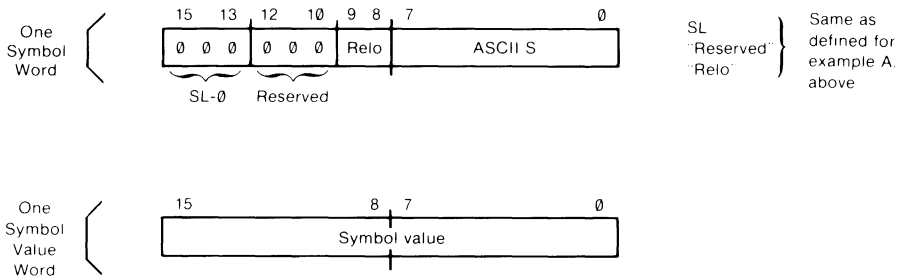




EXAMPLE A. SYMBOL = HP

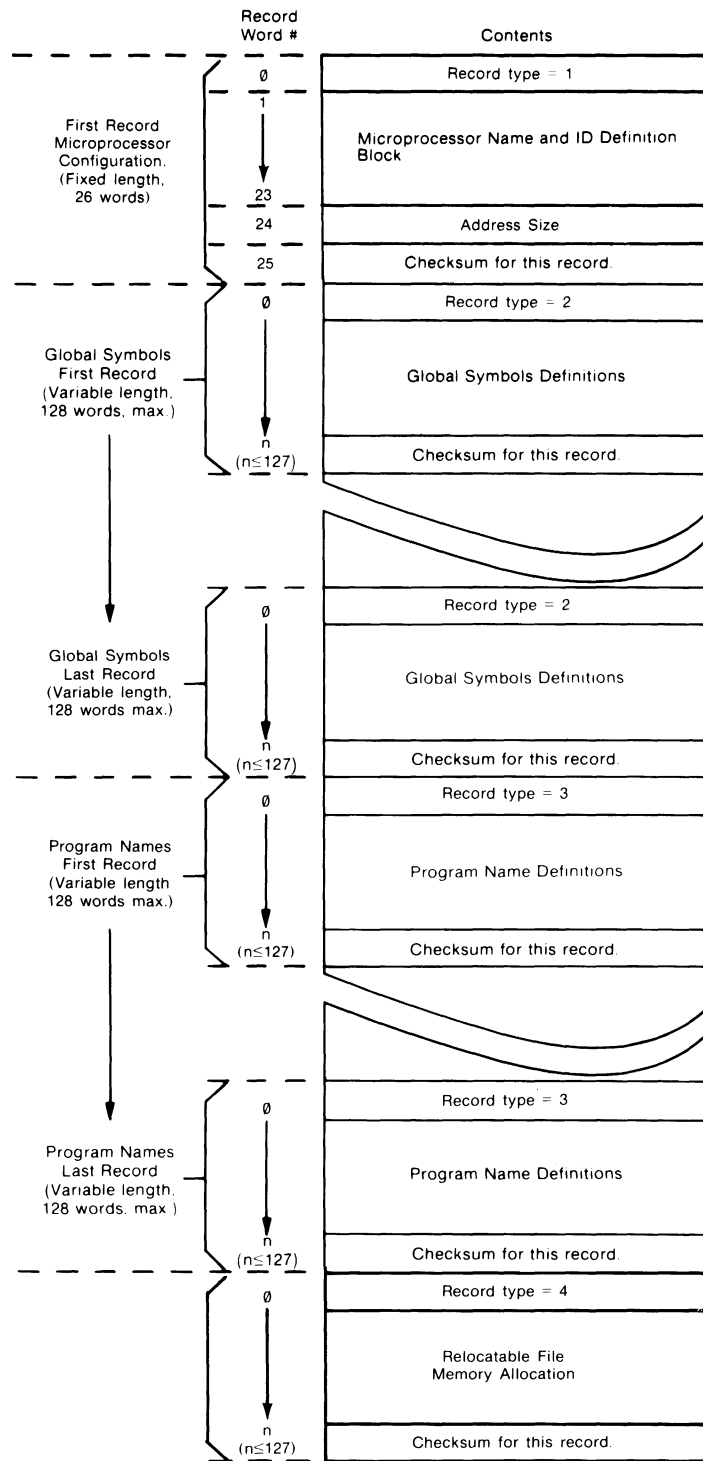


EXAMPLE B. SYMBOL = S

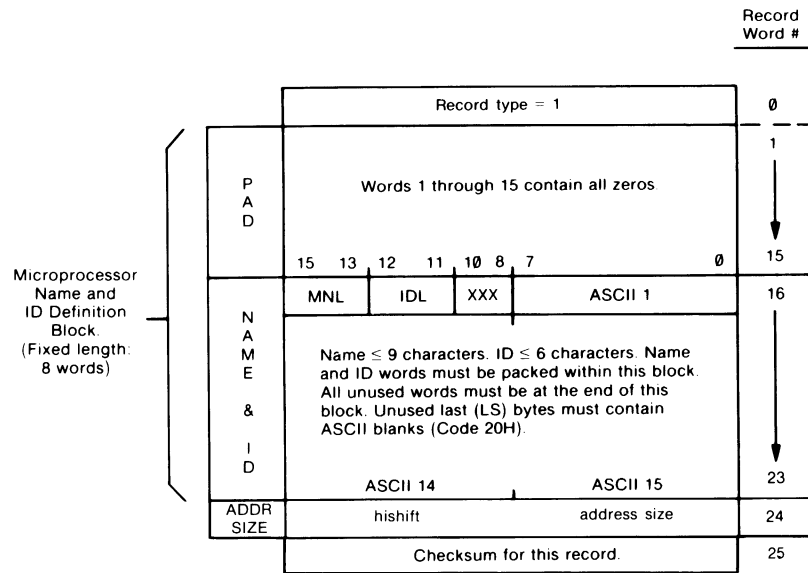


Again, only one 16-bit word is required to contain the symbol value. Thus, only one is used.

Figure 8-28. Assembler Symbol Record/Symbol Definition Block Examples



**Figure 8-29. Linker Symbol File Overall Structure**

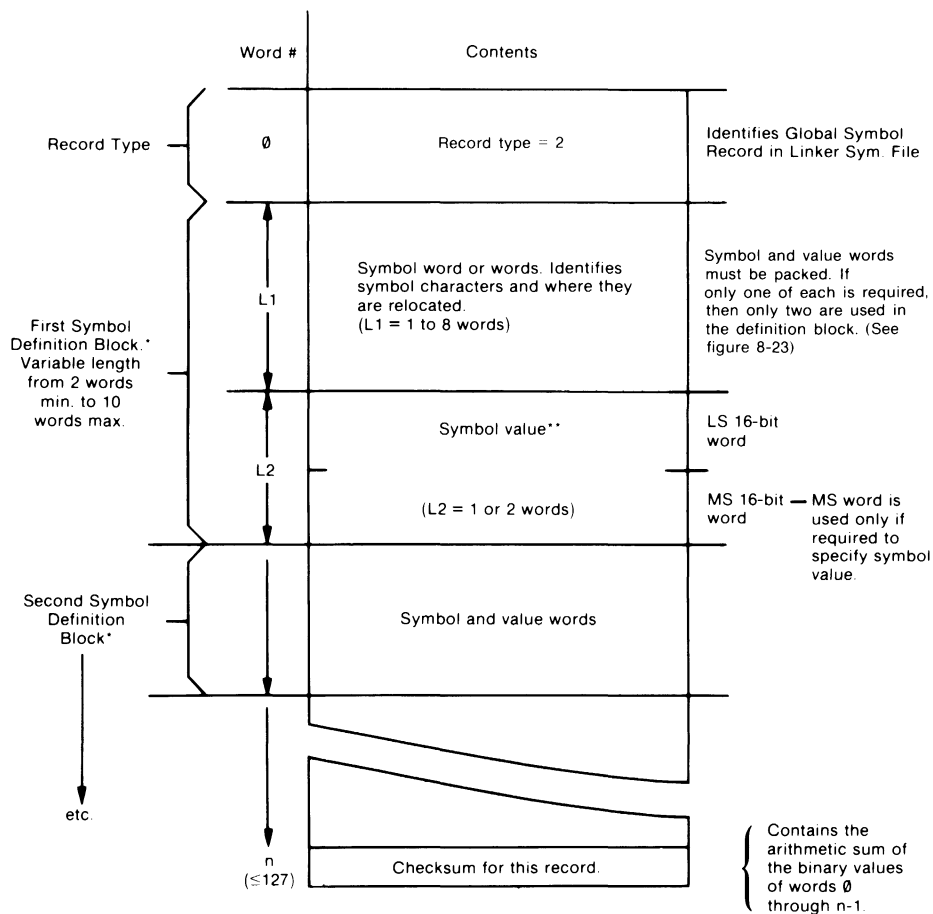


**Notes**

1. Words 1 through 15 are added so that word positions 16-23 in this name record contain the same data as do the corresponding word positions in the name records of the relocatable files.
2. MNL = Number of 16-bit words - 1 required to define the microprocessor name. At least one character in the "ASCII 1" byte is required. Thus, with a one character name, MNL = 0. If all nine characters are used (5 words), MNL = 4.
3. IDL = Actual number of 16-bit words required to define the user ID. If one word is used, IDL = 1. If all three words are used, IDL = 3.
4. Bits 10, 9, and 8 - "don't care" condition.
5. ASCII bytes 1-15 contain the name and ID characters. These words must be packed. That is the ID words must follow the name words. Unused words must be at the end of the block. An unused byte in either a name or ID word must contain an ASCII blank (Code 20H).
6. Word 24 indicates address size where "address size" = 1 indicates one-word addresses (16 bits) and "address size" = 2 indicates two-word addresses (32 bits). "hishift" used when converting logical addresses (segment, offset) to physical addresses.
7. The checksum contains the arithmetic sum of the binary values of words 0 through 24.

**Figure 8-30. Microprocessor Configuration Record Structure**

GLOBAL SYMBOLS RECORD



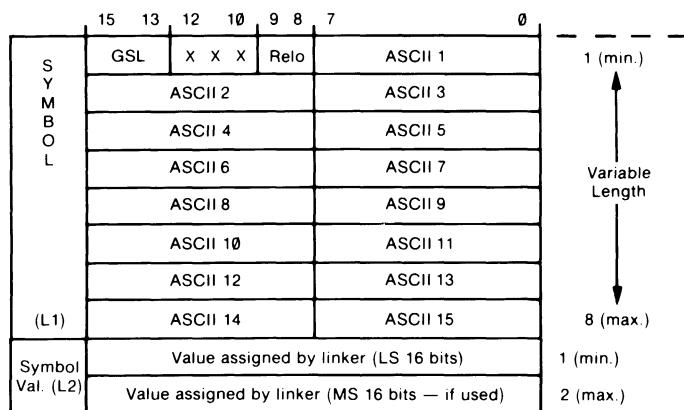
**Notes**

\*For block structure details see "Global Symbols Definition Block Diagram."

\*\*Symbol value assigned by assembler. If relocatable value (not ABS), it will be relocated by the linker.

**Figure 8-31. Global Symbol Record Structure**



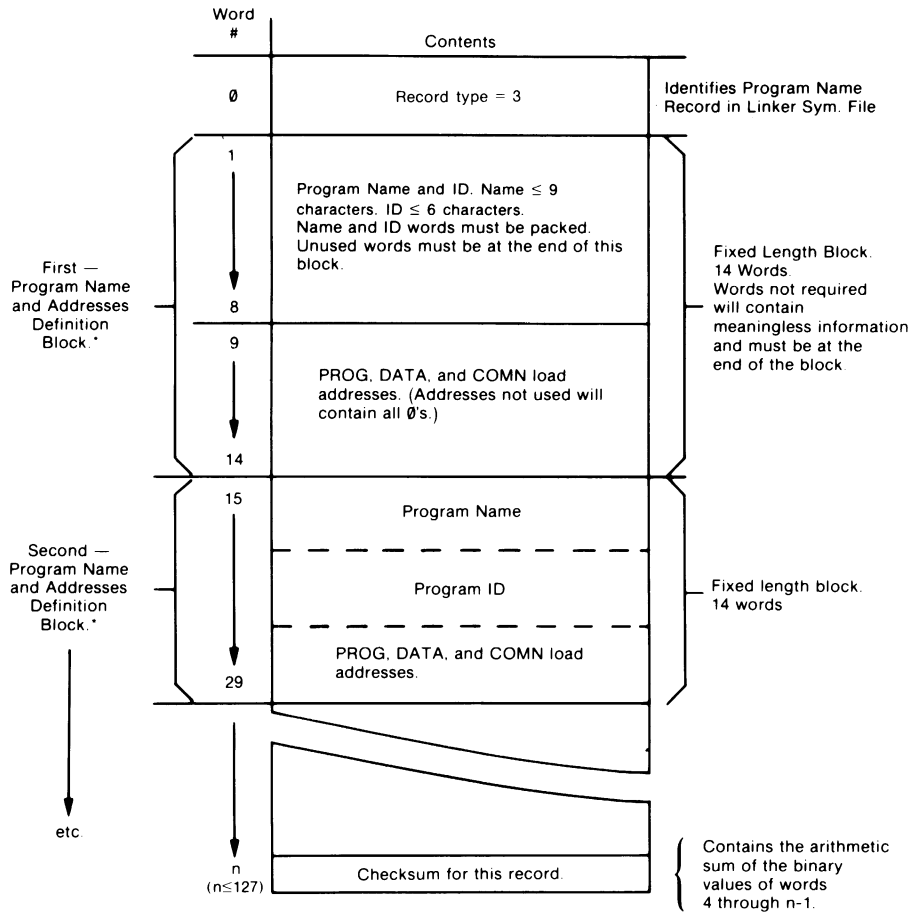


**Notes**

1. GSL = Number of 16-bit words -1 required to define a global symbol. At least one character is required in the "ASCII 1" byte. Thus, with a one character name, name length = 0. If all 15 characters are used (8 words), name length = 7.
2. Bits 12, 11, 10 - "don't care" conditions.
3. "Relo" contains the binary code for area relocated to as follows: 00 = ABS, 01 = PROG, 10 = DATA, and 11 = COMN.
4. The bytes labeled ASCII 1-15 are the maximum number of bytes available to define the symbol. Only the actual number of 16-bit words required to define the symbol will exist. However, if the first byte (MSB) is used, then the second byte (LSB) must contain an ASCII blank (Code 20H).
5. The symbol value is assigned by the assembler. If a relocatable value it will be relocated by the linker. The 8086 microprocessor symbol values are in segment, offset form where LS = offset and MS = segment.

**Figure 8-32. Global Symbol Definition Block**

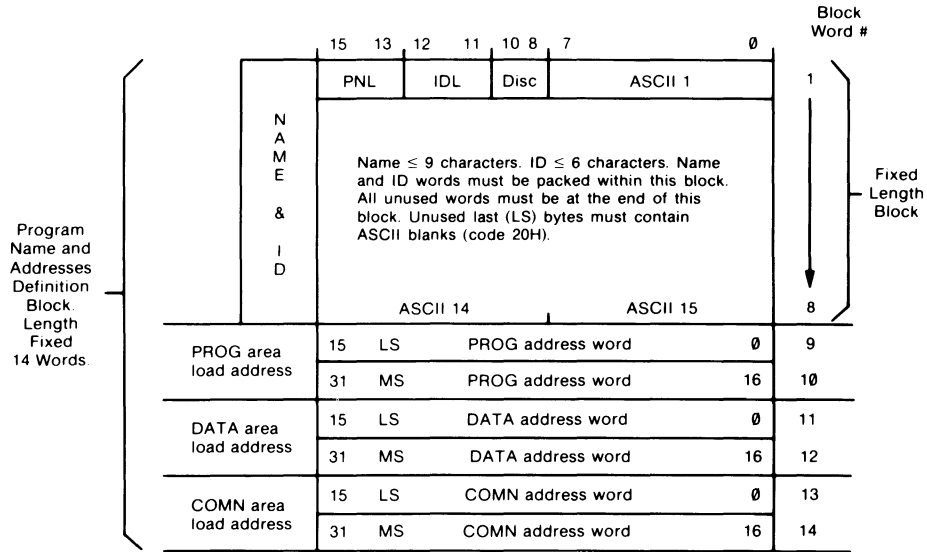
### PROGRAM NAME RECORD



**Notes**

\*For block structure details, see figure 8-34.

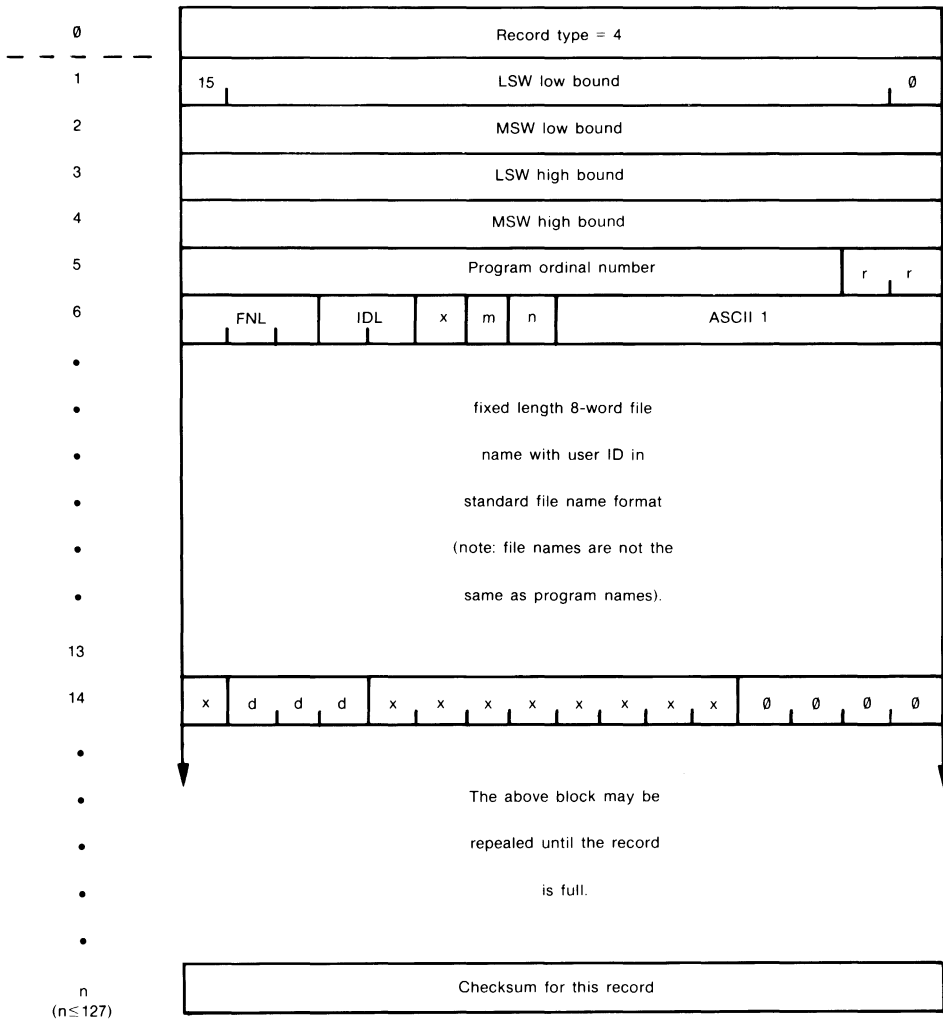
**Figure 8-33. Program Name Record Structure**



#### Notes

1. PNL = Number of 16-bit words -1 required to define the program name. At least one character in the "ASCII 1" byte is required. Thus, with a one character name, PNL=0. If all nine characters are used (5 words), PNL=4.
2. IDL = Actual number of 16-bit words required to define the user ID. If one word is used, IDL = 1. If all three words are used, IDL=3.
3. DISC = The indentifying number of the disc upon which the program resides.
4. ASCII bytes 1-15 contain the name and ID characters. These words must be packed. That is - the ID words must follow the name words. Unused words must be at the end of the block. An unused byte in either a name or ID word must contain an ASCII blank (Code 20H).
5. Load Address Words - The load address words contain the load address assigned by the linker to this program. Unused address words contain all zeros. Load addresses for the 8086 microprocessor are in segment, offset form where LS = offset and MS = segment.

**Figure 8-34. Program Name and Address Definition Block Format**



**Figure 8-34A. RANGE Definition Block Format**

**Notes (for Figure 8-34A)**

1. Words 1 through 4 list the memory space used by the relocatable files. Blocks are sorted on lower bound from smallest to largest. For the 8086 microprocessor, bounds are in offset, segment form where LSW = offset and MSW = segment.

2. Word 5 - a Program name for TYPE 3 records has an implicit ordinal number value which is indicated in word 5. The two bits, rr, indicate program type as follows:

rr = 00 → absolute  
rr = 01 → PROG relocatable  
rr = 10 → DATA relocatable  
rr = 11 → COMN relocatable

3. Word 6 - FNL = number of 16-bit words-1 required to define the file name.

IDL - actual number of 16-bit words required to define user ID. If one word is used, IDL = 1.

x - indicates "don't care" condition.

m - as described under TYPE 3 RECORDS, a file may contain multiple relocatables or a program name different from the file name. If this occurs, m = 1. If m = 0, the file name and program name are the same.

n - If n = 1, the indicated file was a "no-load" file, i.e., the file was linked and relocated but no code was generated.

4. Word 14 - ddd indicates the disc where the file resides. x = "don't care" conditions.

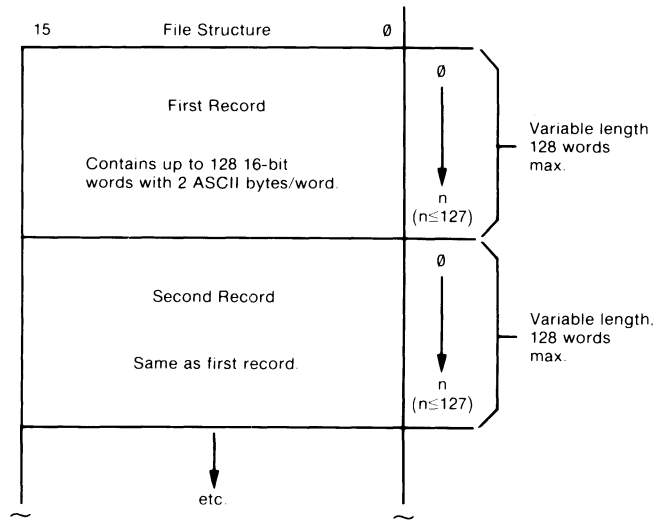


Figure 8-35. Source and Listing Files - Overall Structure

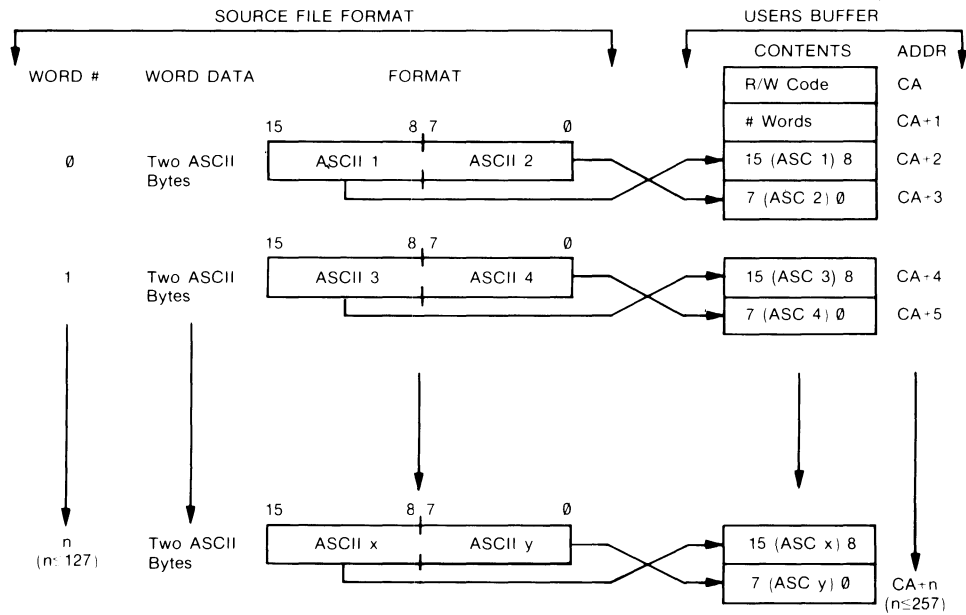


Figure 8-36. Source and Listing File Format