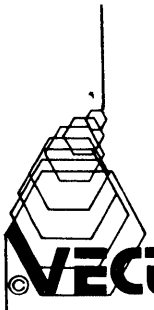

VECTOR GRAPHIC INC. PRESENTS THE SOURCERER

A COMPREHENSIVE DISASSEMBLER FOR 8080 OBJECT CODE: The Sourcerer is designed to convert 8080 object code files to source code files, which are easier to understand and modify. The code is systematically converted to Intel standard mnemonics, and the created file is compatible with most 8080 assemblers, including ESP-1 and others based on the Processor Technology assembler.

CREATE ESP FILES DIRECTLY IN RAM: Files may be formed directly in memory, or may be listed on any output terminal device. Several formats are available, including two with decimal line numbers and formatted constants and symbols. All symbols have a leading H followed by their hex equivalents; thus the assembler treats them as labels. All numerical constants have a leading zero and trailing H so they are treated as hexadecimal constants.

SYMBOL TABLE: The Sourcerer operates in two passes. On the first pass, all three-byte codes are used to form a hex symbol table. This table is used on the second pass to affix labels to the file. The symbol table may be listed separately.

CROSS-REFERENCE TABLE: A cross-reference table may be listed. This table consists of each symbol, the RAM addressed from where it is referenced, and the mnemonic codes that reference it.

The Sourcerer is a unique tool, a must for the true software buff. It allows you, in a very short time, to create source files from all those machine code programs that you want to modify, but are reluctant to hack up with haywire patches. Now you can create your own source file, add commands, change subroutines, or delete unused features. Your newly assembled program will be as efficient and compact as the original!

To use the Sourcerer, you'll need a dedicated 4K block of memory. The code itself occupies just over 2K with another short section devoted to scratchpad, input buffer and stack. The remainder of the 4K block is used for symbol table storage.

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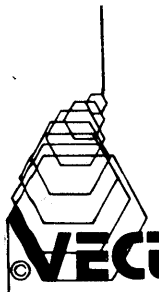

VECTOR GRAPHIC INC.

THE SOURCERER

BY

TOM NUSSMEIER

START 0000

LENGTH 0930

FREE CORE FROM 1000 HEX

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THE SOURCERER

The SOURCERER is a comprehensive dissassembler designed to convert 8080 object code files to source code files, which are easier to understand and modify. The code is systematically converted to INTEL standard mnemonics, and the created file is compatible with most 8080 assemblers, including ALS-8, Imsai, ESP-1 and others based on the Processor Technology assembler. To achieve this, the SOURCERER operates in two separate passes, one to form a symbol table and the second to convert the code to mnemonics. The symbols are placed at the beginning of the appropriate lines as the second pass progresses. For maximum versatility, the two passes are controlled separately. For several of the formats, the symbols are simply hex addresses. In those formats intended for use in an assembler, the symbol is preceded by an H, (example - H237F) so that the assembler will interpret them as labels, not numbers.

The SOURCERER forms the symbol table by examining all the codes in a block of memory (specified by the command), collecting the last two bytes of all three-byte codes, sorting these 16 bit addresses in numerical order, and storing them in a file for future use. It is important to note that all these codes are treated as labels, even though some may be constants. During reassembly, the constants may cause errors, but these must be located the hard way; there is no way to distinguish a constant from a label in an object code file. A similar problem occurs with data tables buried in the object code; the SOURCERER will treat these as commands and attempt to decode them. These must be located and output using the D command (see description of commands below) to prevent errors. Finally, the assembler will require some labels that the SOURCERER will not locate. These usually occur when a data table is used for command decoding. It will be necessary after forming the file to locate these areas and type in the required labels.

Despite the limitations listed above, the SOURCERER is a very powerful tool. The author has used it to create source files from object codes as long as 5000 bytes, and has used these files to modify and reassemble programs both at the same address as the original, and at new locations. Typically, a 1000 byte object can be converted to source in one evening's work, starting with very little knowledge of the program. I recommend, however, that the SOURCERER be used on some of your own software, preferably short programs, to get the necessary familiarity with its operation.

COMMAND DESCRIPTION

There are 12 commands, consisting of one letter each. Many of the commands require addresses; these are typed directly following the commands in hexadecimal notation. Commands are executed by the carriage return, and may be edited or aborted up to the time of execution.

Prompt string - when properly loaded, the program will respond with a triangular bracket and space (>). This signifies that the program is awaiting a command.

Entry and editing - Commands are typed in as single letters. If a non-existent command letter is typed, it will be rejected by the program. The rejected letter will be printed followed by an underline character (hex 5F), which will erase on most video terminals. Proper commands will not be erased. If address fields are to be typed following the command, they must be in hex. Any non-hex character will be rejected. Leading zeros are not required. If more than four hex characters are typed, only the last four will be used. Any character may be erased by typing an underline (5F). Address fields are separated by spaces, but the space between the command and the first field is optional. Any command may be aborted by Control-C. Commands will be discussed in the order in which they are most likely to be used.

S BBBB EEEE - Form symbol table. (BBBB and EEEE are the beginning and end of the code block to be accessed). The symbol table is formed and stored on this pass through the code. If there are tables or other non-code entries in the block, these will be interpreted as code and erroneous entries will be made. (Examining the symbol table for unusual addresses is one method for locating tables.)

T - Display symbol table. Outputs symbol table as a series of hex addresses. 0000 is always output; the dissassembler uses this value to locate the beginning of the symbol table. Table is listed sequentially, 8 addresses per line.

X BBBB EEEE - Display cross-reference table. This command lists every symbol in the symbol table followed by the address and mnemonic code of every location that references the symbol. This is very useful when programs are being modified. However, when long programs are involved, this command is very slow, and the user should be aware that long times may be involved. As an example, printing the cross-reference table for a 5K program can take up to 2 hours. (Note: if a third address field is used with this command, the first symbol to be listed will be equal to or higher than this third field.)

F AAAA - Set RAM file location. Initializes the counters for creating files in RAM. If AAAA = 0, no file will be created. If F is typed without any addresses, the starting and ending address of the file will be displayed. Only two commands will cause a RAM file to be built, D (Data Word) and L (List Format). Other commands will not affect the RAM area.

O LLLL RRRR - Set location offset. If the program to be disassembled is not located at it's usual running address, this command will compensate. LLLL is the address where the object code is located; RRRR is the address where the code normally runs.

D BBBB EEEE - Data word format. Outputs code block as Intel pseudo-op DW. Useful for forming tables for the assembler. This command and the L command will form files in RAM if the R F command has been used to set a starting address.

N BBBB EEEE - Mnemonic format. This command lists the program with hex addresses, the hex version of the code, the ASCII code equivalent, the label, mnemonic, arguments, and data fields, if applicable. ASCII equivalents for two and three byte codes are output on the same line. As with all formats (except L), the listing will appear with all labels, mnemonics, arguments, etc., vertically aligned for easy reading. The N command is recommended for preliminary decoding of a new program.

P BBBB EEEE - Print format. This command dumps code with decimal line numbers, labels with leading H, mnemonics, arguments and data fields. Two-byte data fields will have a leading H to allow referencing to the labels. One-byte data fields will have a leading zero and a trailing H, so that the assembler will treat them as hex constants. This format is one of two that will load directly into an assembler. This particular format is useful only with short programs, as it does add a lot of extra spaces. However, it is very easy to read.

L BBBB EEEE - List format. This command is the same as P except all the excess spaces have been deleted. This command should be used when dumping code onto paper tape for reload ing into an assembler. This command is also the principle command for creating a file in memory.

R DDDD II - Reset line numbers. This command establishes the first decimal line number (DDDD) and the line number interval that will be output with the P, L and D commands. Both DDDD and II should be decimal numbers. This command initializes to a starting value of 1 and an interval of 1.

G AAAA - Goto. Transfers program control to the specified address AAAA. This is a utility command included to allow operating several programs in memory simultaneously without the need for transfering with the front panel switches.

I - Initialize. The SOURCERER is self-initializing the first time it is accessed. After this first initialization, I must be used to re-initialize. When I is typed, followed by a carriage return, the terminal will respond with a message which reads: TYPE Y TO INITIALIZE. At this point, if a Y is typed, full initialization will occur. Any formed symbol table will be deleted, the O and F commands will be reset to zero (Offset and RAM file) and the decimal number counter will be reset to it's initial value. If any letter other than Y is typed, only the decimal counter will be reset. (The message is output to prevent inadvertent loss of the symbol table.)

LOADING AND PATCHING THE SOURCERER

The SOURCERER requires a dedicated 4K block of memory. The code itself occupies just over 2K, with another short section devoted to scratchpad, input buffer and stack. The remainder of the 4K block is used fo symbol table storage. The table is built from the top down, thus even the smallest table will use the zone at the end of the 4K block. There is room in the table for about 700 symbols, which is adequate for nearly any program you might want to disassemble. (A 12K object code will have just about 700 symbols).

I/O PATCHING

The SOURCERER is delivered with standard TTY I/O routines because this is a starting point that most people are familiar with. The output routine is located at Hex X0B0. (The X is the first number of the version that you are using; 3 for the 3000H version, 0 for the 0000 version). Four NOP's follow this routine; they are available for use if necessary. The input routine is located immediately following these NOP's at Hex X0C0. Again, four extra bytes are available after this routine. Be sure that your output routine does not modify any of the registers, and that the input character is returned in the A register.

Immediately following the input routine is the pause routine. This routine allows dumps or listings to be interrupted by the spacebar or aborted by control-C. At location X0D2 the keyboard data port is read (input). This location is delivered with hex code 01, (the TTY data port); change it to match your keyboard port. This completes I/O patching. The input/output and pause routines are listed on the next page.

SOURCERER EXAMPLE

A short program, designed to run at 3000 hex, has been loaded into memory at location 1000. The SOURCERER is loaded at 3000, thus an offset is required. A file of the program will be formed at hex 4000. The program code is 32 hex bytes long. Upper case letters represent the output when running the SOURCERER; lower case comments were added later for clarity.

Hex Dump of program.

```
1000:  21 00 00 CD 22 30 DB FF E6 40 CA 13 30 CD 03 F0
1010:  C3 03 30 DB FF E6 80 C2 2C 30 CD 03 F0 77 23 C3
1020:  03 30 DB 27 E6 08 C2 22 30 DB 26 C9 3E 5F CD 03
1030:  F0 C9
```

```
> I                                  Initialize Command.  Not re-
TYPE Y TO INITIALIZE                 quired  when first starting.

> S 1000 1031                        Form Symbol Table.

> T                                  Display Symbol Table.

SYMBOL TABLE

0000    3003    3013    3022    302C    F003

> X 1000 1031                        Display Cross-Reference Table.

0000
1000 LXI H

3003
1010 JMP    101F JMP

3013
100A JZ

3022
1003 CALL   1026 JNZ

302C
1017 JNZ

F003
100D CALL   101A CALL   102E CALL

> F 4000                             Set File Starting Address.

FILE  4000  4000

> O 1000 3000                        Set  offset - Program Runs at
                                     Address 3000 Hex

> N 1000 1031                        Use N Command for First Pass.

1000:  21  !          LXI   H,0000     Note Hex Addresses,
1003:  CD  3"0  3003  CALL  3022       Hex  Codes,  ASCII.
1006:  DB             IN    FF        Labels are  Offset.
1008:  E6   @         ANI   40        No Leading  0's  or
100A:  CA    0        JZ    3013      H's for this Format.
100D:  CD             CALL  F003
1010:  C3    0        JMP   3003
1013:  DB       3013  IN    FF
1015:  E6             ANI   80
```

```
1017:  C2    ,0          JNZ     302C
101A:  CD                CALL    F003
101D:  77   w            MOV     M,A
101E:  23   #            INX     H
101F:  C3     0          JMP     3003
1022:  DB    '    3022   IN      27
1024:  E6                ANI     08
1026:  C2    "0          JNZ     3022
1029:  DB    &           IN      26
102B:  C9                RET
102C:  3E   >    302C    MVI     A,5F
102E:  CD                CALL    F003
1031:  C9                RET
```

```
> F
```

Examine File Length; File not Formed by "N" Command.

```
FILE  4000  4000
```

```
R 0 10
```

Set Decimal Line Numbers to Start at Zero, Count by 10.

```
> L 1000 1031

0000  LXI H,H0000
0010 H3003 CALL H3022
0020  IN 0FFH
0030  ANI 040H
0040  JZ H3013
0050  CALL HF003
0060  JMP H3003
0070 H3013 IN 0FFH
0080  ANI 080H
0090  JNZ H302C
0100  CALL HF003
0110  MOV M,A
0120  INX H
0130  JMP H3003
0140 H3022 IN 027H
0150  ANI 008H
0160  JNZ H3022
0170  IN 026H
0180  RET
0190 H302C MVI A,05FH
0200  CALL HF003
0210  RET
```

List Format. This Format has Decimal Line Numbers, Proper Spacing, Leading H, to form Label From Hex Address Symbols. Constants Have Leading 0 and Trailing H. This File Also Formed in RAM at Hex 4000.

```
> F
```

Examine File Length

```
FILE  4000  4175
```

```
> D 1000 1008
```

Dump a Little in DW Format.

```
0220   DW 00021H
0230   DW 0CD00H
0240   DW 03022H
0250   DW 0FFDBH
0260   DW 040E6H
```

```
> R 1 1
```

Reset Decimal Line Numbers.

```
> P 1000 1008
```

Use the Print Format.

```
0001          LXI     H,H0000
0002 H3003    CALL    H3022
0003          IN      0FFH
0004          ANI     040H
>
```

```
ØØBØ F5
ØØB1 DB ØØ
ØØB3 E6 8Ø
ØØB5 C2 B1 ØØ
ØØB8 F1
ØØB9 D3 Ø1
ØØBB C9
ØØBC
ØØBC
ØØCØ
ØØCØ DB ØØ
ØØC2 E6 Ø1
ØØC4 C2 CØ ØØ
ØØC7 DB Ø1
ØØC9 E6 7F
ØØCB C9
ØØCC
ØØCC
ØØDØ
ØØDØ F5
ØØD1 DB Ø1
ØØD3 E6 7F
```

```
Ø735 CRT1   PUSH  PSW      OUTPUT ROUTINE
Ø74Ø        IN    ØØ
Ø745        ANI   8ØH
Ø75Ø        JNZ   CRT1+1
Ø755        POP   PSW
Ø76Ø        OUT   Ø1
Ø765        RET
Ø77Ø  *                    4 BYTES RESERVED
Ø775        DS    4        FOR OUTPUT ROUTINE
Ø78Ø  *
Ø785 KEYB   IN    ØØ       INPUT ROUTINE
Ø79Ø        ANI   Ø1
Ø795        JNZ   KEYB
Ø8ØØ        IN    Ø1
Ø8Ø5        ANI   7FH
Ø81Ø        RET
Ø815  *                    4 BYTES RESERVED
Ø82Ø        DS    4        FOR INPUT ROUTINE
Ø825  *
Ø83Ø PAUSE  PUSH  PSW      PAUSE ROUTINE
Ø835        IN    Ø1       READ DATA PORT
Ø84Ø        ANI   7FH
```