SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 310007B

DATE 1 February 1971

PROGRAM TITLE: 810A/B Assembler
(Stand-Alone Version)

PURPOSE: To provide a translation of programs written in SYSTEMS 810A/B Assembler Language into a machine language equivalent suitable for loading and execution.

CONFIGURATION: Minimum: SYSTEMS 810A/B, ASR-33, 4K Memory
Optional: High-Speed Paper Tape Reader/Punch, Line Printer and/or Card Reader

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembler Language

SIZE: 7472_8

NOTE

The stand-alone version of the assembler for 4K systems includes all required I/O routines. For a detailed description of the I/O package used with the assembler, refer to SYSTEMS Catalog number 310003.

USE:

The following provides details for using the SYSTEMS 810A/B Assembler for 4K systems:

I - ASSEMBLY

Software packages required to assemble source programs written in SYSTEMS 810A/B Assembler Language include:

- Catalog No. 310007 - SYSTEMS 810A/B Assembler
- Catalog No. 300000 - SYSTEMS 810A/B Standard Bootstrap Package

The procedure required to assemble includes:

1) MASTER CLEAR the computer;

2) Reset all control switches;

3) Manually enter the following Binary Bootstrap Loader into memory locations 0 - 17_8:

Octal Location	Instruction Code
0	13010U
1	00X000
2	17030U
3	000022
4	111006
5	111002
6	17030U
7	001016
10	17430U
11	033016
12	000022
13	000026
14	113017
15	111006
16	107671
17	007673

U=1 (ASR-33)	X=4 (ASR-33)
U=2 (High-Speed Paper Tape)	X=1 (High-Speed Paper Tape)

USE (Cont'd)

4) Position the SYSTEMS 810A/B Standard Bootstrap Package (Catalog No. 300000) in the proper input device (ASR-33 teletypewriter or high-speed paper tape reader);

5) MASTER CLEAR the computer;

6) Set control switch 0 (zero) if input is from the high-speed paper tape reader, or reset control switch 0 if input is from the ASR-33;

7) Depress START twice - the Standard Bootstrap Package will be loaded;

8) Position the SYSTEMS 810A/B Assembler (Catalog No. 310007) in the proper input device;

9) MASTER CLEAR the computer;

10) Enter 007673_8 (007672_8) for the 810B into the P-Counter;

11) Set control switch 0 (zero) if input is from the high-speed paper tape reader, or reset control switch 0 if input is from the ASR-33.

12) Depress START twice;

13) The assembler will be loaded;

14) MASTER CLEAR the computer;

15) Load the source program in the appropriate input device;

16) Make the appropriate control switch settings (see Table 1, Page 5);

17) Enter 1000_8 into the A-Register (777_8 for the 810B);

18) Depress START twice. During Pass 1, the assembler will read all source input and HALT. At this time, the user should reposition the source input file in the proper input device, set control switch 10, and depress START to initiate Pass 2.

USE (Cont'd)

NOTE

A three-pass assembly is executed if the ASR-33 teletype-writer is the only device used for I/O, and if both listing output and object output are specified. The user should execute a normal two-pass assembly (described above) with control switches 0, 2, 4, 5, 6, 7, 8 set. This will process source input and generate the listing. At this time, the user should re-position the source input file, set control switches 0, 1, 5, 6, 8, 10 and execute a third pass to generate the object output.

NOTE

The last record of the source input file must always be a $ character in column 1, followed by all blank characters.

TABLE 1 - CONTROL SWITCH SETTINGS

CSW	Set	Reset
0	Two Pass Assembly (Set At All Times)	Not Applicable
1	No Symbolic Output	Symbolic Output
2	No Object Output	Object Output
3	Print error list only (CSW 1 reset)	Complete listing (CSW 1 reset)
4	Listing output on ASR-33 (CSW 1 reset)	Listing output on Line Printer (CSW 1 reset)
5	Paper tape source input	Card source input
6	Object output on ASR-33 (CSW 2 reset)	Object output on HSPT (CSW 2 reset)
7	List symbol table (CSW 1 reset)	No symbol table list
8	Paper tape SI from ASR-33 (CSW 5 set)	Paper tape SI from HSPT (CSW 5 reset)
9	SI from ASR-33 keyboard	No SI from ASR-33 keyboard
10	Three-pass Assembly Mode	Not Applicable
11	Not Applicable	Not Applicable
12	Not Applicable	Not Applicable
13	Not Applicable	Not Applicable
14	Not Applicable	Not Applicable
*15	Channel assembly	No channel assembly

(*NOTE - Early models of the 810A were directly connected to I/O devices. If one of these "channel machines" is being used, this control switch must be set.)

METHOD:

(I) PREPARING PAPER TAPE SOURCE

If the user is preparing an original card-image source input paper tape via ASR-33, and a punch error occurs, the record in error may be deleted by punching an "up arrow" character (↑) before punching the line-feed, carriage return for that line of source. This will cause the entire line including the "up arrow" (↑) to be ignored by the assembler. The corrected line of code should follow immediately.

(II) ASSEMBLER ERROR MESSAGES

Assembler error "flags" appear in the source listing between the instruction memory location (second column) and the instruction octal equivalent (third column). Errors are denoted by one letter, signifying:

U = Undefined Symbol
M = Multiply Defined Symbols
A = Address Field Missing Where Required
Q = Undefined Operation Code
D = Data Conversion Error
T = Symbol Table Overflow
E = Any Other Type of Detected Error

Errors will cause the affected fields to be set to zero. More than one error may occur for any one line of code, but only the last errors detected will be flagged.

(III) SYMBOL TABLE SIZE

The symbol table contains all defined symbols in the assembly program plus all literal constants, subroutine names, and modifier instructions.

Symbol table size is approximated by the following formula:

$$400 + 1365\ (N-1) = S + L + C + M,$$

METHOD (Cont'd)

Where:

N = Number of 4096-word (4K) memory modules
S = number of symbolic addresses
L = number of unique literal constants defined
C = number of unique subroutine names called
M = number of times an "undefined" symbol appears in the variable field of an instruction combined with constants by (+) or (-) operators.