The Simplified Instructional Computer

(SIC)

Object File Format (SCOFF)

Section 1: Overview

The purpose of this document is to describe the SIC Common Object File Format (SCOFF). The SCOFF format provides support for object files which can be linked from multiple sources and relocated in memory during loading.

Section 2: SCOFF Format

2.1 Record Types

The object file format for SCOFF consists three types of records: Header (H), Text(T), and End (E).

2.2 The header (H) Record

The header record should appear first in the object file. The header record describes the program/library name, starting address, and length of the object program.

Column	Value
1	H
2-7	Program or Library Name
8-13	Starting address of object program (in hexadecimal)
14-19	Length of the object program in bytes (hexadecimal)

2.3 The text record (T)

Text record(s) represent bytes which comprise executable instructions and constants for assembled programs.

Column	Value
1	T
2-7	Starting address for object code in this record (hexadecimal)
8-9	Length of object code in this record in bytes (hexadecimal)
10-69	Object code, represented in hexadecimal

2.3 End Record

The end record denotes the end of the object file and instructs the loader where to set the program counter (PC)

Column	Value

1	E
2-7	Address of first executable instruction in object program (hexadecimal)

2.4 Modification Record

The modification record denotes records in the object file which must be modified to support relocation. There is one Modification record for each value which must be changed during relocation. Each Modification record specifies the starting address and length of the field whose value must be altered. The record then describes the modification which must be performed.

Column	Value
1	M
2-7	Starting Address of the Modification
8-9	Length of the modification, in half-bytes (hexadecimal)
10	Modification flag (+ or -)
11-16	Symbol whose value should be added or subtracted from the indicated field

Consider the following SIC/XE Program:

Line	Loc	Source statement			Object code
5	0000	COPY	START	0	
10	0000	FIRST	STL	RETADR	17202D
12	0003		LDB	#LENGTH	69202D
13			BASE	LENGTH	
15	0006	CLOOP	+JSUB	RDREC	4B101036
20	000A		LDA	LENGTH	032026
25	000D		COMP	#0	290000
30	0010		JEQ	ENDFIL	332007
35	0013		+JSUB	WRREC	4B10105D
40	0017		J	CLOOP	3F2FEC
45	001A	ENDFIL	LDA	EOF	032010
50	001D		STA	BUFFER	0F2016
55	0020		LDA	#3	010003
60	0023		STA	LENGTH	0F200D
65	0026		+JSUB	WRREC	4B10105D
70	002A		J	@RETADR	3E2003
80	002D	EOF	BYTE	C'EOF'	454F46
95	0030	RETADR	RESW	1	
100	0033	LENGTH	RESW	1	
105	0036	BUFFER	RESB	4096	
110			.		
115			.	SUBROUTINE TO READ RECORD INTO BUFFER	
120			.		
125	1036	RDREC	CLEAR	X	B410
130	1038		CLEAR	A	B400
132	103A		CLEAR	S	B440
133	103C		+LDT	#4096	75101000
135	1040	RLOOP	TD	INPUT	E32019
140	1043		JEQ	RLOOP	332FFA
145	1046		RD	INPUT	DB2013
150	1049		COMPR	A,S	A004
155	104B		JEQ	EXIT	332008
160	104E		STCH	BUFFER,X	57C003
165	1051		TIXR	T	B850
170	1053		JLT	RLOOP	3B2FEA
175	1056	EXIT	STX	LENGTH	134000
180	1059		RSUB		4F0000
185	105C	INPUT	BYTE	X'F1'	F1
195			.		
200			.	SUBROUTINE TO WRITE RECORD FROM BUFFER	
205			.		
210	105D	WRREC	CLEAR	X	B410
212	105F		LDT	LENGTH	774000
215	1062	WLOOP	TD	OUTPUT	E32011
220	1065		JEQ	WLOOP	332FFA
225	1068		LDCH	BUFFER,X	53C003
230	106B		WD	OUTPUT	DF2008
235	106E		TIXR	T	B850
240	1070		JLT	WLOOP	3B2FEF
245	1073		RSUB		4F0000
250	1076	OUTPUT	BYTE	X'05'	05
255			END	FIRST	

Here is the resulting object file with modification records:

```
HCOPY  000000001077
T0000001D17202D69202D4B10103603202629000033200074B10105D3F2FEC032010
T00001D130F20160100030F200D4B10105D3E2003454F46
T001036 1DB410B400B44075101000E32019332FFADB2013A00433200857C003B850
T001053 1D3B2FEA1340004F0000F1B410774000E32011332FFA53C003DF2008B850
T001070073B2FEF4F000005
M00000705+COPY
M00001405+COPY
M00002705+COPY
E000000
```

2.5 Define Record

The define record (D) provides information about external symbols which are defined in the object file. This record type supports linkage.

Column	Contents
1	D
2-7	Name of external symbol defined in this object file
8-13	Relative address of this symbol within the object file (in hex)
14-73	Repeats of information for other external symbols in this object file

2.6 Refer Record

The refer record (R) lists symbols which are used as external references by this object file. Specifically, symbols named using the EXTREF assembler directive during assembly. This record type supports linkage.

Column	Contents
1	R
2-7	Name of external symbol referred to in this object file
8-73	Names of other external references in this object file

Sample Linkage:

Document History

09/10/2020	Initial Release
11/18/2020	Added Relocation and Linkage Information