J136A LOADER FOR STYLE E PROGRAM AND DATA CARDS

J136 is a self-loading routine which loads Style E program and data cards. The loader loads instructions with absolute, relative, and symbolic locations and addresses in either octal or decimal. Operation codes must be in octal. Data words of two forms are accepted: fixed point decimal data punched with decimal point and a specified binary scale factor, and floating decimal data of the form used by J102.

The principle of the loader is straightforward: convert the location, convert and store the word to be loaded, continue this process with the other words of the routine to be loaded until the end of a routine is indicated by a punch in C_{36} at which time sweep back over the routine just loaded filling in absolute equivalents for symbolic addresses which were undefined when first encountered, wipe out the Symbol Table in preparation for another routine, then begin loading the next routine or begin execution according to the punch in C_{36}.

Locations and addresses are four character fields and will be converted base ten unless prefixed by a fifth character (by convention a comma) to indicate base eight. Blank columns are everywhere numerically equivalent to zeros but logically distinct from zeros. Relative locations and addresses consist of a character (A through Z, #, $) followed by a three-digit number. When a relative location or address is converted its absolute equivalent is formed by adding to the three-digit number the contents of the cell reserved for the character by the loader. A character is "defined" by loading a non-negative

integer < 4096 into the cell reserved for the character. If at conversion time the character part of a relative location or address is still undefined (as indicated by a negative number in the cell reserved for the character) the loader will halt. A character may be redefined at any time in the loading process by loading the new number into the cell reserved for the character.

The initial condition of the loader allows for 100 symbols (* 0 through * 99) but this number may be changed at will by the programmer. A symbolic location or address consists of an asterisk followed by a three-digit number. One word is allowed for each symbol in the Symbol Table. When a symbolic location is encountered the loader verifies that the symbol has not previously been defined, then defines the symbol by storing the value of a counter (cell 43 corresponding to the character "$") in the Symbol Table. The loader prepares to store the word to be loaded in the cell indicated by the counter, converts the word, advances the counter by one and stores the word. When a blank location is encountered the treatment is identical to that for a symbolic location except, of course, there is no symbol to define. Notice that the counter is automatically advanced only for symbolic and blank locations. In converting a symbolic address the loader replaces the symbolic address by its absolute equivalent if the symbol has been defined, otherwise an entry is made in the Forward Reference Table so that when loading of the current routine is complete the loader may go back and fill in an absolute address for the symbolic address. If the symbolic

address is still undefined (as indicated by a negative number in the Symbol Table) the loader will halt.

When C_{18} is punched ("12" for +, "11" for -), the loader will interpret the card as containing a data word of the following format:

C_{18}	contains the sign
C_{19-30}	contains the number with decimal point or an integer $< 2^{39}$.
C_{31-35}	is blank for floating decimal numbers or, in the case of fixed point numbers, contains "q" ($0 \leq q \leq 40$) where 2^{-q} is the desired scale factor to apply to the number to scale it down to a proper fraction for internal use. Floating point numbers are converted exactly, fixed point numbers are rounded.

The loader interprets a punch in C_{36} as indicating the end of a routine. The loader fills in absolute addresses for symbolic addresses noted in the Forward Reference Table, then it clears the Symbol Table to -1's in preparation for another routine and finally transfers to the cell corresponding to the punch in C_{36}. If the punch is a comma, the loader will be reentered for loading another routine. If the punch is a period, JOHNNIAC control will pass to cell 27 which according to convention will have been loaded with a transfer instruction to the beginning of the master routine for the program just loaded.

J136A is designed for a master routine-subroutine approach to a problem with relative addresses for blocks of data, symbolic

addresses for internal references in routines and (by convention) a special set of relative addresses using the character "#" for links between routines through a directory provided by the programmer.

A small limitation of J136A is that forward reference symbolic addresses are not permitted in words having absolute or relative locations.

Timing: Loads at full speed except for cards punched in C_{36}.
Storage: 0 - $(499)_{10}$ can be varied.
Program available as: J136A.

J. C. Shaw

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IDENTIF.     LOCN OPN ADDR OPN ADDR     COMMENTS

         1111111111222222222233333333334444444444555555555566666666667777777777
12345678901234567890123456789012345678901234567890123456789012345678901234567890
SAMPLE        1000 020 1234 024 4095     ABSOLUTE DECIMAL LOCATION AND ADDRESSES
SAMPLE       ,1750 020,2322 024,7777     ABSOLUTE OCTAL LOCATION AND ADDRESSES.
SAMPLE        A123 020 A123 010 # 13     RELATIVE LOCATION AND ADDRESSES.
SAMPLE        * 35 020 * 50 024 * 51     SYMBOLIC LOCATION AND ADDRESSES.
SAMPLE           $                1000,  SET THE COUNTER TO 1000 AND PRESET TABL
SAMPLE           $                $100   SKIP THE COUNTER 100.
SAMPLE           $                A  0   SET THE COUNTER EQUAL TO A000.
SAMPLE           A                2000   SET A EQUAL TO 2000.
SAMPLE           A                $  0   SET A EQUAL TO COUNTER VALUE.
SAMPLE        # 10 010 $  0 014 $  0     SET DIRECTORY FOR ROUTINE WHICH FOLLOWS
SAMPLE            &1234.5678901   11     FIXED POINT DATA, Q EQUALS 11.
SAMPLE            -123456789012   39     FIXED POINT DATA, Q EQUALS 39.
SAMPLE            &52.123456789          FLOATING POINT DATA FOR J102.
SAMPLE           . 010 #  1          .   SET LINK TO ROUTINE, CLEAN UP, KICK OFF
```

J136A PROGRAMMED HALTS
(in octal)

NIA	IR	Reason
0034	130 0033 134 0033	No link to beginning of program.
0167	010 0173 134 0166	Ambiguous symbolic location somewhere in the last region, or symbol table wasn't preset to -1's.
0220	001 0220 134 0217	Too many forward references in the current region.
0244	002 0244 134 0243	Undefined symbol in left address somewhere in last region.
0252	130 0251 020 ----	Undefined symbol in right address somewhere in last region.
0275	002 0275 134 0274	Undefined relative location or address on last card.

J136A Programmed Halts
(in octal)

NIA	Action
0034	PR.
0167	PR, 010 0161, PR.
0220	PR.
0244	PR, 010 0242, PR.
0252	PR.
0275	PR, 010 0273, PR.

NIA	Meaning of halts:
0034	No link to beginning of routine.
0167	Ambiguous symbol in region being loaded. Its number plus $(400)_{10}$ appears as the right address in IR of second PR card. (Failure to preset symbol table by a punch in C_{36} also leads to an ambiguous symbol indication.)
0220	Too many forward references.
0244	Undefined symbol in region just loaded. Its number plus $(400)_{10}$ appears as the right address in IR of second PR card.
0252	Undefined symbol in region just loaded. Its number plus $(400)_{10}$ appears as the right address in IR of the PR card.
0275	Undefined character for relative location or address. The character code appears as the right address in IR of the second PR card.

J136A PROGRAMMED HALTS
(in octal)

NIA	IR	Reason
0167	010 0173 134 0166	Ambiguous symbolic location somewhere in the last region, or symbol table wasn't preset to -1's.
0220	001 0220 134 0217	Too many forward references in the current region.
0244	002 0244 134 0243	Undefined symbol in left address somewhere in last region.
0252	130 0251 020 ----	Undefined symbol in right address somewhere in last region.
0275	002 0275 134 0274	Undefined relative location or address on last card.

IDENTIF.	LOCN	OPN	ADDR	OPN	ADDR	COMMENTS
J136E001	$				76,	
J136E002	P				64	
J136E003	T				6	
J136E004	0	100	0	010	* 9	LINK TO BEGINNING OF LOADER.
J136E005	1	100	0	004	5	J135A AS IT EXISTS IN STORAGE.
J136E006	2	101	3	014	3	
J136E007	3					
J136E008	4	075	79	002	2	
J136E009	5	010	1	000	,4000	
J136E010	6					TEMPORARY
J136E011	7					TEMPORARY
J136E012	8					TEMPORARY
J136E013	9					TEMPORARY
J136E014	10					BLANK COLUMN INDICATOR
J136E015	11	100	0000	000	0000	# CELL --- ORIGIN OF DIRECTORY
J136E016	12					TEMPORARY COUNTER
J136E017	13					IMAGE VALUE 1
J136E018	14					IMAGE VALUE 2
J136E019	15					IMAGE VALUE 4
J136E020	16	100	0000	000	0000	CONSTANT
J136E021	17	100	0000	000	0000	A CELL
J136E022	18	100	0000	000	0000	B CELL
J136E023	19	100	0000	000	0000	C CELL
J136E024	20	100	0000	000	0000	D CELL
J136E025	21	100	0000	000	0000	E CELL
J136E026	22	100	0000	000	0000	F CELL
J136E027	23	100	0000	000	0000	G CELL
J136E028	24	100	0000	000	0000	H CELL
J136E029	25	100	0000	000	0000	I CELL
J136E030	26	000	0001	000	0000	CONSTANT
J136E031	27	130	.	134	.	. CELL --- LINK TO BEGINNING OF PROGRAM
J136E032	28	000	0	020	P 11	DUMMY
J136E033	29					IMAGE VALUE 8
J136E034	30					IMAGE VALUE 16
J136E035	31					IMAGE VALUE 32
J136E036	32				544	CONSTANT - CELL
J136E037	33	100	0000	000	0000	J CELL
J136E038	34	100	0000	000	0000	K CELL
J136E039	35	100	0000	000	0000	L CELL
J136E040	36	100	0000	000	0000	M CELL
J136E041	37	100	0000	000	0000	N CELL
J136E042	38	100	0000	000	0000	O CELL
J136E043	39	100	0000	000	0000	P CELL
J136E044	40	100	0000	000	0000	Q CELL
J136E045	41	100	0000	000	0000	R CELL
J136E046	42					TRANSLATOR
J136E047	43	100	0000	000	0000	$ CELL --- COUNTER
J136E048	44				400	* CELL --- ORIGIN OF SYMBOL TABLE
J136E049	45				100	NUMBER OF SYMBOLS PERMITTED
J136E050	46				245	ORIGIN OF FORWARD REFERENCE TABLE.

IDENTIF.	LOCN	OPN	ADDR	OPN	ADDR	COMMENTS
136E051	47				155	NUMBER OF FORWARD REFERENCES PERMITTED.
J136E052	48				8	CONSTANT
J136E053	49	000	0	020 P	1	DUMMY
J136E054	50	100	0000	000	0000	S CELL
J136E055	51	100	0000	000	0000	T CELL
J136E056	52	100	0000	000	0000	U CELL
J136E057	53	100	0000	000	0000	V CELL
J136E058	54	100	0000	000	0000	W CELL
J136E059	55	100	0000	000	0000	X CELL
J136E060	56	100	0000	000	0000	Y CELL
J136E061	57	100	0000	000	0000	Z CELL
J136E062	58	174	0000	000	0000	CONSTANT
J136E063	59	100	0	010 *	9	, CELL --- LINK TO BEGINNING OF LOADER.
J136E064	60					TEMPORARY
J136E065	61					WORD BUILDUP CELL
J136E066	62					TEMPORARY
J136E067	63					CURRENT POSITION IN FWD REF TABLE.
J136E068	P 0&		1		39	POWERS OF TEN
J136E069	P 1&		10		39	
J136E070	P 2&		100		39	
J136E071	P 3&		1000		39	
J136E072	P 4&		10000		39	
J136E073	P 5&		100000		39	
J136E074	P 6&		1000000		39	
J136E075	P 7&		10000000		39	
J136E076	P 8&		100000000		39	
J136E077	P 9&		1000000000		39	
J136E078	P 10&		10000000000		39	
J136E079	P 11&		100000000000		39	
J136E080	* 9	020	46	050	63	PRESET POSITION IN FWD REF TABLE.
J136E081	* 1	101 T	0	101 T	1	COPY, ENCODE AND EDIT IMAGE.
J136E082		004 T	0	020 T	1	
J136E083		075	12	064	29	
J136E084		060	13	101 T	0	
J136E085		101 T	1	004 T	0	
J136E086		020 T	1	075	12	
J136E087		064	14	020	13	
J136E088		064	13	101 T	0	
J136E089		101 T	1	004 T	0	
J136E090		020 T	1	075	12	
J136E091		024	14	064	15	
J136E092		020	13	064	13	
J136E093		101 T	0	101 T	1	
J136E094		004 T	0	020 T	1	
J136E095		075	12	024	14	
J136E096		064	14	020	13	
J136E097		064	13	101 T	1	
J136E098		101 T	0	020 T	1	
J136E099		004 T	0	075	12	
J136E100		024	13	050	13	

IDENTIF.	LOCN	OPN	ADDR	OPN	ADDR	COMMENTS
J136E101		021 P	0	125	13	
J136E102		125	14	125	15	
J136E103		125	29	050 T	4	
J136E104		060 T	2	125 T	4	
J136E105		050	30	101 T	0	
J136E106		101 T	1	020 T	0	
J136E107		004 T	1	075	12	
J136E108		024	30	050	31	
J136E109		020	30	064	30	
J136E110		020 T	4	125 T	2	
J136E111		125	30	125	31	
J136E112		050 T	4	071	23	
J136E113		002 *	2	100	0	IF C36 IS BLANK THEN READ NEXT CARD.
J136E114	* 2	020 $	0	010 *	20	CONVERT LOCATION.
J136E115		010 *	3	060 T	0	
J136E116		056 *	10	056 *	11	SYMBOLIC LOCATION ROUTINE.
J136E117	* 10	004	$	020	----	
J136E118	* 11	006 *	71	060	----	
J136E119	* 4	020	$	024 P	0	ADVANCE COUNTER.
J136E120		050	12	020	$	
J136E121		024	42	056 *	8	PREPARE TO STORE WORD.
J136E122	* 71	010 *	5	134 $	0	HALT IF AMBIGUOUS SYMBOLIC LOCATION.
J136E123	* 3	020 T	4	002 *	12	
J136E124		025	58	002 *	4	IF BLANK LOCATION GO TO * 4.
J136E125	* 12	020	$	050	12	RELATIVE OR ABSOLUTE LOCATION.
J136E126		060 T	0	056 *	8	PREPARE TO STORE WORD.
J136E127	* 5	120	0	050	61	CLEAR WORD BUILDUP.
J136E128		020 T	4	071	5	
J136E129		002 *	80	020	26	IF C18 IS PUNCHED GO TO DATA ROUTINE.
J136E130	* 7	050	62	020 T	4	SET ALTERNATOR.
J136E131		071	9	050 T	4	SHIFT BLANK COLUMN INDICATOR.
J136E132		020 $	0	010 *	40	DISCARD SPACE.
J136E133		020 $	0	010 *	40	CONVERT OPERATION.
J136E134		071	6	050 T	1	
J136E135		020 $	0	010 *	40	
J136E136		071	3	050 T	2	
J136E137		020 $	0	010 *	40	
J136E138		024 T	1	024 T	2	
J136E139		004	61	075	21	
J136E140		074	9	064	61	
J136E141		020 $	0	010 *	20	CONVERT ADDRESS.
J136E142		010 *	6	060 T	0	
J136E143		056 *	13	014 *	13	SYMBOLIC ADDRESS ROUTINE.
J136E144	* 13			020	----	
J136E145		006 *	6	020	63	
J136E146		025	46	025	47	
J136E147		001 *	15	134 $	0	HALT IF TOO MANY FORWARD REFERENCES.
J136E148	* 15	020	63	056 *	14	
J136E149		024 P	0	050	63	
J136E150		020	62	024	$	

IDENTIF.	LOCN	OPN	ADDR	OPN	ADDR	COMMENTS
J136E151	* 14	024	42	050	----	STORE ITEM IN FWD REF TABLE.
J136E152	* 6	060 T	0	056	61	FORM INSTRUCTION.
J136E153		021	62	001	* 7	IF NOT DONE GO TO * 7.
J136E154	* 70	020	12	050	$	
J136E155	* 8	020	61	050	----	STORE WORD.
J136E156		020 T	4	071	5	
J136E157		001 *	1	010	$ 1	IF C36 IS BLANK GO BACK TO * 1.
J136E158		020 $	0	010	* 40	
J136E159	* 64	056 *	16	020	63	SET SWITCH ACCORDING TO C36.
J136E160		025 P	0	056	* 17	SUBSTITUTE FOR FORWARD REFERENCES.
J136E161		050	63	025	46	
J136E162	* 17	005 *	18	020	----	
J136E163		005 *	19	056	* 60	
J136E164	* 60	056 *	61	020	----	
J136E165		072	21	056	* 62	
J136E166	* 62	050 T	0	020	----	
J136E167		002 *	63	134	$ 0	HALT IF UNDEFINED SYMBOL IN LEFT ADDR.
J136E168	* 63	056 T	0	020	T 0	
J136E169	* 61	077	21	050	----	
J136E170	* 19	014 *	64	056	* 65	
J136E171	* 65	056 *	66	020	----	
J136E172		056 *	67	014	* 67	
J136E173	* 67	130 $	0	020	----	HALT IF UNDEFINED SYMBOL IN RIGHT ADDR.
J136E174	* 66	001 *	67	056	----	
J136E175	* 18	014 *	64	004	16	
J136E176		020	*	024	45	
J136E177	* 69	014 *	68	060	----	
J136E178	* 68	020 T	0	025	P 0	
J136E179		056 *	69	050	T 0	
J136E180		025	*	006	* 69	
J136E181	* 16			010	----	, OR . BRANCH
J136E182	* 20	024	26	052	* 25	ADDRESS CONVERSION ROUTINE.
J136E183		052 *	26	120	0	
J136E184		050 T	1	050	T 3	
J136E185		020 $	0	010	* 40	PEEL OFF PREFIX.
J136E186		020 T	4	002	* 27	IF OCTAL GO TO * 27
J136E187		020 P	1	014	* 27	
J136E188	* 27	020	48	050	T 2	
J136E189		020 $	0	010	* 40	CALL FOR HIGH ORDER CHARACTER
J136E190		056 *	21	025	P 1	
J136E191	* 21	001 *	23	020	----	
J136E192		002 *	22	134	$ 0	HALT IF UNDEFINED REGION INDICATOR.
J136E193	* 22	050 T	1	010	* 24	
J136E194	* 23	060 T	3	010	* 24	
J136E195	* 24	020 $	0	010	* 40	
J136E196		004 T	2	036	T 3	
J136E197		060 T	3	010	* 29	
J136E198	* 29	020 $	0	010	* 40	
J136E199		004 T	2	036	T 3	
J136E200		060 T	3	010	* 30	

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IDENTIF.     LOCN OPN ADDR OPN ADDR     COMMENTS

J136E201     * 30 020 $  0 010 * 40
J136E202          004 T  2 024 T  1
J136E203          036 T  3 020 * 21
J136E204          025 * 28 006 * 26
J136E205     * 26 010 ---- 025 P  0
J136E206     * 25 005 ---- 010 * 26
J136E207     * 28 001 * 23 020    *
J136E208     * 40 024   26 052 * 41     CHARACTER ROUTINE.
J136E209          020   31 071   1
J136E210          050   31 020  30
J136E211          075    1 050  30
J136E212          020   29 075   1
J136E213          050   29 020  15
J136E214          075    1 050  15
J136E215          020   14 075   1
J136E216          050   14 020  13
J136E217          075    1 050  13
J136E218          060 T  0 010 * 41
J136E219     * 41 010 ----              EXIT
J136E220     * 80 071   13 050 T  4     DATA ROUTINE.
J136E221          020 P  0 050  62
J136E222          020 $  0 010 * 40
J136E223          071   34 050  60     STORE SIGN CHARACTER SHIFTED.
J136E224     * 81 020   28 050 * 88
J136E225          020 $  0 010 * 40
J136E226          025 P  1 006 * 88     IF DECIMAL POINT GO TO * 88.
J136E227          024 P  1 004 P  1
J136E228          036   61 060  61
J136E229     * 89 020 * 88 025  49
J136E230          001 * 90 020 * 88
J136E231          025 P  0 014 * 81
J136E232     * 90 020 $  0 010 * 20     CONVERT BINARY SCALE FACTOR.
J136E233          020 T  4 002 * 82
J136E234          025   58 001 * 82     IF A SCALE FACTOR GO TO * 82.
J136E235          120    0 004  61     FLOATING POINT DATA.
J136E236          044 P  9 036 * 91
J136E237     * 87 020   60 001 * 86
J136E238          060   61 010 * 70     EXIT
J136E239     * 86 061   61 010 * 70     EXIT
J136E240     * 82 060 T  0 056 * 84     FIXED POINT DATA.
J136E241          020 * 92 065 * 83
J136E242     * 83 020   62 072 ----     ROUNDING.
J136E243     * 84 024   61 076 ----     APPLY SCALE FACTOR.
J136E244          044   62 010 * 87
J136E245     * 88 000    0 020 ----
J136E246          050   62 010 * 89
J136E247     * 91 000,1000 000,0000     CONSTANT
J136E248     * 92 020   62 072  40      DUMMY
J136E249        . 010    0         .
```
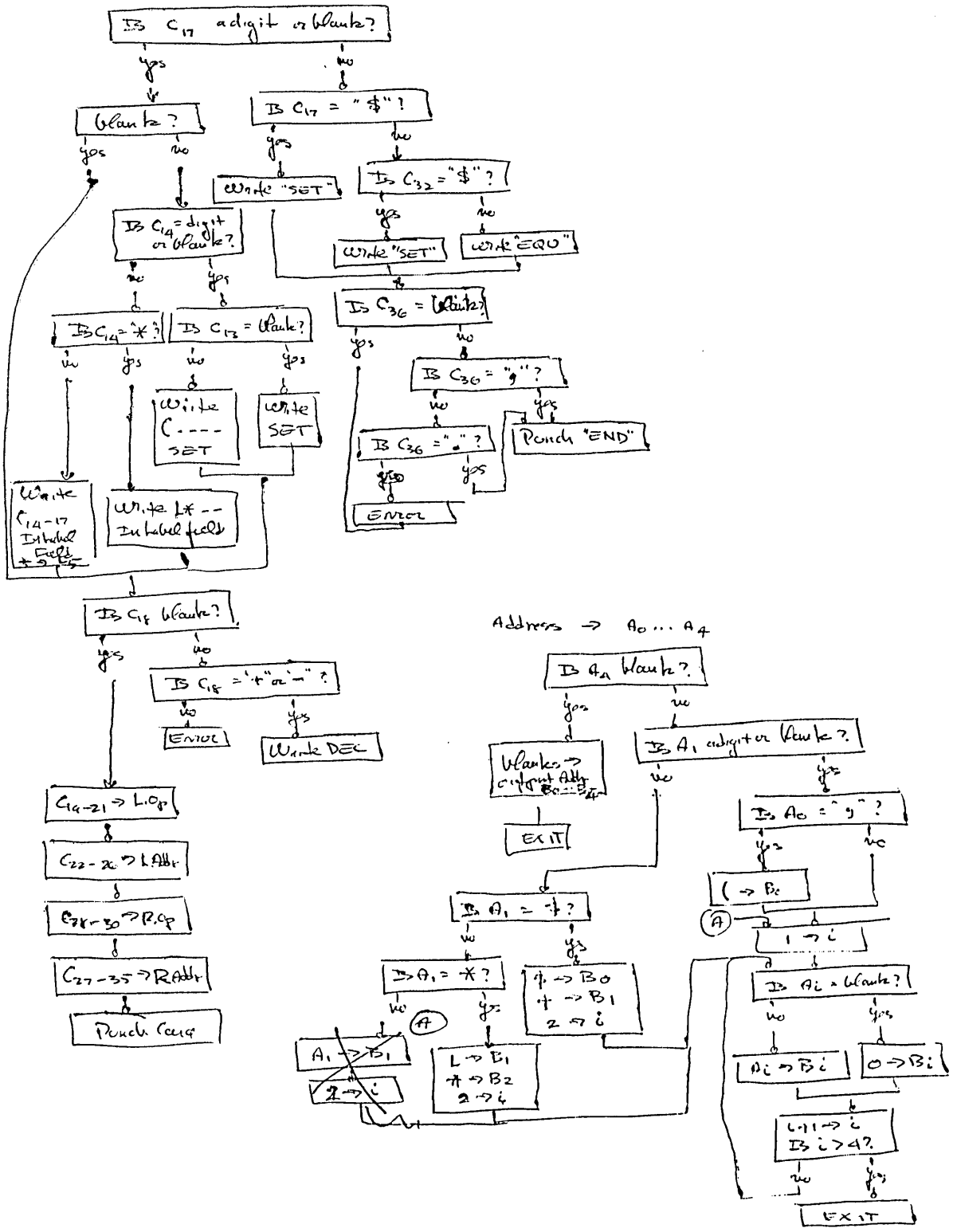

STYLE E

Job No.__________ Programmer________________________ Date____________ Page ___ of ____

ID		LOCN		OPN		ADDR	OPN		ADDR	COMMENTS
01 02 03 04 05 06 07 08	09 10 11 12 13	14 15 16 17	18	19 20 21	22	23 24 25 26	27 28 29 30	31	32 33 34 35 36 37 38 39 40	41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80


Is C17 a digit or blank?
yes
no
blank?
Is C17 = "$"?
yes
no
yes
no
Write "SET"
Is C32 = "$"?
Is C14 = digit or blank?
yes
no
Write "SET"
Write "EQU"
no
yes
Is C14 = "*"?
Is C13 = blank?
Is C36 = blank?
no
yes
no
yes
Write C---- SET
Write SET
Is C36 = "9"?
no
yes
Is C36 = "."?
Punch "END"
yes
no
ERROR
Write C14-17 In label Fields
Write L* -- In label fields
Is C18 blank?
yes
no
Is C18 = "+" or "-"?
no
yes
ERROR
Write DEC
C14-21 → L.Op
C22-26 → LAddr
C28-30 → R.Op
C27-35 → RAddr
Punch Card
Address → A0 ... A4
Is A4 blank?
yes
no
Blanks → output Addr B0 ... B4
Is A1 a digit or blank?
EXIT
yes
no
Is A0 = "9"?
Is A1 = "+"?
yes
no
(→ B0
A
1 → i
Is A1 = "*"?
+ → B0
+ → B1
2 → i
Is Ai = blank?
no
yes
no
yes
A
A1 → B1
1 → i
L → B1
* → B2
2 → i
Ai → Bi
0 → Bi
i+1 → i
Is i > 4?
no
yes
EXIT