

PREPARED BY: J.H. Lanning Jr.

DATE: 3/53

(Tape T-2134-m8 plus)
(Correction tape P-2134-10)

a1 (Read-in)

1172100
1172100

START → si 128

NORMAL 16n → 1 90 36r

RE-ENTRY → 2 rd 212

(104) 3 ad (a3/103) (l.c. or u.c.)

4 td 8r

5 td 4004

6 td 14r

7 td 22r

(4r) 8 ca (-)

9 su 4a3] Is symbol

10 cp 12r] a number?

11 sp (3804/5804)

10r → 12 ca (3303/3103) (3103 is the
normal mode)

13 td 11r

(6r) 14 ca (-)

15 su 0] Is symbol a period?)

16 cp 1r

17 su 5403] l.c. no. or

18 cp 4504] exponent?

19 ca 4303] set to interpret

20 td 6004] digit as an

21 cs 6204] exponent

4804 → 22 ad (-)

23 cp 39r → if digit is zero

24 sf 5103]

25 ts 43r

26 ca 1104

27 su 5103

28 sl 9

29 ts 44r

30 ca 25r

31 td 34r

Form (24,6) version
of digit as an
integer in 143r, 44r,

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a1

SHEET 2
or 20

42r → 32 sp 852 (programmed arithmetic)
33 // mr 497 (i.e., by 10)
(31r, 41r) 34 // ad (-) either 43r or 0;0
35 // sp 852
(16ab) (1r) 36 a0 (37r) (reset to 38r)
37 sp 212
13ab (31r) 38 (f 0) (counter for digits before decimal/f 0)
11ab (31r) (1a) 39 (f 0) (" " " after ")
23r → 40 ca 10 a6 a7] special routine to convert
41 td 34r] "0" to floating point code.
42 sp 32r
(25r) 43 (f 0)] temporary storage for
(29r) 44 (f 0)] integer during read-in

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A2 (PRINT)

or 20

(P) 4404 → 02 sp 916

1 sp 28910

4404 → 2 ca 11a16] store "sp to print"

3 sp 908] control

4 rd 42] read in

5 ao 132] "RINT" by ignoring the first

6 cp 42] symbol

7 -- sp 201

1703 → 8 cs 1593 =] restt counter
(period after
print instr.) 9 ts 132]

10 sp 916

11 sp 23910

(9a16) 12 || (SP82/b0)

(52, 92) 13 (-3) (counter)

53910 → 14 ao 2593] part of SP routine

15 sp 1996

10r → 16 rd 56910 "sp 50a4"

17 sp 806]

46910 → 18 sp 852] START

19 || sp 32]

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(T-2134-m8
P-2134-10)

SHEET 4
OF 20

Q3 (Lower case symbols)

Symbol

0	p a3	
1	p a4	
2	sp 50 a4	e
3	p 9	8
4	sp 0	
5		1
6	sp 50 a4	a
7	p 4	3
8	sp 2 a1	space
9	sp 10 a10	=
10	sp 50 a4	s
11	p 5	4
12	sp 50 a4	i
13	sp 52 a4	t
14	sp 50 a4	u
15	p 3	2
16		shift ribbon
17	(p 0 / sp 8 a2)	.
18	sp 50 a4	d
19	p 6	5
20	sp 50 a4	r
21	p 2	1
22	sp 50 a4	j
23	p 8	7
24	sp 50 a4	n
25	sp 14 a10	g
26	sp 50 a4	f
27	p 7	6
28	sp 50 a4	c
29	sp 55 a4	-
30	sp 50 a4	k
31	p 58 a4	
32	sp 50 a4	t
33	p 38 a4	

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a 3 (continued)

SHEET 5
OF 20

Symbol
z
back space
l
tabulati
w
h
corr. return
y
p
q
o (letter)
stop
b
g
9
m
shift to u.c.
x
n
shift to l.c.
0 (zero)
nullify

(T-2134-m8)
(P-2134-10)

SHEET 6

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a LI (Upper case symbols & misc. program) of 20

Symbol

612 → 0	ca a3	
1	td 3a1	} set lower case
2	sp 2a1	E (not used)
3	p 19	8 (exp.)
4	p 55a3	—
5	0,22000	A (not used)
6	p 59a3 @ dw	3 (exp.)
7	p 14	space
8	sp 2a1	• (see note)
9	sp 2a1	S
10	sp 40a10	4 (exp.)
11	p 15	I (not used)
12 (2a9)(2a9)(2b09)	ad(59a3) dw	/
13	sp a9	J (not used)
14	p 14a9	2 (exp.)
15	p 13	shift ribbon
16)
17	sp a12	D (not used)
18 sp a13		5 (exp.)
19	p 16	R (not used)
(11a10) 20	ts(-) l	1 (exp.)
21	p 12	J (not used)
22 qd 41a13		7 (exp.)
23	p 18	N (not used)
24 (cs2ax/cazax)	not (efflag)	(
25	sp a11	F
26		6 (exp.)
27	p 17	C
28	sp 46a10 sp 50a10	— (exp.)
29	sp 10a9	

used

note: The symbol • can be at the programmer's discretion to denote multiplication, where convenient typographically.

(T-2134-M8)
(P-2134-10)

SHEET 7

OF 20

PREPARED BY: A.H.J.f.

DATE: 3/53 a4 (continued)

			Symbol
52r, 55r → 30	ta 32r		K (not used)
31	sp 18a9		
(30a)32	ca (-)		T (not used)
51r → 33	sp 9a8	compile (ac)	
34	sp2a1	return to scanner	Z (not used)
35	sp2a1		back space
36	ca 2ax		L (not used)
37	sp2a1		tabulate
10a1 → 38	ca 40r		W (not used)
39	su 4a3	sp 0 - } ac now contains } not a or not	
(4a1)40	sp (-)		H (not used)
41	sp2a1		carr. return
57a3 → 42	ca 53a3	shift to upper case	Y (not used)
43	sp 1r		
(5a16)	44 (sp02 / sp2a2)		P
17a1 → 45	ca 39a3	= a5 (number)	
46	td 60r	→ 2	Q (not used)
47	cs 62a3	→ 1	
48	sp 22a1		O (letter) (not used)
49	sp2a1		stop
(3a9) (1a9) (2a9)	→ 50 ad (55a3)	op "mr" initially	B (not used)
24a10 29a10	51 sp(33r)	sp(28a10/33r)	
13a3 → 52	sp 30r	↑ ready code	G (not used)
53	sp5a13	normal mode	
54	120		9 (exp.)
29a3 → 55	sp 30r		
56	sp10a13		M (not used)
57	sp 42r		shift to u.c.
10a1 → 58	ca 33a3	set switch to 38a4 ie multiply false	X (not used)
59	td 10a1		
(19a1, 46r) 60	sp (-)	2 (number of exponent)	V (not used)
61	sp 0r		shift to l.c.
62	111		O (zero exp.)
63	sp2a1		nullify

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a5 (interpret MRA as lower case number)

60a4 → 0	cs 38a1 39a1	
1	ts 38a1 39a1	
18r → 2	ao 38a1 39a1	
3	cp 15r	
4	sp a8	(select new address K)
5	td 7r	
6	sp ax (= sp 852)	store number
(5r) 7	ts (-)	in(K, K+1)
8	sp ax	
9	ca 50a4	form symbol ^{1st mode} m _r K
10	td 13r	or dv K, where
11	ca 7r	K is address at
12	su 47a3	which number has
(10r) 13	ad (-)	just been stored
14	sp 8a6	
3r → 15	sp ax	
16	dv 4a7	(divide by 10)
17	sp ax	
18	sp 2r	

(T-2134-m8)
(P-2134-10)

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DATE: 3/53 Q6 (Interpret MRA as exponent)

SHEET.....
OF..... 20

6044 → 0	ca 1848	store "sp exp" in place of last-stored symbol (mr x or dv x)
1	td 32	
2	ca 182	
(12)3	ex(-)	
4	td 51a3	
5	ca 51a3	store "+x"
6	sp 9a8	
7	sp 192	compute and store the exponent $\neq n$
14a5 → 8	sp 9a8	
39a10 → 9	sp ax	
10	ca a7	
11	sp ax	
12	ca 0	reset MRA and various counters
13	ts 37a1 38a1	
14	ts 38 a1 39a1	
15	ca 132	
16	td 35a1 36a1	
(12a9, 16a9) 17	sp (38a4/14a9)	
18	sp 15a3	"sp exp"
15a2, 7a, 32a10 → 19	ta 252	
20	ca 4ax	apparently this is the exponent of MFL.
21	td 242	
(20a9)(8a9)	(ca 2ax/c5 2ax)	
22	etab	
23	sr * 15	
(212)24	sl (-)	Form $\pm n$, where n is in MRA in (24, 6) form
(192)25	sp (-)	

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(T-2134-118)
(P-2134-10)

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DATE: 3/53 - 97 (Numerical storage)

SHEET 10
OF 20

0	0.00000	0
1	1.47777	
2	0.40000	1
3	0.01000	
4	0.50000	10
5	0.04000	

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DATE: 3/53 a8 (Address selection)

4 all, 405 → 0	ta 72	Select new address for storage of numerical quantity. if < answer returned in A from 197
1	ca 82	
2	su 2193	
3	ts 82	
4	su 182	
5	cp 152	
6	ca 82	
(02) 7	sp (-)	
8	+197	(last address used)

various points → 9	ta 172	Store C(AC) in next available program address. value up.
(11) 10	ts (32)	
11	ao 102	
12	su 47a3	
13	su 82	
14	cp 162	
52 → 15	ck 0 (alarm)	
142 → 16	ao 182	
(92) 17	sp (-)	[return new value of add 1]
18	(1231)	(last occupied program address)

(T-2134-M8)
(P-2134-10)

SHEET 12
OF 20

PREPARED BY:

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DATE: 3/53 a9 (division, etc.)

1304 → 0	ca 1204	(divide)
1	ex 5004	
2	ex 1204	
3	sp 5r	
3a/6 4	sp 2a1 / 14010	(the 14010 mode is never used)
3r, 10r, 14r, 30r → 5	ta 9r	
6	ca 22a6	for common switch
7	ex 2404	{ eflag negated
8	ex 22a6	
(5r) 9	sp (-)	
2904 → 10	sp 5r	could save two by (upper case minus)
11	ca 1404	"(a9)" true
12	td 1706	rflag
13	sp 2a1	(want to 3r here.)
2706 → 14	sp 5r	
15	ca 17r	false
16	td 1706	
17	sp 3804	
28r, 12010, 22010 → 18	ta 27r	(reset dr & ex/s to normal)
19	ca 3604	"ca 2ax" false
20	ts 22a6	← eflag
21	ca 45a3	"cs 2ax" true
22	ts 2404	not(eflag)
23	ca 404	"55a3" = @ M
24	td 5004	op
25	ca 604	@dr.
26	td 1204	op
(18r) 27	sp (-)	
8012 → 28	sp 18r	(reset dr & ex/s to non-normal)
29	sp 5r	
30 31	ca 1204	
31 32	ex 5004	
32 33	ex 1204	
33 34	sp 9012	

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DATE: 3/53 A 10 (Equals, comma, SP, CP)

1011,3011 → 0	ta 91	
1	ca 1804	=sp a 3=
2	sp 908	
3	td (681)	
4	su 6203	=1
5	ts(631)	
6	td 81	
7	ca 91	
(61) 8	ex(-)	
(01) 9	SP(-)	
903 → 10	sp 01	(equals)
11	td 2004	
17011 → 12	sp 1809	
13	sp 201	
2503 → 14	ca 2204	"ad 4 flag" (comma)
15	sp 908	
16	ca 2004	
17	sp 908	
18	ca 631	
19	td 211	
20	ca 681	
(191) 21	td (-)	
22	sp 1809	
Ha2 → 23	ca 5812	=28010= flag
24	td 5104	flag
25	ca 5804	=3303= false
26	td 1201	nflag
27	sp(201) 491	? 491 is just sp 201; this switch no logical
5104 → 28	ca 591	=3304= true
29	td 5104	+flag
30	ca 601	=3103= true
31	td 1201	nflag
32	sp 1906	carried to third word
33	ad 571	

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(P-2134-10)

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DATE: 3/53

010 (continued)

SHEET 14
or 20

34 td 3812
35 ca 10a8 ts (next inst add)
36 su 47a3 ts 0
37 ad 4a3 sp 0
(34a) 38 ts (-) all+n, < sp loc of next inst
39 sp 9a6
10a4 → 40 ca 5212 (SP)
51/2 → 41 ts 5612
42 rd 4212
43 su 54a4 = 20 (the code for R)
44 cp 0 ~ (provision for future)
45 su 21a4 = 12 (SR, CR instructions)
46 cp 18a2 (START)
47 ca 6112 (SP)
48 td 25a3
49 sp 2a1
28a4 → 50 ca 5712 (CP)
51 sp 4112
52 11 sp a14
comes after 25a3 → 53 sp 14a2
25a3 → 54 ca 6212
55 sp 4812
4/r 56 11 (sp a14 / cp a14)
57 11 cp a14
58 + 2812
59 + 33a4
60 + 31a3
61 + 5312
62 + 1412
63-67 to] storage for addresses used by
68-72 to] parenthesis routines in forming
73-77 to] and storing sp orders

(T-2134-m 8)
(P-2134-10)

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SHEET 15
OF 20

DATE: 3/53.911 (Left parenthesis)

25a4 → 0 sp 9a8 (store dummy symbol)

1 a0 3a10

2 a0 5a10

3 sp a10

4 sp a8

6r 5 td(73a10)

6 a0 5r

7 ca 12a4 op1

8 su 50a4 op

9 cp 11r

10 sp 2a1

9r → 11 ca 5a10

12 td 14r

13 td 16r

(12r)14 ca (-)

15 ad 18r

not worked (13r)16 ts(-)

17 sp 12a10

18 0.04000 -5a7

(T-2134-M8)
(P-2134-10)

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DATE: 3/53 a12 (Right parenthesis)

SHEET 16
OF 20

17a4	$\rightarrow 0$	ca 5a10	loc of stack 1 [b]
1		td 4r	
2		su 62a3	=1
3		td 5a10	
(17) 4		ca (-)	stack 1 [b]
5		td 29r	
6		su 18a11	tag - b
7		cp 36r	
8		sp 28a9	
37r	$\rightarrow 9$	ca 5a11	loc of stack 1 [b]
10		su 62a3	
11		td 5a11	
12		td 16r	
13		td 32r	
14		ca 22a4	
15		sp 9a8	
(22) 16		ca (-)	stack 1 [b]
17		ad 47a3	ts 0
18		sp 9a8	
19		ca 3a10	loc of stack 2 [b]
20		td 24r	
21		su 62a3	
22		td 3a10	
23		td 25r	
(20r) 24		ca (-)	stack 2 [b]
(23r) 25		ex (-)	stack 2 [b]
26		ad 4a3	
27		sp 9a8	
28		ad 62a3	=1
not noted	(5r) 29	td (-)	
30		ca 5a04	
31		td 33r	

(T-2134-M 8)

(P-2134-10)

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SHEET 17

OF 20

DATE: 3/53 A 12 (continued)

(13r) 32	cac(-)
(31r) 33	ad(-)
34	sp 9a8
35	sp 2a1
72 → 36	sp 18a9
37	sp 92

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DATE: 3/53 a 13 (Interpretive routines)

18
SHEET
OF 20

$\rightarrow 0$	$ta 4r$	equals
1	$ca 07$	
2	$ts 41r$	
3	$ca 207$	
4	$sp(-)$	
$\rightarrow 5$	$ta 9r$	plus
6	$ad 41r$	
7	$ts 41r$	
8	$ca 207$	
9	$sp(-)$	
$\rightarrow 10$	$ta 14r$	minus
11	$ad 41r$	
12	$ts 41r$	
13	$cs 2a7$	
14	$sp(-)$	
$\rightarrow 15$	$ta 21r$	exponent
16	$ta 27r$	
17	$spax$	
18	$ao 21r$	
19	$td 32r$	
20	$ao 32r$	
21	$cs(-)$	2nd parameter
22	$cp 37r$	what is it?
23	$ts 40r$	
24	$cs 40r$	
25	$ts 40r$	
26	$ca 210$	=dV=0
27	$ad(-)$	1st parameter
28	$ts 34r$	
29	$ao 40r$	
30	$cp 33r$	37 $ts 40r$
31	$sp 0x$	38 $ca 55a3 = mv$
32	$sp(-)$	39 $sp 27r$
33	$spax$	40 +0 -1n1 counter
34	$(mrc-)/dV(-)$	41 +0 { temporary sym
35	$spax$	42 +0 } storage for arithmetic
36	$sp 29r$	

(T-2134-M8)
(P-2134-10)

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DATE: 3/53

a15 (Print control)

SHEET 19
or 20

- 0 || ta 32] print address of 1st character to be printed
- 1 || sp ax
- 2 si 149
- (or) 3 ca (-)
- 4 td 162
- 5 td 82
- 6 cp 92] If next symbol is an spondle
- 7 sp ax carry it out. Since symbols
- (S) 8 || sp (-) to be printed are stored as
- 9 su a3] form "mrx, mry, etc.
- 10 clc 10 and print the "mr" activates this
- 11 rc 112 1st letter
- 12 a0 32
- 13 ca 594 (0.22000 - "=")
- 14 rc 142
- 15 sp ax
- (4r) 16 || ca (-) print
- 17 || sp 222 (24,6) print number
- 18 || sp 12 routine

(T-2134-M8)
(P-2134-10)

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DATE: 3/53

SHEET 20
OF 20

a16 (used in a2)

0 ta 10r
1 ca 409] set, tr-sp 201 and
2 ex 2503 reset
3 ex 409
4 ca 12r] set P to sp 202
5 ex 4404] (and reset)
6 ex 12r
7 ca 1202] set . to sp 802
8 ex 1703] (and reset)
9 ex 1202
10 sp (-)
11 // sp 915
12 // (sp 202 / sp 92)

Miscellaneous

210 dv 0

211 = 0.014 and also "1t" in print routine. Equations are not allowed 0 as a number, thus 0.014 is not used in a meaningful way.

212-221 = 1.014 - 10.014 : storage for sp orders to initial addresses of numbered equations (a maximum of 10 allowed)

222 (24,6) print routine

852 = "ax" = (24,6) programmed arithmetic