RECOMP II USERS' PROGRAM NO. 1081

PROGRAM TITLE: FLOATING POINT NUMBER INPUT FROM CONSOLE

PROGRAM CLASSIFICATION: Utility

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PURPOSE: Allows console keyboard to be used for direct
                          entry of decimal numbers in floating point
                          format. Features a visual display of the num-
                          ber as it is entered and small round-off errors
                          and low storage requirements.

DATE: 12 June 1961

RESEARCH DIVISION - SERVOMECHANISMS, INC.

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Allows console keyboard to be used for direct entry of decimal numbers in floating point format. Features a visual display of the number as it is entered and small round off errors and low storage requirements.

USE:

(A) Calling Sequence:

(1) TRA to the location of this routine from either a right or left instruction with anything in the A and R registers. The display is cleared immediately, and the number is to be entered. Following entry of the number, return is made to the next half word following the location from which transfer was made.

(2) TRA to (Loc'n + 0.1) is exactly like (1), but the display is not cleared until a digit of the number is entered.

(B) Entering Numbers:

(1) When this routine is ready to accept a number, the "alpha" pilot will light. Enter the number at the console keyboard, using the decimal point if it is required. The decimal may be entered as often as desired, but only the first decimal point is recognized.

(2) The sign may be entered at any time (before after, or in the middle of a string of digits), and as many times as whim or fumbling demands. The last sign entered is displayed and used to set the sign of the number. If no sign is entered, the number will be assumed to be positive and displayed as positive.

(3) The individual digits of the number (including the decimal) are displayed as they are entered. Digits should not be entered much faster than 5 digits per second.

(4) To terminate the string, push the "enter" key; return is made to the main program with the number in normalized floating point in the A and R registers.

(5) If an error is detected while the numeric digits are being entered (before pushing the enter key), it may be corrected by pushing the "clear" button, which clears the display and allows the number to be re-entered correctly.

(6) In no case should any of the start or display buttons be pressed while a number is being entered.

RESTRICTIONS:

(1) Accuracy: At least 38 significant numeric bits of the number are retained correctly at all times; numbers, therefore, have a relative error less than 1×10^{-11}. Integers less than 2^{38} are converted exactly, as are all numbers which are entered in less than twelve digits and whose exact binary equivalent is expressable in less than 38 significant bits

(11/8 + 1/1024 = 1.3259765625, for example).

(2) Range: More digits than will be entered in usual practice

$(10^{-10^{11}} <$ number $< 10^{10^{11}})$,

however, only the last 15 digits entered will be displayed.

(3) Digits should not be entered at a rate much faster than 5 per second. Faster entry will make the display and perhaps the number incorrect. If the display is correct, the number will be correct.
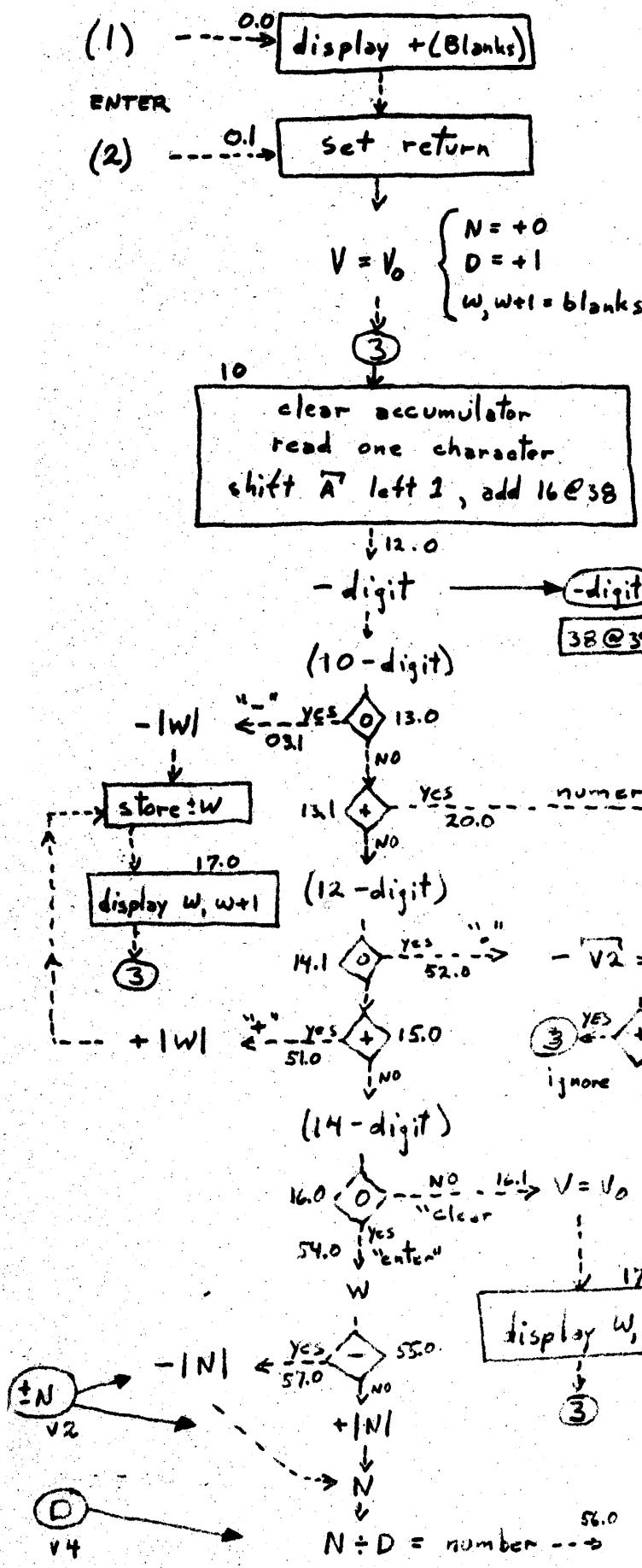
(4) Storage: 60 (octal) sectors, plus temporary use of both high speed loops.

UNITERMS:

Data, number, binarization, input.

(1) ----- 0.0 → | display +(Blanks) |

ENTER

(2) ----- 0.1 → | set return |

$V = V_0$
$\begin{cases} N = +0 \\ D = +1 \\ w, w+1 = blanks \end{cases}$

$V_0 \begin{cases} 40,41 & +10 & \text{multiplier} \\ 42,43 & +0 & N \\ 44,45 & +1 & D \\ 46 & w & \} \text{ BCD words} \\ 47 & w+1 & \} (\text{+ blanks}) \end{cases}$

③

10
| clear accumulator
read one character
shift $\overline{A}$ left 1, add 16 @ 38 |

↓ 12.0

$- digit$ ────→ $\boxed{-digit}$ 05
$\boxed{38 @ 39}$ 04

$(10 - digit)$

digit	Key struck
0	0
1	1
---	---
9	9
10	-
11	+
12	.
13	clear
14	enter
15	none
garble	others

$-|w|$ ←--"-"--- YES ◇ 13.0
            03.1   NO

→ | store ±w | 13.1 ◇ ± ── YES → numeric digit ----------→ $10(\pm N)$
                       20.0   NO

17.0
| display w, w+1 | $(12 - digit)$

③

$(\pm N)$
V2

integral digit +   digit after decimal

21.1   23.0

$+|w|$ ←--"."--- YES ◇ . 14.1
            52.0

$- \overline{V2} = \mp N$

$\pm(10N + digit)$ $\mp(10N + digit)$

$+|w|$ ←--"+"--- YES ◇ + 15.0
            51.0   NO

③ ── YES ◇ + ── NO ----→ new N → $(\pm N)$ ← = new ± N
                                          V2
ignore   enter decimal

↓ 24.0

$(14 - digit)$

$(D) → 10 \cdot D$
V4   = new D

16.0 ◇ 0 ---NO--- 16.1 → $V = V_0$
       "clear"
54.0 ↓ YES "enter"

w

| display w, w+1 | 17.0

③

36.1

| shift BCD words left,
add in digit, + restore |

$\pm N$ ──→ $-|N|$ ← YES ◇ - 55.0
V2   57.0   NO

(D) ──→ $+|N|$
V4

N

(w) $(w+1)$
V6   V7

56.0
$N \div D = number$ ---→ EXIT

Program No. 128-R Title CONSOLE FLOATING POINT DATA INPUT ROUTINE

Programmed by: W. Wellman   Date 5-3-61

Loc'n	Cm'd	Addr.	Contents	Accumulator	b	Remarks
00	D.I.S	.4.6.1				← enter here to clear display
	S.AK	7.7.7.00				← enter here NOT to " "
.1	A.D.D	.4.5.0				
	S.T.A	.5.6.1				
.2	C.T.L	.10.0	L_1			
	C.T.V	.4.0.0	V_0			
.3	T.R.A	7.7.6.00	→L_1			
	C.L.S	7.7.7.61		$-|w|$		← -- "-"
.4	S.T.O	7.7.7.60				
	T.R.A	7.7.67.0				
.5	╳		digit			
.6	+.00	0000.0	38 @ 39			
	-.00	0.023.0				
.7	C.T.L	.2.00				
	T.R.A	7.7600	L_2			
.10	C.L.A	.4.2.0		zero		
	R.DY	7.7.61.0				ENTER CHARACTER
.1	A.D.D	.3.00	16 @ 39	digit @ 39		
	A.L.S	0.0.01.0		- digit @ 38		
.2	S.T.O	.0.50	digit			
	A.D.D	.5.00	10 @ 38	-digit +10		
.3	T.Z.E	.0.3.1				--→ 10 = "-"
	T.P.L	.0.70				digit <10 --→ NUMBER
.4	A.D.D	7.7.7.10	2 @ 38	12-digit		(shift)
	T.Z.E	.520				--→ 12 = "•"
.5	T.P.L	.5.10				--→ 11 = "+"
	A.D.D	7.7.7.10	2 @ 38	14 - digit		
.6	T.Z.E	.5.4.0	↓clear =15,13			--→ 14 = "enter"
	C.T.V	.4.00	V_0			
.7	D.I.S	7.7.6.1				
	T.R.A	7.7.6.0.0				
.2.0	F.C.A	7.7.7.20		$|N|$		
	F.M.P	7.7.700	10	(old N)×10		
.1	T.M.L	7.7.630	-•-			→{ : decimal pt has been entered }
	F.S.B	.0.50	(-digit)	new $|N|$		
.2	F.S.T	7.7.7.20				
	T.R.A	7.7.6.51				
.3	F.A.D	.0.50	(-digit)	new -$|N|$		
	F.S.T	7.7.7.20				
.4	F.C.A	7.7.740				
	F.M.P	7.7.700	10			
.5	F.S.T	7.2.740		divisor		
	C.L.A	7.7.7.70	w+1	w+1, BCD		
.6	A.R.S	00.43.0				
	A.L.S	00.0.30		first 4 bits only		
.7	C.T.L	.30.0	L_3			
	T.R.A	7.7.61.0				

L_1 (left margin, row .10)

L_2 (left margin, row .2.0)

Program No. 128-R Title _____

Programmed by: _____　Date _____

Loc'n	Cm'd	Addr.	Contents	Accumulator	b	Remarks
L_3　0030	+.0.0	00.0.0.0	16 @ 39		..	
....	-.0.0	001.00			..	
....1	S.T.0	7.7.6.1.0	(here)	first BCD char. of	..	
....	C.L.A	7.7.7.6.0	w	w+1	..	
....2	T.m.1	7.7.6.7.0	↓+　─→		..	($\overline{w}$ bears sign of)
....	A.D.D	7.7.6.1.0			..	number
....3	A.L.S	0.0.0.4.0			..	
....	S.T.0	7.7.7.6.0	new w		..	
....4	C.L.S	..050	+digit		..	
....	A.L.S	0.0.0.6.0			..	
....5	A.D.D	7.7.7.7.0	w+1		..	
....	A.L.S	0.0.0.4.0			..	
....6	S.T.0	7.7.7.7.0			..	
....	C.T.W	..1.0.0	L_1 ─→go to 17		..	
....7	S.U.B	7.7.6.1.0			..	
....	T.R.A	7.7.6.3.0			..	
V_5　..4.0	+.5.0	00.0.0.0			..	
....	-.0.0	0.0.0.0.0		10	..	
....1	+.0.0	0.0.0.0.0			..	
....	-.0.0	00.0.2.0	2 @ 38		..	
....2	+.0.0	0.0.0.0.0	+zero	N in base	..	
....	-.0.0	0.0.0.0.0			..	
....3	+.0.0	0.0.0.0.0	+zero		..	
....	-.0.0	0.0.0.0.0			..	
....4	+.4.0	0.0.0.0.0	1 @ 1		..	
....	-.0.0	0.0.0.0		Divisor in loop	..	
....5	+.0.0	0.0.0.0.0	1 @ 39	: 10^n	..	
....	-.0.0	0.0.0.0.1		when no Nº st fractional digits	..	
....6	+.6.7	3.5.6.7.0	w		..	
....	+.6.7	3.5.0.0.0		BCD words	..	
....7	+.6.7	3.5.6.7.0	w+1		..	
....	+.6.7	2.0.0.0.0			..	
....50	+.0.0	0.0.0.0.0	.	10 @ 38	..	
....	-.0.0	0.0.1.2.0			..	
....51	C.L.A	7.7.7.6.1	|w|	|N|	..	←--" + "
....	T.R.A	..0.4.0			..	
....52	F.C.S	7.7.7.2.0		±|N|	..	←---"."
....	T.P.L	7.7.6.0.0	↑→ decimal has been entered before		---→sign of	
....53	C.T.L	..2.0.0	L_2		..	
....	T.R.A	7.7.6.2.0	store (-|N|); change BCD words		..	
....54	F.C.A	7.7.7.2.0		exp of N → R	..	←---- enter
....	C.L.A	7.7.7.6.0	$\overline{w}$		..	
....55	T.m.1	..5.7.0	↓+ sign ⇒		..	
....	C.L.A	7.7.7.2.1		+|N|	..	
....56	F.D.V	7.7.7.4.0	divisor		..	
....	T.R.A	0.0.0.0.0	EXIT		..	
....57	C.L.S	7.7.7.2.1	.	-|N|	..	
....	T.R.A	..5.6.0			..	