APPROVED BY
J. Snyder

IDENTIFICATION

Variable Column Fraction Print, MU PRF1

L. D. Fosdick - October 8, 1956

Midwestern Universities Research Association, Madison, Wisconsin

PURPOSE

To print, on-line, one to five fixed point fractions, F_i, in from one to five columns with a five digit integer line label.

RESTRICTIONS

The MURA PRINTER BOARD 1 is required. See attached sheet for wiring diagram.

METHOD

Accuracy: $-3 \times 10^{-11} \leq |F_i \text{ (printed)}| - |F_i \text{ (correct value)}| \leq 0$
Range: : $-(1 - 2^{-35}) \leq F_i \leq 1 - 2^{-35}$

USAGE

Calling Sequence:

UA SAP		MURASS	
Loc.	Instruction	Loc.	Instruction
α	TSX PRF1, 4	α	BTSX A 4
$\alpha + 1$	(prefix) B, 0, C	$\alpha + 1$	C N B 0 C
$\alpha + 2$	return	$\alpha + 2$	return

where

(prefix) = N = the number of fractions, $1 \leq N \leq 5$.
B = integer label to identify line of print.
C = location of first fraction, with successive fractions in C + 1, C + 2, etc.

On entry to this subroutine the fixed point fractions $F_0, F_1, \ldots, F_{N-1}$ in locations C, C + 1, . . ., C + N - 1, respectively, will be printed via the 716 printer as 11 digit fractions. The fractions will appear in order, $F_0, F_1, \ldots, F_{N-1}$ from left to right in N column on one line. Positive fractions are printed without sign, negative fractions with sign. The decimal point is not printed and is assumed to be immediately to the left of the first digit of the fraction. To the left of the N columns on the same line a five digit integer B

will be printed, to serve as a line label. At the very left of the line the letter F will appear to indicate that the numbers printed are fractions.

If prefix is PZE, that is N = 0, and C is the location of any positive number, then just the label B is printed.

Space Required:

	UA SAP	MURASS
82 words program at:	PRF1	A
20 words temporary at:	COMMON	T

CODING INFORMATION

Timing: 511.5 + 3.8N ms. is the average time if the printer is not in motion upon entry. The printer will be kept running at full speed (150 lines per minute) if the time between exit and successive entry to this program does not exceed 110.5 - 3.8N ms..

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      REM PRF1 MURA VARIABLE COLUMN FRACTION PRINT                    MU   PRF1
RF1   SXD COMMON,1      SAVE IR1                                    PRF1  0001
      SXD COMMON+1,2    SAVE IR2                                    PRF1  0002
      SXD COMMON+2,4    SAVE IR4                                    PRF1  0003
      PXD 11            CLEAR AC                                    PRF1  0004
      LDQ 1,4           PROG. PARA. IN MQ                           PRF1  0005
      LGL 3             N INTO AC                                   PRF1  0006
      STO COMMON+3      N INTO COMMON+3                             PRF1  0007
      LGL 15            C INTO AC                                   PRF1  0008
      ADD COMMON+3      FORM C+N                                    PRF1  0009
      STA PRF1+28       PLANT FRACTION CALL                         PRF1  0010
      STA PRF1+38       ADDRESSES                                   PRF1  0011
      RQL 18            LABEL TO ADDRESS OF MQ                      PRF1  0012
      LXA PRF1+3,1      SET IR1=11                                  PRF1  0013
      CLA COMMON+3      N INTO AC                                   PRF1  0014
      ALS 2             4N IN AC                                    PRF1  0015
      STA PRF1+17       PLANT SHIFT ADDRESS                         PRF1  0016
      CAL PRF1+81                                                   PRF1  0017
      ARS               SET UP NUMBER BANK FOR                      PRF1  0018
      STO COMMON+20,1   FIRST ENTRY                                 PRF1  0019
      TIX PRF1+18,1,1   LOOP, OUT AFTER 11 PASSES                   PRF1  0020
      PXD 6             CLEAR AC                                    PRF1  0021
      DVP PRF1+78       DIVIDE BY 10                                PRF1  0022
      ALS 28            POSITION REMAINDER                          PRF1  0023
      ORS COMMON+20,1   REMAINDER INTO STORAGE                      PRF1  0024
      TXI PRF1+25,1,1   STEP IR1 BY + 1                             PRF1  0025
      TXL PRF1+20,1,5   LOOP, OUT AFTER 5 PASSES                    PRF1  0026
      LXA COMMON+3,4    SET IR4=N                                   PRF1  0027
      LXA PRF1+3,2      SET IR2=11                                  PRF1  0028
      LDQ 0,4           FRACTION INTO MQ, PLANTED ADDRESS           PRF1  0029
      MPY PRF1+78       FRACTION TIMES 10                           PRF1  0030
      ALS 30,1          POSITION DIGIT FOR STORAGE                  PRF1  0031
      ORS COMMON+20,2   DIGIT INTO NUMBER BANK                      PRF1  0032
      TIX PRF1+29,2,1   LOOP, OUT AFTER 11 PASSES                   PRF1  0033
      TXI PRF1+34,1,4   STEP IR1 BY 4                               PRF1  0034
      TIX PRF1+27,4,1   LOOP, OUT AFTER N PASSES                    PRF1  0035
      WPR               SELECT THE PRINTER                          PRF1  0036
      PSE 247           PULSE EXIT HUB 7 FOR F                      PRF1  0037
      LXA COMMON+3,1    SET IR1=N                                   PRF1  0038
      CLA 0,1           FRACTION INTO AC, ADDRESS PLANTED           PRF1  0039
      TPL PRF1+41       TRANSFER IF FRACTION +                      PRF1  0040
      PSE 243,4         PULSE EXIT HUBS FOR -                       PRF1  0041
      TXI PRF1+42,4,-1  STEP IR4 BY - 1                             PRF1  0042
      TIX PRF1+38,1,1   LOOP, OUT AFTER N PASSES                    PRF1  0043
      CAL PRF1+79       T EQUAL TO 10 INTO AC                       PRF1  0044
      ACL PRF1+80       REPLACE T BY T-1                            PRF1  0045
      SLW COMMON+4      STORE T-1 FIXED                             PRF1  0046
      SLW COMMON+5      STORE T-1 SHIFTING                          PRF1  0047
      CAL PRF1+80       EXTRACTOR INTO AC                           PRF1  0048
      SLW COMMON+6      STORE EXTRACTOR                             PRF1  0049
      LXA PRF1+20,1     SET IR1 EQUAL TO 6                          PRF1  0050
      LXA PRF1+5,2      SET IR2 EQUAL TO 3                          PRF1  0051
      LXA PRF1+14,4     SET IR4 EQUAL TO 2                          PRF1  0052
      CAL COMMON+7,4    SHIFT T, EXTRACTOR                          PRF1  0053
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ARS 4              4 PLACES TO THE RIGHT                          PRF1  0054
SLW COMMON+7,4     FOR NEXT COLUMN                                PRF1  0055
TIX PRF1+52,4,1    LOOP, OUT AFTER 2 PASSES                       PRF1  0056
LXA PRF1+3,4       SET IR4 EQUAL TO 11                            PRF1  0057
CAL COMMON+20,4    DIGIT INTO AC                                  PRF1  0058
ANA COMMON+6       EXTRACT DIGIT                                  PRF1  0059
CAS COMMON+5       COMPARE WITH T                                 PRF1  0060
TRA PRF1+62        0 BINARY IMAGE BIT IF DIGIT GREATER THANT      PRF1  0061
CLA PRF1+62        1 BINARY IMAGE BIT IF DIGIT = T                PRF1  0062
LRS 1              0 BINARY IMAGE BIT IF DIGIT LESS THAN T        PRF1  0063
TIX PRF1+57,4,1    LOOP, OUT AFTER 11 PASSES                      PRF1  0064
TNX PRF1+68,1,1    TRANSFER WHEN ALL COLUMNS PROCESSED            PRF1  0065
TIX PRF1+51,2,1    LOOP, OUT AFTER 3 PASSES                       PRF1  0066
STQ COMMON+7       STORE LEFT IMAGE                               PRF1  0067
TRA PRF1+50        RETURN TO FORM RIGHT IMAGE                     PRF1  0068
STQ COMMON+8       STORE RIGHT IMAGE                              PRF1  0069
CPY COMMON+7       COPY LEFT IMAGE                                PRF1  0070
CPY COMMON+8       COPY RIGHT IMAGE                               PRF1  0071
CAL COMMON+4       T INTO AC                                      PRF1  0072
ANA PRF1+80        CLEAN IT OFF                                   PRF1  0073
TNZ PRF1+44        TRANSFER IF T NOT EQUAL TO ZERO                PRF1  0074
LXD COMMON,1       RESTORE IR1                                    PRF1  0075
LXD COMMON+1,2     RESTORE IR2                                    PRF1  0076
LXD COMMON+2,4     RESTORE IR4                                    PRF1  0077
TRA 2,4            EXIT                                           PRF1  0078
HTR 10             CONSTANT FOR FRACTION CONVERSION               PRF1  0079
OCT 500000000000 CONSTANT FOR T EQUAL TO 10                       PRF1  0080
OCT 740000000000 EXTRACTOR                                        PRF1  0081
OCT 001777777777 CONSTANT FOR INITIAL SET-UP OF NBR BANK          PRF1  0082
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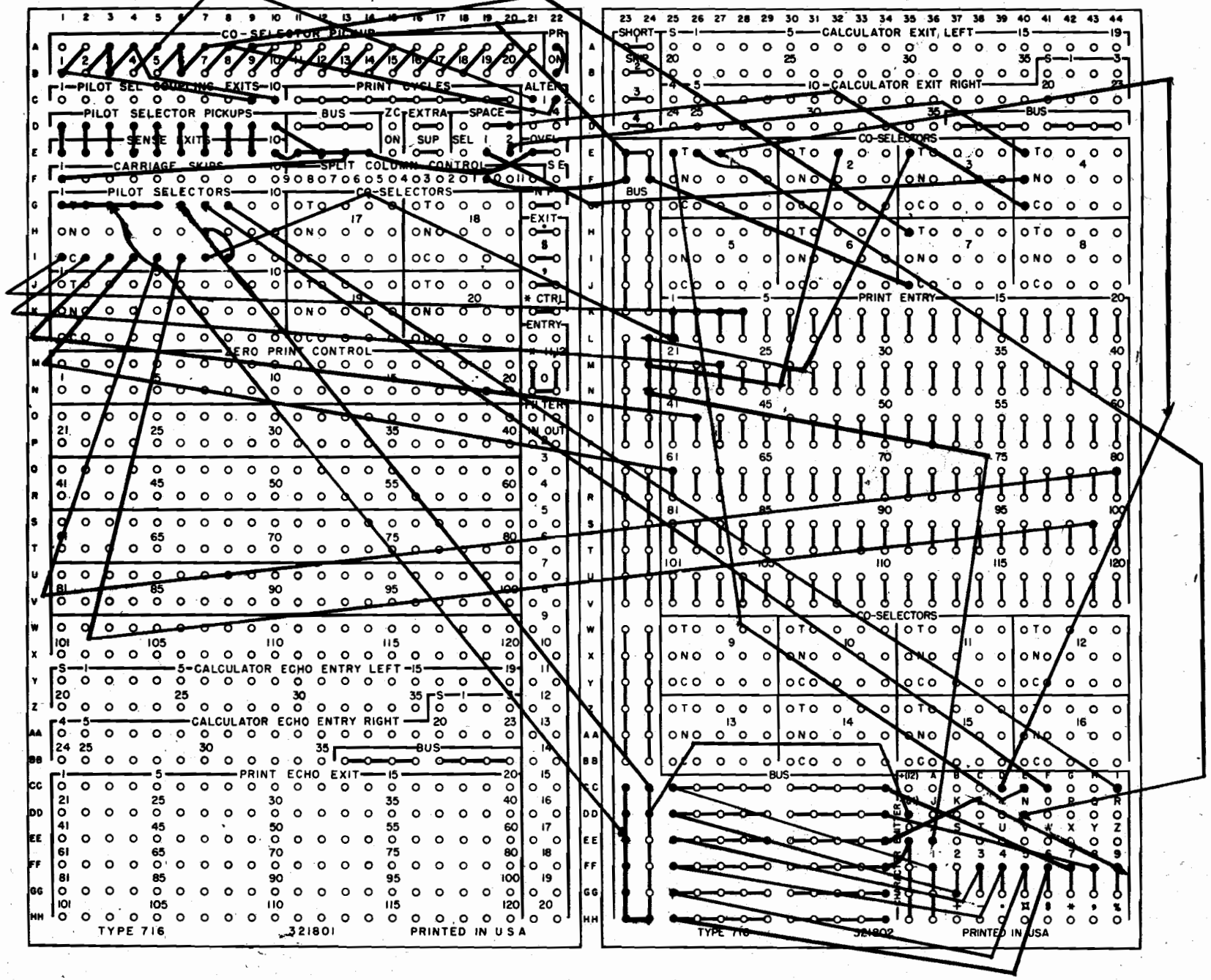
Form 24-6127-0

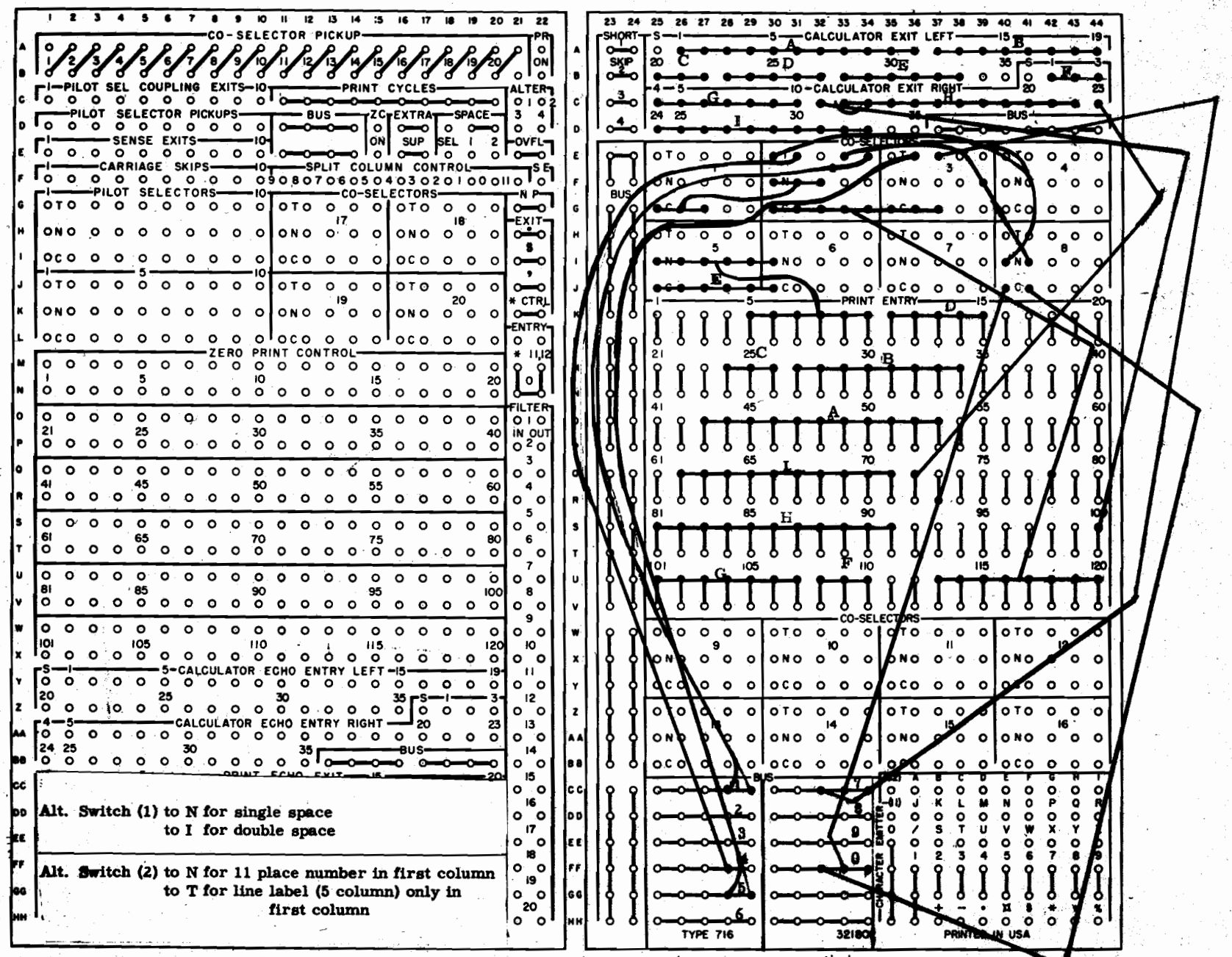
TYPE 716 PRINTER



MURA PRINTER BOARD

Form 24-6127-0

TYPE 716 PRINTER



Alt. Switch (1) to N for single space
to I for double space

Alt. Switch (2) to N for 11 place number in first column
to T for line label (5 column) only in
first column

EXAMPLE DATE 04/01/57

MURA PRINTER BOARD

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