APPROVED BY
J N Snyder

IDENTIFICATION

Variable Column Integer or Fraction Print, MU PIF1

E. M. Zographos, February 12, 1957

Midwestern Universities Research Association, Madison, Wisconsin

PURPOSE

To print, on-line, one to five numbers, either all fractions, F_i, or all integers, I_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: $-3 \times 10^{-11} \leq |F_i \text{ (printed)}| - |F_i \text{ (correct value)}| \leq 0$
Exact for I_i

Range: $-(1 - 2^{-35}) \leq F_i \leq 1 - 2^{-35}$
$-(2^{35} - 1) \leq I_i \leq 2^{35} - 1$

USAGE

Calling Sequence:

UA SAP

Loc.	Instruction
α	TSX PIF1, 4
$\alpha + 1$	(prefix) B, D, C
$\alpha + 2$	return

MURASS

Loc.	Instruction
α	BTSX A 4
$\alpha + 1$	C N B D C
$\alpha + 2$	return

where:
(prefix) = N = the number of fractions (integers), $1 \leq N \leq 5$
B = integer label to identify line of print
C = location of first fraction (integer), with successive fractions (integers) in C + 1, C + 2, etc.
D = 0, fractions are printed
D = 1, integers are printed

On entry to this subroutine the fixed point fractions (integers) F_0, $F_1, \ldots,$ F_{N-1} (I_0, $I_1, \ldots,$ I_{N-1}) in memory locations C, C + 1, . . . , C + N - 1, respectively, will be printed via the 716 printer as 11 digit fractions (integers). The fractions (integers) will appear in order, F_0, $F_1, \ldots,$ F_{N-1} (I_0, $I_1, \ldots,$ I_{N-1}), from left to right in N columns on one line. Positive fractions (integers) are printed without sign, negative fractions (integers) with sign. The decimal point is not printed and is assumed to be immediately to the left of the first digit of the fraction or immediately to the right of the least significant digit of the integer. 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 far left of the line F (I) will appear to indicate that the numbers printed are fractions (integers).

If the 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
102 words program at:	PIF1	A
21 words temporary at:	COMMON	T

CODING INFORMATION

Timing: 511.7 + 4.4N 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/min.) if the time between exit and re-entry does not exceed 110.3 - 4.4N ms.

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      REM PIF1 MURA VARIABLE COLUMN INTEGER-FRACTION PRINT          MU  PIF1
PIF1  SXD COMMON,1     SAVE IR1                                    PIF1  0001
      SXD COMMON+1,2   SAVE IR2                                    PIF1  0002
      SXD COMMON+2,4   SAVE IR4                                    PIF1  0003
      PXD 11,0         CLEAR AC                                    PIF1  0004
      LDQ 1,4          PARAMETER IN MQ                             PIF1  0005
      LGL 3            SHIFT N TO AC                               PIF1  0006
      STO COMMON+3                                                 PIF1  0007
      LGL 15           SHIFT C = STARTING ADDRESS TO AC            PIF1  0008
      ADD COMMON+3     C+N                                         PIF1  0009
      STA PIF1+34      PLANT CALL ADDRESSES                        PIF1  0010
      STA PIF1+46                                                  PIF1  0011
      STA PIF1+88                                                  PIF1  0012
      LGL 3            SHIFT D TO AC                               PIF1  0013
      STO COMMON+20                                                PIF1  0014
      RQL 15           B TO ADDRESS OF MQ                          PIF1  0015
      LXA PIF1+3,1     SET IR1=11                                  PIF1  0016
      CLA COMMON+3     N                                           PIF1  0017
      ALS 2            4N                                          PIF1  0018
      STA PIF1+20      PLANT SHIFT ADDRESS                         PIF1  0019
      CAL PIF1+101                                                 PIF1  0020
      ARS 0            SET UP NUMBER BANK                          PIF1  0021
      STO COMMON+20,1  FOR FIRST ENTRY                             PIF1  0022
      TIX PIF1+21,1,1  LOOP RE-ENTRY, OUT AFTER 11 PASSES          PIF1  0023
      PXD 6,0          CLEAR AC                                    PIF1  0024
      DVP PIF1+98      DIVIDE BY 10                                PIF1  0025
      ALS 28           POSITION REMAINDER                          PIF1  0026
      ORS COMMON+20,1  FOR STORAGE                                 PIF1  0027
      TXI PIF1+28,1,1  ADD 1 TO IR1                                PIF1  0028
      TXL PIF1+23,1,5  LOOP RE-ENTRY, OUT AFTER 5 PASSES           PIF1  0029
      CLA COMMON+20    D                                           PIF1  0030
      LBT                                                          PIF1  0031
      TRA PIF1+86      D=0, PRINT FRACTIONS                        PIF1  0032
      LXA COMMON+3,4   D=1, PRINT INTEGERS, SET IR4=N              PIF1  0033
      LXA PIF1+4,2     SET IR2=1                                   PIF1  0034
      LDQ 0,4          INTEGER IN MQ                               PIF1  0035
      PXD 0,0          CLEAR AC                                    PIF1  0036
      DVP PIF1+98      DIVIDE BY 10                                PIF1  0037
      ALS 30,1         POSITION CODED DIGIT                        PIF1  0038
      ORS COMMON+20,2  FOR STORAGE                                 PIF1  0039
      TXI PIF1+40,2,1  ADD 1 TO IR2                                PIF1  0040
      TXL PIF1+35,2,11 LOOP RE-ENTRY, OUT AFTER 11 PASSES          PIF1  0041
      TXI PIF1+42,1,4  ADD 4 TO IR4                                PIF1  0042
      TIX PIF1+33,4,1  LOOP RE-ENTRY, OUT AFTER N PASSES           PIF1  0043
      WPR              SELECT PRINTER                              PIF1  0044
      SPR 8            PULSE EXIT HUB 8 FOR I                      PIF1  0045
      LXA COMMON+3,1   SET IR1=N                                   PIF1  0046
      CLA 0,1          NUMBER IN AC                                PIF1  0047
      TPL PIF1+49      TRANSFER IF NUMBER IS +                     PIF1  0048
      PSE 243,4        PULSE EXIT HUB FOR -                        PIF1  0049
      TXI PIF1+50,4,-1 ADD -1 TO IR4                               PIF1  0050
      TIX PIF1+46,1,1  LOOP RE-ENTRY, OUT AFTER N PASSES           PIF1  0051
      CAL PIF1+99      T                                           PIF1  0052
      ACL PIF1+100     T-1                                         PIF1  0053
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SLW COMMON+4      STORE T-1 (FIXED)                          PIF1  0054
SLW COMMON+5      STORE T-1 (SHIFTING)                       PIF1  0055
CAL PIF1+100      EXTRACTOR IN AC                            PIF1  0056
SLW COMMON+6                                                 PIF1  0057
LXA PIF1+23,1     SET IR1=6                                  PIF1  0058
LXA PIF1+5,2      SET IR2=3                                  PIF1  0059
LXA PIF1+17,4     SET IR4=2                                  PIF1  0060
CAL COMMON+7,4    SHIFT T, EXTRACTOR                         PIF1  0061
ARS 4             4 PLACES TO RIGHT                          PIF1  0062
SLW COMMON+7,4    FOR NEXT COLUMNS                           PIF1  0063
TIX PIF1+60,4,1   LOOP RE-ENTRY, OUT AFTER 2 PASSES          PIF1  0064
LXA PIF1+3,4      SET IR4=11                                 PIF1  0065
CAL COMMON+20,4   NUMBER IN AC                               PIF1  0066
ANA COMMON+6      EXTRACT COLUMNS                            PIF1  0067
CAS COMMON+5      COMPARE WITH T                             PIF1  0068
TRA PIF1+70       AC MORE THAN T                             PIF1  0069
CLA PIF1+70       AC=T                                       PIF1  0070
LRS 1             AC LESS THAN T                             PIF1  0071
TIX PIF1+65,4,1   LOOP RE-ENTRY, OUT AFTER 11 PASSES         PIF1  0072
TNX PIF1+76,1,1   LOOP RE-ENTRY, OUT AFTER 6 PASSES          PIF1  0073
TIX PIF1+59,2,1   LOOP RE-ENTRY, OUT AFTER 3 PASSES          PIF1  0074
STQ COMMON+7      STORE LEFT IMAGE                           PIF1  0075
TRA PIF1+58                                                  PIF1  0076
STQ COMMON+8      STORE RIGHT IMAGE                          PIF1  0077
CPY COMMON+7      COPY LEFT IMAGE                            PIF1  0078
CPY COMMON+8      COPY RIGHT IMAGE                           PIF1  0079
CAL COMMON+4      T IN AC                                    PIF1  0080
ANA PIF1+100      CLEAN IT OFF                               PIF1  0081
TNZ PIF1+52       TRANSFER IF NOT ZERO TO CONTINUE           PIF1  0082
LXD COMMON,1      HERE IF = 0,RESTORE IR1                    PIF1  0083
LXD COMMON+1,2    RESTORE IR2                                PIF1  0084
LXD COMMON+2,4    RESTORE IR4                                PIF1  0085
TRA 2,4           OUT                                        PIF1  0086
LXA COMMON+3,4    HERE FOR FRACTIONS, SET IR4=N              PIF1  0087
LXA PIF1+3,2      SET IR2=11                                 PIF1  0088
LDQ 0,4           FRACTION IN MQ                             PIF1  0089
MPY PIF1+98       MULTIPLY BY 10                             PIF1  0090
ALS 30,1          POSITION CODED DIGIT                       PIF1  0091
ORS COMMON+20,2   FOR STORAGE                                PIF1  0092
TIX PFI1+89,2,1   LOOP RE-ENTRY, OUT AFTER 11 PASSES         PIF1  0093
TXI PIF1+94,1,4   ADD 4 TO IR1                               PIF1  0094
TIX PIF1+87,4,1   LOOP RE-ENTRY, OUT AFTER N PASSES          PIF1  0095
WPR               SELECT PRINTER                             PIF1  0096
SPR 7             PULSE EXIT HUB 7 FOR F                     PIF1  0097
TRA PIF1+45                                                  PIF1  0098
HTR 10            CONSTANTS                                  PIF1  0099
OCT 500000000000                                             PIF1  0100
OCT 740000000000                                             PIF1  0101
OCT 001777777777                                             PIF1  0102
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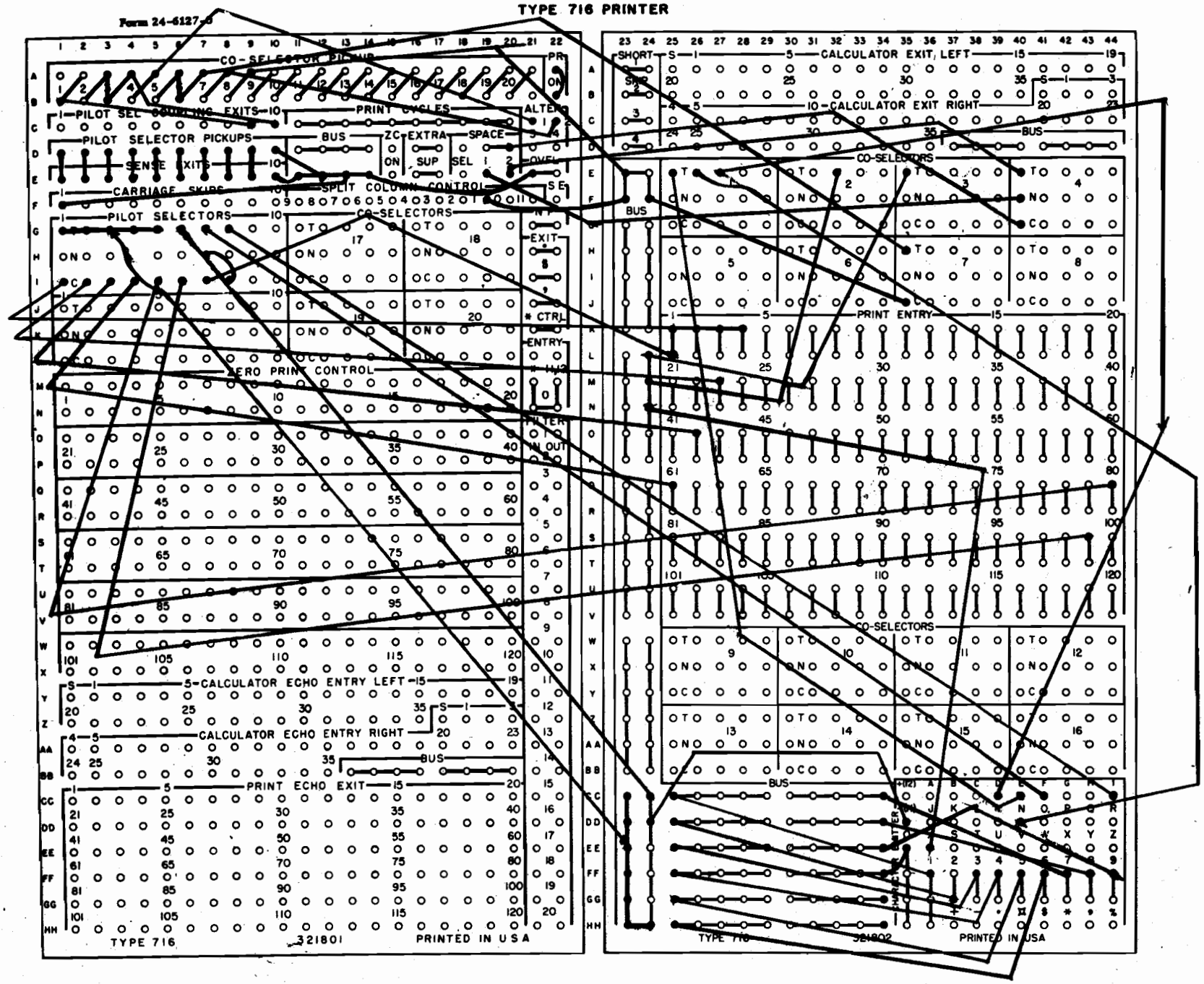
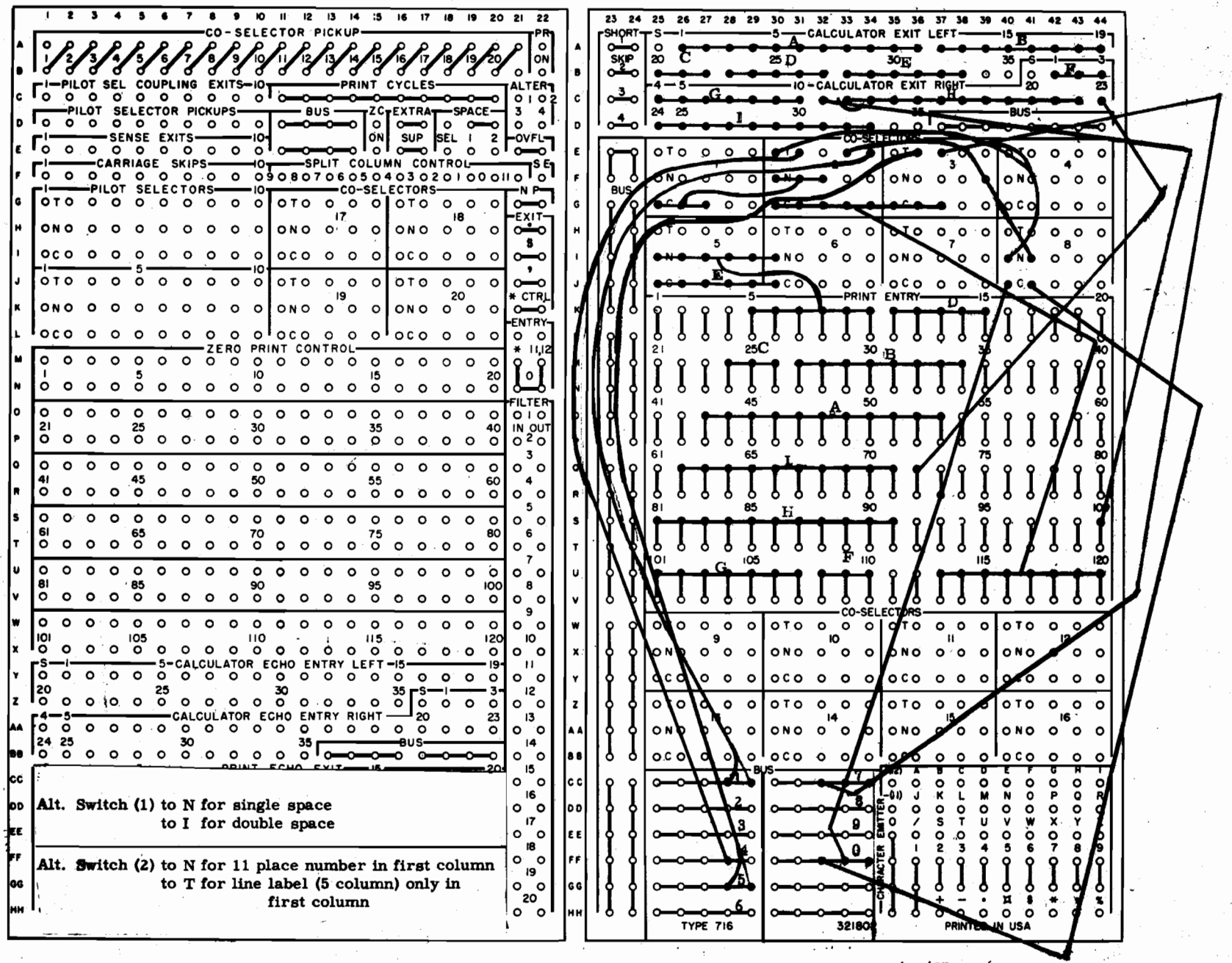
MURA PRINTER BOARD

TYPE 716 PRINTER



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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