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THE ENGLISH ELECTRIC CO., LTD.

NELSON RESEARCH LABORATORIES
STAFFORD
MATHEMATICAL PHYSICS LABORATORY.

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Reference
Order No.

Front Sheet.

Data Sheet 1.

Figure Sheet S6/10021.

DEUCE Subroutine No. 22 (P03)

Report by

T.D. Westrup.

SUMMARY

The attached document gives working details of a DEUCE Subroutine for punching 3 signed decimal numbers on a card with S decimal digits each.

The subroutine was originally prepared at N.P.L. has been tested and corrected on the N.P.L. DEUCE at Blackheath, and has been copied into all instruction delay lines and tested in each.

T.D. WESTRUP.

MATHEMATICAL PHYSICS LABORATORY.

NW

Description. Punches 3 signed decimal numbers on a card, with signs in DEUCE columns 1, 11, and 21, and S decimal digits each.
The numbers are punched as if they had a decimal point after the first digit and must therefore be less than 10.

First Order.

Data.
a, b, c the numbers to be punched ($|a|$, $|b|$, $|c| < 10$)
S the number of decimal digits required ($1 \leq S \leq 9$)
p the number of binary places in a, b, c($16 \leq p \leq 31$)

Result. a, b, c, converted to decimal and punched on a card.

card
- a: 1st DEUCE column. Sign (Y positive, X negative); 2nd to (S+1)th column, S decimal digits.
- b: 11th DEUCE column. Sign. (Y positive, X negative); 12th to (S+11)th column, S decimal digits.
- c: 21st DEUCE column. Sign. (Y positive, X negative); 22nd to (S+21)th column, S decimal digits.

The decimal point lies after the 1st. decimal digit in each number.

TIME: $8\frac{1}{4}$ m.s. before Y row single shot.
3 m.s. after 9 " " "

Instructions for Use.

Stores used.	13	14	15	16	$20_{2,3}$	$21_{2,3}$	17_0	17_1	17_2	TCB
Contents at Entry.	Link	–	–	–	–	–	a	b	c	OFF
Contents at Exit.	–	–	–	$\lvert a \rvert$	–	–	$\lvert a \rvert$	$\lvert b \rvert$	$\lvert c \rvert$	OFF

Occupies. D.L.2 and m.c.'s 0-15 of D.L.3.

Entry. D.L.2 (m.c. 28)

Parameters.
$P_{S+2,\ S+12,\ S+22}$. in m.c. 16 of D.L.2
$10^{-(S-1)}\ 2^{31}$ in m.c. 0 of D.L.3
Wait number (2p-34) in m.c. 30 of D.L.2
Wait number S in m.c. 8 of D.L.2 ($1 \leq S \leq 8$)
or source number 14 in m.c. 8 of D.L.2 (S = 9)

Constants etc. available. Waste instruction, 1 0 - 0, 0, 2 in m.c. 26 of D.L.2.
(0) 21- 0, 0, 0 in m.c. 15 of D.L.3.
(0) 21- 0, 0, 0 in m.c. 10 of D.L.3.

"Clear Punch" Instruction. There is no "Clear punch" instruction in this subroutine but if required it may be inserted in place of the waste instruction in m.c. 26 of D.L.2.

D. L. 2 Track

Card Nos.

D.L. 3 Track

Card Nos.

mc	NIS	S	D	C	W	T		mc	NIS	S	D	C	W	T		
																Y
																X
																0
																1
0	3	24	27		0	0		0		$\frac{1}{2} \times 10^{-(s-1)}$ to 32 b.p.						2
1	2	24	14		0	0		1	3	13	27		0	1		3
2	2	30	13		0	0		2	3	28	22	d	0	11		4
3	2	25	28		0	0		3	3	15	29		0	3	X	5
4	2	17	16		3	6		4	3	26	15		0	4		6
5	2	13	22		0	0		5	3	13	16		0	0		7
6	2	26	15		0	0		6	3	30	15		0	1		8
7	2	21	28		0	0		7	3	16	26	d	0	1		9
8	2	24	14	l	s	8		8	2	3	14		2	1		Y
9	2	26	15		0	2		9	3	27	14		0	0		X
10	2	30	21		1	1		10	0	21	0	l	0	0		0
11	2	26	29		0	21	X	11	3	3	21	d	0	2		1
12	2	27	14		0	0		12		P_1, P_{11}, P_{21}.						2
13	2	21	22	d	1	2		13	3	17	13		13	14		3
14	2	2	15		0	3		14	2	13	17		2	1		4
15	2	24	14	l	6	15		15	0	21	0	l	0	0		5
16		P_{s+2}, P_{s+12}, P_{s+22}.						16								6
17	2	21	20	d	4	5		17								7
18	2	24	27		0	0		18								8
19	2	17	21		3	6		19								9
20	2	16	21		0	0		20								Y
21	2	15	29		0	0	X	21								X
22	2	17	16		2	3		22								0
23	2	2	24		0	0		23								1
24	2	20	22	l	0	7		24								2
25	2	27	26		0	9		25								3
26	1	0	0		0	2		26								4
27	2	30	21		0	1		27								5
28	2	13	1		0	1		28								6
29	2	3	22		1	2		29								7
30	2	21	22	l	2p-34	29		30								8
31	3	10	24		0	5		31								9

2_{28} 13 - 1_{30} Plant link

2_{31} 10 - 24 Stimulate punch

3_6 30 - 15

3_9 27 - 14

3_{11} $3_{13,14}$ - $21_{2,3}$

3_{15} 21_3 - 0

Q_{17} [3_{13} 17_0 - 13]

3_1 13 - 27

+ / −

3_4 26 - 15 | 3_5 13 - 16

3_7 16 - 26 (2mc)

3_{10} 21_2 - 0

Q_{12}[3_{14} 13 - 17_0]

2_{15} 24 - 14 (10mc)

2_0 24 - 27

Forms $|a|$, $|b|$, $|c|$ and prepares sign digits to be punched on Y and X rows.

+ / −

3_2 28 - 22 (2mc) | 3_3 15 - 29X

3_8 3_{12} - 14 [3_{12} is $P_{1,11,21}$]

2_{11} 26 - 29X

Punch sign digits on Y and X rows

2_2 30 - 13 Row Count

2_4 17_1 - 16 (m.c.9) Put $|b|$ into 16

2_{12} 27 - 14 Digit selector.

2_{14} 2_{16} - 15 [2_{16} is $P_{s+2,\ s+12,\ s+22}$]

2_{19} 17_0 - 21_2 (m.c.24) Put $|a|$ into 21_2

2_{27} 30 - 21_3

2_{30} 21 - 22 (64 - 2p m.c.) Shift up $|a|$ so that binary point lies between even and odd halves of 21.

2_{29} 3_0 - 22_2 [3_0 is $\frac{1}{2}\times 10^{-(s-1)}$ to 32 b.p.]

2_1 24 - 14 Shift up digit selector in 14.

2_3 25 - 28 Have s decimal digits been found?

Z / NZ

2_5 13 - 22_3 | 2_6 26 - 15

2_7 21_3 - 28 | 2_8 24 - 14 (9-s m.c.)

Z / NZ | 2_{18} 24 - 27

2_9 26 - 15 | 2_{10} 30 - 21_3

+ / −

2_{20} 16 - 21_2 | 2_{21} 15 - 29X

2_{22} 17_2 - 16 (m.c.26) | 2_{23} 2 - 24

2_{13} 21 - 22 (2 m.c.)

2_{17} 21 - 20 (2m.c.)

2_{24} 20 - 22 (8 m.c.)

Z / NZ

2_{25} 27 - 26 | 2_{26} 0 - 0

1_{30}

(5) If not is the no. in 21_3 equal to the row no?

(9) If so score in 15 (13),(24).Multiply the number in 21_2 by 10.

(6) If so, Remove "end of no. indication" from 15
(8) Shift up digit selector to beginning of next decimal No. (18) Have all 3 sets of dec. digits been found? (20) No. Put next no. to be punched into 21_2 and $|c|$ into 16 (21) Yes, punch decimal digits (23) Row 9? (25) No. "Increase" row count by -1 (26) Yes. Waste.

Flow Diagram and Coding for DEUCE Subroutine P03.
Punch 3 Signed S- Digit Numbers.

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