

IDENTIFICATION

VARIABLE COLUMN FLOATING DECIMAL PRINT, MU PFD3
704 SAP PROGRAM

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PURPOSE

To print on one line, via the 716 on-line printer, an integer line label of five digits plus sign, and one to eight rounded floating point decimal numbers of eight digits plus sign and decimal point in the fraction and two digits plus sign in the exponent.

RESTRICTIONS

The MURA II printer board is used.

METHOD

Accuracy: $\pm 1/2$ in the eighth significant figure

Range: $1/2 (2^{-128}) \leq |x| \leq (1 - 2^{-27}) (2^{127})$

USAGE

This routine is entered by the calling sequence:

α	TSX	PFD3, 4
$\alpha + 1$	N-1	L, O, LWA
$\alpha + 2$	return	

where N is the number of floating point numbers to be printed, L is the location of the integer line label, and LWA (last word address) is the highest ordered location of the numbers to be printed. (The numbers found in numerically ascending locations are printed from left to right. The rightmost number is found in location LWA).

SPACE REQUIRED

197 words program at PFD3

24 words temporary at COMMON

CODING INFORMATION

Timing: If $N - 1 \geq 5$ (6 or more numbers to be printed), two print cycles are required. For $N - 1 \leq 4$, the printer can be maintained at full speed (150 lines per minute).

	REM PFD3 MURA FLOATING DECIMAL PRINT		MU PFD3
PFD3	SXD X1,1	SAVE IRS	PFD3 0001
	SXD X2,2		PFD3 0002
	SXD X4,4		PFD3 0003
	CAL 1,4		PFD3 0004
	STA B	LOC. OF LABEL	PFD3 0005
	ARS 15		PFD3 0006
	PDX 0,1	N-1	PFD3 0007
	STD U+1		PFD3 0008
	TXL **3,1,4		PFD3 0009
	SUB D4		PFD3 0010
	STD W	1ST CYCLE PRINT TIMER	PFD3 0011
	ARS 3		PFD3 0012
	STA D	LWA	PFD3 0013
	TXI **1,1,1		PFD3 0014
	SXD U,1		PFD3 0015
	CLA F		PFD3 0016
	STA V	ARS 7	PFD3 0017
	LXA H1,4	1	PFD3 0018
	CAL MZE,4		PFD3 0019
	STA T		PFD3 0020
A	LXA L,2	24	PFD3 0021
	STZ COMMON+24,2	CLEAR IMAGE	PFD3 0022
	TIX *-1,2,1		PFD3 0023
B	LDQ **	LABEL	PFD3 0024
	CAL D2048	OCT 004000000000	PFD3 0025
	TIX **2,4,12	BRANCH IF 2ND PRINT CYCLE	PFD3 0026
	TXI R,2,4	DO LABEL IF 1ST CYCLE	PFD3 0027
	SLW BIT	SAVE SLIDING BIT	PFD3 0028
	CAL MZE,4	HOUSEKEEP ORSES	PFD3 0029
	STA M		PFD3 0030
	STA T		PFD3 0031
	PXD 0,0	CLEAR AC	PFD3 0032
D	FAD **,1	NORMALIZE NUMBER	PFD3 0033
	STO FRACT	CLEAR FRACT AND EXP IF ZERO	PFD3 0034
	STO EXP		PFD3 0035
	TZE J	IF ZERO, NO CONVERSION	PFD3 0036
	LRS 35		PFD3 0037
	LLS 8		PFD3 0038
	STQ FRACT	SAVE MANTISSA	PFD3 0039
	SSP		PFD3 0040
	SUB H128	FORM EXPONENT	PFD3 0041
	LRS 35		PFD3 0042
	MPY LNLN	LN2/LN10	PFD3 0043
	SUB H1	1	PFD3 0044
	STO EXP	INTEGER PART OF EXPONENT	PFD3 0045
	MPR LN	(LN10)/4	PFD3 0046
	STO EKS	X/4=Q(LN10)/4	PFD3 0047
	STZ JAY	CLEAR J COUNTER	PFD3 0048
	STZ SUM	CLEAR SUM	PFD3 0049
	CLA SXNTH	1/16	PFD3 0050
E	STO TEA	TERM OF **X SUM	PFD3 0051
	ADD SUM		PFD3 0052
	STO SUM	(1/16)(E**X)	PFD3 0053
	CLA JAY		PFD3 0054
	ADD H1	1	PFD3 0055
	STO JAY		PFD3 0056
F	PXD 7,0	CLEAR AC	PFD3 0057
	LDQ TEA		PFD3 0058
	LLS 2	4T	PFD3 0059

	DVP JAY	4T/J	PFD3 0060
	MPR EKS	(X/4)(4T/J)	PFD3 0061
	TNZ E	BRANCH UNTIL CONVERGES	PFD3 0062
	LDQ SUM		PFD3 0063
	MPY FRACT		PFD3 0064
	STO FRACT	MANTISSA*(1/16)(10**Q)	PFD3 0065
	TOV **1	RESET OVERFLOW IND.	PFD3 0066
	LLS 4	MULTIPLY BY 16	PFD3 0067
	TOV 6	BRANCH IF 1 OR MORE	PFD3 0068
	SSP		PFD3 0069
	CAS TENTH	1/10	PFD3 0070
X1	TXI 1,0,0,0	GREATER THAN 1/10	PFD3 0071
X2	TXI 1,0,0,0	EQUALS 1/10	PFD3 0072
	LRS 35	LESS THAN 1/10	PFD3 0073
	MPY H10	10	PFD3 0074
	CLS H1	1	PFD3 0075
	TRA H		PFD3 0076
G	LRS 4	RESTORE MQ	PFD3 0077
	CLA FRACT	RESTORE AC	PFD3 0078
	LRS 31	EQUIVALENT TO LRS 35	PFD3 0079
	DVP H10	10	PFD3 0080
	CLA H1	1	PFD3 0081
H	ADD EXP	EXP=EXP+OR-1	PFD3 0082
	TNZ **2		PFD3 0083
	SSP	SSP IF ZERO	PFD3 0084
	STO EXP	NEW EXPONENT OF 10	PFD3 0085
	PXD 0,0	CLEAR AC	PFD3 0086
	LLS 35	FRACTION TO AC	PFD3 0087
	LDQ FRACT		PFD3 0088
	LLS 0	CORRECT SIGN TO AC	PFD3 0089
	ACL ROUND	OCT 340	PFD3 0090
	PBT		PFD3 0091
X4	TXI J,0,**		PFD3 0092
	CLA EXP	FRACTION=1	PFD3 0093
	ADD H1	ADJUST EXPONENT	PFD3 0094
	TNZ **2		PFD3 0095
	SSP	SSP IF ZERO	PFD3 0096
	STO EXP		PFD3 0097
	CLA TENTH	FRACTION=1/10	PFD3 0098
	LLS 0	CORRECT SIGN TO AC	PFD3 0099
J	LRS 35	CONVERT FRACTION TO IMAGE	PFD3 0100
	TXI **1,2,7	X2=8	PFD3 0101
	SXD U,1	SAVE NUMBER COUNT	PFD3 0102
	CAL BIT		PFD3 0103
	TQP **2		PFD3 0104
	ORS COMMON+23,4	FRACTION SIGN TO IMAGE	PFD3 0105
K	ARS 1		PFD3 0106
	SLW BIT		PFD3 0107
L	PXD 24,0	CLEAR AC	PFD3 0108
	MPY H10	10	PFD3 0109
	PAX 0,1	X1=DIGIT	PFD3 0110
	CAL BIT		PFD3 0111
M	ORS **,1	FRACTION TO IMAGE	PFD3 0112
	TXL P,2,7	BRANCH AFTER DEC. PT. IN	PFD3 0113
	ARS 1	SLIDE BIT	PFD3 0114
	TNZ N	BRANCH IF BIT NOT LOST	PFD3 0115
	TXI **1,4,12	FLIP TO IMAGE RIGHT	PFD3 0116
	CAL MZE,4	HOUSEKEEP ORSES	PFD3 0117
	STA M		PFD3 0118
	STA T		PFD3 0119
	CAL MZE	NEW BIT=-0	PFD3 0120

N	ORS COMMON+14,4	DEC. PT. TO IMAGE	PFD3	0121
	ORS COMMON+19,4		PFD3	0122
	ORS COMMON+24,4		PFD3	0123
P	TIX K,2,1	LOOP FOR 8 DIGITS	PFD3	0124
	LDQ EXP	CONVERT EXPONENT TO IMAGE	PFD3	0125
Q	ARS 3		PFD3	0126
	TXI *+1,2,1	X2=2	PFD3	0127
	TNZ R	BRANCH IF BIT NOT LOST	PFD3	0128
	CAL MZE-1	HOUSEKEEP ORS	PFD3	0129
	STA T		PFD3	0130
	CAL MZE	NEW BIT=-0	PFD3	0131
R	SLW BIT		PFD3	0132
	PXD 0,0	CLEAR AC	PFD3	0133
	LLS 0		PFD3	0134
	DVH H10	10	PFD3	0135
S	PAX 12,1	X1=DIGIT	PFD3	0136
	CAL BIT		PFD3	0137
	TNZ T	BRANCH IF BIT NOT LOST	PFD3	0138
	CAL MZE,4	HOUSEKEEP ORS	PFD3	0139
	STA T		PFD3	0140
	CAL H1	NEW BIT=HTR 1	PFD3	0141
T	ORS **,1	EXPONENT TO IMAGE	PFD3	0142
	ALS 1	SLIDE BIT	PFD3	0143
	TIX R,2,1	LOOP FOR 2 DIGITS	PFD3	0144
	LXD U,1	RESTORE NUMBER COUNT	PFD3	0145
	TOP **3		PFD3	0146
	ORS COMMON+23,4	EXPONENT SIGN TO IMAGE	PFD3	0147
U	TXI V,0,**	NUMBER COUNT SAVIOUR	PFD3	0148
	TXH V,1,**		PFD3	0149
	ORS COMMON+24,4		PFD3	0150
V	LRS **	7,3,4	PFD3	0151
	SLW BIT		PFD3	0152
W	TXL X,1,**	BRANCH FOR 1ST CYCLE PRINT	PFD3	0153
	CLA V	7,3,4	PFD3	0154
	SUB G	4	PFD3	0155
	TZE **3	3,-1,0	PFD3	0156
	TMI **2	3,-1	PFD3	0157
	STA V	3	PFD3	0158
	TXI C,1,-1	LOOP FOR NEXT NUMBER	PFD3	0159
X	WPR	SELECT PRINTER	PFD3	0160
	SPR 6	SPREAD COLUMNS	PFD3	0161
	CLA G	LRS 4	PFD3	0162
	CAS V	LRS 3 OR 4	PFD3	0163
	TRA **2		PFD3	0164
	SPR 9	2ND CYCLE PULSE	PFD3	0165
	STO V	LRS 4	PFD3	0166
	PXD COMMON+9,0	CLEAR AC	PFD3	0167
	STD W	CLEAR TXL DECREMENT	PFD3	0168
	LXA S,2	12	PFD3	0169
	CPY COMMON+24,2	IMAGE LEFT	PFD3	0170
	CPY COMMON+12,2	IMAGE RIGHT	PFD3	0171
	TIX *-2,2,1		PFD3	0172
	TXL **2,1,0	BRANCH IF FINISHED	PFD3	0173
	TXI A,1,-1	LOOP FOR 2ND CYCLE	PFD3	0174
	LXD X1,1	RESTORE IRS	PFD3	0175
	LXD X2,2		PFD3	0176
	LXD X4,4		PFD3	0177
	TRA 2,4	EXIT	PFD3	0178
	HTR COMMON+21		PFD3	0179
MZE	MZE 0		PFD3	0180
H1	HTR 1		PFD3	0181

D4 HTR 0,0,4
 H10 HTR 10
 M8 HTR 128
 D2048 HTR 0,0,2048
 BIT HTR **
 FRACT HTR **
 EXP HTR **
 EKS HTR **
 JAY HTR **
 SUM HTR **
 TEA HTR **
 LNLN PON 27156,4,6688
 LN PTW 28397,0,9915
 SXNTH PZE 0,0,8192
 TENTH PZE 19661,1,13107
 ROUND PZE 224
 END PFD3

SLIDING BIT
 FRACTION
 EXPONENT
 X/4 FOR E**X
 J COUNTER
 (1/16)E**X
 TERM IN SUM
 LN2/LN10
 (LN10)/4
 1/16
 1/10
 ROUNDING CONSTANT

PFD3 0182
 PFD3 0183
 PFD3 0184
 PFD3 0185
 PFD3 0186
 PFD3 0187
 PFD3 0188
 PFD3 0189
 PFD3 0190
 PFD3 0191
 PFD3 0192
 PFD3 0193
 PFD3 0194
 PFD3 0195
 PFD3 0196
 PFD3 0197
 PFD3 0198