

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

PROGRAM DESCRIPTION

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Catalog Number 301016C

IDENTIFICATION: SEL 810A/B Divide-Fixed/Double Precision Subroutine.

AUTHOR: Systems Engineering Laboratories

ACCEPTED: July 23, 1969

PURPOSE: To compute a double-precision quotient from a double precision dividend and divisor.

COMPUTER CONFIGURATION: Basic SEL 810A or 810B

SUBROUTINES REQUIRED: None

STORAGE: 120 octal locations plus literals and intermap references

TIMING: 116 cycles plus normalizing time of 9 cycles per bit.

CALLING SEQUENCE:

	LAA	DVND	MSB	DIVIDEND
	LBA	DVND+1	LSB	DIVIDEND
X	CALL	DDIV		
X+1	DAC	DVSR		Address of most significant word of divisor.

USE: After the execution of the program, the return is made to X+2 with the double precision quotient in the A- and B-Accumulators.

METHOD: The divisor is normalized, and a shift instruction is constructed to scale the dividend to the same place. If the dividend is greater than the divisor, the overflow latch is set upon exiting and the answer should be considered invalid. If both the dividend and divisor are zero, the quotient is set to zero.

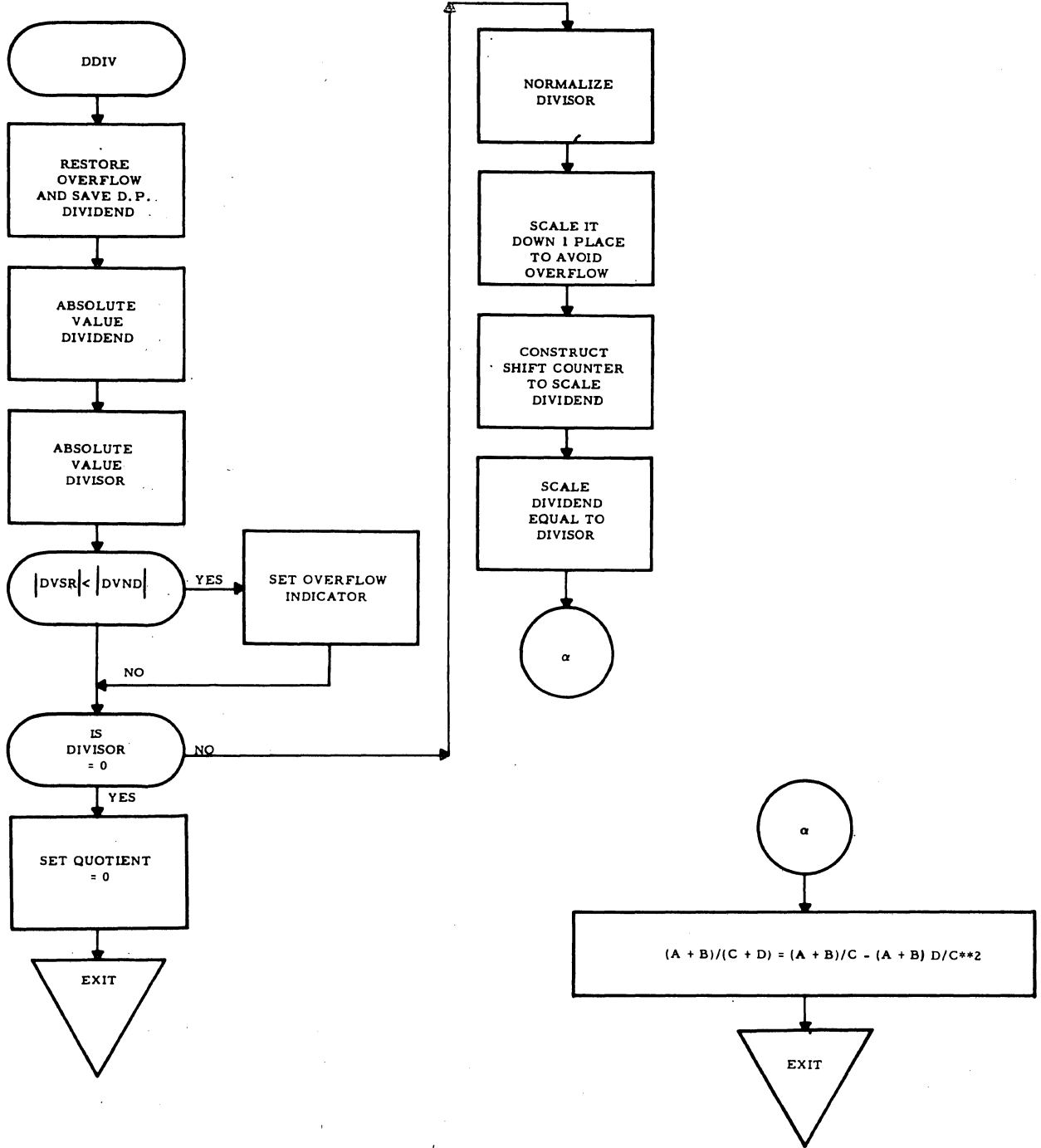
METHOD: (Cont'd)

The double precision quotient is produced from the approximation:

$$\frac{A + B}{C + D} = \frac{A + B}{C} - \frac{(A + B)D}{C^2}$$

NOTE

Version C incorporates a change to correct an error which occurs when the divisor is negative.



DOUBLE PRECISION FIXED POINT DIVIDE CAT. 301016C

0002			*	7/23/69	
0003			*	DOUBLE PRECISION FIXED POINT DIVIDE	
0004			*	CALLING SEQUENCE	
0005			*	LAA MSB DIVIDEND	
0006			*	LBA LSB DIVIDEND	
0007			*	CALL DDIV	
0008			*	DAC MSB DIVISOR	
0009	00000	00000000		REL	
0010	00000	50000000		NAME DDIV, DDIV	
0011	00000	00000000	DDIV	HLT	
0012	00001	00000025		SOF	RESET OVERFLOW
0013	00002	00000033		NOP	
0014	00003	03100106		STA DVND	SAVE MSB DIVIDEND
0015	00004	04100107		STB DVND+1	SAVE LSB DIVIDEND
0016	00005	00000024		SAP	
0017	00006	00000002		NEG	
0018	00007	03100110		STA TEST 55 64	ABSOLUTE VALUE DIVIDEND
0019	00010	02300000		LBA DDIV	ADDRESS DIVISOR
0020	00011	14100000		IMS DDIV N+X	
0021	00012	01077743		LAA =-29 N+X	NORMALIZE COUNTER
0022	00013	03100111		STA NMCT N+P	
0023	00014	01400000		LAA 0,1	MSB DIVISOR
0024	00015	00000024		SAP	
0025	00016	00000002		NEG	
0026	00017	15100110		CMA TEST	IS ABSOLUTE DIVISOR GREATER THEN ABS. DIVID.
0027	00020	10000000		DIV =0	NO, SET OVERFLOW
0028	00021	00000033		NOP	
0029	00022	00000022		SAZ	YES, IS MSB DIVISOR ZERO
0030	00023	11100031		BRU =+6	NO, CONTINUE
0031	00024	01400001		LAA 1,1	YES, CHECK LSB
0032	00025	00000022		SAZ	IS IT ZERO
0033	00026	11100031		BRU =+3	NO, CONTINUE
0034	00027	00000005		TAB	
0035	00030	11300000		BRU DDIV	EXIT
0036	00031	01400000		LAA 0,1	DOUBLE
0037	00032	02400001		LBA 1,1	PRECISION DIVISOR

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0038	00033	00000032	DDV1 SN0 NORMALIZED
0039	00034	11100100	BRU NORM NO, SHIFT NEXT BIT
0040	00035	00000112	FRA 1 → YES, SCALE IT DOWN TO AVOID OVERFLOW
0041	00036	03100112	STA DVSR <i>5602</i> SAVE NORMALIZED DIVISOR
0042	00037	04100113	STB DVSR+1 <i>5602</i>
0043	00040	01100111	LAA NMCT
0044	00041	06077743	SMA =-29 <i>-29</i> CONSTRUCT SHIFT COUNTER TO
0045	00042	15000017	CMA =15 SCALE DIVIDEND
0046	00043	11100104	BRU NOP
0047	00044	11100104	BRU NOP
0048	00045	06000017	SMA =15 <i>41</i>
0049	00046	02100114	LBA FL15 <i>FL15</i>
0050	00047	04100056	AB2 STB AB1
0051	00050	00000616	LSL 6
0052	00051	05100115	AMA FLAI CONSTRUCT FLA INSTRUCTION FOR DIVIDEND
0053	00052	03100055	STA **3
0054	00053	01100106	LAA DVND MSB DIVIDEND
0055	00054	02100107	LBA DVND+1 LSB DIVIDEND
0056	00055	00000017	FLA ** SCALE IT EQUAL TO DIVISOR
0057	00056	00000033	AB1 NOP <i>FL15</i>
0058	00057	00000112	FRA 1
0059			$(A+B)/(C+D) = (A+B)/C - (A+B)D/C**2$
0060	00060	10100112	DIV DVSR+1 <i>5602</i> $(A+B)/C$
0061	00061	03100116	STA QUOT
0062	00062	00000006	IAB
0063	00063	00000110	RSA 1 SCALE DOWN REMAINDER
0064	00064	03100117	STA RMDR SAVE REMAINDER
0065	00065	01100113	LAA DVSR+1 D
0066	00066	00000110	RSA 1
0067	00067	00000002	NEG -D
0068	00070	00000005	TAB
0069	00071	07100116	MPY QUOT
0070	00072	05100117	AMA RMDR
0071	00073	10100112	DIV DVSR
0072	00074	02000000	LBA =0 *C LMG
0073	00075	00001612	FRA 14 *C LMG
0074	00076	05100116	AMA QUOT ADD 2 TERMS

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0075 00077 11300000 BRU* DDIV EXIT
0076 00100 00000117 NORM FLA 1
0077 00101 14100111 IMS NMCT
0078 00102 11100033 BRU DDV1
0079 00103 11100035 BRU DDV1+2
0080 00104 02000033 NOP LBA = '33 NOP OP-CODE
0081 00105 11100047 BRU A82
0082 00106 00000002 DVND BSS 2
0083 00110 00000000 TEST HLT
0084 00111 00000000 NMCT HLT
0085 00112 00000002 DVSM BSS 2
0086 00114 00001717 FL1D FLA 15
0087 00115 00000017 FLA1 FLA 0
0088 00116 00000000 QUOT HLT
0089 00117 00000000 RMDR HLT
0090 00120 70400000 END
ERRORS 0000 00000

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5 6 3 6