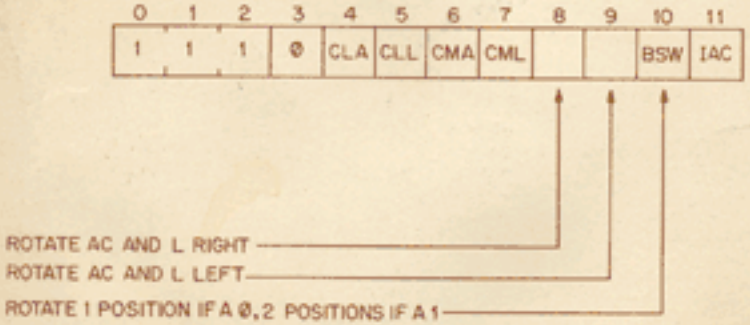
BASIC INSTRUCTIONS

			Time (μsec.)
AND	0000	logical AND	2.6
TAD	1000	2's complement add	2.6
ISZ	2000	increment, and skip if zero	2.6
DCA	3000	deposit and clear AC	2.6
JMS	4000	jump to subroutine	2.6
JMP	5000	jump	1.2
IOT	6000	in/out transfer	—
OPR	7000	operate	1.2

Memory Reference Instruction Bit Assignments

GROUP 1 OPERATE MICROINSTRUCTIONS (1.2μsec)

			Sequence
NOP	7000	no operation	—
CLA	7200	clear AC	1
CLL	7100	clear link	1
CMA	7040	complement AC	2
CML	7020	complement link	2
RAR	7010	rotate AC and link right one	4
RAL	7004	rotate AC and link left one	4
RTR	7012	rotate AC and link right two	4
RTL	7006	rotate AC and link left two	4
IAC	7001	increment AC	3
BSW	7002	swap bytes in AC	4



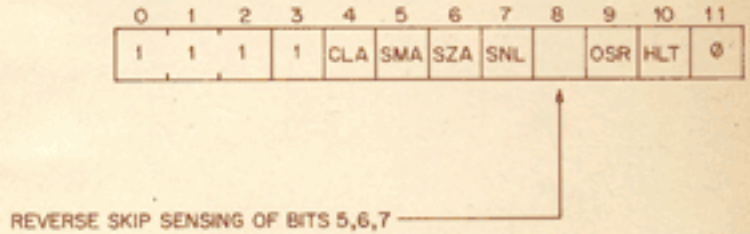
Logical Sequences:

1—CLA, CLL
2—CMA, CML
3—IAC
4—RAR, RAL, RTR, RTL, BSW

Group 1 Operate Instruction Bit Assignments

GROUP 2 OPERATE MICROINSTRUCTIONS (1.2μsec.)

			Sequence
SMA	7500	skip on minus AC	1
SZA	7440	skip on zero AC	1
SPA	7510	skip on plus AC	1
SNA	7450	skip on non-zero AC	1
SNL	7420	skip on non-zero link	1
SZL	7430	skip on zero link	1
SKP	7410	skip unconditionally	1
OSR	7404	inclusive OR, switch register with AC	3
HLT	7402	halts the program	3
CLA	7600	clear AC	2



Logical Sequences:

1 (Bit 8 is Zero)—Either SMA or SZA or SNL
1 (Bit 8 is One)—Both SPA and SNA and SZL
2 —CLA
3 —OSR, HLT

Group 2 Operate Instruction Bit Assignments

COMBINED OPERATE MICROINSTRUCTIONS (1.2μsec.)

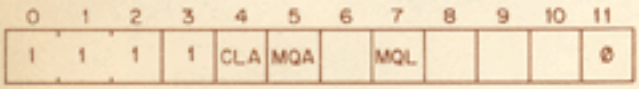
				Sequence
CIA		7041	complement and increment AC	2,3
LAS		7604	load AC with switch register	2,3
STL		7120	set link (to 1)	1,2
GLK		7204	get link (put link in AC bit 11)	1,4
CLA	CLL	7300	clear AC and link	1
CLL	RAR	7110	shift positive number one right	1,4
CLL	RAL	7104	shift positive number one left	1,4
CLL	RTL	7106	clear link, rotate 2 left	1,4
CLL	RTR	7112	clear link, rotate 2 right	1,4
SZA	CLA	7640	skip if AC=0, then clear AC	1,2
SZA	SNL	7460	skip if AC=0 or link is 1, or both	1
SNA	CLA	7650	skip if AC≠0, then clear AC	1,2
SMA	CLA	7700	skip if AC<0, then clear AC	1,2
SMA	SZA	7540	skip if AC≤0	1
SMA	SNL	7520	skip if AC<0 or link is 1, or both	1
SPA	SNA	7550	skip if AC>0	1
SPA	SZL	7530	skip if AC≥0, and if the link is 0	1
SPA	CLA	7710	skip if AC≥0, then clear AC	1,2
SNA	SZL	7470	skip if AC≠0 and link=0	1

LOADING CONSTANTS INTO THE AC (1.2 μsec)

OCTAL Constant	Decimal Constant	OCTAL Instruction	Instructions Combined				
5777	-1025	7352	CLA	CLL	CMA	RTR	
6000	-1024	7333	CLA	CLL	CML	IAC	RTR
7775	-3	7346	CLA	CLL	CMA	RTL	
7776	-2	7344	CLA	CLL	CMA	RAL	
7777	-1	7340	CLA	CLL	CMA		
4000	-0	7330	CLA	CLL	CML	RAR	
0000	0	7300	CLA	CLL			
0001	1	7301	CLA	CLL	IAC		
0002	2	7305	CLA	CLL	IAC	RAL	
0002	2	7326	CLA	CLL	CML	RTL	
0003	3	7325	CLA	CLL	CML	IAC	RAL
0004	4	7307	CLA	CLL	IAC	RTL	
0006	6	7327	CLA	CLL	CML	IAC	RTL
0100	64	7302	CLA	IAC	BSW		
2000	1024	7332	CLA	CLL	CML	RTR	
3777	2047	7350	CLA	CLL	CMA	RAR	

MQ MICROINSTRUCTIONS (1.2μsec.)

NOP	7401	no operation
CLA	7601	clear AC
MQL	7421	load MQ from AC then clear AC
MQA	7501	inclusive OR the MQ with the AC
CAM	7621	clear AC and MQ
SWP	7521	swap AC and MQ
ACL	7701	load MQ into AC
CLA, SWP	7721	load AC from MQ then clear MQ

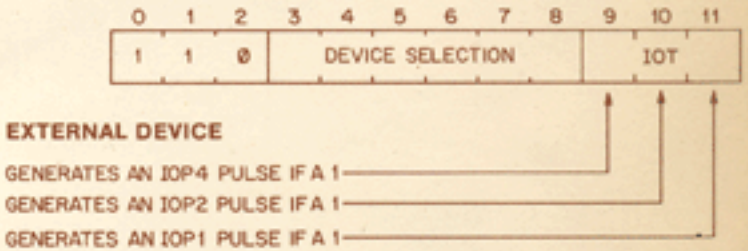


Logical Sequence:
1—CLA
2—MQA, MQL
3—ALL OTHERS

MQ Microinstruction Bit Assignments

INTERNAL IOT MICROINSTRUCTIONS PROGRAM INTERRUPT AND FLAG (1.2μsec.)

SKON	6000	skip if interrupt ON, and turn OFF
ION	6001	turn interrupt ON
IOF	6002	turn interrupt OFF
SRQ	6003	skip on interrupt request
GTF	6004	get interrupt flags
RTF	6005	restore interrupt flags
SGT	6006	skip on Greater Than flag
CAF	6007	clear all flags



IOT Instruction Bit Assignments

EXTENDED ARITHMETIC ELEMENT KE8-E (optional)

MODE INSTRUCTIONS

SWAB	7431	switch Mode from A to B
SWBA	7447	switch Mode from B to A

SHIFT INSTRUCTIONS

SCA	7441	logical OR step counter with AC
SCA CLA	7641	step counter to AC
SCL	7403 (Mode A)	step counter load (from memory)
NMI	7411	normalize
SHL	7413	shift left
ASR	7415	arithmetic shift right
LSR	7417	logical shift right
ASC	7403 (Mode B)	AC to step counter

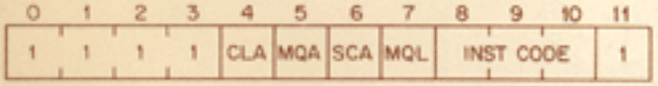
ARITHMETIC INSTRUCTIONS

MVY	7405	multiply
DVI	7407	divide
SAM	7457 (Mode B)	subtract AC from MQ

DOUBLE PRECISION INSTRUCTIONS (MODE B)

DLD	7763	double precision load
DST	7445	double precision store
DAD	7443	double precision add
DPIC	7573	double precision increment
DCM	7575	double precision complement
DPSZ	7451	double precision skip if zero

EAE MODE A BIT ASSIGNMENTS



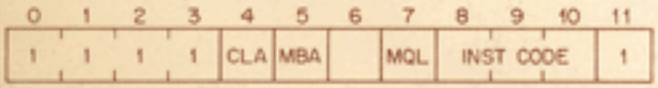
Logical Sequence 1* 2 2 2 3

*Except for MQL
**Cannot be combined with other EAE operations

Instruction Code

0=No Operation
1=SCL
2=MUY
3=DVI
4=NMI**
5=SHL
6=ASR
7=LSR

EAE MODE B BIT ASSIGNMENTS



Logical Sequence 1* 2 2 3

*Except for MQL
**Cannot be combined with other EAE operations
***Bits 5 and 7 must be 1

Instruction Code

Bit 6=0	Bit 6=1
0=No Operation	0=SCA
1=ACS	1=DAD
2=MUY	2=DST
3=DVI	3=SWBA
4=NMI**	4=DPSZ
5=SHL	5=DPIC***
6=ASR	6=DCM***
7=LSR	7=SAM

EAE INSTRUCTION DIFFERENCES

Instruction	Mode A	Mode B
MUY	The next location holds the multiplier	The next location holds the address of the multiplier
DVI	The next location holds the divisor	The next location holds the address of the divisor
SHL LSR ASR	The next location holds one less than the number of shifts. On right shifts, MQ11 is lost.	The next location holds the number of shifts. (A shift of zero places is legal.) On right shifts, MQ11 is shifted into the GT flag.

EAE INSTRUCTION TIMES

Mode A

	MEM CYCLES	INSTR TIME	LONGEST CYCLE	NOTES
SWAB	1	1.2μs	1.2μs	
SWBA	1	1.2	1.2	
SCL	2	2.6	1.4	
MUY	2	7.4	6.2	
DVI	2	7.4	6.2	No overflow
NMI	1	1.5+.3N	8.1	
SHL	2	2.6+.3N	8.9*	25-place shift
ASR	2	2.6+.3N	8.9*	25-place shift
LSR	2	2.6+.3N	8.9*	25-place shift
SCA	1	1.2	1.2	

Mode B

	MEM CYCLES	INSTR TIME	LONGEST CYCLE	NOTES
SWAB	1	1.2μs	1.2μs	
SWBA	1	1.2	1.2	
ACS	1	1.2	1.2	
MUY	3	8.6	6.2	
DVI	3	8.6	6.2	No overflow
NMI	1	1.5+.3N	8.1	
SHL	2	2.9+.3N	9.2**	25-place shift
ASR	2	2.9+.3N	9.2**	25-place shift
LSR	2	2.9+.3N	9.2**	25-place shift
SCA	1	1.2	1.2	
DAD	4	5.2	1.4	
DST	4	5.2	1.4	
DPSZ	1	1.2	1.2	
DPIC	1	1.6	1.6	
DCM	1	1.6	1.6	
SAM	1	1.2	1.2	

*Computed from 1.4+.3N
**Computed from 1.7+.3N

Rim Loader (Low Speed)	
7756/	6032
7757/	6031
7760/	5357
7761/	6036
7762/	7106
7763/	7006
7764/	7510
7765/	5357
7766/	7006
7767/	6031
7770/	5367
7771/	6034
7772/	7420
7773/	3776
7774/	3376
7775/	5356

Rim Loader (High Speed)	
7756/	6014
7757/	6011
7760/	5357
7761/	6016
7762/	7106
7763/	7006
7764/	7510
7765/	5374
7766/	7006
7767/	6011
7770/	5367
7771/	6016
7772/	7420
7773/	3776
7774/	3376
7775/	5357

CONTROL CODES

8-bit ASCII Code	Character Name	Remarks
000	null	Ignored in ASCII input.
200	leader/trailer	Leader/trailer code precedes and follows the data portion of binary files.
203	CTRL/C	OS/8 break character, forces return to Keyboard Monitor, echoed as ↑C.
207	BELL	CTRL/G.
211	TAB	CTRL/I, horizontal tabulation.
212	LINE FEED	Used as a control character by the Command Decoder and ODT.
213	VT	CTRL/K, vertical tabulation.
214	FORM	CTRL/L, form feed.
215	RETURN	Carriage return, generally echoed as carriage return followed by a line feed.
217	CTRL/O	Break Character, used conventionally to suppress Teletype output, echoed as ↑O.
225	CTRL/U	Delete current input line, echoed as ↑U.
232	CTRL/Z	End-of-File character for all ASCII and binary files (in relocatable binary files CTRL/Z is not a terminator if it occurs before the trailer code).
233	ESC	Escape replaces ALTMODE on some terminals. Considered equivalent to ALTMODE.
375	ALTMODE	Special break character for Teletype input.
376	PREFIX	PREFIX replaces ALTMODE on some terminals. Considered equivalent to ALTMODE.
377	RUBOUT	Key is labeled DELETE on some terminals. Deletes the previous character typed.

8-bit ASCII Code	6-bit Code	DEC 029 Card Code	DEC 026 Card Code	Character Representation	Remarks
240	40	blank	blank		space (non-printing)
241	41	11-8-2	12-8-7	!	exclamation point
242	42	8-7	0-8-5	"	quotation marks
243	43	8-3	0-8-6	#	number sign[10]
244	44	11-8-3	11-8-3	$	dollar sign
245	45	0-8-4	0-8-7	%	percent
246	46	12	11-8-7	&	ampersand
247	47	8-5	8-6	'	apostrophe or acute accent
250	50	12-8-5	0-8-4	(	opening parenthesis
251	51	11-8-5	12-8-4[1]	)	closing parenthesis
252	52	11-8-4	11-8-4	*	asterisk
253	53	12-8-6	12	+	plus
254	54	0-8-3	0-8-3	,	comma
255	55	11	11	-	minus sign or hyphen
256	56	12-8-3	12-8-3	.	period or decimal point
257	57	0-1	0-1	/	slash
260	60	0	0	0	
261	61	1	1	1	
262	62	2	2	2	
263	63	3	3	3	
264	64	4	4	4	
265	65	5	5	5	
266	66	6	6	6	
267	67	7	7	7	
270	70	8	8	8	
271	71	9	9	9	
272	72	8-2	11-8-2	:	colon
273	73	11-8-6	0-8-2	;	semicolon
274	74	12-8-4	12-8-6	<	less than
275	75	8-6	8-3	=	equals
276	76	0-8-6	11-8-6	>	greater than
277	77	0-8-7	12-8-2	?	question mark
300	00	8-4	8-4	@	at sign
301	01	12-1	12-1	A	
302	02	12-2	12-2	B	
303	03	12-3	12-3	C	
304	04	12-4	12-4	D	
305	05	12-5	12-5	E	
306	06	12-6	12-6	F	
307	07	12-7	12-7	G	

CHARACTER CODES

8-bit ASCII Code	6-bit Code	DEC 029 Card Code	DEC 026 Card Code	Character Representation	Remarks
310	10	12-8	12-8	H	
311	11	12-9	12-9	I	
312	12	11-1	11-1	J	
313	13	11-2	11-2	K	
314	14	11-3	11-3	L	
315	15	11-4	11-4	M	
316	16	11-5	11-5	N	
317	17	11-6	11-6	O	
320	20	11-7	11-7	P	
321	21	11-8	11-8	Q	
322	22	11-9	11-9	R	
323	23	0-2	0-2	S	
324	24	0-3	0-3	T	
325	25	0-4	0-4	U	
326	26	0-5	0-5	V	
327	27	0-6	0-6	W	
330	30	0-7	0-7	X	
331	31	0-8	0-8	Y	
332	32	0-9	0-9	Z	
333	33	12-8-2[5]	11-8-5	[	opening bracket, SHIFT/K
334	34	11-8-7[6]	8-7	\	backslash, SHIFT/L[8]
335	35	0-8-2	12-8-5	]	closing bracket, SHIFT/M
336	36	12-8-7[7]	8-5	^	circumflex[2]
337	37	0-8-5[3]	8-2[3]	_	underline[4,9]

Footnotes:

(1) On some DEC 026 Keyboards this character is graphically represented as ¤.
(2) On most DEC Teletypes circumflex is replaced by up-arrow (↑).
(3) A card containing this code in column 1 with all remaining columns blank is an end-of-file card.
(4) On most DEC Teletypes underline is replaced by backarrow (←).
(5) On some 029 keyboards this character is graphically represented as a cent sign (¢).
(6) On some 029 keyboards this character is graphically represented as logical NOT (¬).
(7) On some 029 keyboards this character is graphically represented as vertical bar (|).
(8) On some LP8 line printers, the character diamond (◊) is printed instead of backslash.
(9) On some LP8 line printers, the character heart (♡) is printed instead of underline.
(10) The number sign on some terminals is replaced by pound sign (£).