

B. D. PIERCE

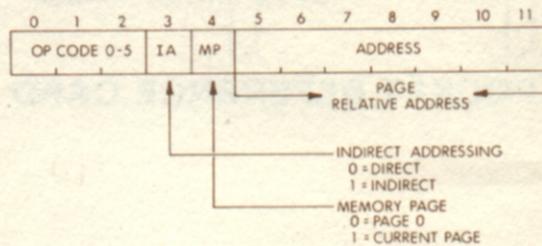
**pdp8**

**POCKET REFERENCE CARD**

**digital**

## BASIC INSTRUCTIONS

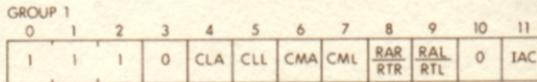
AND	0000	logical AND	2.6
TAD	1000	2's complement add	2.6
ISZ	2000	increment, and skip if zero	2.6
DCA	3000	deposit and clear AC	2.6
JMS	4000	jump to subroutine	2.6
JMP	5000	jump	1.2
IOT	6000	in/out transfer	—
OPR	7000	operate	1.2



## Memory Reference Instruction Bit Assignments

## GROUP 1 OPERATE MICROINSTRUCTIONS (1.2 $\mu$ sec)

NOP	7000	no operation	Sequence
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 (1.2 $\mu$ sec)

SMA	7500	skip on minus AC	Sequence
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 (1.2 $\mu$ sec.)

CIA	7041	complement and increment AC	Sequence
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	7300	clear AC and link	1
CLL	7110	shift positive number one right	1, 4
CLL	7104	shift positive number one left	1, 4
CLL	7106	clear link, rotate 2 left	1, 4
CLL	7112	clear link, rotate 2 right	1, 4
SZA	7640	skip if AC=0, then clear AC	1, 2
SZA	7460	skip if AC=0 or link is 1, or both	1
SNA	7650	skip if AC=0, then clear AC	1, 2
SMA	7700	skip if AC<0, then clear AC	1, 2
SMA	7540	skip if AC<0	1
SMA	7520	skip if AC<0 or link is 1, or both	1
SPA	7550	skip if AC>0	1
SPA	7530	skip if AC>0, and if the link is 0	1
SPA	7710	skip if AC>0, then clear AC	1, 2
SNA	7470	skip if AC=0 and link=0	1

### MQ MICROINSTRUCTIONS (1.2 $\mu$ sec.)

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

0	1	2	3	4	5	6	7	8	9	10	11
1	1	1	1	CLA	MQA		MQL				1

### Logical Sequence:

- 1—CLA
- 2—MQA, MQL
- 3—ALL OTHERS

### MQ Microinstruction Bit Assignments

### TELETYPE KEYBOARD/READER

			Time ( $\mu$ sec.)
KCF	6030	Clear Keyboard/Reader Flag, do not start Reader	1.2
KSF	6031	Skip if Keyboard/Reader Flag = 1	1.2
KCC	6032	Clear AC and Keyboard/Reader Flag, set Reader run	1.2
KRS	6034	Read Keyboard/Reader Buffer Static	1.2
KIE	6035	AC 11 to Keyboard/Reader Interrupt Enable F.F.	1.2
KRB	6036	Clear AC, Read Keyboard Buffer, Clear Keyboard Flags	1.2

### TELETYPE TELEPRINTER/PUNCH

SPF	6040	Set Teleprinter/Punch Flag	1.2
TSF	6041	Skip if Teleprinter/Punch Flag = 1	1.2
TCF	6042	Clear Teleprinter/Punch Flag	1.2
TPC	6044	Load Teleprinter/Punch Buffer	1.2
		Select and Print	
SPI	6045	Skip if Teletype Interrupt	1.2
TLS	6046	Load Teleprinter/Punch Buffer, Select and Print and Clear Teleprinter/Punch Flag	1.2

### HIGH SPEED PERFORATED TAPE READER—TYPE PR8-E

RPE	6010	Set Interrupt Enable for Reader and Punch	1.2
RSF	6011	Skip if Reader Flag = 1	1.2
RRB	6012	Read Reader Buffer and Clear Flag	1.2
RCF	6014	Clear Flag and Buffer and Fetch Character	1.2
RCC	6016	Read Reader Buffer, Clear Flag and Buffer, and Fetch Character	
PCE	6020	Clear Interrupt Enable for Reader and Punch	1.2

### HIGH SPEED PERFORATED TAPE PUNCH—TYPE PP8-E

RPE	6010	Set Interrupt Enable for Reader and Punch	1.2
PCE	6020	Clear Interrupt Enable for Reader and Punch	1.2
PSF	6021	Skip if Punch Flag = 1	1.2
PCF	6022	Clear Flag and Buffer	1.2
PPC	6024	Load Buffer and Punch Character	1.2
PLS	6026	Clear Flag and Buffer, Load Buffer and Punch Character	1.2

### EXTERNAL IOT MICROINSTRUCTIONS

#### DECTAPE AND CONTROL TYPE TU56/TC08

Time ( $\mu$ sec.)

DTRA	6761	read status register A	2.6
DTCA	6762	clear status register A	2.6
DTXA	6764	load status register A	2.6
DTSF	6771	skip on flags	2.6
DTRB	6772	read status register B	2.6
DTLB	6774	load status register B	2.6

### RANDOM ACCESS DISC FILE TYPE DF32D

DCMA	6601	clear disk memory address register, & disk flags	2.6
DMAR	6603	load disk memory address register & read	3.6
DMAW	6605	load disk memory address register and write	3.6
DCEA	6611	clear disk extended address register and address memory extension	2.6
DSAC	6612	skip on address confirmed flag	2.6
DEAL	6615	load disk extended address and memory address extension	3.6
DEAC	6616	read disk extended address register	3.6
DFSE	6621	skip on zero error flag	2.6
DFSC	6622	skip on data completion flag	2.6
DMAC	6626	read disk memory address register	3.6

### INTERNAL IOT MICROINSTRUCTIONS PROGRAM INTERRUPT AND FLAG (1.2 $\mu$ sec.)

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

0	1	2	3	4	5	6	7	8	9	10	11
1	1	0	DEVICE SELECTION				IOT				

GENERATES AN IOP4 PULSE IF A 1  
 " " IOP2  
 " " IOP1

### 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 band  
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

0	1	2	3	4	5	6	7	8	9	10	11
1	1	1	1	CLA	MQA	SCA	MQL	INST CODE	1		

Logical Sequence 1\* 2 2 2 3 Instruction Code

0=No Operation  
1=SCL

2=MUY  
3=DVI  
4=NMI\*\*  
5=SHL  
6=ASR  
7=LSR

**EAE MODE B BIT ASSIGNMENTS**

0	1	2	3	4	5	6	7	8	9	10	11
1	1	1	1	CLA	MBA		MQL	INST CODE	1		

Logical Sequence 1\* 2 2 3 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

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

**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	1.2 $\mu$ s	1.2 $\mu$ s	
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	1.2 $\mu$ s	1.2 $\mu$ s	
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.

## CHARACTER CODES

8-bit ASCII Code	DEC 029 Code	DEC 026 Card	Character Representation	Remarks
240	40	blank	blank	
241	41	11-8-2	12-8-7	! space (non-printing)
242	42	8-7	0-8-5	quotation marks
243	43	8-3	0-8-6	# number sign <sup>16</sup>
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	} 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	
261	61	1	1	
262	62	2	2	
263	63	3	3	
264	64	4	4	
265	65	5	5	
266	66	6	6	
267	67	7	7	
270	70	8	8	
271	71	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	DEC 029 Code	DEC 026 Card	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	11-8-5	[ opening bracket, SHIFT/K
334	34	11-8-7	8-7	\ backslash, SHIFT/L
335	35	0-8-2	12-8-5	] closing bracket, SHIFT/M
336	36	12-8-7	8-5	^ circumflex <sup>2</sup>
337	37	0-8-5	8-2	underline <sup>4</sup>

## Footnotes:

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

# digital

DIGITAL EQUIPMENT CORPORATION, Maynard, Massachusetts. Telephone: (617) 897-5111 • ARIZONA, Phoenix • CALIFORNIA, Sunnyvale, Santa Ana, Los Angeles, Oakland, San Diego and San Francisco (Mountain View) • COLORADO, Engelwood • CONNECTICUT, Meriden • DISTRICT OF COLUMBIA, Washington (Riverdale, Md.) • FLORIDA, Orlando • GEORGIA, Atlanta • ILLINOIS, Northbrook • INDIANA, Indianapolis • LOUISIANA, Metairie • MARYLAND, Riverdale • MASSACHUSETTS, Cambridge and Waltham • MICHIGAN, Ann Arbor and Detroit (Southfield) • MINNESOTA, Minneapolis • MISSOURI, Kansas City and Maryland Heights • NEW JERSEY, Fairfield, Metuchen and Princeton • NEW MEXICO, Albuquerque • NEW YORK, Huntington Station, Manhattan, New York, Syracuse and Rochester • NORTH CAROLINA, Durham/Chapel Hill • OHIO, Cleveland, Dayton and Euclid • OKLAHOMA, Tulsa • OREGON, Portland • PENNSYLVANIA, Bluebell, Paoli and Pittsburgh • TENNESSEE, Knoxville • TEXAS, Dallas and Houston • UTAH, Salt Lake City • WASHINGTON, Bellevue • WISCONSIN, Milwaukee • ARGENTINA, Buenos Aires • AUSTRALIA, Adelaide, Brisbane, Crows Nest, Melbourne, Norwood, Perth and Sydney • AUSTRIA, Vienna • BELGIUM, Brussels • BRAZIL, Rio de Janeiro, Sao Paulo and Porto Alegre • CANADA, Alberta, Vancouver, British Columbia, Hamilton, Mississauga and Ottawa, Ontario, and Quebec • CHILE, Santiago • DENMARK, Copenhagen and Hellerup • FINLAND, Helsinki • FRANCE, Grenoble and Rungis • GERMANY, Cologne, Hannover, Frankfurt, Munich and Stuttgart • INDIA, Bombay • ISRAEL, Tel Aviv • ITALY, Milano • JAPAN, Osaka and Tokyo • MEXICO, Mexico City • NETHERLANDS, The Hague • NEW ZEALAND, Auckland • NORWAY, Oslo • PHILIPPINES, Manila • PUERTO RICO, Miramar and Santurce • REPUBLIC OF CHINA, Taiwan • SCOTLAND, West Lothian • SPAIN, Barcelona and Madrid • SWEDEN, Solna and Stockholm • SWITZERLAND, Geneva and Zurich • UNITED KINGDOM, Birmingham, Bristol, Edinburgh, London, Manchester, Reading and Warwickshire • VENEZUELA, Caracas