INPUT/OUTPUT TRANSFER INSTRUCTIONS (cont.)

Mnemonic	Code	Operation	Cycles
		CARD READERS	
CRSF	706701	Skip if card reader flag=1.	1
CRSA	706704	Select and read alphanumeric.	1
CRRB	706712	Read the card reader buffer.	1
CRSB	706744	Select and read binary.	1
		DECtape SYSTEM	
MMRD	707512	Read one word into AC.	1
MMWR	707504	Write one word from AC.	1
MMSE	707644	Select transport from AC 2-5.	1
MMLC	707604	Set DECtape control from AC 12-17.	1
MMRS	707612	Read status bits into AC 0-8.	1
MMDF	707501	Skip on DECtape data flag.	1
MMBF	707601	Skip on DECtape block end flag.	1
MMEF	707541	Skip on DECtape error flag.	1

MODEL 33 ASR/KSR TELETYPE CODE (ASCII) IN OCTAL FORM

Character	8-Bit Code (in Octal)	Character	8-Bit Code (in Octal)
A	301	!	241
B	302	"	242
C	303	#	243
D	304	$	244
E	305	%	245
F	306	&	246
G	307	'	247
H	310	(	250
I	311	)	251
J	312	*	252
K	313	+	253
L	314	,	254
M	315	—	255
N	316	.	256
O	317	/	257
P	320	:	272
Q	321	;	273
R	322	<	274
S	323	=	275
T	324	>	276
U	325	?	277
V	326	@	300
W	327	[	333
X	330	\	334
Y	331	]	335
Z	332	↑	336
		←	337
0	260	Leader/Trailer	200*
1	261	Line-Feed	212*
2	262	Carriage-Return	215
3	263	Space	240
4	264	Rub-out	377*
5	265	Blank	000*
6	266	EOT	204
7	267	WRU	205
8	270	RU	206
9	271	Bell	207
		Act Mode	375

* Ignored by the operating system.

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INSTRUCTION LIST

MEMORY REFERENCE INSTRUCTIONS

Mnemonic	Code	Operation	Cycles*
CAL	00	Call subroutine	2
DAC	04	Deposit accumulator	2
JMS	10	Jump to subroutine	2
DZM	14	Deposit zero in memory	2
LAC	20	Load accumulator	2
XOR	24	Boolean exclusive OR	2
ADD	30	Add, 1's complement	2
TAD	34	Add, 2's complement	2
XCT	40	Execute	1**
ISZ	44	Increment and skip if zero	2
AND	50	Boolean AND	2
SAD	54	Skip if AC different from memory	2
JMP	60	Jump	1

* Cycle time is 1.75 microseconds.

** Plus execution time of instruction referenced.

Indirect addressing: Adding "I" to any memory reference instruction, e.g., DZM I Y, causes C(Y) to be taken as the effective address, and adds 1 cycle to the execution time.

OPERATE INSTRUCTIONS

Mnemonic	Code	Operation Executed	Event Time
OPR or NOP	740000	Operate group or no operation.	
CMA	740001	Complement accumulator	
CML	740002	Complement link.	
OAS	740004	Inclusive OR AC switches with AC.	3
RAL	740010	Rotate AC and link left.	3
RAR	740020	Rotate AC and link right.	2
HLT	740040	Halt.	—
SMA	740100	Skip if AC<0.	1
SZA	740200	Skip if AC=0.	1
SNL	740400	Skip if link≠0.	1
SKP	741000	Skip unconditionally.	1
SPA	741100	Skip if AC positive.	1
SNA	741200	Skip if AC≠0.	1
SZL	741400	Skip if link=0.	1
RTL	742010	Rotate AC and L left two places.	2,3
RTR	742020	Rotate AC and L right two places.	2,3
CLL	744000	Clear link.	2
STL	744002	Set link=1.	2,3
RCL	744010	Clear link, then rotate AC and L left.	2,3
RCR	744020	Clear link, then rotate AC and L right.	2,3
CLA	750000	Clear AC.	2
CLC	750001	Clear and complement AC.	2,3
LAS	750004	Load AC from switches.	2,3
GLK	750010	Get link into AC 17.	2,3
LAW	76XXXX	Load the AC with LAW XXXX.	—

EAE INSTRUCTIONS

Mnemonic	Code	Operation	Time (sec)
EAE	640000	No operation.	1.75
LRS	640500	Long right shift.	1.6+0.1n
LRSS	660500	Long right shift, signed.	1.6+0.1n
LLS	640600	Long left shift.	1.6+0.1n
LLSS	660600	Long left shift, signed.	1.6+0.1n
ALS	640700	Accumulator left shift.	1.6+0.1n
ALSS	660700	Accumulator left shift, signed.	1.6+0.1n
NORM	640444	Normalize, unsigned.	2.4+0.35n+0.2m
NORMS	660444	Normalize, signed.	1.6+0.1n
MUL	653122	Multiply, unsigned.	1.6+0.1n
MULS	657122	Multiply, signed.	2.4+0.1n+0.25m
DIV	640323	Divide, unsigned.	2.4+0.1n+0.25m
DIVS	644323	Divide, signed.	2.4+0.35n+0.2m
IDIV	653323	Integer divide, unsigned.	2.4+0.35n+0.2m
IDIVS	657323	Integer divide, signed.	2.4+0.35n+0.2m
FRDIV	650323	Fraction divide, unsigned.	2.4+0.35n+0.2m
FRDIVS	654323	Fraction divide, signed.	2.4+0.35n+0.2m
LACQ	641002	Load AC with C(MQ).	1.75
LACS	641001	Load AC with C(SC).	1.75
CLQ	650000	Clear MQ.	1.75
ABS	644000	Take absolute value of AC.	1.75
GSM	664000	Get sign and magnitude.	1.75
OSC	640001	Inclusive OR the SC into the AC.	1.75
OMQ	640002	Inclusive OR the MQ into the AC.	1.75
CMQ	640004	Complement the MQ.	1.75
LMQ	652000	Load MQ with C(AC).	1.75

n=shift count
m=one bits in multiplier quotient

INPUT/OUTPUT TRANSFER INSTRUCTIONS

Mnemonic	Code	Operation	Cycles
		PROGRAM INTERRUPT	
IOF	700002	Interrupt off. Disable the PIC.	1
ION	700042	Interrupt on. Enable the PIC.	1
ITON	700062	Interrupt and trap on.	1
		REAL TIME CLOCK	
CLSF	700001	Skip if clock flag=1.	1
CLOF	700004	Clear flag and disable the clock.	1
CLON	700044	Clear flag and enable the clock.	1
		PERFORATED TAPE READER	
RSF	700101	Skip if reader flag=1.	1
RCF	700102	Inclusive OR reader buffer into AC and clear flag.	1
RRB	700112	Read reader buffer and clear reader flag.	1
RSA	700104	Reader in alphanumeric.	1
RSB	700144	Reader in binary.	1

INPUT/OUTPUT TRANSFER INSTRUCTIONS (cont.)

Mnemonic	Code	Operation	Cycles
		PERFORATED TAPE PUNCH	
PSF	700201	Skip if punch flag=1.	1
PCF	700202	Clear punch flag.	1
PSA or PLS	700204 700206	Punch alphanumeric.	1
PSB	700244	Punch binary.	1
		I/O EQUIPMENT	
IORS	700314	Input/output read status.	1
TTS	703301	Skip if KSR 33 is used.	1
CAF	703302	Clear all flags.	1
SKP7	703341	Skip if processor is a PDP-7.	1
		TELETYPE KEYBOARD	
KSF	700301	Skip if keyboard flag=1.	1
KRB	700312	Read the keyboard buffer and clear flag.	1
		TELETYPE TELEPRINTER	
TSF	700401	Skip if teleprinter flag=1.	1
TCF	700402	Clear the teleprinter flag.	1
TLS	700406	Load teleprinter buffer, select and print; set flag.	1
		OSCILLOSCOPE DISPLAY TYPE 34A AND PRECISION CRT DISPLAY TYPE 30D	
DXC	700502	Clear X-coordinate buffer.	1
DYC	700602	Clear Y-coordinate buffer.	1
DXL	700506	Load X-coordinate buffer.	1
DYL	700606	Load Y-coordinate buffer.	1
DXS	700546	Load X-coordinate buffer and display.	1
DYS	700646	Load Y-coordinate buffer and display.	1
DSF	700701	Skip if display flag=1.	1
DCF	700702	Clear display flag.	1
DLB*	700706	Load brightness register.	1
		GENERAL PURPOSE MULTIPLEXER CONTROL TYPE 139	
ADSM	701103	Select MX channel.	1
ADIM	701201	Increment channel address.	1
		ANALOG-TO-DIGITAL CONVERTERS	
ADSF	701301	Skip if converter flag=1.	1
ADSC	701304	Select and convert.	1
ADRB	701312	Read converter buffer.	1
		AUTOMATIC PRIORITY INTERRUPT TYPE 172	
CAC	705501	Clear all channels.	1
ASC	705502	Enable selected channel(s).	1
DSC	705604	Disable selected channel(s).	1
EPI	700044	Enable API.	1
DPI	700004	Disable API.	1
ISC	705504	Initiate break on selected channel.	1
DBR	705601	Debreak.	1
		MEMORY EXTENSION CONTROL TYPE 148	
SEM	707701	Skip if in extend mode.	1
EEM	707702	Enter extend mode.	1
LEM	707704	Leave extend mode.	1
EMIR	707742	Extend mode interrupt restore.	1

* Applicable on 30D, not on 34A.