

UNIVAC

DATA PROCESSING DIVISION

494

REAL - TIME SYSTEM REFERENCE CARD - I

CHARACTER CODES

FD ①	X5-3 ①	80-COLUMN CARD	CONSOLE	0751/0755 1004 PRINTERS ②	ASCII ②, ③	BAUDOT ③, ④
00	56	7-8	§	@ *		
01	17	12-5-8	§	[
02	01	11-5-8	%]		
03	35	12-7-8	LF	#		
04	57	11-7-8	CR	Δ *		
05	00	BLANK	SPACE	SPACE		
06	24	12-1	A	A	301	03
07	25	12-2	B	B	302	31
10	26	12-3	C	C	303	16
11	27	12-4	D	D	304	11
12	30	12-5	E	E	305	01
13	31	12-6	F	F	306	15
14	32	12-7	G	G	307	32
15	33	12-8	H	H	310	24
16	34	12-9	I	I	311	06
17	44	11-1	J	J	312	13
20	45	11-2	K	K	313	17
21	46	11-3	L	L	314	22
22	47	11-4	M	M	315	34
23	50	11-5	N	N	316	14
24	51	11-6	O	O	317	30
25	52	11-7	P	P	320	26
26	53	11-8	Q	Q	321	27
27	54	11-9	R	R	322	12
30	65	0-2	S	S	323	05
31	66	0-3	T	T	324	20
32	67	0-4	U	U	325	07
33	70	0-5	V	V	326	36
34	71	0-6	W	W	327	23
35	72	0-7	X	X	330	35
36	73	0-8	Y	Y	331	25
37	74	0-9	Z	Z	332	21
40	77	12-4-8))		
41	02	11	-	-		
42	63	12	+	+		
43	36	12-6-8	<	<		
44	37	3-8	=	=		
45	76	6-8	>	>		
46	20	2-8	-	&		
47	42	11-3-8	\$	\$		
50	41	11-4-8	*	*		
51	55	0-4-8	((
52	61	0-5-8	"	" *		
53	21	5-8	:	:		
54	23	12-0	?	? *		
55	43	11-0	!	! *		
56	62	0-3-8	COMMA	COMMA		
57	15	0-6-8	®	® *		
60	03	0	0	0	260	26
61	04	1	1	1	261	27
62	05	2	2	2	262	23
63	06	3	3	3	263	01
64	07	4	4	4	264	12
65	10	5	5	5	265	20
66	11	6	6	6	266	25
67	12	7	7	7	267	07
70	13	8	8	8	270	06
71	14	9	9	9	271	30
72	40	4-8	APOS.	APOS.		
73	16	11-6-8	;	;		
74	64	0-1	/	/		
75	22	12-3-8	.	.		
76	75	0-7-8	⏏	⏏ *		
77	60	0-2-8	↑	STOP CODE		

① This coding is used when 1004 Printer is used on-line to the 494.

② ASCII Code as used with Teletype* mode is 33 and 35.

③ Blank spaces are for individual user code equivalent.

④ LTRS Code (37) must precede first character in a group of alphabetic characters (A-Z); FIGS Code (33) must precede first character in a group of figures, digits, symbols, and special characters.

*Registered trademark of American Telephone and Telegraph Company

INSTRUCTION REPERTOIRE

INSTRUCTION REPERTOIRE

TYPE	MNEMONIC CODE		OCTAL CODE	OPERATION	CLASS
	ASM	SPURT			
TRANSFER	LQ	ENT*Q	10	Y → Q	Rd
	LA	ENT*A	11	Y → A	Rd
	LB	ENT*B _j	12	Y → B _j	Rd
	ZB	CL*B _j	12	0's → B _j	Rd
	NOP	NO-OP	12	NO OPERATION	Rd
	SQ	STR*Q	14	Q → Y	St
	ZQ	CL*Q	14	0's → Q	St/Rd
	NQ	CP*Q	14	Q → Y (STR+Q+Q)	St
	SA	STR*A	15	A → Y	St
	NA	CP*A	15	A → A (STR+A+A)	St
	ZA	CL*A	15	0's → A	Rd
	SB	STR*B _j	16	(B _j) → Y	St
	SZ	CL*Y	16	0's → Y	St
	DPL	DPENT	7721	(Y, Y+1) → AQ	-
	DPS	DPSTR	7725	AQ → (Y, Y+1)	-
CPL	CREL	7731	(Y)5-0 → A29-24, ..., (Y+4)5-0 → A5-0	-	
CPU	CREU	7732	(Y)20-15 → A29-24, ..., (Y+4)20-15 → A5-0	-	
CUL	CRSL	7735	A29-24*(Y)5-0, ..., A5-0*(Y+4)5-0	-	
CUU	CRSU	7736	A29-24*(Y)20-15, ..., A5-0*(Y+4)20-15	-	
SHIFT	RSQ	RSH*Q	01	SHIFT Q RIGHT	Rd
	RSA	RSH*A	02	SHIFT A RIGHT	Rd
	RSAQ	RSH*AQ	03	SHIFT AQ RIGHT	Rd
	LSQ	LSH*Q	05	SHIFT Q LEFT	Rd
	LSA	LSH*A	06	SHIFT A LEFT	Rd
	LSAQ	LSH*AQ	07	SHIFT AQ LEFT	Rd
	LRSQ	LRSQ	7751	SHIFT Q RIGHT	-
	LRSA	LRSA	7755	SHIFT A RIGHT	-
LRSAQ	LRSAQ	7756	SHIFT AQ RIGHT	-	
COMPARE	TA	COM*A	04	COMPARE Y TO A AND SKIP PER j	Rd
	TQ	COM*Q	04	COMPARE Y TO Q AND SKIP PER j	Rd
	TR	COM*AQ	04	SKIP PER j IF Y RANGES BETWEEN A AND Q	Rd
	TLP	COM*MASK	43	COMPARE A TO LP(Y*Q) AND SKIP PER j	Rd
	DPTE	DPCME	7723	SKIP IF AQ = (Y, Y + 1)	-
	DPTL	DPCML	7727	SKIP IF AQ < (Y, Y + 1)	-
	MATE	MACE	7753	SKIP IF LP(A*Q) = LP(Y*Q) (ALPHA TEST) ①	-
MATL	MACL	7757	SKIP IF LP(A*Q) < LP(Y*Q) (ALPHA TEST) ①	-	
JUMP	JT/J	JP	60/61	Y → P IF j CONDITION SATISFIED	Rd
		RIL		RELEASE INTERRUPT LOCKOUT	
		RILJP		RELEASE INTERRUPT LOCKOUT AND Y → P	
	SLJ	RJP	65	P + 1 → Y, Y + 1 → P PER j AND KEY	Rd
	SLJT	SIL, RJP OR SILRJP	64	P + 1 → Y, Y + 1 → P PER j; SIL PER j	Rd
	ER	XQT	7737	(Y) = NI; RETURN IF NO SKIP OR JUMP AT NI	-
	LBJ	EBJP*Bx	774x	P → Bx, Y → P	-

TYPE	MNEMONIC CODE		OCTAL CODE	OPERATION	CLASS
	ASM	SPURT			
SEQUENCE MODIFYING	R	RPT	70	REPEAT NI Y TIMES; Y → B7	Rd
	TBI	BSK*B _j	71	IF (B _j) = Y, 0's → B _j ; SKIP; IF (B _j) ≠ Y, (B _j) + 1 → B _j	Rd
	JBD	BJP*B _j	72	IF (B _j) ≠ 0, (B _j) - 1 → B _j ; AND JUMP	Rd
				IF (B _j) = 0, NI	
	TSET	TSET	7752	IF Y _{14-0} = 0, 1's → Y_{14-0}}; IF Y_{14-1} = 1, 1's → Y_{14-0}}}}	-
	EXRN	EXRN	7754	INTERRUPT AND INTERRUPT	-
FIXED POINT BINARY	A	ADD*A	20	A + Y → A	Rd
	AQ	ADD*Q	26	Q + Y → Q	Rd
	LAQ	ENT*Y+Q	30	Y + Q → A	Rd
	SAQ	STR*A+Q	32	A + Q → Y, A	St
	RA	RPL*A+Y	24	Y + A → Y, A	Rp
	RAQ	RPL*Y+Q	34	Y + Q → Y, A	Rp
	RI	RPL*Y+1	36	Y + 1 → Y, A	Rp
	AN	SUB*A	21	A - Y → A	Rd
	ANQ	SUB*Q	27	Q - Y → Q	Rd
	LANQ	ENT*Y-Q	31	Y - Q → A	Rd
	SANQ	STR*A-Q	33	A - Q → Y, A	St
	RAN	RPL*A-Y	25	A - Y → Y, A	Rp
	RANQ	RPL*Y-Q	35	Y - Q → Y, A	Rp
	RD	RPL*Y-1	37	Y - 1 → Y, A	Rp
DPA	DPADD	7722	AQ + (Y, Y+1) → AQ	-	
DPAN	DPSUB	7726	AQ - (Y, Y + 1) → AQ	-	
DPN	DPCP	7724	CP (AQ) → AQ	-	
M	MUL	22	Q x Y → AQ	Rd	
D	DIV	23	(AQ ÷ Y) → Q; REMAINDER → A	Rd	
FLOATING POINT BINARY	SFS	SFSH	7730	NORMALIZE A, SHIFT COUNT → Q	-
	FA	FADD	7701	AQ _{FP} + (Y, Y + 1) _{FP} → AQ _{FP}	-
	FAN	FSUB	7702	AQ _{FP} - (Y, Y + 1) _{FP} → AQ _{FP}	-
	FM	FMUL	7703	AQ _{FP} x (Y, Y + 1) _{FP} → AQ _{FP}	-
	FD	FDIV	7705	AQ _{FP} ÷ (Y, Y + 1) _{FP} → AQ _{FP}	-
	FP	FPP	7706	(Y) _C AND AQ _M → AQ _{FP}	-
FU	FPU	7707	AQ _{FP} → Y _C AND AQ _M	-	
FIXED POINT DECIMAL	DT	DTEST	7710	SKIP PER Y	-
	DA	DADD	7711	AQ _D + (Y, Y + 1) _D → AQ _D	-
	DAC	DADDC	7715	AQ _D + (Y, Y + 1) _D + CARRY → AQ _D	-
	DAN	DSUB	7712	AQ _D - (Y, Y + 1) _D → AQ _D	-
	DANB	DSUBB	7716	AQ _D - (Y, Y + 1) _D - BORROW → AQ _D	-
	DN	DCP	7714	9's OR 10's COMPLEMENT (AQ) → AQ PER Y	-
	DTE	DCME	7713	SKIP IF AQ _D = (Y, Y + 1) _D	-
	DTL	DCML	7717	SKIP IF AQ _D < (Y, Y + 1) _D	-
	DCL	DCVL	7733	(Y) ₀₋₅ THRU (Y + 4) ₀₋₅ _D → AQ _{BINARY}	-
	DCU	DCVU	7734	(Y) ₁₅₋₂₀ THRU (Y + 4) ₁₅₋₂₀ _D → AQ _{BINARY}	-

① ALPHA TEST MEANS THAT SIGN BIT IS TREATED AS PART OF ABSOLUTE VALUE OF WORD.

LP = Logical Product
 ie 1 bits only where Y & Q
 have corresponding 1 bits.

INSTRUCTION REPERTOIRE

TYPE	MNEMONIC CODE		OCTAL CODE	OPERATION	CLASS	
	ASM	SPURT				
LOGICAL	LLP	ENT*LP	40	LP (Y·Q) → A	Rd	
	SAND	STR*LP	47	LP (Q·A) → Y	St	
	RPL	RPL*LP	44	LP (Q·Y) → Y, A	Rp	
	ALP	ADD*LP	41	LP (Y·Q) + A → A	Rd	
	RALP	RPL*A+LP	45	LP (Y·Q) + A → Y, A	Rp	
	ANLP	SUB*LP	42	A - LP (Y·Q) → A	Rd	
	RANLP	RPL*A-LP	46	A - LP (Y·Q) → Y, A	Rp	
	OR	SEL*SET	50	IF A_n OR $Y_n = 1, 1 \rightarrow A_n$	Rd	
	ROR	RSE*SET	54	IF A_n OR $Y_n = 1, 1 \rightarrow A_n; A \rightarrow Y$	Rp	
	XOR	SEL*CP	51	IF $A_n = Y_n, 0 \rightarrow A_n; A_n \neq Y_n, 1 \rightarrow A_n$	Rd	
	RXOR	RSE*CP	55	IF $A_n = Y_n, 0 \rightarrow A_n; A_n \neq Y_n, 1 \rightarrow A_n; A \rightarrow Y$	Rp	
	NOT	SEL*CL	52	IF $Y_n = 1$, CLEAR A_n	Rd	
	RNOT	RSE*CL	56	IF $Y_n = 1$, CLEAR $A_n; A \rightarrow Y$	Rp	
	SSU	SEL*SU	53	IF $Q_n = 1, Y_n \rightarrow A_n$	Rd	
	RSSU	RSE*SU	57	IF $Q_n = 1, Y_n \rightarrow A_n; A \rightarrow Y$	Rp	
	INPUT/OUTPUT	LC	EXT·FCT·CO·Y	13	Y AND EXTERNAL FUNCTION → CHCSR	Rd
		SC	STR*CO*Y	17	INPUT CHIASR → Y	St
JIC		JP*Y*	62	Y → P IF INPUT CHCSR ACTIVE	Rd	
		CO* ACTIVE IN				
JOC		JP*Y*CO	63	Y → P IF OUTPUT CHCSR ACTIVE	Rd	
		ACTIVE OUT				
DIC		TERM*CO	66	TERMINATE INPUT CHCSR	Rd	
DOC		TERM*CO	67	TERMINATE OUTPUT CHCSR	Rd	
LIC	OUT·CO	73	ACTIVATE INPUT CHCSR	Rd		
LOC	OUT·CO OR C·Y	74	ACTIVATE OUTPUT OR EF CHCSR	Rd		
LICM	IN*CO*Y MONITOR	75	SAME AS 73, WITH MONITOR	Rd		
LOCM	OUT·CO OR C·Y MONITOR	76	SAME AS 74, WITH MONITOR	Rd		
TRANSFER	LIFR	EIFR	7761	Y → IFR, (Y + 1) → RIR	-	
	LPLR	EPLR	7762	Y → PLR	-	
	SIFR	SIFR	7765	IFR → Y	-	
	LRIR	ERIR	7766	Y → RIR	-	
	ISI	SSI	7770	SYNCHRONOUS INTERRUPT PER Y	-	
	LBW	EWB	7771	(Y) → B1, ..., (Y + 6) → B7	-	
	SCN	SCHN	7772	I/O CHIASR OR PECSR → Y	-	
	LCSR	ECSR	7773	Y4-0 → CSR	-	
SBW	SWB	7775	B1 → Y, ..., B7 → (Y + 6)	-		

INSTRUCTION AND DATA FORMATS

77 INSTRUCTION WORD																																			
77g	g	b	y																																
29	24	23	18	17	15	14	0																												
NORMAL INSTRUCTION WORD																																			
f		j	k	b	y																														
29	24	23	21	20	18	17	15	14	0																										
I/O INSTRUCTION WORD																																			
f		j	k	b	y																														
29	24	23	20	18	17	15	14	0																											
FIXED POINT HALFWORD OPERANDS																																			
S MSB		LSB		S MSB		LSB		LSB																											
2	9	28	15	4	13	0																													
FIXED POINT SINGLE PRECISION OPERAND																																			
S MSB		LSB																																	
2	9	28	0																																
FIXED POINT DOUBLE PRECISION OPERAND																																			
S MSB		LSB						LSB		LSB																									
5	9	58	30				29	0																											
A REGISTER AND/OR ADDRESS X					Q REGISTER AND/OR ADDRESS X + 1																														
FLOATING POINT OPERAND																																			
S CHARACTERISTIC		FIXED POINT PART (MANTISSA)																																	
5	9	58	48	47	30				29	0																									
A REGISTER AND/OR ADDRESS X					Q REGISTER AND/OR ADDRESS X + 1																														
DECIMAL OPERAND																																			
Z9	C9	Z8	C8	Z7	C7	Z6	C6	Z5	C5	Z4	C4	Z3	C3	Z2	C2	Z1	C1	Z0	S	C0															
58	57	54	52	51	48	46	45	42	41	40	39	36	35	34	33	30	28	27	24	23	22	21	18	17	16	15	12	11	10	9	6	5	4	3	0
A REGISTER AND/OR ADDRESS X										Q REGISTER AND/OR ADDRESS X + 1																									

NOTES:

f designator is function code. j designator usually indicates condition for skipping next instruction. k or k̄ designator is modifier of effective operand. b designator indicates index register the contents of which are added to y, the basic operand or operand address, to form the effective operand or operand address. g designator is function code modifier. j is usually not used in 494 instructions, and set to zero. S bit is sign bit. MSB and LSB are most and least significant bits, respectively. Z bit(s) are zone bits associated with the character bits, C bits.

PLR (PROGRAM LOCKIN REGISTER)										
0 0 0 0			UPPER LIMIT				0 0 0 0		LOWER LIMIT (LL)	
29	26	25	15				14	11	10	0

RIR (RELATIVE INDEX REGISTER)											
NOT USED				0		RELATIVE INDEX		0 0 0 0 0 0			
29	18					17	16	6		5	0

IFR (INTERNAL FUNCTION REGISTER)									
Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ
2	2	2	2	2	2	2	2	2	1
9	18	17	16	15	14	13	12	11	10
8							7	6	5

- ① Captured instruction address, operand address or operand.
- ② j designator of Repeat instruction.
- ③ 00 = No Read protection, no Guard mode, no Write protection.
- ④ 01 = Guard mode, Read protection, Write protection.
- ⑤ 10 = Write Protection, no Guard mode, no Read protection.
- ⑥ 11 = Guard mode, Write Protection, no Read protection.
- ⑦ Decimal End-Of Carry Indicator.
- ⑧ Decimal Overflow Indicator.
- ⑨ 1 = Worker B registers; 0 = Executive B registers.
- ⑩ 1 = 15-Bit B1, B2, B3, 17-Bit B4, B5, B6, B7; 0 = 15-Bit B1-B7
- ⑪ 1 = RIR bias of memory references with B0-B3, LL bias with B4-B7.
- ⑫ 0 = RIR bias of memory references with B0-B7
- ⑬ 1 = Repeat mode.
- ⑭ X Not used.

BCW (BUFFER CONTROL WORD)

ADDRESS COUNT		CURRENT ADDRESS	
29	18		17
		16	
0			

INTERPRETATION OF k DESIGNATOR

INTERPRETATION OF j DESIGNATOR

NORMAL Y FORMATION BY k DESIGNATOR

k	READ CLASS	STORE CLASS	REPLACE CLASS
0			
1			
2			
3			
4			
5			
6			
7			

Handwritten notes:
 - Next to k=0: 'Q' Receiving
 - Next to k=4: 'A' Receiving
 - Next to k=7: 'Enter with A'

EXCEPTIONS

J, SLJ, JBD	RSQ, RSA, LSA, LSAQ	LB	SA	SB	SQ	R	SAND	ASM
J, RIL, RJP, SIL, BJB'B)	RSHQ, RSH, RSH*AO, LSH*AO, LSH*AP, LSH*APQ	ENT* \bar{B}_j	STR*A	STR*B \bar{j}	STR*Q	RPT	STR*LP	SPURT
0	Y = \bar{y}	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
1	Y = \bar{y}_{0-15}	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
2	Y = $\bar{y}_{0-15-20}$	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
3	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
4	Y = \bar{y}	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
5	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
6	Y = $\bar{y}_{0-15-20}$	Y = \bar{y}_{0-5}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}	Y = \bar{y}_{0-16}
7	Y = A \bar{j}	Y = A $\bar{0-5}$	Y = A $\bar{0-16}$	Y = A $\bar{0-16}$	Y = A $\bar{0-16}$	Y = A $\bar{0-16}$	Y = A $\bar{0-16}$	Y = A $\bar{0-16}$

Handwritten notes:
 - Next to k=4: 'NO OPERATION'
 - Next to k=5: 'CP(A)+A'
 - Next to k=6: 'CP(B \bar{j})+A \bar{j} , ZERO FILL'
 - Next to k=7: 'CP(B \bar{j})+ \bar{y}_{0-16} , SIGN EXT.'

NOTES:

- M indicates word in memory; R indicates word in register.
- Designation \bar{y} is sum of (\bar{B}_b) and y; designation \bar{y}_{i-1} is contents of word at location \bar{y} .
- Z_L is lower 15 bits of word Z; Z_U is upper 15 bits of word Z.

NORMAL j DESIGNATION

OCAL CODE	MNEM. CODE	NORMAL (7)	RESULTS (SPURT) MUL/M (ASM)
0		NO SKIP	NO SKIP
1	SKIP	SKIP	SKIP
2	QPOS	SKIP IF $Q_S = +$	SKIP IF NO OVERFLOW (A=0)
3	QNEG	SKIP IF $Q_S = -$	SKIP IF OVERFLOW
4	AZERO	SKIP IF A = +0	SKIP IF SIGNED PRODUCT ≤ 31 BITS
5	ANOT	SKIP IF A $\neq +0$	SKIP IF OVERFLOW
6	APOS	SKIP IF $A_S = +$	SKIP
7	ANEG	SKIP IF $A_S = -$	NO SKIP

EXCEPTIONS

OCAL CODE	TA/TQ/TR	J, SLJ	ASM
	COM*A/COM*Q/COM*AQ	JP, RJP (61/65)	SPURT

OCAL CODE	MNEM.	RESULTS (5)	MNEM.	RESULTS
0	x	x		JUMP
1	SKIP (6)	SKIP	KEY 1	JUMP IF KEY 1 SET
2	YLESS	x/SKIP IF $Y \leq Q/x$	KEY 2	JUMP IF KEY 2 SET
3	YMORE	x/SKIP IF $Y > Q/x$	KEY 3	JUMP IF KEY 3 SET
4	YIN	x/x/SKIP IF $A < Y \leq Q$	STOP	STOP
5	YOUT	x/x/SKIP IF $Y > Q$ OR $Y \leq A$	STOP 5	STOP IF KEY 5 SET
6	YLESS	SKIP IF $Y \leq A/x/x$	STOP 6	STOP IF KEY 6 SET
7	YMORE	SKIP IF $Y > A/x/x$	STOP 7	STOP IF KEY 7 SET

EXCEPTIONS

OCAL CODE	JP/RJP (60/64)	D	ASM
		DIV	SPURT

OCAL CODE	MNEM. (2)	RIL/SIL	RIL/JUMP/SIL, RETURN JUMP	NO SKIP
0	RIL/SIL (2)	RIL/SIL	RIL/JUMP/SIL, RETURN JUMP	NO SKIP
1	QPOS	JUMP IF $Q_S = +$	NOOP	SKIP
2	QNEG	JUMP IF $Q_S = -$	OF	SKIP IF NO OVERFLOW
3	AZERO	JUMP IF (A) = +0	AZERO	SKIP IF A = +0
4	ANOT	JUMP IF (A) $\neq +0$	ANOT	SKIP IF A $\neq +0$
5	APOS	JUMP IF $A_S = +$	APOS	SKIP IF $A_S = +$
6	ANEG	JUMP IF $A_S = -$	ANEG	SKIP IF $A_S = -$

EXCEPTIONS

OCAL CODE	RPT	ENT*LP, RPL*LP	ASM
			SPURT

OCAL CODE	MNEM. (3)	RESULTS	MNEM.	RESULT (7)
0	ADV	$\bar{y}_{NE} = \bar{y} + 1$	SKIP	NO SKIP
1	BACK	$\bar{y}_{NE} = \bar{y} - 1$	EVEN	SKIP
2	ADDB	$\bar{y}_{NE} = \bar{y} + 1$	ODD	SKIP IF A = EVEN NO. OF 1 BITS
3	R	$\bar{y}_{NE} = \bar{y} + n \times (B_b)$	AZERO	SKIP IF A = ODD NO. OF 1 BITS
4	ADVR	$\bar{y}_{NE} = \bar{y} + 1$	ANOT	SKIP IF A = +0
5	BACKRNE/BACKR (4)	$\bar{y}_{NE} = \bar{y} - 1$	APOS	SKIP IF $A_S \neq +$
6	ADDBR	$\bar{y}_{NE} = \bar{y} + n \times (B_b)$	ANEG	SKIP IF $A_S = -$

EXCEPTIONS

OCAL CODE	AQ, ANQ	ASM
	ADD*Q, SUB*Q	SPURT

OCAL CODE	MNEM.	RESULTS (7)
0		NO SKIP
1	SKIP	SKIP
2	APOS	SKIP IF $A_S = +$
3	ANEG	SKIP IF $A_S = -$
4	QZERO	SKIP IF Q = +0
5	QNOT	SKIP IF Q $\neq +0$
6	QPOS	SKIP IF $Q_S = +$
7	QNEG	SKIP IF $Q_S = -$

NOTES:

- FOR SPURT, EQUIVALENT MNEMONICS ARE RILJP/SILRJP.
- RIL = RELEASE INTERRUPT LOCKOUT; SIL = SET INTERRUPT LOCKOUT.
- DESIGNATORS OF 0, 1, 2, AND 3 USED WITH READ OR STORE CLASS INSTRUCTIONS. DESIGNATORS OF 4, 5, 6, AND 7 USED WITH REPLACE CLASS INSTRUCTIONS.
- \bar{y}_{NE} REPRESENTS \bar{y} OF NEXT EXECUTION.
- RESULT OF REPEATED REPLACE CLASS USING \bar{y}_{NE} IS STORED AT $\bar{y}_{NE} + (B_b)$.
- ASM/SPURT
- x INDICATES ILLEGAL OR INVALID USE
- NOT USED IN SPURT
- A_S = SIGN BIT OF A; Q_S = SIGN BIT OF Q (0 FOR POSITIVE, 1 FOR NEGATIVE)

FIXED CORE LOCATIONS

ADDRESS	490 MODE	494 MODE																											
000000	Entry-Illegal Instruction. P-counter has directed control to word with 00 or 77 in function position.	Entry-Illegal Instruction 1. P-counter has directed control to word with 00 or 7700 in function position. 2. With Guard Mode set, program has attempted an I/O or Executive instruction.																											
000001	Entry-Memory Protect. Memory Guard violation	Entry-Memory Protect 1. Memory Guard violation 2. Interrupt lockout has exceeded 100 micro-seconds.																											
000002	Entry-Power Loss External power failure when maintenance panel switch is ENABLED.																												
000003	Entry-Memory Parity 0 Bank 0 parity failure - maintenance panel switch ENABLED.																												
000004	Entry-Memory Parity 1 Bank 1 parity failure - maintenance panel switch ENABLED																												
000005	Entry-BCW Parity Parity error on BCW read - maintenance panel switch ENABLED																												
000006	Entry-Output Data Parity Parity error on read of output data word - maintenance panel switch ENABLED																												
000007	Exec-Failure Indicator 7 = Power loss 77 - ^{Memory} Parity	Entry-EXEC RETURN EXRN (f=7754) read																											
000010	Exec-Date Fielddata response to Enter YYDDD	Entry-Floating Point Underflow. Characteristic of result, in FP arithmetic or pack operation, is less than 0 (biased) or -1024D (unbiased).																											
000011	Not Used	Entry-Floating Point Overflow 1. Characteristic of result, in FP arithmetic or pack operation exceeds capacity (3777). 2. FP division by 0 attempted.																											
000012	Not Used	Entry-External. Synchronous 1 Signal has been applied to Synchronous Interrupt line 0.																											
000013	Not Used	Entry-External. Synchronous 2 Signal has been applied to Synchronous Interrupt line 1.																											
000014	Entry-Real Time Clock Overflow RTC cycles from 777777 to 0 - maintenance panel switch ENABLED																												
000015	Entry-Day Clock Every 6 seconds - maintenance panel switch ENABLED																												
000016	Day Clock																												
	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Hours</th> <th colspan="2">Minutes</th> <th colspan="2">Hundredths</th> <th rowspan="2">Console I/O Character</th> </tr> <tr> <th>Tens</th> <th>Units</th> <th>Tens</th> <th>Units</th> <th>Tens</th> <th>Units</th> </tr> </thead> <tbody> <tr> <td>29</td> <td>28</td> <td>27</td> <td>24</td> <td>23</td> <td>20</td> <td>19</td> <td>16</td> <td>15</td> <td>12</td> <td>11</td> <td>8</td> <td>7</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">Update every 600 milliseconds - maintenance panel switch ENABLED</p>		Hours		Minutes		Hundredths		Console I/O Character	Tens	Units	Tens	Units	Tens	Units	29	28	27	24	23	20	19	16	15	12	11	8	7	0
Hours		Minutes		Hundredths		Console I/O Character																							
Tens	Units	Tens	Units	Tens	Units																								
29	28	27	24	23	20	19	16	15	12	11	8	7	0																
000017	Real Time Clock																												
	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Not Used</th> <th>Real Time Clock (Bit Counter)</th> </tr> </thead> <tbody> <tr> <td>29</td> <td>18</td> <td>17</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">Update every 200 microseconds - maintenance panel switch ENABLED</p>		Not Used	Real Time Clock (Bit Counter)	29	18	17	0																					
Not Used	Real Time Clock (Bit Counter)																												
29	18	17	0																										
000020	Entry-External Interrupt C0	Entry-External Interrupt-ESI																											
000021	Entry-External Interrupt C1	Entry-Input MONITOR Interrupt-ESI																											
000022	Entry-External Interrupt C2	Entry-Output MONITOR Interrupt-ESI																											
000023	Entry-External Interrupt C3	Entry-Memory Parity 2. Bank 2 parity failure - maintenance panel switch ENABLED																											
000024	Entry-External Interrupt C4	Entry-External Interrupt-ISI																											
000025	Entry-External Interrupt C5	Entry-Input MONITOR interrupt-ISI																											
000026	Entry-External Interrupt C6	Entry-Output MONITOR interrupt-ISI																											
000027	Entry-External Interrupt C7	Entry-Memory Parity 3. Bank 3 parity failure - maintenance panel switch ENABLED																											
000030	Entry-External Interrupt C10	Entry-Test and Set 7752 instruction finds bit 14 of specified location = 1. P counter advanced by 1.																											

FIXED CORE LOCATIONS

ADDRESS	490 MODE	494 MODE
000031	Entry-External Interrupt C11	Not Used
000032	Entry-External Interrupt C12	Not Used
000033	Entry-External Interrupt C13	Not Used
000034	Entry-External Interrupt C14	Not Used
000035	Entry-External Interrupt C15	Not Used
000036	Exec-Register A Storage Stored after RTC interrupt.	Not Used
000037	Exec-Register Q Storage Stored after RTC interrupt.	Not Used
000040	Entry-Input MONITOR Interrupt Locations 000040 thru 000057 = C0 thru C15 respectively.	BCR-Output Locations 000040 thru 000067 = C0 thru C27 respectively.
000060	Entry-Output MONITOR Interrupt Locations 000060 thru 000077 = C0 thru C15 respectively.	(000070-000077 not used)
000100	BCR-Input Locations 000100 thru 000115 = C0 thru C15 respectively.	BCR-Input Locations 000100 thru 000127 = C0 thru C27 respectively.
000120	BCR-Output Locations 000120 thru 000135 = C0 thru C15 respectively.	(locations 000130 and over are unassigned)
000137	Exec-REX494 Entry U = Inter-Bank I/O request L = REX494 Start Address	
000140	Exec-REX494 Entry U = Single bank I/O request L = CKSTAT	
000141	Exec-REX494 Entry U = TAKEOVER L = TYPEC	
000142	Exec-REX494 Entry U = Console/STOPRUN/ TERMRUN L = Servo Lockout Release	
000143	Exec-REX494 Entry U = Acquire Communication Interrupt L = EXCHANGE	
000144	Exec-REX494 Entry U = REX error message routine L = Utility requests/ Initialize or normalize real time.	
000145	Exec-REX494 Entry U = Set Interval Timer L = Address of REX Utility Table	
000146	Exec-REX494 Entry U = Change Memory Guard L = Address of Date	
000147	Exec-Fieldata Time	
000200	Exec-SU Drum address of user's site utility routine	

- BCR: Buffer Control Register - Contains the operative BCW during ISI I/O transfer or the dummy BCW during ESI I/O transfer.
- Entry: Hardware transfers control, but does not set P-counter, to the software-furnished instruction in this location when the specified (interrupt) condition occurs.
- Exec: The location is loaded and/or controlled by software, not hardware.
- ESI: Externally Specified Index - I/O transfer is controlled by the BCW whose address is specified by the peripheral during each transfer.
- ISI: Internally Specified Index - I/O transfer is controlled by the BCW located in the channel associated BCR.
- MONITOR: Hardware generates an interrupt when the BCW's word count is reduced from 1 to 0.

WORD FORMATS

UNISERVO VI C AND VIII C OPERATIONS

FUNCTION WORD FORMAT	B0	0	MFC	P	D	X	F	G	T	0	U
2					1	1	1	1			
9/28		18	17	15	4	3	2	1	0	9	8
										5	4
										3	0

NOTE: BITS 28 THROUGH 18 AND BIT 04 ARE ALWAYS 0 BITS.

B: Bootstrap function.

U: Logical no. of tape unit.

T: Track field. 0 for 7-Track. For 9-Track, 0 for all functions except repeated attempt(s) to Read Forward.

G: Gain. 0 for normal-gain amplification; 9 for low-gain.

F: Format. 0 for 7-Track; 0 or 1 for 9-Track.

X: Translate. For 7-Track, 0 if no Translate option or option not used; 1 if Translate option used. For 9-Track option, always 0.

D: Density

0: Density determined by manual DENSITY selector (must be set to 800 frames/inch in 9-Track mode).

1: 200 frames/inch (not used in 9-Track mode).

2: 556 frames/inch (not used in 9-Track mode).

3: 800 frames/inch.

P: Parity. 0 = odd parity, 1 = even parity

MFC: Main Function Code

0: Bootstrap or Write End-of-File (9-Track mode only)

1: Read Backward

2: Rewind with Interlock

3: Rewind to Load Point

4: Bootstrap

5: Write

6: Read Forward

7: Skip/Write or Skip Only (9-Track mode only)

FUNCTION WORDS (OCTAL)

9-TRACK: PERMISSIBLE BITS 17-09

READ FORWARD: 602, 632, 603, and 633

READ BACKWARD: 102, 132, 103, and 133

WRITE: 503 and 533

SKIP/WRITE: 703 and 733

SKIP ONLY (1): 743 and 773 (742, 772)

WRITE END-OF-FILE: 003 and 033

BOOTSTRAP: 400 and 000 (with 000, entire word is 4000000000)

REWIND WITH INTERLOCK: 200

REWIND TO LOAD POINT: 300

9-TRACK: PERMISSIBLE BITS 08-05

READ FORWARD: ON FIRST ATTEMPT, 0 BITS; ON REPEATED ATTEMPT(S) DUE TO ERROR, CONTENTS ARE

TAKEN FROM BIT POSITIONS 08-05 OF STATUS WORD

ALL OTHER FUNCTIONS: 0-BITS

7-TRACK: PERMISSIBLE BITS 17-09

FUNCTION	NORMAL GAIN				LOW GAIN			
	DENSITY				DENSITY			
	MANUAL	200	556	800	MANUAL	200	556	800
READ FORWARD (1)(2)	600	610	620	630	601	611	621	631
READ BACKWARD (1)(2)	100	110	120	130	101	111	121	131
WRITE (1)(2)	NU	NU	NU	NU	501	511	521	531
SKIP/WRITE (1)(2)	NU	NU	NU	NU	701	711	721	731
BOOTSTRAP (3)	NU							
REWIND WITH INTERLOCK	400/000				200			
REWIND TO LOAD POINT					300			

(1) FOR EVEN PARITY: ADD 40 (octal).

(2) FOR USE OF TRANSLATE OPTION: ADD 4

(3) IF BITS 17-04 = 000, ENTIRE FUNCTION WORD = 4000000000.

(4) VI C USES 743,773; VIII C USES 742,772.

STATUS WORD FORMAT

NOT USED	MASTER BITS	T	1	M
29	18 17	9 8	5 4	3 0

NOTE: BIT 04 IS ALWAYS A 1 BIT

STATUS WORD CONTENTS	
BIT POSITION	CONDITION
17	ABNORMAL FRAME COUNT
16	(POSSIBLE) END-OF-FILE
15	END-OF-TAPE WARNING/LOAD POINT
14	INTERLOCK
13	BUSY
12	PARITY ERROR
11	LATE ACKNOWLEDGE ERROR
10	TAPE WASH
9	INVALID FUNCTION
8-5	T: BAD TRACK
3-0	M: FRAME COUNT/MODULE 5

WORD FORMATS

PUNCHED CARD SUBSYSTEM OPERATIONS

FUNCTION WORD FORMAT	FC	IGNORED BY SUBSYSTEM
	29 24 23	0

FUNCTION CODES (OCTAL) WITHOUT INTERRUPT ①

FC	FUNCTION
02	PUNCH-NORMAL STACKER (0)
03	PUNCH-SELECT STACKER (1)
04	CONDITION PUNCH FOR TRANSLATE
05	CONDITION PUNCH FOR CARD IMAGE BY COLUMN
06	CONDITION PUNCH FOR CARD IMAGE BY ROW
23	TERMINATE
41	TRANSFER, NO TRIP
42	TRANSFER, TRIP FILL
43	TRIP ONE, NO TRANSFER
62	CONDITION READER FOR TRANSLATE
63	CONDITION READER FOR CARD IMAGE BY COLUMN
64	CONDITION READER FOR CARD IMAGE BY ROW

① TO OBTAIN SAME FUNCTION WITH INTERRUPT, ADD 10 (OCTAL) TO FUNCTION CODE (FC).

STATUS WORD FORMAT	SC	IGNORED BY SUBSYSTEM
	29 26 25	0

STATUS CODES

SC (BINARY)	CONDITION	SC ① (OCTAL)
0100	SEQUENCE ERROR	20
0110	CHARACTER COUNT ERROR	30
1000	NORMAL COMPLETION	40
1010	ILLEGAL FUNCTION CODE	50
1011	PUNCH/CHECK ERROR OR READER LIGHT/DARK CHECK	54
1100	INAPPROPRIATE FUNCTION CODE	60
1110	ILLEGAL CHARACTER CODE	70
1111	INTERLOCK FAULT	74

① ADD TWO 0 BITS TO RIGHT OF BINARY CODE FOR OCTAL CODE

HIGH SPEED PRINTER SUBSYSTEM OPERATIONS

FUNCTION WORD FORMAT	FC	LINE SPACING	NOT USED
	29 24 23	18 17	0

FUNCTION CODES (OCTAL)

FC	FUNCTION
02	PRINT WITHOUT INTERRUPT
12	PRINT WITH INTERRUPT
23	TERMINATE WITHOUT INTERRUPT
33	TERMINATE WITH INTERRUPT

STATUS WORD FORMAT	STATUS CODE	NOT USED
	29 26 25	0

STATUS CODES

SC (BINARY)	CONDITION	SC ① (OCTAL)
1000	NORMAL COMPLETION	40
1001	OUT OF FORMS	44
1010	INVALID FUNCTION	50
1111	INTERLOCK FAULT	74

① ADD TWO 0 BITS TO RIGHT OF BINARY CODE FOR OCTAL CODE

MASS STORAGE OPERATIONS

FH-432 AND FH-880 DRUMS

FUNCTION WORD	FC	BEGINNING DRUM ADDRESS			
		DRUM	BAND	ANGULAR ADDRESS	
	29 24 23	21 18 17	11 10	0	

① BITS 23 AND 22 NOT USED BY FH-432; BIT 22 IS PART OF DRUM ADDRESS FOR FH-880

FH-432/FH-1782 DRUMS (MIXED)

FUNCTION WORD	FC	BEGINNING DRUM ADDRESS			
		P	DRUM	BAND	ANGULAR ADDRESS
	29 24 23 21 20 18 17		11 10	0	

P = PARTITION DESIGNATOR

WORD FORMATS

MASS STORAGE OPERATIONS (Continued)

DRUM FUNCTION CODES (OCTAL)

FC	FUNCTION
02	WRITE
23	TERMINATE WITHOUT INTERRUPT
33	TERMINATE WITH INTERRUPT
40	BOOTSTRAP WITHOUT INTERRUPT
42	CONTINUOUS READ
45	SEARCH
46	SEARCH READ
50	BOOTSTRAP WITH INTERRUPT
52	BLOCK READ
55	BLOCK SEARCH
56	BLOCK SEARCH READ

STATUS WORD FORMAT A	SC	CORRESPONDING BITS IN OVERFLOW WORD
	29 24 23	0

STATUS WORD FORMAT B	SC	0 0	DRUM ADDRESS
	29 24 23	2 2 2 2 2 1	0

NOTE: BIT 22 USED BY FH-880; ALWAYS 0 BIT FOR FH-432; BITS 23-0 USED BY FH-1782

STATUS WORD FORMAT C	SC	0 0	INDETERMINATE
	29 24 23	2 2 2 2 2 1	0

NOTE: BIT 22 USED BY FH-880; ALWAYS 0 BIT FOR FH-432; BITS 23-0 MAY BE USED BY FH-1782

DRUM STATUS CODES (OCTAL)

SC	FORMAT	CONDITION
20	B	ANGULAR ADDRESS ①
02	C	LATE ACKNOWLEDGE ③
04	A	END-OF-BLOCK (WORD -- 1)
05	B	SEARCH FIND
06	B	OVERFLOW PARITY ERROR
07	B	NON-CONTINUOUS READ PARITY ERROR OR CHARACTER COUNT ERROR ②
14	C	MACHINE FAULT
34	C	END-OF-FILE ②
40	C	NORMAL COMPLETION ②
50	C	ILLEGAL FUNCTION ②
54	C	ILLEGAL ADDRESS ②
64	B	CONTINUOUS READ PARITY ERROR ① ②
60	B	CHANNEL SYNCHRONIZER CHARACTER COUNT ERROR ① ②
70	C	CHARACTER COUNT SEQUENCE ERROR ①
60	C	WRITE CHARACTER COUNT ERROR ① ①

① FH-880 ONLY ② RIGHTMOST TWO BITS OF SC ARE IGNORED BY FH-880. ③ FH-1782 ONLY
④ SC = 61-67 ON FH-1782.

FASTRAND II FUNCTION WORD

FC	UNIT	POSITION	TRACK	SECTOR
29 24 23	2 2 2 2 2 0 19	12 11	6 5	0

1 BIT INHIBIT FOR HEAD-POSITIONING ALL 1 BITS FOR FASTBAND REFERENCES

FASTRAND II FUNCTION CODES (OCTAL)

FC	FUNCTION
12	WRITE WITH INTERRUPT
20	POSITION WITHOUT INTERRUPT
23	TERMINATE WITHOUT INTERRUPT
30	POSITION WITH INTERRUPT
33	TERMINATE WITH INTERRUPT
52	READ
53	DATA RECOVERY READ (L)
54	SEARCH FIRST WORD (LONG)
55	SEARCH FIRST WORD (SHORT)
56	SEARCH ALL WORDS (LONG)
57	SEARCH ALL WORDS (SHORT)

① FOR USE BY UNIVAC MAINTENANCE PERSONNEL

NORMAL STATUS WORD

SC	UNIT	POSITION	TRACK	SECTOR
29 24 23	2 2 2 2 2 0 19	12 11	6 5	0

SPECIAL STATUS WORD (SC = 10)

SC	INDE-TERMINATE	SHIFT SENTINEL	INDE-TERMINATE	DATA CHECK CHARACTER
29 24 23	17 16	12 11	6 5	0

FASTRAND II STATUS CODES (OCTAL)

SC	CONDITION
04	TIME OUT - INPUT
05	END OF POSITION - INPUT
06	PHASE ERROR
07	NON-RECOVERABLE ERROR
10	NORMAL END-DATA RECOVERY ①
14	ADDRESS ERROR
20	LATE ACKNOWLEDGE
24	END OF POSITION - OUTPUT
34	SECTOR LENGTH ERROR
40	NORMAL COMPLETION
50	INVALID FUNCTION CODE
54	INVALID ADDRESS/WRITE LOCKOUT
60	WRITE ERROR

① FOR USE BY UNIVAC MAINTENANCE PERSONNEL