ASCII CODE

7-Bit Octal Code	Character	7-Bit Octal Code	Character	7-Bit Octal Code	Character
000	NUL	053	+	126	V
001	SOH	054	,	127	W
002	STX	055	–	130	X
003	ETX	056	.	131	Y
004	EOT	057	/	132	Z
005	ENQ	060	0	133	[
006	ACK	061	1	134	\
007	BEL	062	2	135	]
010	BS	063	3	136	↑
011	HT	064	4	137	←
012	LF	065	5	140	`
013	VT	066	6	141	a
014	FF	067	7	142	b
015	CR	070	8	143	c
016	SO	071	9	144	d
017	SI	072	:	145	e
020	DLE	073	;	146	f
021	DC1	074	<	147	g
022	DC2	075	=	150	h
023	DC3	076	>	151	i
024	DC4	077	?	152	j
025	NAK	100	@	153	k
026	SYN	101	A	154	l
027	ETB	102	B	155	m
030	CAN	103	C	156	n
031	EM	104	D	157	o
032	SUB	105	E	160	p
033	ESC	106	F	161	q
034	FS	107	G	162	r
035	GS	110	H	163	s
036	RS	111	I	164	t
037	US	112	J	165	u
040	SP	113	K	166	v
041	!	114	L	167	w
042	"	115	M	170	x
043	#	116	N	171	y
044	$	117	O	172	z
045	%	120	P	173	{
046	&	121	Q	174	|
047	'	122	R	175	}
050	(	123	S	176	~
051	)	124	T	177	DEL
052	*	125	U		

ASSEMBLY OPERATING PROCEDURE

IN:

1 Teletype reader without parity checking
2 Teletype reader with parity checking
3 Paper tape reader without parity checking
4 Paper tape reader with parity checking
5 Teletype keyboard without parity checking

LIST:

1 Teletype Model 33
2 Teletype Model 35
3 Line printer
4 Paper tape punch (for ASR33)
5 Paper tape punch (for ASR35)

BIN:

1 Teletype punch without local symbols
2 Paper tape punch without local symbols
3* Teletype punch with local symbols
4* Paper tape punch with local symbols

MODE:

1 Pass 1
2 Pass 2 — Output object tape
3 Pass 2 — Output listing
4 Pass 2 — Output object tape and listing
5 — Output symbol list

*Relocatable assembler only

RELOCATABLE LOADER MODES

Mode Response	Effect
1	Load a relocatable binary or a relocatable library tape from the teletype
2	Load a relocatable binary or a relocatable library tape from the paper tape reader
3	Force a load address for normally relocatable code
4	Complement the load all symbols switch
5	Print current memory limits
6	Print a loader map
7	Reinitialize the loader
8	Terminate the load process to prepare for execution

BOOTSTRAP LOADER

```
TTI: X = 10      PTR: X = 12      Enter at BSTRP
07757   126440   GET:    SUBO     1,1
07760   0636--            SKPDN    X
07761   000777           JMP      .-1
07762   0605--           DIAS     0,X

07763   127100           ADDL     1,1
07764   127100           ADDL     1,1
07765   107003           ADD      0,1,SNC
07766   000772           JMP      GET+1
07767   001400           JMP      0,3

07770   0601--   BSTRP:  NIOS     X
07771   004766           JSR      GET
07772   044402           STA      1,.+2
07773   004764           JSR      GET
                         ...
                         ...
```

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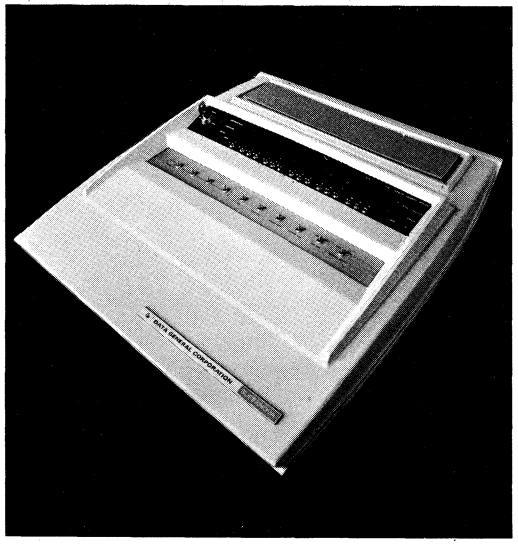
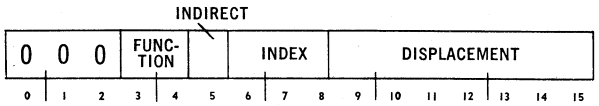
INSTRUCTION REFERENCE CARD



NOVA SUPER NOVA

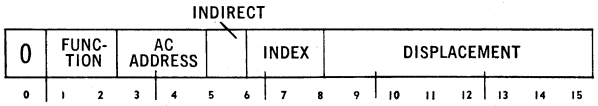
HARDWARE INSTRUCTIONS

MEMORY REFERENCE WITHOUT ACCUMULATOR



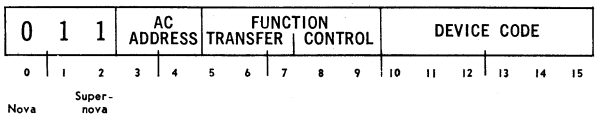
Nova	Super-nova	
2.6μ	.8μ	00 JMP
3.5	1.4	01 JSR
5.2	1.8	10 ISZ
5.2	1.8	11 DSZ

MEMORY REFERENCE WITH ACCUMULATOR



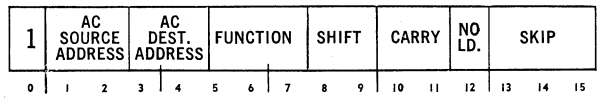
Nova		Super-nova	
5.2μ	01 LDA	1.6μ	
5.5	10 STA	1.6	

INPUT-OUTPUT



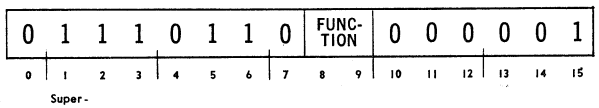
Nova	Super-nova				
4.4μ	3.3μ	000	NIO	01	S
4.4	2.9	001	DIA	10	C
4.7	3.3	010	DOA	11	P
4.4	2.9	011	DIB		
4.7	3.3	100	DOB		
4.4	2.9	101	DIC		
4.7	3.3	110	DOC		
4.4	2.9	111	SKP	00	BN
				01	BZ
				10	DN
				11	DZ

ARITHMETIC AND LOGIC



Nova	Super-nova								
5.6μ	.8*μ	000	COM	01	L	01	Z	001	SKP
5.6	.8	001	NEG	10	R	10	O	010	SZC
5.6	.8	010	MOV	11	S	11	C	011	SNC
5.6	.8	011	INC					100	SZR
5.9	.8	100	ADC					101	SNR
5.9	.8	101	SUB					110	SEZ
5.9	.8	110	ADD					111	SBN
5.9	.8	111	AND						

SUPERNOVA MULTIPLY/DIVIDE

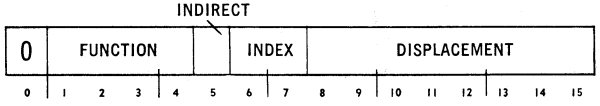


Super-nova		
3.8μ avg.	11	MUL
6.9	01	DIV

*All Supernova times doubled if a skip occurs

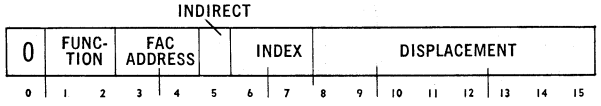
FLOATING POINT INSTRUCTIONS

MEMORY REFERENCE WITHOUT ACCUMULATOR



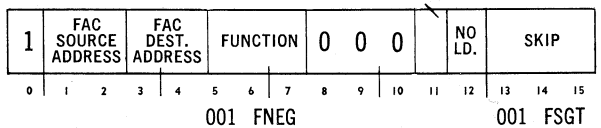
0000	FJMP	1100	FFLO
0001	FJSR	1101	FLD3
0010	FISZ	1110	FST3
0011	FDSZ	1111	FFIX

MEMORY REFERENCE WITH ACCUMULATOR



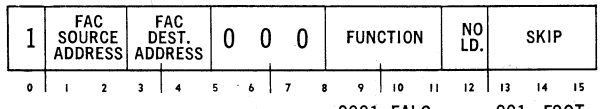
01	FLDA
10	FSTA

ARITHMETIC (OPTIONAL NORMALIZATION)



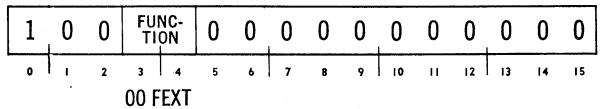
001	FNEG	001	FSGT
010	FMOV	010	FSLT
011	FPOS	011	FSNR
100	FMNS	100	FSZR
101	FSUB	101	FSGE
110	FADD	110	FSLE
111	FRND	111	FSKP

ARITHMETIC (ALWAYS NORMALIZED)



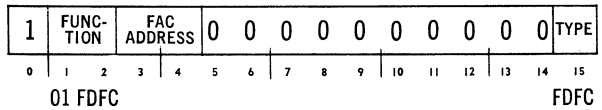
0001	FALG	001	FSGT
0010	FATN	010	FSLT
0011	FCOS	011	FSNR
0100	FMPY	100	FSZR
0101	FSIN	101	FSGE
0110	FTAN	110	FSLE
1000	FDIV	111	FSKP
1001	FEXP		
1010	FSQR		
1100	FHLV		

SPECIAL



00	FEXT
01	FIC2
10	FIC3
11	FHLT

CONVERSION



01	FDFC	FDFC	1 I
10	FFDC		FFDC
			1 F

SPECIAL INSTRUCTION MNEMONICS

READS	=	DIA	–,CPU	=	060477
IORST	=	DICC	0,CPU	=	062677
HALT	=	DOC	0,CPU	=	063077
INTEN	=	NIOS	CPU	=	060177
INTDS	=	NIOC	CPU	=	060277
INTA	=	DIB	–,CPU	=	061477
MSKO	=	DOB	–,CPU	=	062077
MUL	=	DOCP	2,MDV	=	073301
DIV	=	DOCS	2,MDV	=	073101
FETR	=	JSR	@ 4	=	006004
FINI	=	JSR	@ 5	=	006005

For no-op use JMP .+ 1 = 000401

IN-OUT DEVICES

Octal Device Code	Mnemonic	Priority Mask Bit	Device
01	MDV*	—	Multiply/Divide
02	MAP1†	—	Mapping
03	MAP2†	—	Mapping
10	TTI	14	Teletype input
11	TTO	15	Teletype output
12	PTR	11	Paper tape reader
13	PTP	13	Paper tape punch
14	RTC	13	Real time clock
15	PLT	12	Incremental plotter
16	CDR	10	Card reader
17	LPT	12	Line printer
20	DSK	9	Disk
21	ADCV	8	A/D converter
22	MTA	10	Magnetic tape
23	DACV	—	D/A converter
24	TTY	0	16 line TTY mpx
77	CPU	—	Central processor

*Nova option
†Supernova option

UNSIGNED SKIP CONDITIONS

SUBZ #	S,D,SNC	; SKIP IF (D) $\geq$ (S)
SUB #	S,D,SZR	; SKIP IF (D) = (S)
ADCZ #	S,D,SNC	; SKIP IF (D) $>$ (S)