

DEFINED      FUNCTION                      KEYSTROKES                      ACCEPTABLE      MARGINAL      SLOW  
 =====

STATISTICAL FUNCTIONS  
 =====

NOTE: DO OP 10 TO MAKE SURE THE SIMULATOR  
 IS IN DECIMAL MODE FOR STAT. FUNCT.

17.4	SIGMA+	2ND SIGMA+		X
17.5	SIGMA-	INV 2ND SIGMA+	X	
18.82	CLR STAT	OP 22		X
18.85	LIN REGR	OP 23		X
18.88	MEANS	OP 26		X
??.	STD ERR MEAN	INV OP 26		X
18.91	SAM STD DEV	OP 27		X
18.93	POP STD DEV	INV OP 27		X
18.95	CORR COEF	OP 24		X
18.98	Y' =	OP 25		X
18.100	X' =	INV OP 25		X

"MATH" FUNCTIONS  
 =====

17.71	PI	PI SYMBOL	X	
17.69	SIGNUM	INV OP 28		X
17.19	FACTORIAL	2ND ( )!		X
17.18	INVERSE	( ) -1	X	
17.36	SQ ROOT	2ND ROOT SIGN	X	
17.35	INT POWER	( )N	X	
17.38	LOG X	2ND LOG	X	
17.39	ANTILOG X	INV 2ND LOG	X	
17.41	LN X	2ND LN	X	
17.42	E**X	INV 2ND LN	X	
17.37	RAISE POWER	UP ARROW	X	

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
17.40	END SUPERSCRIPT	DOWN ARROW	X		
17.59	DIVISION	DIV SYMBOL	X		
17.70	MULTIPLY	X	X		
18.51	EXECUTE IMPLIED	MULTIPLY	X		
17.83	SUBTRACTION	-	X		
17.96	ADDITION	+	X		
17.114	EQUALS	=	X		
17.97	COS	2ND COS	X		
17.98	ARCCOS	INV 2ND COS	X		
17.115	SIN	2ND SIN	X		
17.116	ARCSIN	INV 2ND SIN	X		
17.84	TAN	2ND TAN	X		
17.85	ARCTAN	INV 2ND TAN	X		
17.68	ABS VALUE	OP 28		X	
17.110	UNARY MINUS	I - I	X		
17.111	SIGN CHANGE	INV I - I	X		
CONVERSIONS					
17.7	P-->R	2ND P-->R	X		
17.8	R-->P	INV 2ND P-->R	X		
17.51	ENG UNITS	2ND ENG	X		
17.52	CLEAR ENG	INV 2ND ENG	X		
17.49	ENTER EXPONENT	EE	X		
17.50	CLEAR EE	INV EE	X		
17.54	FIX DEC PT	2ND FIX		X	
17.55	CLEAR FIX	INV 2ND FIX		X	
17.57	DISPLAY INTEGER	2ND INT	X		

CONVERSIONS

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17.7 P-->R 2ND P-->R X

17.8 R-->P INV 2ND P-->R X

17.51 ENG UNITS 2ND ENG X

17.52 CLEAR ENG INV 2ND ENG X

17.49 ENTER EXPONENT EE X

17.50 CLEAR EE INV EE X

17.54 FIX DEC PT 2ND FIX X

17.55 CLEAR FIX INV 2ND FIX X

17.57 DISPLAY INTEGER 2ND INT X

DEFINED      FUNCTION                      KEYSTROKES                      ACCEPTABLE      MARGINAL      SLOW  
 =====

17.58	DISPLAY FRACT	INV 2ND INT	X		
17.81	DMS TO DEC DEG	2ND DMS			X
17.82	DEC DEG TO DMS	INV 2ND DMS			X
18.28	OCTAL MODE OPERATION		X		
18.32	DECIMAL MODE OPERATION		X		
18.48	HEX MODE OPERATION		X		
18.55	DEG --> RAD	OP 18			X
18.57	RAD --> DEG	INV OP 18			X
18.59	RAD --> GRAD	OP 19			X
18.61	GRAD --> RAD	INV OP 19			X
18.63	GRAD --> DEG	OP 20			X
18.65	DEG --> GRAD	INV OP 20			X
18.113	UNNORMALIZED #	OP 41			X
18.115	RESTORE NORMAL#	INV OP 41			X
17.60	TRIG ANGLE MODE	2ND DRG			X
17.61	DEGREE MODE	INV 2ND DRG			X

## PROGRAMMING MODES

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17.1	EQUATION MODE	EQN	X		
17.3	EVALUATE EQN	EVAL	X		
17.2	LEARN MODE	LRN	X		
17.62	SINGLE STEP	-->	X		
17.63	CURSOR RIGHT	ALPH -->	X		
17.72	BACK STEP	<--	X		
17.73	CURSOR LEFT	ALPH <--	X		

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
17.64	INSERT	2ND INS		X	
17.74	DELETE	2ND DEL		X	
17.31	SUBROUTINE	SBR	X		
17.32	RETURN	INV SBR	X		
17.33	LABELED SBR	2ND LBL SBR	X		
17.34	LABEL	2ND LBL	X		
17.45	GO TO	GTO	X		
17.46	GO TO LABEL	GTO 2ND LBL	X		
17.47	GO FORWARD REL	2ND GFR	X		
17.48	GO BACKWARD REL	INV 2ND GFR	X		
17.65	INDIRECT FIELD	2ND IND	X		
17.75	IF >	2ND IF >	X		
17.76	IF <	INV 2ND IF >	X		
17.77	IF >=	2NDIF> 2NDIF=	X		
17.78	IF <=	INV2NDIF>2NDIF=	X		
17.79	IF =	2ND IF =	X		
17.80	IF NOT =	INV 2ND IF =	X		
17.86	RUN/STOP	R/S	X		
17.88	RESET	2ND RST			X
17.89	FLIP FLAG	INV 2ND RST FF	X		
17.90	IF FLAG	2ND IFF	X		
17.91	INV IF FLAG	INV 2ND IFF	X		
17.92	SET FLAG	2ND STF	X		
17.93	INV SET FLAG	INV 2ND STF	X		
17.94	DECR & SKIP 0	2ND DSZ	X		
17.95	INV DSZ	INV 2ND DSZ	X		
17.112	PAUSE	2ND PAU	X		

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
17. 11	NOP	2ND NOP	X		

FUNCTIONS NOT AVAILABLE ON KEYBOARD  
(MAY BE GENERATED IN PROGRAM)

SBIT	SET BIT	CODE A0	X		
RBIT	RESET BIT	CODE A1	X		
FBIT	FLIP BIT	CODE A2	X		
TBIT	TEST BIT	CODE A3	X		
INV TBIT	TST&SKIP IF SET INV	CODE A3	X		
STOD	STO A DIGIT	CODE A4	X		
RCLD	RECALL A DIGIT	CODE A5	X		
HIER	SET HIER REGIS.	CODE A6	X		
INV HIER	RESET TO USER REGISTERS		X		
INDH	INDIR HIER REG	CODE A7	X		
INV INDH	RESET IND HIER REGISTERS		X		
RCLH	RECALL HIER REG	CODE A8	X		
STOH	STORE HIER REG	CODE A9	X		

## MEMORY

17. 6	SWAP DISP-AUX		X		
17. 9	INCREMENT REG	OP A-Z			X
17. 10	DECREMENT REG	INV OP A-Z			X
17. 15	DEFINE VAR	2ND DFN RCL V			X
17. 20	STORE	STO	X		
17. 21	CLR MEMORIES	2ND CMS			X

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
17.22	CLR PROGRAM	INV 2ND CMS			X
17.23	RECALL	RCL	X		
17.25	STORE +	STO +	X		
17.26	STORE -	STO -	X		
17.27	STORE X	STO X	X		
17.28	STORE /	STO /	X		
17.29	EXCHANGE	2ND EXC	X		
17.99	CLEAR ENTRY	CE/CLR	X		
17.100	CLR EQUATION	2ND CEQ	X		
17.101	GENERAL CLEAR	CE/CLR CE/CLR	X		
17.102	LST PGM MEMORY	2ND LST	X		
17.104	LST REGISTERS	INV 2ND LST		X	
17.105	LST HIER CONT	HIER INV 2ND LST		X	

### PERIPHERALS

17.13	PROGRAM	PGM MMNN			X
17.108	PRINT DISPLAY	2ND PRT	X		
17.109	ADVANCE PAPER	INV 2ND PRT	X		
17.66	DOWNL CRAM/CROM	2ND READ		X	
17.67	WRITE TO CRAM	INV 2ND READ		X	

### MISCELLANEOUS

17.12	2ND FUNCTION	2ND	X		
17.30	INVERSE FUNCT	INV	X		
17.14	DEFINE	DFN	X		

DEFINED      FUNCTION                      KEYSTROKES                      ACCEPTABLE      MARGINAL      SLOW  
 =====

17.16	DEFINE OP	2ND DFN OP NN			X
17.17	DEFINE INV OP	2ND DFN INV OP NN			X
17.24	RECALL DATE	INV TIME DATE			X
17.118	ON/TIME/PROMPT				X
17.43	ALPHA STATE 1	ALPH		X	
17.44	ALPHA STATE 2	2ND ALPH		X	
17.113	ALPHA SHIFT	SHIFT KEY ALPH		X	
17.117	FORMAT ALPH #	ALPHA		X	
17.53	LEFT PAREN	(		X	
17.56	RIGHT PAREN	)		X	
17.106	NUMERALS	0-9		X	
17.107	DECIMAL PT	.		X	

DEFINE OP CODES  
 =====

18.2	OP DEFINITIONS	DFN OP 0			X
18.5	SET DEFAULTS	DFN OP 1			X
18.46	ERROR MESSAGE#	DFN OP 2			X
18.12	MEM PARTITION	DFN OP 3			X
18.14	DEFAULT PART.	DFN INV OP 3			X
18.16	ALL CUE PROMPT	DFN OP 4			X
18.19	YES/NO CUE	DFN OP 5			X
18.22	ENT/CONT CUE	DFN OP 6			X
18.25	CONT CUE	DFN OP 7			X
18.28	OCTAL MODE	DFN OP 8			X
18.31	RECALL ALPHA	DFN OP 9			X

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
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18.31	RECALL ALPHA	DFN INV OP 9		X	
18.33	DECIMAL MODE	DFN OP 10		X	
18.36	PRIMARY MODULE#	DFN OP 11		X	
?? ??	ANGLE MODE:	DFN OP 12		X	
18.39	ROUND DISPLAY	DFN OP 13		X	
18.42	SAVE STATUS	DFN OP 14		X	
18.44	EXCHANGE STATUS	DFN INV OP 14		X	
18.156	->SHIFT ALPHA->	DFN OP 15		X	
18.158	<-SHIFT ALPHA<-	DFN INV OP 15		X	
18.49	HEX MODE	DFN OP 16		X	
18.52	IMPLIED MULT	DFN OP 17		X	
18.54	DEACTIVAT I. M.	DFN INV OP 17		X	
18.56	D->R CONVERSION	DFN OP 18		X	
18.58	R->D CONVERSION	DFN INV OP 18		X	
18.60	R->G CONVERSION	DFN OP 19		X	
18.62	G->R CONVERSION	DFN INV OP 19		X	
18.64	G->D CONVERSION	DFN OP 20		X	
18.66	D->G CONVERSION	DFN INV OP 20		X	
18.154	SELF TEST 1	DFN OP 21		X	
18.154	SELF TEST 2	DFN INV OP 21		X	
18.83	CLR STATISTICS	DFN OP 22		X	
18.86	INTERCEPT-SLOPE	DFN OP 23		X	
18.96	CORRELAT. COEFF	DFN OP 24		X	
18.99	Y = MX + B	DFN OP 25		X	
18.101	X = (Y-B)/M	DFN INV OP 25		X	
18.89	XBAR =	DFN OP 26		X	
?? ??	STD ERR MEAN	DFN INV OP 26		X	



DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
18.92	SAMPLE ST DEV	DFN OP 27		X	
18.94	POPUL ST DEV	DFN INV OP 27		X	
17.68	ABSOLUTE VAL	DFN OP 28		X	
17.69	SIGNUM FUNCT	DFN INV OP 28		X	
18.111	SHOW FLAGS SET	DFN OP 29		X	
18.79	24 HOUR TIME	DFN OP 30		X	
18.81	12 HOUR TIME	DFN INV OP 30		X	
18.68	PAUSE TIMING	DFN OP 31		X	
18.70	DEFAULT PAUSE	DFN INV OP 31		X	
18.103	LST PGM LABELS	DFN OP 32		X	
??????		DFN OP 33	NOTE: OP 33 NO LONGER EXISTS		
18.141	RD CASS MAIN/MOD	DFN OP 34		X	
18.143	WR CASS MAIN/MOD	DFN INV OP 34		X	
18.146	RD CASS PGM STEPS	DFN OP 35		X	
18.148	WR CASS PGM STEPS	DFN INV OP 35		X	
18.151	RD CASS REGISTERS	DFN OP 36		X	
18.153	WR CASS REGISTERS	DFN INV OP 36		X	
18.118	DISP->PGM CNTR	DFN OP 37		X	
18.120	PGM CNTR->DISP	DFN INV OP 37		X	
18.122	DISP->PGM STEP	DFN OP 38		X	
18.124	PGM STEP->DISP	DFN INV OP 38		X	
18.126	PGM STEP<->DISP INC PC	DFN OP 39		X	
18.128	PGM STEP<->DISP DEC PC	DFNINVOP39		X	
18.131	SOFT PARTITION	DFN OP 40		X	
18.132	HARD PARTITION	DFN INV OP 40		X	
18.114	UNNORMALIZED #	DFN OP 41		X	
18.116	CANCEL UNNORM#	DFN INV OP 41		X	

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
??.	???	I/O BUFFER->I/O DFN OP 42		X	
??.	???	I/O->I/O BUFFER DFN INV OP 42		X	
??.	???	SHOW 13 DIGITS DFN OP 43		X	
18.	134	SET ALARM DFN OP 44		X	
18.	136	RESET ALARM DFN INV OP 44		X	
18.	138	PAU TIMING TONE DFN OP 45		X	
??.	???	ERROR TONE DFN OP 46		X	
??.	???	CUE TONE DFN OP 47		X	
??.	???	NO CUE TONE DFN INV OP 47		X	
18.	72	COPY CRAM DFN OP 48		X	
18.	75	NAME CRAM DFN OP 49		X	
18.	77	ERASE MODULE DFN INV OP 49		X	
18.	106	ELIMINATE PC DISP DFN OP 50		X	
18.	108	RESTORE PC DISP DFN INV OP 50		X	
18.	160	INCREMENT REG DFN OP A-Z		X	
18.	162	DECREMENT REG DFN INVOP A-Z		X	

## UNDEFINED INVERSES -

\*\*\*\*\* ALL OF THESE WORK CORRECTLY ON DFN INV OP ## \*\*\*\*\*

18.	3	INV OP 0		X	
18.	6	INV OP 1		X	
18.	47	INV OP 2		X	
18.	17	INV OP 4		X	
18.	20	INV OP 5		X	
18.	23	INV OP 6		X	
18.	26	INV OP 7		X	
18.	29	INV OP 8		X	

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
18.34	INV OP 10			X	
18.37	INV OP 11			X	
?? ??	INV OP 12			X	
18.40	INV OP 13			X	
18.50	INV OP 16			X	
18.84	INV OP 22			X	
18.87	INV OP 23			X	
18.97	INV OP 24			X	
18.112	INV OP 29			X	
18.104	INV OP 32			X	
?? ??	INV OP 33 (LABEL NOT FOUND)			X	
?? ??	INV OP 43			X	
18.139	INV OP 45			X	
18.73	INV OP 48			X	
OP CODES					
=====					
18.1	OP DEFINITIONS	OP 0		X	
18.4	SET DEFAULTS	OP 1		X	
18.45	ERROR MESSAGE#	OP 2		X	
18.11	MEM PARTITION	OP 3			X
18.13	DEFAULT PART.	INV OP 3			X
18.15	ALL CUE PROMPT	OP 4		X	
18.18	YES/NO CUE	OP 5		X	
18.21	ENT/CONT CUE	OP 6		X	
18.24	CONT CUE	OP 7		X	
*18.27 **	OCTAL MODE	OP 8		X	
18.30	RECALL ALPHA	OP 9		X	

DEFINED      FUNCTION                      KEYSTROKES                      ACCEPTABLE    MARGINAL    SLOW  
 =====

*18.32 **	DECIMAL MODE	OP 10			X
18.35	PRIMARY MODULE#	OP 11			X
?? ??	ANGLE MODE: DEG	OP 12			X
18.38	ROUND DISPLAY	OP 13			X
18.41	SAVE STATUS	OP 14			X
18.43	EXCHANGE STATUS	INV OP 14			X
18.155	->SHIFT ALPHA->	OP 15			X
18.157	<-SHIFT ALPHA<-	INV OP 15			X
*18.48 **	HEX MODE	OP 16			X
*18.51 **	IMPLIED MULT	OP 17			X
*18.53 **	DEACTIVAT I. M.	INV OP 17			X
*18.55 **	D->R CONVERSION	OP 18			X
*18.57 **	R->D CONVERSION	INV OP 18			X
*18.59 **	R->G CONVERSION	OP 19			X
*18.61 **	G->R CONVERSION	INV OP 19			X
*18.63 **	G->D CONVERSION	OP 20			X
*18.65 **	D->G CONVERSION	INV OP 20			X
18.154	SELF TEST 1	OP 21			X
18.154	SELF TEST 2	INV OP 21			X
*18.82 **	CLR STATISTICS	OP 22			X
*18.85 **	INTERCEPT-SLOPE	OP 23			X
*18.95 **	CORRELAT. COEFF	OP 24			X
*18.98 **	Y = MX + B	OP 25			X
*18.100 **	X = (Y-B)/M	INV OP 25			X
*18.88 **	MEANS	OP 26			X
*?? ?? **	STD ERR MEAN	INV OP 26			X
*18.91 **	SAMPLE ST DEV	OP 27			X

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
*18.93 **	POPUL ST DEV	INV OP 27		X	
*17.68 **	ABSOLUTE VAL	OP 28		X	
*17.69 **	SIGNUM FUNCT	INV OP 28		X	
18.109	SHOW FLAGS SET	OP 29		X	
18.78	24 HOUR TIME	OP 30		X	
18.80	12 HOUR TIME	INV OP 30		X	
18.67	PAUSE TIMING	OP 31		X	
18.69	DEFAULT PAUSE	INV OP 31		X	
18.102	LST PGM LABELS	OP 32		X	
??????		OP 33	NOTE: OP 33 NO LONGER EXISTS		
18.140	RD CASS MAIN/MOD	OP 34		X	
18.142	WR CASS MAIN/MOD	INV OP 34		X	
18.145	RD CASS PGM STEPS	OP 35		X	
18.147	WR CASS PGM STEPS	INV OP 35		X	
18.149	RD CASS REGISTERS	OP 36		X	
18.152	WR CASS REGISTERS	INV OP 36		X	
18.117	DISP->PGM CNTR	OP 37		X	
18.119	PGM CNTR->DISP	INV OP 37		X	
18.121	DISP->PGM STEP	OP 38		X	
18.123	PGM STEP->DISP	INV OP 38		X	
18.125	PGM STEP<->DISP INC PC	OP 39		X	
18.127	PGM STEP<->DISP DEC PC	INV OP 39		X	
18.129	SOFT PARTITION	OP 40		X	
18.130	HARD PARTITION	INV OP 40		X	
*18.113 **	UNNORMALIZED #	OP 41		X	
*18.115 **	CANCEL UNNORM#	INV OP 41		X	
?? ???	I/O BUFFER->I/O	OP 42		X	

DEFINED	FUNCTION	KEYSTROKES	ACCEPTABLE	MARGINAL	SLOW
??.???	I/O->I/O BUFFER	INV OP 42		X	
??.???	SHOW 13 DIGITS	OP 43		X	
18.133	SET ALARM	OP 44		X	
18.135	RESET ALARM	INV OP 44		X	
18.138	PAU TIMING TONE	OP 45		X	
??.???	ERROR TONE	OP 46		X	
??.???	CUE TONE	OP 47		X	
18.71	COPY CRAM	OP 48		X	
18.74	NAME CRAM	OP 49		X	
18.76	ERASE MODULE	INV OP 49		X	
18.105	ELIMINATE PC DISP	OP 50		X	
18.107	RESTORE PC DISP	INV OP 50		X	
*18.159**	INCREMENT REG	OP A-Z		X	
*18.161**	DECREMENT REG	INV OP A-Z		X	

\*'S INDICATE OP CODES WHICH ARE ALSO LISTED UNDER OTHER CATEGORIES

303 FUNCTIONS LISTED  
 106 ACCEPTABLE FUNCTIONS  
 193 MARGINAL FUNCTIONS  
 4 SLOW FUNCTIONS

DEFINED FUNCTION KEYSTROKES DATE CHECKED AVERAGE TIME REQUIRED (SEC)

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STATISTICAL FUNCTIONS  
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NOTE: DO OP 10 TO MAKE SURE THE SIMULATOR IS IN DECIMAL MODE FOR STAT. FUNCT.

17.4	SIGMA+	2ND SIGMA+	5/6/80	3.5
17.5	SIGMA-	INV 2ND SIGMA+	5/6/80	4.0
18.82	CLR STAT	OP 22	5/6/80	6.3
18.85	LIN REGR	OP 23	5/6/80	10.55
18.88	MEANS	OP 26	5/6/80	4.95
?? ??	STD ERR MEAN	INV OP 26	5/8/80	8.03
18.91	SAM STD DEV	OP 27	5/6/80	9.05
18.93	POP STD DEV	INV OP 27	5/6/80	6.3
18.95	CORR COEF	OP 24	5/6/80	7.75
18.98	Y' =	OP 25	5/6/80	10.85
18.100	X' =	INV OP 25	5/6/80	10.9

"MATH" FUNCTIONS  
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17.71	PI	PI SYMBOL	5/6/80	NEGLIGIBLE
17.69	SIGNUM	INV OP 28	5/6/80	5.1
17.19	FACTORIAL	2ND ( )!	5/6/80	RANGE: 2.5-18.4
17.18	INVERSE	( ) -1	5/6/80	< .5
17.36	SQ ROOT	2ND ROOT SIGN	5/6/80	< .6
17.35	INT POWER	( ) N	5/6/80	< .7 MAX
17.38	LOG X	2ND LOG	5/6/80	< .7
17.39	ANTILOG X	INV 2ND LOG	5/6/80	< .7
17.41	LN X	2ND LN	5/7/80	< .6
17.42	E**X	INV 2ND LN	5/7/80	< .6
17.37	RAISE POWER	UP ARROW	5/7/80	< .6
17.40	END SUPERSCRIP	DOWN ARROW	5/7/80	< .6

\*\*\*\*\*

ALEX SPEED CHECKOUT

05/21/80

15:25:42

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DEFINED

FUNCTION

KEYSTROKES

DATE  
CHECKED

AVERAGE TIME  
REQUIRED (SEC)

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17.59	DIVISION	DIV SYMBOL	5/7/80	< .6
17.70	MULTIPLY	X	5/7/80	< .5
18.51	IMPLIED MULT	OP 17	5/7/80	< .55
18.53	DEACTIVATE I.M.	INV OP 17	5/7/80	4.05
17.83	SUBTRACTION	-	5/7/80	< .5
17.96	ADDITION	+	5/7/80	< .5
17.114	EQUALS	=	5/7/80	NEGLIGIBLE
17.97	COS	2ND COS	5/7/80	< .53
17.98	ARCCOS	INV 2ND COS	5/7/80	< .6
17.115	SIN	2ND SIN	5/7/80	< .58
17.116	ARCSIN	INV 2ND SIN	5/7/80	< .63
17.84	TAN	2ND TAN	5/7/80	< .475
17.85	ARCTAN	INV 2ND TAN	5/7/80	< .6
17.68	ABS VALUE	OP 28	5/7/80	4.5
17.110	UNARY MINUS	I - I	5/7/80	.6
17.111	SIGN CHANGE	2ND +/-	5/7/80	< .35

CONVERSIONS

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17.7	P-->R	2ND P-->R	5/7/80	2.5
17.8	R-->P	INV 2ND P-->R	5/7/80	2.26
17.51	ENG UNITS	2ND ENG	5/7/80	< .4
17.52	CLEAR ENG	INV 2ND ENG	5/7/80	< .5
17.49	ENTER EXPONENT	EE	5/7/80	< .35
17.50	CLEAR EE	INV EE	5/7/80	< .4
17.54	FIX DEC PT	2ND FIX	5/7/80	5.0
17.55	CLEAR FIX	INV 2ND FIX	5/7/80	4.75
17.57	DISPLAY INTEGER	2ND INT	5/7/80	< .33



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ALEX SPEED CHECKOUT

05/21/80

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17.58	DISPLAY FRACT	INV 2ND INT	5/7/80	< .34
17.81	DMS TO DEC DEG	2ND DMS	5/7/80	2.37
17.82	DEC DEG TO DMS	INV 2ND DMS	5/7/80	2.37
18.28	OCTAL MODE	OP 8	5/14/80	BASE 10: 11.53-11.8 BASE 16: 16.67-17.67
18.32	DECIMAL MODE	OP 10	5/14/80	BASE 8: 4.53-6.97 BASE 16: 5.67-7.37
18.48	HEX MODE	OP 16	5/14/80	BASE 8: 13.1-15.73 BASE 10: 11.03-11.1
18.55	DEG --> RAD	OP 18	5/8/80	4.13
18.57	RAD --> DEG	INV OP 18	5/8/80	4.1
18.59	RAD --> GRAD	OP 19	5/8/80	4.2
18.61	GRAD --> RAD	INV OP 19	5/8/80	4.2
18.63	GRAD --> DEG	OP 20	5/8/80	4.07
18.65	DEG --> GRAD	INV OP 20	5/8/80	4.1
18.113	UNNORMALIZED #	OP 41	5/8/80	5.6
18.115	RESTORE NORMAL#	INV OP 41	5/8/80	5.6
17.60	TRIG ANGLE MODE	2ND DRG	5/8/80	1.7
17.61	DEGREE MODE	INV 2ND DRG	5/8/80	1.4

PROGRAMMING MODES

=====

17.1	EQUATION MODE	EQN	5/8/80	NEGLIGIBLE
17.3	EVALUATE EQN	EVAL	5/16/80	<.5 MINIMUM
17.2	LEARN MODE	LRN	5/8/80	NEGLIGIBLE
17.62	SINGLE STEP	-->	5/8/80	NEGLIGIBLE
17.63	CURSOR RIGHT	ALPH -->	5/12/80	NEGLIGIBLE
17.72	BACK STEP	<--	5/8/80	NEGLIGIBLE

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17.73	CURSOR LEFT	ALPH <--	5/12/80	NEGLIGIBLE
17.64	INSERT	2ND INS	5/8/80	3.2
17.74	DELETE	2ND DEL	5/8/80	6.47
17.31	SUBROUTINE	SBR	5/19/80	<.3 (WITH R/S)
17.32	RETURN	INV SBR	5/19/80	<.3 (WITH SBR)
17.33	LABELED SBR	2ND LBL SBR	5/19/80	<.3 (WITH SBR)
17.34	LABEL	2ND LBL	5/19/80	SEE INDIVIDUAL USES
17.45	GO TO	GTO	5/15/80	NEGLIGIBLE
17.46	GO TO LABEL	GTO 2ND LBL	5/19/80	<.2
17.47	GO FORWARD REL	2ND GFR	5/19/80	<.2
17.48	GO BACKWARD REL	INV 2ND GFR	5/19/80	<.4
17.65	INDIRECT FIELD	2ND IND	5/20/80	USES NO EXTRA TIME
17.75	IF >	2ND IF >	5/16/80	<.3
17.76	IF <	INV 2ND IF >	5/16/80	<.3
17.77	IF >=	2NDIF> 2NDIF=	5/16/80	<.3
17.78	IF <=	INV2NDIF>2NDIF=	5/16/80	<.3
17.79	IF =	2ND IF =	5/16/80	<.3
17.80	IF NOT =	INV 2ND IF =	5/16/80	<.3
17.86	RUN/STOP	R/S	5/16/80	NEGLIGIBLE
17.88	RESET	2ND RST	5/16/80	NEGLIGIBLE
17.89	FLIP FLAG	INV 2ND RST FF	5/16/80	NEGLIGIBLE
17.90	IF FLAG	2ND IFF	5/19/80	NEGLIGIBLE
17.91	INV IF FLAG	INV 2ND IFF	5/19/80	NEGLIGIBLE
17.92	SET FLAG	2ND STF	5/14/80	NEGLIGIBLE
17.93	INV SET FLAG	INV 2ND STF	5/19/80	NEGLIGIBLE
17.94	DECR & SKIP 0	2ND DSZ	5/19/80	<.093
17.95	INV DSZ	INV 2ND DSZ	5/19/80	<.103
17.112	PAUSE	2ND PAU	5/19/80	<.085

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17.11	NOP	2ND NOP	5/16/80	0.007
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FUNCTIONS NOT AVAILABLE ON KEYBOARD  
(MAY BE GENERATED IN PROGRAM)

?SBIT	SET BIT	CODE A0	5/20/80	.1
?RBIT	RESET BIT	CODE A1	5/20/80	.1
?FBIT	FLIP BIT	CODE A2	5/20/80	.1
?TBIT	TEST BIT	CODE A3	5/20/80	.07
?INV TBIT	TST&SKIP IF SET INV	CODE A3	5/20/80	.36
?STOD	STO A DIGIT	CODE A4	5/20/80	.4
?RCLD	RECALL A DIGIT	CODE A5	5/20/80	.43
?HIER	SET HIER REGIS.	CODE A6	5/19/80	NEGLIGIBLE
?INVHIER	RESET TO USER REG INV	CODE A6	5/19/80	NEGLIGIBLE
?INDH	INDIR HIER REG	CODE A7	5/20/80	.05
?INV INDH	RESET IND HIER REG INV	CODE A7	5/20/80	.25
?RCLH	RECALL HIER REG	CODE A8	5/20/80	.42
?STOH	STORE HIER REG	CODE A9	5/20/80	.37

MEMORY

17.6	SWAP DISP-AUX	<=>	5/14/80	NEGLIGIBLE
17.9	INCREMENT REG	OP A-Z	5/14/80	1.1
17.10	DECREMENT REG	INV OP A-Z	5/14/80	1.1
17.15	RECALL VAR	2ND DFN RCL V	5/19/80	11.4
17.20	STORE	STO	5/14/80	NEGLIGIBLE
17.21	CLR MEMORIES	2ND CMS	5/14/80	5.63 SEC + 1SEC/6 REG

17.22	CLR PROGRAM	INV 2ND CMS	5/14/80	6.7
17.23	RECALL	RCL	5/14/80	NEGLIGIBLE
17.25	STORE +	STO +	5/14/80	NEGLIGIBLE
17.26	STORE -	STO -	5/14/80	< .5
17.27	STORE X	STO X	5/14/80	< .5
17.28	STORE /	STO /	5/14/80	< .5
17.29	EXCHANGE	2ND EXC	5/14/80	.75
17.99	CLEAR ENTRY	CE/CLR	5/14/80	NEGLIGIBLE
17.100	CLR EQUATION	2ND CEQ	5/14/80	NEGLIGIBLE
17.101	GENERAL CLEAR	CE/CLR CE/CLR	5/14/80	NEGLIGIBLE
17.102	LST PGM MEMORY	2ND LST	5/20/80	.11/PGM STEP
17.104	LST REGISTERS	INV 2ND LST	5/20/80	.41/REGISTER
17.105	LST HIER CONT (HIER) INV2NDLST		5/20/80	.43/REGISTER
	MUST GET INTO HIER MODE FROM A PROGRAM			

PERIPHERALS

=====

17.13	PROGRAM	PGM MMNN	5/21/80	NEGLIGIBLE
17.108	PRINT DISPLAY	2ND PRT		
17.109	ADVANCE PAPER	INV 2ND PRT		
17.66	DOWNL CRAM/CROM	2ND READ	5/21/80	74.37SEC + .23SEC/STEP
17.67	WRITE TO CRAM	INV 2ND READ	5/21/80	25.59SEC + .327SEC/STEP

MISCELLANEOUS

=====

17.12	2ND FUNCTION	2ND	5/12/80	NEGLIGIBLE
17.30	INVERSE FUNCT	INV	5/12/80	NEGLIGIBLE
17.14	DEFINE	DFN	5/12/80	NEGLIGIBLE

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17.16	DEFINE OP	2ND DFN OP NN	5/12/80	SEE INDIVIDUAL OP
17.17	DEFINE INV OP	2NDDFNINVOP NN	5/12/80	SEE INDIVIDUAL OP
17.24	RECALL DATE	TIME DATE SWITCH	5/13/80	6.02
17.118	ON/TIME/PROMPT			
17.43	ALPHA STATE 1	ALPH	5/12/80	NEGLIGIBLE
17.44	ALPHA STATE 2	2ND ALPH	5/12/80	NEGLIGIBLE
17.113	ALPHA SHIFT	SHIFT KEY ALPH	5/12/80	NEGLIGIBLE
17.117	FORMAT ALPH #	ALPHA	5/12/80	.4
17.53	LEFT PAREN	(	5/12/80	NEGLIGIBLE
17.56	RIGHT PAREN	)	5/12/80	NEGLIGIBLE
17.106	NUMERALS	0-9	5/12/80	NEGLIGIBLE
17.107	DECIMAL PT	.	5/12/80	NEGLIGIBLE

DEFINE OP CODES

=====

18.2	OP DEFINITIONS	DFN OP 0	5/15/80	1.47
18.5	SET DEFAULTS	DFN OP 1	5/15/80	1.43
18.46	ERROR MESSAGE#	DFN OP 2	5/15/80	1.5
18.12	MEM PARTITION	DFN OP 3	5/15/80	7.8
18.14	DEFAULT PART.	DFN INV OP 3	5/20/80	6.83
18.16	ALL CUE PROMPT	DFN OP 4	5/15/80	3.38
18.19	YES/NO CUE	DFN OP 5	5/15/80	3.42
18.22	ENT/CONT CUE	DFN OP 6	5/15/80	3.33
18.25	CONT CUE	DFN OP 7	5/15/80	3.32
18.28	OCTAL MODE	DFN OP 8	5/15/80	6.6
18.31	RECALL ALPHA	DFN OP 9	5/15/80	2.0
18.31	RECALL ALPHA	DFN INV OP 9	5/15/80	1.87

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18.33	DECIMAL MODE	DFN OP 10	5/15/80	6.7
18.36	PRIMARY MODULE#	DFN OP 11	5/15/80	2.07
?? ??	ANGLE MODE:	DFN OP 12	5/15/80	5.55
18.39	ROUND DISPLAY	DFN OP 13	5/15/80	2.03
18.42	SAVE STATUS	DFN OP 14	5/15/80	2.03
18.44	EXCHANGE STATUS	DFN INV OP 14	5/15/80	2.08
18.156	->SHIFT ALPHA->	DFN OP 15	5/15/80	2.03
18.158	<-SHIFT ALPHA<-	DFN INV OP 15	5/15/80	1.8
18.49	HEX MODE	DFN OP 16	5/15/80	6.97
18.52	IMPLIED MULT	DFN OP 17	5/15/80	2.5
18.54	DEACTIVAT I.M.	DFN INV OP 17	5/15/80	9.66
18.56	D->R CONVERSION	DFN OP 18	5/15/80	4.0
18.58	R->D CONVERSION	DFN INV OP 18	5/15/80	4.05
18.60	R->G CONVERSION	DFN OP 19	5/15/80	4.0
18.62	G->R CONVERSION	DFN INV OP 19	5/15/80	4.05
18.64	G->D CONVERSION	DFN OP 20	5/15/80	4.0
18.66	D->G CONVERSION	DFN INV OP 20	5/15/80	4.2
18.154	SELF TEST 1	DFN OP 21	5/15/80	2.4
18.154	SELF TEST 2	DFN INV OP 21	5/15/80	2.6
18.83	CLR STATISTICS	DFN OP 22	5/15/80	2.5
18.86	INTERCEPT-SLOPE	DFN OP 23	5/15/80	2.6
18.96	CORRELAT. COEFF	DFN OP 24	5/15/80	2.55
18.99	Y = MX + B	DFN OP 25	5/15/80	2.55
18.101	X = (Y-B)/M	DFN INV OP 25	5/15/80	2.7
18.89	XBAR =	DFN OP 26	5/15/80	2.65
?? ??	STD ERR MEAN	DFN INV OP 26	5/15/80	2.73
18.92	SAMPLE ST DEV	DFN OP 27	5/15/80	2.7

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18.94	POPUL ST DEV	DFN INV OP 27	5/15/80	2.8
17.68	ABSOLUTE VAL	DFN OP 28	5/15/80	2.7
17.69	SIGNUM FUNCT	DFN INV OP 28	5/15/80	2.8
18.111	SHOW FLAGS SET	DFN OP 29	5/15/80	2.75
18.79	24 HOUR TIME	DFN OP 30	5/15/80	9.23
18.81	12 HOUR TIME	DFN INV OP 30	5/15/80	9.3
18.68	PAUSE TIMING	DFN OP 31	5/15/80	3.3
18.70	DEFAULT PAUSE	DFN INV OP 31	5/15/80	2.9
18.103	LST PGM LABELS	DFN OP 32	5/15/80	3.0
??????	RD CASS MAIN	DFN OP 33	5/15/80	3.0
??????	WR CASS MAIN	DFN INV OP 33	5/15/80	3.25
18.141	RD CASS MOD	DFN OP 34	5/15/80	3.3
18.143	WR CASS MOD	DFN INV OP 34	5/15/80	3.2
18.146	RD CASS PGM STEPS	DFN OP 35	5/15/80	3.2
18.148	WR CASS PGM STEPS	DFN INV OP 35	5/15/80	3.25
18.151	RD CASS REGISTERS	DFN OP 36	5/15/80	3.15
18.153	WR CASS REGISTERS	DFN INV OP 36	5/15/80	3.37
18.118	DISP->PGM CNTR	DFN OP 37	5/15/80	3.4
18.120	PGM CNTR->DISP	DFN INV OP 37	5/15/80	3.35
18.122	DISP->PGM STEP	DFN OP 38	5/15/80	3.55
18.124	PGM STEP->DISP	DFN INV OP 38	5/15/80	3.8
18.126	PGM STEP<->DISP INC PC	DFN OP 39	5/15/80	5.7
18.128	PGM STEP<->DISP DEC PC	DFN INV OP 39	5/15/80	5.8
18.131	SOFT PARTITION	DFN OP 40	5/15/80	8.2
18.132	HARD PARTITION	DFN INV OP 40	5/15/80	8.4
18.114	UNNORMALIZED #	DFN OP 41	5/15/80	8.3
18.116	CANCEL UNNORM#	DFN INV OP 41	5/15/80	8.5
? . ???	I/O BUFFER->I/O	DFN OP 42	5/15/80	3.5

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? . ???	I/O->I/O BUFFER	DFN INV OP 42	5/15/80	3.65
?? . ???	SHOW 13 DIGITS	DFN OP 43	5/15/80	3.55
18.134	SET ALARM	DFN OP 44	5/15/80	6.35
18.136	RESET ALARM	DFN INV OP 44	5/15/80	6.3
18.138	PAU TIMING TONE	DFN OP 45	5/15/80	3.85
?? . ???	ERROR TONE	DFN OP 46	5/16/80	6.0
?? . ???	CUE TONE	DFN OP 47	5/16/80	8.7
?? . ???	NO CUE TONE	DFN INV OP 47	5/16/80	11.65
18.72	COPY CRAM	DFN OP 48	5/16/80	4.05
18.75	NAME CRAM	DFN OP 49	5/16/80	4.13
18.77	ERASE MODULE	DFN INV OP 49	5/16/80	4.1
18.106	ELIMINATE PC DISP	DFN OP 50	5/16/80	9.05
18.108	RESTORE PC DISP	DFN INV OP 50	5/16/80	9.05
18.160	INCREMENT REG	DFN OP A-Z	5/16/80	6.5 A - 7.05 Z
18.162	DECREMENT REG	DFN INVOP A-Z	5/16/80	6.6 A - 6.95 Z

UNDEFINED INVERSES -

\*\*\*\*\* ALL OF THESE WORK CORRECTLY ON DFN INV OP ## \*\*\*\*\*

FOR UNDEFINED INVERSES DFN INV OPS REQUIRE : 1.57 SEC TO 4.04 SEC

18.3	INV OP 0	5/16/80	1.23
18.6	INV OP 1	5/16/80	1.43
18.47	INV OP 2	5/16/80	1.57
18.17	INV OP 4	5/16/80	2.8
18.20	INV OP 5	5/16/80	2.83
18.23	INV OP 6	5/16/80	2.9
18.26	INV OP 7	5/16/80	2.87
18.29	INV OP 8	5/16/80	2.03



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18.34	INV OP 10		5/16/80	2.33
18.37	INV OP 11		5/16/80	2.43
?? ??	INV OP 12		5/16/80	2.6
18.40	INV OP 13		5/16/80	2.68
18.50	INV OP 16		5/16/80	3.27
18.84	INV OP 22		5/16/80	3.9
18.87	INV OP 23		5/16/80	3.97
18.97	INV OP 24		5/16/80	4.07
18.112	INV OP 29		5/16/80	4.27
18.104	INV OP 32		5/16/80	4.7
?? ??	INV OP 43		5/16/80	5.23
18.139	INV OP 45		5/16/80	5.47
18.73	INV OP 48		5/16/80	5.43

OP CODES

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18.1	OP DEFINITIONS	OP 0	5/9/80	8:35.3 MIN TOTAL
18.4	SET DEFAULTS	OP 1	5/8/80	7.1
18.45	ERROR MESSAGE#	OP 2	5/9/80	2.9
18.11	MEM PARTITION	OP 3	5/12/80	12.6
18.13	DEFAULT PART.	INV OP 3	5/12/80	15.0
18.15	ALL CUE PROMPT	OP 4	5/20/80	9.65
18.18	YES/NO CUE	OP 5	5/20/80	9.2
18.21	ENT/CONT CUE	OP 6	5/20/80	9.05
18.24	CONT CUE	OP 7	5/20/80	9.13
*18.27 **	OCTAL MODE	OP 8	5/14/80	BASE 10: 11.53-11.8 BASE 16: 16.67-17.67
18.30	RECALL ALPHA	OP 9	5/13/80	2.23
18.30	RECALL ALPHA	INV OP 9	5/13/80	2.2

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DEFINED	FUNCTION	KEYSTROKES	DATE	AVERAGE TIME
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*18.32 **	DECIMAL MODE	OP 10	5/14/80	BASE 8: 4.53-6.97 BASE 16: 5.67-7.37
18.35	PRIMARY MODULE#	OP 11	5/14/80	4.3
?? ??	ANGLE MODE: DEG	OP 12	5/13/80	5.45
18.38	ROUND DISPLAY	OP 13	5/13/80	3.02
18.41	SAVE STATUS	OP 14	5/14/80	8.25
18.43	EXCHANGE STATUS	INV OP 14	5/20/80	44.77
18.155	->SHIFT ALPHA->	OP 15	5/14/80	19.67
18.157	<-SHIFT ALPHA<-	INV OP 15	5/14/80	19.78
*18.48 **	HEX MODE	OP 16	5/14/80	BASE 8: 13.1-15.73 BASE 10: 11.03-11.1
*18.51 **	IMPLIED MULT	OP 17	5/7/80	<.55
*18.53 **	DEACTIVAT I. M.	INV OP 17	5/7/80	4.05
*18.55 **	D->R CONVERSION	OP 18	5/8/80	4.13
*18.57 **	R->D CONVERSION	INV OP 18	5/8/80	4.1
*18.59 **	R->G CONVERSION	OP 19	5/8/80	4.2
*18.61 **	G->R CONVERSION	INV OP 19	5/8/80	4.2
*18.63 **	G->D CONVERSION	OP 20	5/8/80	4.07
*18.65 **	D->G CONVERSION	INV OP 20	5/8/80	4.1
18.154	SELF TEST 1	OP 21	5/14/80	3.6
18.154	SELF TEST 2	INV OP 21	5/14/80 5/21/80	13.83 (FAIL) 1387.4 (PASS)
*18.82 **	CLR STATISTICS	OP 22	5/6/80	6.3
*18.85 **	INTERCEPT-SLOPE	OP 23	5/6/80	10.55
*18.95 **	CORRELAT. COEFF	OP 24	5/6/80	7.75
*18.98 **	Y = MX + B	OP 25	5/6/80	10.85
*18.100 **	X = (Y-B)/M	INV OP 25	5/6/80	10.9
*18.88 **	MEANS	OP 26	5/6/80	4.95
*?? ?? **	STD ERR MEAN	INV OP 26	5/8/80	8.03

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*18.91	** SAMPLE ST DEV	OP 27	5/6/80	9.05
*18.93	** POPUL ST DEV	INV OP 27	5/6/80	6.3
*17.68	** ABSOLUTE VAL	OP 28	5/7/80	4.5
*17.69	** SIGNUM FUNCT	INV OP 28	5/6/80	5.1
18.109	SHOW FLAGS SET	OP 29	5/14/80	8.0 SEC + 2.1/FLAG
18.78	24 HOUR TIME	OP 30	5/14/80	6.9
18.80	12 HOUR TIME	INV OP 30	5/14/80	7.23
18.67	PAUSE TIMING	OP 31	5/14/80	4.8
18.69	DEFAULT PAUSE	INV OP 31	5/14/80	8.5
18.102	LST PGM LABELS	OP 32		
??????	RD CASS/MAIN	OP 33		
??????	WR CASS/MAIN	INV OP 33		
18.140	RD CASS MOD	OP 34		
18.142	WR CASS MOD	INV OP 34		
18.145	RD CASS PGM STEPS	OP 35		
18.147	WR CASS PGM STEPS	INV OP 35		
18.149	RD CASS REGISTERS	OP 36		
18.152	WR CASS REGISTERS	INV OP 36		
18.117	DISP->PGM CNTR	OP 37	5/14/80	7.35
18.119	PGM CNTR->DISP	INV OP 37	5/14/80	5.25
18.121	DISP->PGM STEP	OP 38	5/14/80	8.0
18.123	PGM STEP->DISP	INV OP 38	5/14/80	7.1
18.125	PGM STEP<->DISP INC PC	OP 39	5/14/80	12.2
18.127	PGM STEP<->DISP DEC PC	INV OP39	5/14/80	11.8
18.129	SOFT PARTITION	OP 40	5/14/80	5.07
18.130	HARD PARTITION	INV OP 40	5/14/80	5.17
*18.113	** UNNORMALIZED #	OP 41	5/8/80	5.6

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*18.115 **	CANCEL UNNORM#	INV OP 41	5/6/80	5.6
??.	???	I/O BUFFER->I/O OP 42		
??.	???	I/O->I/O BUFFER INV OP 42		
??.	???	SHOW 13 DIGITS OP 43	5/14/80	9.37
18.133	SET ALARM	OP 44	5/14/80	25.6 (13.05 IF 0)
18.135	RESET ALARM	INV OP 44	5/14/80	10.57
18.138	PAU TIMING TONE	OP 45		
??.	???	ERROR TONE OP 46		
??.	???	CUE TONE OP 47		
18.71	COPY CRAM	OP 48		
18.74	NAME CRAM	OP 49	5/21/80	44.1
18.76	ERASE MODULE	INV OP 49	5/21/80	42.9
18.105	ELIMINATE PC DISP	OP 50	5/14/80	5.77
18.107	RESTORE PC DISP	INV OP 50	5/14/80	5.75
*18.159**	INCREMENT REG	OP A-Z	5/14/80	1.1
*18.161**	DECREMENT REG	INV OP A-Z	5/14/80	1.1

\*'S INDICATE OP CODES WHICH ARE ALSO LISTED UNDER OTHER CATEGORIES

289 FUNCTIONS TIMED TO DATE

## ALEX SPEED CHECKOUT

FUNCTION	KEYSTROKES	TIME (SEC) REQUIRED TI-88	TIME (SEC) REQUIRED TI-59
STATISTICAL FUNCTIONS =====			
NOTE: DO OP 10 TO MAKE SURE THE SIMULATOR IS IN DECIMAL MODE FOR STAT. FUNCT.			
<i>Oct. 20, 1980</i>			
SIGMA+	2ND SIGMA+	2.42	1.067
SIGMA-	INV 2ND SIGMA+	2.875	1.1
CLR STAT	OP 22	1.4	1.267
LIN REGR	OP 23	1.6	1.3
MEANS	OP 26	1.075	.667
STD ERR MEAN	INV OP 26	1.55	NA
SAM STD DEV	OP 27	1.7	1.3
POP STD DEV	INV OP 27	1.675	1.1
CORR COEF	OP 24	1.6	1.3
Y' =	OP 25	1.8	1.467
X' =	INV OP 25	1.8	1.5
"MATH" FUNCTIONS =====			
INVERSE	( ) -1	.052	.0493
SQ ROOT	2ND ROOT SIGN	.088	.0567
INT POWER	( ) N	.074	.061
LOG X	2ND LOG	.31775	.128
ANTILOG X	INV 2ND LOG	.3653	.1197
LN X	2ND LN	.27575	.104
E**X	INV 2ND LN	.29482	.1507
DIVISION	DIV SYMBOL	.0695	.0797
MULTIPLY	X	.0560	.064
17.83	SUBTRACTION	-	.0295
17.96	ADDITION	+	.027
17.97	COS	2ND COS	.633
17.98	ARCCOS	INV 2ND COS	.5467

Oct. 20, 1980

17.115	SIN	2ND SIN	.583	.395
17.116	ARCSIN	INV 2ND SIN	.5467	.2412
17.84	TAN	2ND TAN	.436	.2747
17.85	ARCTAN	INV 2ND TAN	.3906	.1487

NOTE: ALTHOUGH THE ACTUAL EXECUTION TIME OF AN INDIVIDUAL FUNCTION ON THE TI-88 MAY BE MORE THAN THE TI-59, THE OVERHEAD OF RUNNING A PROGRAM TO COMPUTE THAT FUNCTION ON THE TI-88 IS FROM 40-50 PERCENT LESS THAN THE TI-59. THIS DIFFERENCE IN OVERHEAD SPEED MEANS THAT COMPARABLE PROGRAMS ON THE TWO CALCULATORS RUN FASTER ON THE 88.

ONBOARD CROM FUNCTION SPEEDS

ALICE MYERS

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OP CODE	FUNCTION	TIME (SEC) JUNE 6, 1980	TIME (SEC) JAN 8, 1981
OP 57	DISPLAY TO I/O	.7	.4
OP 58	I/O TO DISPLAY	.7	.4
OP 09	RECALL ALPHA	.7	.6
OP 15	<-SHIFT<-	.7	.4
OP 66	PAU TIMING TONE	.7	.4
OP 14	->SHIFT->	.8	.5
OP 67	ERROR TONE	.9	.7
OP 68	NO ERROR TONE	.9	.7
OP 69	CUE TONE	.9	.7
OP 70	NO CUE TONE	.9	.7
	INVERSE FIX	.9	.8
	ERROR MESSAGE	.9 (3.2)	1.0
OP 13	ROUND DISPLAY	.9	.7
OP 10	ABS VAL	1.0	.4
OP 44	SOFT PARTITION	1.0	.6
OP 45	HARD PARTITION	1.0	.6
OP 77	ELIMINATE PC DISPLAY	1.0	.7
OP 78	RESTORE PC DISPLAY	1.0	.7
OP 36	MEANS	1.1	.8
OP 42	UNNORMALIZED #	1.1	.8
OP 43	CANCEL UNNORM #	1.1	.8
OP 65	RESET ALARM	1.1	.7
	FIX	1.1	1.0
OP 72	SHOW 13 DIGITS	1.1	.4
OP 18	IMPLIED MULT.	1.2	.7
OP 19	NO IMPLIED MULT.	1.2	.7

NOTE: TIMES IN PARENTHESES ARE THOSE RECORDED ON 11/4/1980 WHICH ARE SLOWER THAN THOSE RECORDED ON 6/6/1980.

OP 22	D->R CONVERSION	1.2	.8
OP 23	R->D CONVERSION	1.2	.8
OP 24	R->G CONVERSION	1.2	.8
OP 25	G->R CONVERSION	1.2	.8
OP 26	G->D CONVERSION	1.2	.8
OP 27	D->G CONVERSION	1.2	.8
OP 11	SIGNUM FUNCT	1.2	.7
	DEG	1.2	.7
OP 31	CLEAR STATISTICS	1.2	.8
OP 21	SELF TEST 1	1.3	NOT APPL.
OP 08	ERROR MESSAGE	1.3	1.0
OP 41	PRIMARY MODULE #	1.3	1.1
OP 33	CORRELATION COEFFICIENT	1.3	1.1
OP 37	STD ERROR MEAN	1.4	1.0
OP 62	PAUSE TIMING	1.4	1.0
OP 61	DEFAULT PAU TIMING	1.4	1.0
	DRG	1.4	.8
OP 32	INTERCEPT/SLOPE	1.4	1.0
OP 38	POPUL ST DEV	1.7	1.1
OP 46	DISP->PGM CTR	1.7	.7
OP 59	24 HOUR TIME	1.75	1.1
OP 34	Y=MX+B	1.8	1.1
OP 35	X=(Y-B)/M	1.8	1.2
OP 39	SAMPLE ST DEV	1.9	1.0
	DMS->DD	1.9 (2.4)	1.7
OP 01	SET DEFAULTS	1.9 (3.4)	2.1
OP 04	ALL CUE	1.9	.4
OP 12	ANGLE MODE	1.9	.8
OP 60	12 HOUR TIME	1.95	1.1
	DD->DMS	2.0 (4.3)	2.6
OP 17	DECIMAL MODE	2.0	.7



OP 05	YES/NO CUE	2.0	.4
OP 06	ENT/CONT CUE	2.0	.4
OP 07	CONT CUE	2.0	.4
OP 47	PGM STEP->DISPLAY	2.1	.4
	RECTANGULAR->POLAR	2.3	1.4
OP 48	DISP->PGM STEP	2.3	.4
OP 74	NAME CRAM (RENAME ONLY)	2.4	1.3
	DATE	2.5	1.2
	POLAR->RECTANGULAR	2.5	.9
	SIGMA+	2.7	1.5
	TIME	3.0	1.2
	SIGMA-	3.2	1.8
OP 20	SAVE STATUS	4.0	1.0
OP 03	PARTITION	5.0	2.9
OP 02	DEFAULT PARTITION	5.2	2.5
OP 73	ERASE MODULE	6.0	3.3*
OP 16	HEX MODE	6.1	.8
OP 21	EXCHANGE STATUS	9.5	1.2
OP 74	NAME CRAM (FIRST TIME)	14.0	4.4*
OP 75	COPY CRAM	31.2	16.1
OP 29	SELF TEST 2	394.0	66.0

\* TIME BEFORE THE FIRST PARTITION MESSAGE IS SHOWN.

NOTE: OPS 49-56, OP 64, OP 30 AND OP 21 ARE INTERACTIVE OR HAVE MULTILINE MESSAGES AND WERE NOT TIMED.

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TIMES FOR FUNCTIONS THAT VARY IN LENGTH  
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FACTORIAL (SMALLEST ARGUMENT)	1.95	1.1
FACTORIAL (LARGEST ARGUMENT)	10.7	10.0
LIST REGISTERS	15.9/26 REGS OR .7 PER REG	10.4/26 OR .4 PER REG
LIST HIER REGS	33.5/63 REGS OR .53 PER REG	23.7/63 OR .38/REG

OP 40 LIST PGM LABELS

<1SEC/LBL  
+ START

SAME

OP 71 SHOW FLAGS SET

3. 5+. 57/FLAG

2. 5+. 55/FLAG

READ

10/16 STEPS  
111/592 STEPS

6. 5/10  
25. 5/592

WRITE (NO CHANGE CATALOGUE)  
(NO CHANGE CATALOGUE)

11. 5/16 STEPS  
120/900 STEPS

7. 2/16  
35. 3/900

WRITE (CHANGE CATALOGUE)  
(CHANGE CATALOGUE)

48. 2/16 STEPS  
157/900 STEPS

17. 8/16  
46/900

CLEAR REGISTERS

7. 21+. 085/REG

1. 7

CLEAR PGM

6+. 0034/STEP

1. 5

TI-88 SPEED COMPARISONS

<u>TEST PROGRAM</u>	<u>TI-59</u>	<u>TI-88 PRIOR TO JAN. 1981</u>	<u>TI-88 AFTER JAN. 1981</u>	<u>HP-41C</u>
1. UPLOAD 1000 PROGRAM STEPS		77.4 SEC	49.2 SEC	
2. EXECUTE 100 + KEYS	5.2 SEC ( 1/X )	4.2 SEC	2.3 SEC	3.2 SEC
3. LBL A 1 + GTL A	145.6MS	94.3MS	50.9MS	56.5MS
4. HP ARTICLE: PV FOR A BOND	38.5SEC	37 SEC	24.6 SEC	37 SEC
5. LBL A 1 SUM 40 GTO 0002 (HIER)		141.8MS	102.7MS	
6. 69 !		14.7 SEC	10.1 SEC	
7. UPLOAD 100 PROGRAM STEPS 1ST TIME		35 SEC	21.7 SEC	
8. DOWNLOAD 1000 PROGRAM STEPS			108 SEC	

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