

CARD #	LOC	CODE	CARD				
3			666666	555555	333333	000000	
4			6	5	3	0	0
5			6	5	3	0	0
6			666666	555555	333333	0	0
7			6 6	5	3	0	0
8			6 6	5	3	0	0
9			666666	555555	333333	000000	
10							
11							
12							
13				000000	000000	333333	
14				0 0	0 0		3
15			-----	0 0	0 0		3
16			-----	0 0	0 0	333333	
17			-----	0 0	0 0		3
18				0 0	0 0		3
19				000000	000000	333333	
20							
21							
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25							
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6530-003 IS AN AUDIO CASSETT TAPE  
RECORDER EXTENSION OF THE BASIC  
KIM MONITOR

IT FEATURES TWO BASIC ROUTINES  
LOADT-LOAD MEM FROM AUDIO TAPE  
DUMPT-STOR MEM ONTO AUDIO TAPE

LOADT  
ID=00 IGNORE ID  
ID=FF IGN. ID USE SA FOR START ADDR  
ID=01-FE IGN.ID USE ADDR ON TAPE

DUMPT  
ID=00 SHOULD NOT BE USED  
ID=FF SHOULD NOT BE USED  
ID=01-FE NORMAL ID RANGE  
SAL LSB STARTING ADDRESS  
SAH MSB  
EAL LSB ENDING ADDRESS  
EAH MSB

CARD #	LOC	CODE	CARD
54			;
55			;
56			EQUATES
57			;
58			SET UP FOR 6530-002 I/O
59			;
58		SAD	=\$1740 6530 A DATA
59		PAOD	=\$1741 6530 A DATA DIRECTION
60		SBD	=\$1742 6530 B DATA
61		PBDD	=\$1743 6530 B DATA DIRECTION
62		CLK1T	=\$1744 DIV BY 1 TIME
63		CLK8T	=\$1745 DIV BY 8 TIME
64		CLK64T	=\$1746 DIV BY 64 TIME
65		CLKKT	=\$1747 DIV BY 1024 TIME
66		CLKRDI	=\$1747 READ TIME OUT BIT
67		CLKROD	=\$1746 READ TIME
68			;
69	0000		◆=\$00EF
70			;
71			MPU REG. SAVX AREA IN PAGE 0
72	00EF	PCL	◆◆◆+1 PROGRAM CNT LOW
73	00F0	PCH	◆◆◆+1 PROGRAM CNT HI
74	00F1	PREG	◆◆◆+1 CURRENT STATUS REG.
75	00F2	SPUSER	◆◆◆+1 CURRENT STACK POINT
76	00F3	ACC	◆◆◆+1 ACCUMULATOR
77	00F4	XREG	◆◆◆+1 X INDEX
78	00F5	YREG	◆◆◆+1 Y INDEX
79			;
80			;
81			KIM FIXED AREA IN PAGE 0
82	00F6	CHKHI	◆◆◆+1
83	00F7	CHKSUM	◆◆◆+1
84	00F8	INL	◆◆◆+1 INPUT BUFFER
85	00F9	INH	◆◆◆+1 INPUT BUFFER
86	00FA	POINTL	◆◆◆+1 LSB OF OPEN CELL
87	00FB	POINTH	◆◆◆+1 MSB OF OPEN CELL
88	00FC	TEMP	◆◆◆+1
89	00FD	TMPX	◆◆◆+1
90	00FE	CHAR	◆◆◆+1
91	00FF	MODE	◆◆◆+1
92			;
93			;
94			KIM FIXED AREA IN PAGE 23
95	0100		◆=\$17E7
96	17E7	CHKL	◆◆◆+1
97	17E8	CHKH	◆◆◆+1
98	17E9	SAVX	◆◆◆+3
99	17EC	VEB	◆◆◆+6
100	17F2	CNTL30	◆◆◆+1
101	17F3	CNTH30	◆◆◆+1
102	17F4	TIMH	◆◆◆+1
103	17F5	SAL	◆◆◆+1
104	17F6	SAH	◆◆◆+1
105	17F7	EAL	◆◆◆+1

CARD #	LOC	CODE	CARD	
106	17F8		EAH	◆◆◆+1
				HI ENDING ADDRESS
107	17F9		ID	◆◆◆+1
108			;	
109			;	INTERRUPT VECTORS
110			;	
111	17FA		NMIV	◆◆◆+2
				STOP VECTOR (STOP=1000)
112	17FC		RSTV	◆◆◆+2
				RST VECTOR
113	17FE		IRQV	◆◆◆+2
				IRQ VECTOR (BRK= 1000)
114			;	

CARD #	LOC	CODE	CARD		
116	1800			◆=\$1800	
117				;	
118				;	INIT VOLATILE EXECUTION BLOCK
119				;	DUMP MEM TO TAPE
120				;	
121	1800	A9 AD	DUMPT	LDA #SAD	LOAD ABSOLUTE INST
122	1802	8D EC 17		STA VEB	
123	1805	20 32 19		JSR INTVEB	
124				;	
125	1808	A9 27		LDA #S27	TURN OFF DATAIN PB5
126	180A	8D 42 17		STA SBD	
127	180D	A9 BF		LDA #SBF	CONVERT PB7 TO OUTPUT
128	180F	8D 43 17		STA PBDD	
129				;	
130	1812	A2 64		LDX #S64	100 CHARS
131	1814	A9 16	DUMPT1	LDA #S16	SYN CHAR'S
132	1816	20 7A 19		JSR OUTCHT	
133	1819	CA		DEX	
134	181A	D0 F8		BNE DUMPT1	
135				;	
136				;	
137	181C	A9 2A		LDA #/◆	START CHAR
138	181E	20 7A 19		JSR OUTCHT	
139				;	
140	1821	AD F9 17		LDA ID	OUTPUT ID
141	1824	20 61 19		JSR OUTBT	
142				;	
143	1827	AD F5 17		LDA SAL	OUTPUT STARTING
144	182A	20 5E 19		JSR OUTBTC	ADDRESS
145	182D	AD F6 17		LDA SAH	
146	1830	20 5E 19		JSR OUTBTC	
147				;	
148	1833	AD ED 17	DUMPT2	LDA VEB+1	CHECK FOR LAST
149	1836	CD F7 17		CMP EAL	DATA BYTE
150	1839	AD EE 17		LDA VEB+2	
151	183C	ED F8 17		SBC EAH	
152	183F	90 24		BCC DUMPT4	
153				;	
154	1841	A9 2F		LDA #//	OUTPUT END OF DATA CHR
155	1843	20 7A 19		JSR OUTCHT	
156	1846	AD E7 17		LDA CHKL	LAST BYTE HAS BEEN
157	1849	20 61 19		JSR OUTBT	OUT PUT NOW OUTPUT
158	184C	AD E8 17		LDA CHKH	CHKSUM
159	184F	20 61 19		JSR OUTBT	
160				;	
161				;	
162	1852	A2 02		LDX #S02	2 CHAR'S
163	1854	A9 04	DUMPT3	LDA #S04	EOT CHAR
164	1856	20 7A 19		JSR OUTCHT	
165	1859	CA		DEX	
166	185A	D0 F8		BNE DUMPT3	
167				;	

CARD #	LOC	CODE	CARD		
168	185C	A9 00	LDA	#\$00	DISPLAY 0000
169	185E	85 FA	STA	POINTL	FOR NORMAL EXIT
170	1860	85 FB	STA	POINTH	
171	1862	4C 4F 1C	JMP	START	
172			:		
173	1865	20 EC 17	DUMPT4 JSR	VEB	DATA BYTE OUTPUT
174	1868	20 5E 19	JSR	OUTBTC	
175			:		
176	186B	20 EA 19	JSR	INCVEB	
177	186E	4C 33 18	JMP	DUMPT2	
178			:		
179			:	LOAD MEMORY FROM TAPE	
180			:		
181			:		
182	1871	0F 19	TAB .WORD	LOAD12	
183	1873	A9 8D	LOADT LDA	#\$8D	INIT VOLATILE EXECUTION
184	1875	8D EC 17	STA	VEB	BLOCK WITH STA ABS.
185	1878	20 32 19	JSR	INTVEB	
186			:		
187	187B	A9 4C	LDA	#\$4C	JUMP TYPE RTRN
188	187D	8D EF 17	STA	VEB+3	
189	1880	AD 71 18	LDA	TAB	
190	1883	8D F0 17	STA	VEB+4	
191	1886	AD 72 18	LDA	TAB+1	
192	1889	8D F1 17	STA	VEB+5	
193			:		
194	188C	A9 07	LDA	#\$07	RESET PB5=0 (DATA IN)
195	188E	8D 42 17	STA	SBD	
196			:		
197	1891	A9 FF	SYNC LDA	#\$FF	CLEAR SAVX FOR SYNC AREA
198	1893	8D E9 17	STA	SAVX	
199			:		
200	1896	20 41 1A	SYNC1 JSR	RDBIT	GET A BIT
201	1899	4E E9 17	LSR	SAVX	SHIFT BIT INTO CHAR
202	189C	0D E9 17	ORA	SAVX	
203	189F	8D E9 17	STA	SAVX	
204	18A2	AD E9 17	LDA	SAVX	GET NEW CHAR
205	18A5	C9 16	CMP	#\$16	SYN CHAR
206	18A7	D0 ED	BNE	SYNC1	
207			:		
208	18A9	A2 0A	LDX	#\$0A	TEST FOR 10 SYN CHARS
209	18AB	20 24 1A	SYNC2 JSR	RDCHT	
210	18AE	C9 16	CMP	#\$16	
211	18B0	D0 DF	BNE	SYNC	IF NOT 10 CHAR RE-SYNC
212	18B2	CA	DEX		
213	18B3	D0 F6	BNE	SYNC2	
214			:		
215			:		
216	18B5	20 24 1A	LOADT4 JSR	RDCHT	LOOK FOR START OF
217	18B8	C9 2A	CMP	* *	DATA CHAR
218	18BA	F0 06	BEQ	LOAD11	
219	18BC	C9 16	CMP	#\$16	IF NOT * SHOULD BE SYN

CARD #	LOC	CODE	CARD			
220	18BE	D0 D1		BNE	SYNC	
221	18C0	F0 F3		BEQ	LOADT4	
222						
223	18C2	20 F3 19	LOAD11	JSR	RDBYT	READ ID FROM TAPE
224	18C5	CD F9 17		CMP	ID	COMPARE WITH REQUESTED ID
225	18C8	F0 0D		BEQ	LOADT5	
226	18CA	AD F9 17		LDA	ID	DEFAULT 00 READ RECORD
227	18CD	C9 00		CMP	#\$00	ANYWAY
228	18CF	F0 06		BEQ	LOADT5	
229	18D1	C9 FF		CMP	#\$FF	DEFAULT FF IGNOR SA ON
230	18D3	F0 17		BEQ	LOADT6	TAPE
231	18D5	D0 9C		BNE	LOADT	
232						
233	18D7	20 F3 19	LOADT5	JSR	RDBYT	GET SA FROM TAPE
234	18DA	20 4C 19		JSR	CHKT	
235	18DD	8D ED 17		STA	VEB+1	SAVX IN VEB+1,2
236	18E0	20 F3 19		JSR	RDBYT	
237	18E3	20 4C 19		JSR	CHKT	
238	18E6	8D EE 17		STA	VEB+2	
239	18E9	4C F8 18		JMP	LOADT7	
240						
241	18EC	20 F3 19	LOADT6	JSR	RDBYT	GET SA BUT IGNORE
242	18EF	20 4C 19		JSR	CHKT	
243	18F2	20 F3 19		JSR	RDBYT	
244	18F5	20 4C 19		JSR	CHKT	
245						
246						
247	18F8	A2 02	LOADT7	LDX	#\$02	GET 2 CHARS
248	18FA	20 24 1A	LOAD13	JSR	RDCHT	GET CHAR(X)
249	18FD	C9 2F		CMP	#\$/	LOOK FOR LAST CHAR
250	18FF	F0 14		BEQ	LOADT8	
251	1901	20 00 1A		JSR	PACKT	CONVERT TO HEX
252	1904	D0 23		BNE	LOADT9	Y=1 NON-HEX CHAR
253	1906	CA		DEX		
254	1907	D0 F1		BNE	LOAD13	
255						
256	1909	20 4C 19		JSR	CHKT	COMPUTE CHECKSUM
257	190C	4C EC 17		JMP	VEB	SAVX DATA IN MEMORY
258	190F	20 6A 19	LOAD12	JSR	INCVEB	INCREMENT DATA POINTER
259	1912	4C F8 18		JMP	LOADT7	
260						
261	1915	20 F3 19	LOADT8	JSR	RDBYT	END OF DATA COMPARE CHKSUM
262	1918	CD E7 17		CMP	CHKL	
263	191B	D0 0C		BNE	LOADT9	
264	191D	20 F3 19		JSR	RDBYT	
265	1920	CD E8 17		CMP	CHKH	
266	1923	D0 04		BNE	LOADT9	
267	1925	A9 00		LDA	#\$00	NORMAL EXIT
268	1927	F0 02		BEQ	LOAD10	
269						
270	1929	A9 FF	LOADT9	LDA	#\$FF	ERROR EXIT
271	192B	85 FA	LOAD10	STA	POINTL	

CARD #	LOC	CODE	CARD	STA	POINTH
272	192D	85 FB			
273	192F	4C 4F 1C		JMP	START
274					

CARD #	LOC	CODE	CARD
276			;
277			;
278			;
279			;
280			;
281	1932	AD F5 17	INTVEB LDA SAL
282	1935	8D ED 17	STA VEB+1
283	1938	AD F6 17	LDA SAH
284	193B	8D EE 17	STA VEB+2
285	193E	A9 60	LDA #\$60 RTS INST
286	1940	8D EF 17	STA VEB+3
287	1943	A9 00	LDA #\$00 CLEAR CHKSUM AREA
288	1945	8D E7 17	STA CHKL
289	1948	8D E8 17	STA CHKH
290	194B	60	RTS
291			;
292			;
293			;
294			;
295	194C	A8	CHKT TAY
296	194D	18	CLC
297	194E	6D E7 17	ADC CHKL
298	1951	8D E7 17	STA CHKL
299	1954	AD E8 17	LDA CHKH
300	1957	69 00	ADC #\$00
301	1959	8D E8 17	STA CHKH
302	195C	98	TYA
303	195D	60	RTS
304			;
305			;
306			;
307			;
308	195E	20 4C 19	OUTBTC JSR CHKT COMP CHKSUM
309	1961	A8	OUTBT TAY SAVX DATA BYTE
310	1962	4A	LSR A SHIFT OFF LSD
311	1963	4A	LSR A
312	1964	4A	LSR A
313	1965	4A	LSR A
314	1966	20 6F 19	JSR HEXOUT OUT PUT MSD
315	1969	98	TYA
316	196A	20 6F 19	JSR HEXOUT OUT PUT LSD
317	196D	98	TYA
318	196E	60	RTS
319			;
320			;
321			;
322			;
323	196F	29 0F	HEXOUT AND #\$0F
324	1971	C9 0A	CMP #\$0A
325	1973	18	CLC
326	1974	30 02	BMI HEX1
327	1976	69 07	ADC #\$07



CARD #	LOC	CODE	CARD			
328	1979	69 30	HEX1	ADC	#B30	
329						
330						OUTPUT TO TAPE ONE ASCII
331						CHAR USE SUB'S ONE + ZRO
332						
333	197A	8E E9 17	OUTCHT	STX	SAVX	
334	197D	8C EA 17		STY	SAVX+1	
335	1980	A0 08		LDY	#B08	START BIT
336	1982	20 9E 19	CHT1	JSR	ONE	
337	1985	4A		LSR	A	GET DATA BIT
338	1986	B0 06		BCS	CHT2	
339	1988	20 9E 19		JSR	ONE	DATA BIT=1
340	198B	4C 91 19		JMP	CHT3	
341	198E	20 C4 19	CHT2	JSR	ZRO	DATA BIT=0
342	1991	20 C4 19	CHT3	JSR	ZRO	
343	1994	88		DEY		
344	1995	D0 EB		BNE	CHT1	
345	1997	AE E9 17		LDX	SAVX	
346	199A	AC EA 17		LDY	SAVX+1	
347	199D	60		RTS		
348						
349						
350						OUTPUT 1 TO TAPE
351						9 PULSES 138 MICROSEC EACH
352						
353	199E	A2 09	ONE	LDX	#B09	
354	19A0	48		PHA		SAVX A
355	19A1	2C 47 17	ONE1	BIT	CLKRDI	WAIT FOR TIME OUT
356	19A4	10 FB		BPL	ONE1	
357	19A6	A9 7E		LDA	#126	
358	19A8	8D 44 17		STA	CLK1T	
359	19AB	A9 A7		LDA	#BA7	
360	19AD	8D 42 17		STA	SBD	SET PB7=1
361	19B0	2C 47 17	ONE2	BIT	CLKRDI	
362	19B3	10 FB		BPL	ONE2	
363	19B5	A9 7E		LDA	#126	
364	19B7	8D 44 17		STA	CLK1T	
365	19BA	A9 27		LDA	#B27	
366	19BC	8D 42 17		STA	SBD	RESET PB7=0
367	19BF	CA		DEX		
368	19C0	D0 DF		BNE	ONE1	
369	19C2	68		PLA		
370	19C3	60		RTS		
371						
372						
373						OUTPUT 0 TO TAPE
374						6 PULSES 207 MICROSEC EACH
375						
376	19C4	A2 06	ZRO	LDX	#B06	
377	19C6	48		PHA		SAVX A
378	19C7	2C 47 17	ZRO1	BIT	CLKRDI	
379	19CA	10 FB		BPL	ZRO1	

CARD #	LDC	CODE	CARD		
380	190C	A9 03	LDA	#195	
381	190E	8D 44 17	STA	CLK1T	
382	19D1	A9 A7	LDA	#\$A7	
383	19D3	8D 42 17	STA	SBD	SET PB7=1
384	19D6	2C 47 17	ZR02	BIT	CLKRDI
385	19D9	10 FB	BPL	ZR02	
386	19DB	A9 03	LDA	#195	
387	19DD	8D 44 17	STA	CLK1T	
388	19E0	A9 27	LDA	#\$27	
389	19E2	8D 42 17	STA	SBD	RESET PB7=0
390	19E5	CA	DEX		
391	19E6	D0 DF	BNE	ZR01	
392	19E8	68	PLA		RESTORE A
393	19E9	60	RTS		
394			:		
395			:	SUB TO INC WEB+1,2	
396			:		
397	19EA	EE ED 17	INCWEB	INC	WEB+1
398	19ED	D0 03	BNE	INCVE1	
399	19EF	EE EE 17		INC	WEB+2
400	19F2	60	INCVE1	RTS	
401			:		
402			:	SUB TO READ BYTE FROM TAPE	
403			:		
404	19F3	20 24 1A	RDBYT	JSR	RDCHT
405	19F6	20 00 1A		JSR	PACKT
406	19F9	20 24 1A	RDBYT2	JSR	RDCHT
407	19FC	20 00 1A		JSR	PACKT
408	19FF	60		RTS	
409			:		
410			:	PACK A=ASCII INTO SAVX	
411			:	AS HEX DATA	
412			:		
413	1A00	C9 30	PACKT	CMP	#\$30
414	1A02	30 1E		BMI	PACKT3
415	1A04	C9 47		CMP	#\$47
416	1A06	10 1A		BPL	PACKT3
417	1A08	C9 40		CMP	#\$40
418	1A0A	30 03		BMI	PACKT1
419	1A0C	18		CLC	
420	1A0D	69 09		ADC	#\$09
421	1A0F	2A	PACKT1	ROL	A
422	1A10	2A		ROL	A
423	1A11	2A		ROL	A
424	1A12	2A		ROL	A
425	1A13	A0 04		LDY	#\$04
426	1A15	2A	PACKT2	ROL	A
427	1A16	2E E9 17		ROL	SAVX
428	1A19	88		DEY	
429	1A1A	D0 F9		BNE	PACKT2
430	1A1C	AD E9 17		LDA	SAVX
431	1A1F	A0 00		LDY	#\$00

Y=0 VALID HEX CHAR

CARD #	LOC	CODE	CARD		
432	1A21	60		RTS	Y=0 VALID HEX
433	1A22	C8	PACKT3	INY	Y=1 NOT HEX
434	1A23	60		RTS	
435				:	
436				:	GET 1 CHAR FROM TAPE AND RETURN
437				:	WITH CHAR IN A USE SAVX+1 TO ASM CHAR
438				:	
439	1A24	9E EB 17	RDCHT	STX SAVX+2	
440	1A27	A2 08		LDX #B08	READ 8 BITS
441	1A29	20 41 1A	RDCHT1	JSR RDBIT	GET NEXT DATA BIT
442	1A2C	4E EA 17		LSR SAVX+1	RIGHT SHIFT CHAR
443	1A2F	0D EA 17		ORA SAVX+1	OR IN SIGN BIT
444	1A32	9D EA 17		STA SAVX+1	REPLACE CHAR
445	1A35	CA		DEX	
446	1A36	D0 F1		BNE RDCHT1	
447				:	
448	1A38	AD EA 17		LDA SAVX+1	MOVE CHAR INTO A
449	1A3B	2A		ROL A	SHIFT OFF PARITY
450	1A3C	4A		LSR A	
451	1A3D	AE EB 17		LDX SAVX+2	
452	1A40	60		RTS	
453				:	
454				:	THIS SUB GETS ONE BIT FROM
455				:	TAPE AND RETURNS IT IN SIGN OF A
456				:	
457	1A41	2C 42 17	RDBIT	BIT SBD	WAIT FOR END OF START BIT
458	1A44	10 FB		BPL RDBIT	
459	1A46	AD 46 17		LDA CLKRDT	GET START BIT TIME
460	1A49	A0 FF		LDY #BFF	A=256-T1
461	1A4B	8C 46 17		STY CLK64T	SET UP TIMER
462				:	
463	1A4E	A0 14		LDY #B14	
464	1A50	98	RDBIT3	DEY	DELAY 100 MICROSEC
465	1A51	D0 FD		BNE RDBIT3	
466				:	
467	1A53	2C 42 17	RDBIT2	BIT SBD	WAIT FOR NEXT START BIT
468	1A56	30 FB		BMI RDBIT2	
469				:	
470	1A58	38		SEC	
471	1A59	ED 46 17		SBC CLKRDT	$(256-T1) - (256-T2) = T2 - T1$
472	1A5C	A0 FF		LDY #BFF	
473	1A5E	8C 46 17		STY CLK64T	SET UP TIMER FOR NEXT BIT
474				:	
475	1A61	A0 07		LDY #B07	
476	1A63	88	RDBIT4	DEY	DELAY 50 MICROSEC
477	1A64	D0 FD		BNE RDBIT4	
478				:	
479	1A66	49 FF		EOR #BFF	COMPLEMENT SIGN OF A
480	1A68	29 80		AND #B80	MASK ALL EXCEPT SIGN
481	1A6A	60		RTS	

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CARD # LOC      CODE      CARD
483      ;
484      ;          DIAGNOSTICS
485      ;          MEMORY
486      ;          PLLCAL
487      ;
488      ;
489      ;
490      ;          PLLCAL OUTPUT 166 MICROSEC
491      ;          PULSE STRING
492      ;
493      1A6B  A9 27      PLLCAL LDA    #$27
494      1A6D  8D 42 17      STA    SBD          TURN OFF DATIN PB5=1
495      1A70  A9 BF          LDA    #$BF          CONVERT PB7 TO OUTPUT
496      1A72  8D 43 17      STA    PBDD
497      ;
498      1A75  2C 47 17      PLL1   BIT    CLRDI
499      1A78  10 FB          BPL    PLL1
500      1A7A  A9 9A          LDA    #154         WAIT 166 MICRO SEC
501      1A7C  8D 44 17      STA    CLK1T
502      1A7F  A9 A7          LDA    #$A7         OUTPUT PB7=1
503      1A81  8D 42 17      STA    SBD
504      ;
505      1A84  2C 47 17      PLL2   BIT    CLRDI
506      1A87  10 FB          BPL    PLL2
507      1A89  A9 9A          LDA    #154
508      1A8B  8D 44 17      STA    CLK1T
509      1A8E  A9 27          LDA    #$27         PB7=0
510      1A90  8D 42 17      STA    SBD
511      1A93  4C 75 1A      JMP    PLL1
512      ;
513      ;
514      ;          INTERRUPTS PAGE 27
515      ;
516      1A96      *+*+$0164  RESERVED FOR TEST
517      1BFA  6B 1A      NMIP27 .WORD PLLCAL
518      1BFC  6B 1A      RSTP27 .WORD PLLCAL
519      1BFE  6B 1A      IROP27 .WORD PLLCAL
520      ;

```

CARD #	LOC	CODE	CARD			
522						
523						
524						
525						
526			666666	555555	333333	000000
527			6	5	3	0 0
528			6	5	3	0 0
529			666666	555555	333333	0 0
530			6 6	5	3	0 0
531			6 6	5	3	0 0
532			666666	555555	333333	000000
533						
534						
535						
536				000000	000000	222222
537				0 0	0 0	2
538			-----	0 0	0 0	2
539			-----	0 0	0 0	222222
540			-----	0 0	0 0	2
541				0 0	0 0	2
542				000000	000000	222222
543						

CARD #	LOC	CODE	CARD
545			:
546			:
547			:
548			:
549			COPYRIGHT
550			MOS TECHNOLOGY INC.
551			DATE OCT 13 1975   REV E
552			:
553			KIM   :TTY INTERFACE
554			:KEYBOARD INTERFACE
555			:7 SEG 6 DIGIT DISPLAY
556			:
557			:
558			TTY CMDS:
559			G   GOEXEC
560			CR  OPEN NEXT CELL
561			LF  OPEN PREV. CELL
562			.   MODIFY OPEN CELL
563			SP  OPEN NEW CELL
564			L   LOAD (OBJECT FORMAT)
565			Q   DUMP FROM OPEN CELL ADDR TO HI LIMIT
566			RD  RUB OUT - RETURN TO START (KIM)
567			((ALL ILLEGAL CHAR ARE IGNORED))
568			:
569			:
570			KEYBOARD CMDS:
571			ADDR SETS MODE TO MODIFY CELL ADDRESS
572			DATA SETS MODE TO MODIFY DATA IN OPEN CELL
573			STEP INCREMENTS TO NEXT CELL
574			RST  SYSTEM RESET
575			RUN  GOEXEC
576			STOP \$1000 CAN BE LOADED INTO NMIV TO
577			USE STOP FEATURE
578			PC   DISPLAY PC
579			:
580			:
581			CLOCK IS NOT DISABLED IN SIGMA 1
582			:

CARD #	LOC	CODE	CARD			
584	1000			*=\$1000		
585				;		
586				;		
587	1000	85 F3	SAVE	STA	ACC	KIM ENTRY VIA STOP (NMI)
588	1002	68		PLA		OR BRK (IRQ)
589	1003	85 F1		STA	PREG	
590	1005	68	SAVE1	PLA		KIM ENTRY VIA JSR (A LOST)
591	1006	85 EF		STA	PCL	
592	1008	85 FA		STA	POINTL	
593	100A	68		PLA		
594	100B	85 F0		STA	PCH	
595	100D	85 FB		STA	POINTH	
596	100F	84 F5	SAVE2	STY	YREG	
597	1011	86 F4		STX	XREG	
598	1013	BA		TSX		
599	1014	86 F2		STX	SPUSER	
600	1016	20 88 1E		JSR	INITS	
601	1019	40 4F 10		JMP	START	
602				;		
603	1010	60 FA 17	NMIT	JMP	(NMIV)	NON-MASKABLE INTERRUPT TRAP
604	101F	60 FE 17	IRQT	JMP	(IRQV)	INTERRUPT TRAP
605				;		
606	1022	A2 FF	RST	LDX	#\$FF	KIM ENTRY VIA RST
607	1024	9A		TXS		
608	1025	86 F2		STX	SPUSER	
609	1027	20 88 1E		JSR	INITS	
610				;		
611				;		
612	102A	A9 FF	DETCPS	LDA	#\$FF	COUNT START BIT
613	102C	8D F3 17		STA	CNTH30	ZERO CNTH30
614	102F	A9 01		LDA	#\$01	MASK HI ORDER BITS
615	1031	2C 40 17	DET1	BIT	SAD	TEST
616	1034	D0 19		BNE	START	KEYBD SSM TEST
617	1036	30 F9		BMI	DET1	START BIT TEST
618	1038	A9 FC		LDA	#\$FC	
619	103A	18	DET3	CLC		THIS LOOP COUNTS
620	103B	69 01		ADC	#\$01	THE START BIT TIME
621	103D	90 03		BCC	DET2	
622	103F	EE F3 17		INC	CNTH30	
623	1042	AC 40 17	DET2	LDY	SAD	CHECK FOR END OF START BIT
624	1045	10 F3		BPL	DET3	
625	1047	8D F2 17		STA	CNTL30	
626	104A	A2 09		LDX	#\$08	
627	104C	20 6A 1E		JSR	GETS	GET REST OF THE CHAR
628				;		TEST CHAR HERE
629				;		
630				;		
631				;		
632				;		
633				;		
634				;		
635				;		MAKE TTY/KB SELECTION

CARD #	LOC	CODE	CARD			
636	104F	20 8C 1E	START	JSR	INIT1	
637	1052	A9 01		LDA	#\$01	
638	1054	2C 40 17		BIT	SAD	
639	1057	D0 1E		BNE	TTYKB	
640	1059	20 2F 1E		JSR	CRLF	PRT CR LF
641	105C	A2 0A		LDX	#\$0A	TYPE OUT KIM
642	105E	20 31 1E		JSR	PRTST	
643	1061	4C AF 1D		JMP	SHOW1	
644						
645	1064	A9 00	CLEAR	LDA	#\$00	
646	1066	85 F8		STA	INL	CLEAR INPUT BUFFER
647	1068	85 F9		STA	INH	
648	106A	20 5A 1E	READ	JSR	GETCH	GET CHAR
649	106D	C9 01		CMP	#\$01	
650	106F	F0 06		BEQ	TTYKB	
651	1071	20 AC 1F		JSR	PACK	
652	1074	4C DB 1D		JMP	SCAN	
653						
654						
655						
656						
657	1077	20 19 1F	TTYKB	JSR	SCAND	IF A=0 NO KEY
658	107A	D0 D3		BNE	START	
659	107C	A9 01	TTYKB1	LDA	#\$01	
660	107E	2C 40 17		BIT	SAD	
661	1081	F0 CC		BEQ	START	
662	1083	20 19 1F		JSR	SCAND	
663	1086	F0 F4		BEQ	TTYKB1	
664	1088	20 19 1F		JSR	SCAND	
665	108B	F0 EF		BEQ	TTYKB1	
666						
667	108D	20 6A 1F	GETK	JSR	GETKEY	
668	1090	C9 15		CMP	#\$15	
669	1092	10 BB		BPL	START	
670	1094	C9 14		CMP	#\$14	
671	1096	F0 44		BEQ	PCCMD	DISPLAY PC
672	1098	C9 10		CMP	#\$10	ADDR MODE=1
673	109A	F0 2C		BEQ	ADDRM	
674	109C	C9 11		CMP	#\$11	DATA MODE=1
675	109E	F0 2C		BEQ	DATAM	
676	10A0	C9 12		CMP	#\$12	STEP
677	10A2	F0 2F		BEQ	STEP	
678	10A4	C9 13		CMP	#\$13	RUN
679	10A6	F0 31		BEQ	GOV	
680	10A8	0A	DATA	ASL	A	SHIFT CHAR INTO HIGH
681	10A9	0A		ASL	A	ORDER NIBBLE
682	10AA	0A		ASL	A	
683	10AB	0A		ASL	A	
684	10AC	85 FC		STA	TEMP	STORE IN TEMP
685	10AE	A2 04		LDX	#\$04	
686	10B0	A4 FF	DATA1	LDY	MODE	TEST MODE 1=ADDR
687	10B2	D0 0A		BNE	ADDR	MODE=0 DATA



CARD #	LOC	CODE	CARD			
688	1CB4	B1 FA	LDA	(POINTL),Y	GET DATA	
689	1CB6	06 FC	ASL	TEMP	SHIFT CHAR	
690	1CB8	2A	ROL	A	SHIFT DATA	
691	1CB9	91 FA	STA	(POINTL),Y	STORE OUT DATA	
692	1CBB	4C C3 1C	JMP	DATA2		
693			:			
694	1CBE	0A	ADDR ASL	A	SHIFT CHAR	
695	1CBF	26 FA	ROL	POINTL	SHIFT ADDR	
696	1CC1	26 FB	ROL	POINTH	SHIFT ADDR HI	
697	1CC3	CA	DATA2 DEX			
698	1CC4	D0 EA	BNE	DATA1	DO 4 TIMES	
699	1CC6	F0 08	BEQ	DATAM2	EXIT HERE	
700			:			
701	1CC8	A9 01	ADDRM LDA	#\$01		
702	1CCA	D0 02	BNE	DATAM1		
703			:			
704	1CCC	A9 00	DATAM LDA	#\$00		
705	1CCE	85 FF	DATAM1 STA	MODE		
706	1CD0	4C 4F 1C	DATAM2 JMP	START		
707			:			
708	1CD3	20 63 1F	STEP JSR	INCPT		
709	1CD6	4C 4F 1C	JMP	START		
710			:			
711	1CD9	4C C8 1D	GOV JMP	GOEXEC		
712			:			
713			:			
714			:	DISPLAY PC BY MOVING		
715			:	PC TO POINT		
716			:			
717	1CDC	A5 EF	PCCMD LDA	PCL		
718	1CDE	85 FA	STA	POINTL		
719	1CE0	A5 F0	LDA	PCH		
720	1CE2	85 FB	STA	POINTH		
721	1CE4	4C 4F 1C	JMP	START		
722			:			
723			:	LOAD PAPER TAPE FROM TTY		
724			:			
725	1CE7	20 5A 1E	LOAD JSR	GETCH	LOOK FOR FIRST CHAR	
726	1CEA	09 3B	CMP	#\$3B	SMICOLON	
727	1CEC	D0 F9	BNE	LOAD		
728	1CEE	A9 00	LOADS LDA	#\$00		
729	1CF0	85 F7	STA	CHKSUM		
730	1CF2	85 F6	STA	CHKHI		
731			:			
732	1CF4	20 9D 1F	JSR	GETBYT	GET BYTE CNT	
733	1CF7	AA	TAX		SAVE IN X INDEX	
734	1CF8	20 91 1F	JSR	CHK	COMPUTE CHKSUM	
735			:			
736	1CFB	20 9D 1F	JSR	GETBYT	GET ADDRESS HI	
737	1CFE	85 FB	STA	POINTH		
738	1D00	20 91 1F	JSR	CHK		
739	1D03	20 9D 1F	JSR	GETBYT	GET ADDRESS LO	

CARD #	LOC	CODE	CARD			
740	1D06	85 FA		STA	POINTL	
741	1D08	20 91 1F		JSR	CHK	
742						
743	1D0B	8A		TXA		IF CNT=0 DONT
744	1D0C	F0 0F		BEO	LOAD3	GET ANY DATA
745						
746	1D0E	20 9D 1F	LOAD2	JSR	GETBYT	GET DATA
747	1D11	91 FA		STA	(POINTL),Y	STORE DATA
748	1D13	20 91 1F		JSR	CHK	
749	1D16	20 63 1F		JSR	INCPT	NEXT ADDRESS
750	1D19	CA		DEX		
751	1D1A	D0 F2		BNE	LOAD2	
752	1D1C	E8		INX		X=1 DATA RECORD
753						X=0 LAST RECORD
754	1D1D	20 9D 1F	LOAD3	JSR	GETBYT	COMPARE CHKSUM
755	1D20	C5 F6		CMP	CHKHI	
756	1D22	D0 17		BNE	LOADE1	
757	1D24	20 9D 1F		JSR	GETBYT	
758	1D27	C5 F7		CMP	CHKSUM	
759	1D29	D0 13		BNE	LOADER	
760						
761	1D2B	8A		TXA		X=0 LAST RECORD
762	1D2C	D0 B9		BNE	LOAD	
763						
764	1D2E	A2 0C	LOAD7	LDX	#\$0C	X-OFF KIM
765	1D30	A9 27	LOAD8	LDA	#\$27	
766	1D32	8D 42 17		STA	SBD	DISABLE DATA IN
767	1D35	20 31 1E		JSR	PRTST	
768	1D38	4C 4F 1C		JMP	START	
769						
770	1D3B	20 9D 1F	LOADE1	JSR	GETBYT	DUMMY
771	1D3E	A2 11	LOADER	LDX	#\$11	X-OFF ERR KIM
772	1D40	D0 EE		BNE	LOAD8	
773						
774						
775						
776						
777						
778	1D42	A9 00	DUMP	LDA	#\$00	
779	1D44	85 F8		STA	INL	
780	1D46	85 F9		STA	INH	CLEAR RECORD COUNT
781	1D48	A9 00	DUMP0	LDA	#\$00	
782	1D4A	85 F6		STA	CHKHI	CLEAR CHKSUM
783	1D4C	85 F7		STA	CHKSUM	
784						
785	1D4E	20 2F 1E	DUMP1	JSR	CRLF	PRINT CR LF
786	1D51	A9 3B		LDA	#\$3B	PRINT SMICOLON
787	1D53	20 A0 1E		JSR	OUTCH	
788	1D56	A5 FA		LDA	POINTL	TEST POINT GT OR ET
789	1D58	CD F7 17		CMP	EAL	HI LIMIT GO TO EXIT
790	1D5B	A5 FB		LDA	POINTH	
791	1D5D	ED F8 17		SBC	EAH	

CARD #	LOC	CODE	CARD			
792	1D60	90 18		BCC	DUMP4	
793						
794	1D62	A9 00		LDA	#\$00	PRINT LAST RECORD
795	1D64	20 3B 1E		JSR	PRTBYT	0 BYTES
796	1D67	20 0C 1F		JSR	OPEN	
797	1D6A	20 1E 1E		JSR	PRTPNT	
798						
799	1D6D	A5 F6		LDA	CHKHI	PRINT CHKSUM
800	1D6F	20 3B 1E		JSR	PRTBYT	FOR LAST RECORD
801	1D72	A5 F7		LDA	CHKSUM	
802	1D74	20 3B 1E		JSR	PRTBYT	
803	1D77	4C 64 1C		JMP	CLEAR	
804						
805	1D7A	A9 18	DUMP4	LDA	#\$18	PRINT 24 BYTE CNT
806	1D7C	AA		TAX		SAVE AS INDEX
807	1D7D	20 3B 1E		JSR	PRTBYT	
808	1D80	20 91 1F		JSR	CHK	
809	1D83	20 1E 1E		JSR	PRTPNT	
810						
811	1D86	A0 00	DUMP2	LDY	#\$00	PRINT 24 BYTES
812	1D88	B1 FA		LDA	(POINTL),Y	GET DATA
813	1D8A	20 3B 1E		JSR	PRTBYT	PRINT DATA
814	1D8D	20 91 1F		JSR	CHK	COMP CHKSUM
815	1D90	20 63 1F		JSR	INCPT	INCREMENT POINT
816	1D93	CA		DEX		
817	1D94	D0 F0		BNE	DUMP2	
818						
819	1D96	A5 F6		LDA	CHKHI	PRINT CHKSUM
820	1D98	20 3B 1E		JSR	PRTBYT	
821	1D9B	A5 F7		LDA	CHKSUM	
822	1D9D	20 3B 1E		JSR	PRTBYT	
823	1DA0	E6 F8		INC	INL	INCREMENT RECORD CNT
824	1DA2	D0 02		BNE	DUMP3	
825	1DA4	E6 F9		INC	INH	
826	1DA6	4C 48 1D	DUMP3	JMP	DUMPO	
827						
828	1DA9	20 0C 1F	SPACE	JSR	OPEN	OPEN NEW CELL
829	1DAC	20 2F 1E	SHOW	JSR	CR LF	PRINT CR LF
830	1DAF	20 1E 1E	SHOW1	JSR	PRTPNT	
831	1DB2	20 9E 1E		JSR	OUTSP	PRT SPACE
832	1DB5	A0 00		LDY	#\$00	PRINT DATA SPECIFIED
833	1DB7	B1 FA		LDA	(POINTL),Y	BY POINT AD = LDA EXT
834	1DB9	20 3B 1E		JSR	PRTBYT	
835	1DBC	20 9E 1E		JSR	OUTSP	PRT SPACE
836	1DBF	4C 64 1C		JMP	CLEAR	
837						
838	1DC2	20 63 1F	RTRN	JSR	INCPT	OPEN NEXT CELL
839	1DC5	4C AC 1D		JMP	SHOW	
840						
841	1DC8	A6 F2	GOEXEC	LDX	SPUSER	
842	1DCA	9A		TXS		
843	1DCB	A5 FB		LDA	POINTH	PROGRAM RUNS FROM

CARD #	LOC	CODE	CARD		
844	1DCD	48	PHA		OPEN CELL ADDRESS
845	1DCE	A5 FA	LDA	POINTL	
846	1DD0	48	PHA		
847	1DD1	A5 F1	LDA	PREG	
848	1DD3	48	PHA		
849	1DD4	A6 F4	LDX	XREG	RESTORE REGS
850	1DD6	A4 F5	LDY	YREG	
851	1DD8	A5 F3	LDA	ACC	
852	1DDA	40	RTI		
853			;		
854	1DDB	C9 20	SCAN	CMP	#\$20 OPEN CELL
855	1DDD	F0 CA		BEQ	SFACE
856	1DDF	C9 7F		CMP	#\$7F RUB OUT (KIM)
857	1DE1	F0 1B		BEQ	STV
858	1DE3	C9 0D		CMP	#\$0D NEXT CELL
859	1DE5	F0 DB		BEQ	RTRN
860	1DE7	C9 0A		CMP	#\$0A PREV CELL
861	1DE9	F0 1C		BEQ	FEED
862	1DEB	C9 2E		CMP	#\$.
863	1DED	F0 26		BEQ	MODIFY
864	1DEF	C9 47		CMP	#\$G GO EXEC
865	1DF1	F0 D5		BEQ	GOEXEC
866	1DF3	C9 51		CMP	#\$Q DUMP FROM OPEN CELL TO HI LIMIT
867	1DF5	F0 0A		BEQ	DUMPV
868	1DF7	C9 4C		CMP	#\$L LOAD TAPE
869	1DF9	F0 09		BEQ	LOADV
870	1DFB	4C 6A 1C		JMP	READ IGNORE ILLEGAL CHAR
871			;		
872	1DFE	4C 4F 1C	STV	JMP	START
873	1E01	4C 42 1D	DUMPV	JMP	DUMP
874	1E04	4C E7 1C	LOADV	JMP	LOAD
875			;		
876	1E07	38	FEED	SEC	
877	1E08	A5 FA	LDA	POINTL	DEC DOUBLE BYTE
878	1E0A	E9 01	SBC	#\$01	AT POINTL AND POINTH
879	1E0C	95 FA	STA	POINTL	
880	1E0E	B0 02	BCS	FEED1	
881	1E10	C6 FB		DEC	POINTH
882	1E12	4C AC 1D	FEED1	JMP	SHOW
883			;		
884	1E15	A0 00	MODIFY	LDY	#\$00 GET CONTENTS OF INPUT BUFF
885	1E17	A5 F8		LDA	INL INL AND STOR IN LOC
886	1E19	91 FA		STA	(POINTL),Y SPECIFIED BY POINT
887	1E1B	4C C2 1D		JMP	RTRN
888			;		
889			;		END OF MAIN LINE

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CARD # LOC      CODE      CARD
891          :          SUBROUTINES FOLLOW
892          :
893          :
894          :
895          :          SUB TO PRINT POINTL,POINTH
896          :
897  1E1E  A5 FB      PRTPNT LDA   POINTH
898  1E20  20 3B 1E          JSR   PRTBYT
899  1E23  20 91 1F          JSR   CHK
900  1E26  A5 FA          LDA   POINTL
901  1E28  20 3B 1E          JSR   PRTBYT
902  1E2B  20 91 1F          JSR   CHK
903  1E2E  60          RTS
904          :
905          :          PRINT STRING OF ASCII CHAR FROM
906          :          TOP+X TO TOP
907          :
908  1E2F  A2 07      CRLF  LDX   #$07
909  1E31  BD D5 1F      PRTST LDA   TOP,X
910  1E34  20 A0 1E          JSR   OUTCH
911  1E37  CA          DEX
912  1E38  10 F7          BPL   PRTST      STOP ON INDEX ZERO
913  1E3A  60          PRT1  RTS
914          :
915          :          PRINT 1 HEX BYTE AS TWO ASCII CHAR' S
916          :
917  1E3B  85 FC      PRTBYT STA   TEMP
918  1E3D  4A          LSR   A          SHIFT CHAR RIGHT 4 BITS
919  1E3E  4A          LSR   A
920  1E3F  4A          LSR   A
921  1E40  4A          LSR   A
922  1E41  20 4C 1E          JSR   HEXTA      CONVERT TO HEX AND PRINT
923  1E44  A5 FC          LDA   TEMP      GET OTHER HALF
924  1E46  20 4C 1E          JSR   HEXTA      CONVERT TO HEX AND PRINT
925  1E49  A5 FC          LDA   TEMP      RESTORE BYTE IN A AND RETURN
926  1E4B  60          RTS
927          :
928  1E4C  29 0F      HEXTA  AND   #$0F      MASK HI 4 BITS
929  1E4E  C9 0A          CMP   #$0A
930  1E50  18          CLC
931  1E51  30 02          BMI   HEXTA1
932  1E53  69 07          ADC   #$07      ALPHA HEX
933  1E55  69 30      HEXTA1 ADC   #$30      DEC HEX
934  1E57  4C A0 1E          JMP   OUTCH      PRINT CHAR
935          :
936          :          SET 1 CHAR FROM TTY
937          :          RETURN FROM SUB WITH CHAR IN A
938          :          X IS PRESERVED AND Y RETURNED = FF
939          :
940  1E5A  86 FD      GETCH  STX   TMPX      SAVE X REG
941  1E5C  A2 08          LDX   #$08      SET UP 8 BIT CNT
942  1E5E  A9 01          LDA   #$01

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CARD #	LOC	CODE	CARD			
943	1E60	2C 40 17	GET1	BIT	SAD	
944	1E63	D0 22		BNE	GET6	
945	1E65	30 F9		BMI	GET1	WAIT FOR START BIT
946	1E67	20 D4 1E		JSR	DELAY	DELAY 1 BIT
947	1E6A	20 EB 1E	GET5	JSR	DEHALF	DELAY 1/2 BIT TIME
948	1E6D	AD 40 17	GET2	LDA	SAD	GET 8 BITS
949	1E70	29 80		AND	#\$80	MASK OFF LOW ORDER BITS
950	1E72	46 FE		LSR	CHAR	SHIFT RIGHT CHARACTER
951	1E74	05 FE		DRA	CHAR	
952	1E76	85 FE		STA	CHAR	
953	1E78	20 D4 1E		JSR	DELAY	DELAY 1 BIT TIME
954	1E7B	CA		DEX		
955	1E7C	D0 EF		BNE	GET2	GET NEXT CHAR
956	1E7E	20 EB 1E		JSR	DEHALF	EXIT THIS RTN
957						
958	1E81	A6 FD		LDX	TMPX	
959	1E83	A5 FE		LDA	CHAR	
960	1E85	2A		ROL	A	SHIFT OFF PARITY
961	1E86	4A		LSR	A	
962	1E87	60	GET6	RTS		
963						
964						INITIALIZATION FOR SIGMA
965						
966	1E88	A2 01	INITS	LDX	#\$01	SET KB MODE TO ADDR
967	1E8A	86 FF		STX	MODE	
968						
969	1E8C	A2 00	INIT1	LDX	#\$00	
970	1E8E	8E 41 17		STX	PADD	FOR SIGMA USE SADD
971	1E91	A2 3F		LDX	#\$3F	
972	1E93	8E 43 17		STX	PBDD	FOR SIGMA USE SBDD
973	1E96	A2 07		LDX	#\$07	ENABLE DATA IN
974	1E98	8E 42 17		STX	SBD	OUTPUT
975	1E9B	D8		CLD		
976	1E9C	78		SEI		
977	1E9D	60		RTS		
978						
979						PRINT 1 CHAR CHAR=A
980						X IS PRESERVED Y RETURNED = FF
981						OUTSP PRINTS 1 SPACE
982						
983	1E9E	A9 20	OUTSP	LDA	#\$20	
984	1EA0	85 FE	OUTCH	STA	CHAR	
985	1EA2	86 FD		STX	TMPX	
986	1EA4	20 D4 1E		JSR	DELAY	10/11 BIT CODE SYNC
987	1EA7	AD 42 17		LDA	SBD	START BIT
988	1EA9	29 FE		AND	#\$FE	
989	1EAC	8D 42 17		STA	SBD	
990	1EAF	20 D4 1E		JSR	DELAY	
991	1EB2	A2 08		LDX	#\$08	
992	1EB4	AD 42 17	OUT1	LDA	SBD	DATA BIT
993	1EB7	29 FE		AND	#\$FE	
994	1EB9	46 FE		LSR	CHAR	

CARD #	LOC	CODE	CARD		
995	1EBB	69 00	ADC	#\$00	
996	1EBD	8D 42 17	STA	SBD	
997	1EC0	20 D4 1E	JSR	DELAY	
998	1EC3	CA	DEX		
999	1EC4	D0 EE	BNE	OUT1	
1000	1EC6	AD 42 17	LDA	SBD	STOP BIT
1001	1EC9	09 01	ORA	#\$01	
1002	1ECB	8D 42 17	STA	SBD	
1003	1ECE	20 D4 1E	JSR	DELAY	STOP BIT
1004	1ED1	A6 FD	LDX	TMPX	RESTORE INDEX
1005	1ED3	60	RTS		
1006			:		
1007			:	DELAY 1 BIT TIME	
1008			:	AS DETERMEND BY DETCPS	
1009			:		
1010	1ED4	AD F3 17	DELAY LDA	CNTH30	THIS LOOP SIMULATES THE
1011	1ED7	8D F4 17	STA	TIMH	DETCPS SECTION AND WILL DELAY
1012	1EDA	AD F2 17	LDA	CNTL30	1 BIT TIME
1013	1EDD	38	DE2 SEC		
1014	1EDE	E9 01	DE4 SBC	#\$01	
1015	1EE0	B0 03	BCS	DE3	
1016	1EE2	CE F4 17	DEC	TIMH	
1017	1EE5	AC F4 17	DE3 LDY	TIMH	
1018	1EE8	10 F3	BPL	DE2	
1019	1EEA	60	RTS		
1020			:		
1021			:	DELAY HALF BIT TIME	
1022	1EEB	AD F3 17	DEHALF LDA	CNTH30	DOUBLE RIGHT SHIFT OF DELAY
1023	1EEE	8D F4 17	STA	TIMH	CONSTANT FOR A DIV BY 2
1024	1EF1	AD F2 17	LDA	CNTL30	
1025	1EF4	4A	LSR	A	
1026	1EF5	4E F4 17	LSR	TIMH	
1027	1EF8	90 E3	BCC	DE2	
1028	1EFA	09 80	ORA	#\$80	
1029	1EFC	B0 E0	BCS	DE4	
1030			:		
1031			:	SUB TO DETERMINE IF KEY IS	
1032			:	DEPRESSED OR COMDION OF SSW	
1033			:	KEY NOT DEP OR TTY MODE	A = 0
1034			:	KEY DEP OR KB MODE	A NOT ZERO
1035			:		
1036			:		
1037	1EFE	A0 03	AK LDY	#\$03	3 ROWS
1038	1F00	A2 01	LDX	#\$01	DIGIT 0
1039			:		
1040	1F02	A9 FF	ONEKEY LDA	#\$FF	
1041	1F04	8E 42 17	AK1 STX	SBD	OUTPUT DIGIT
1042	1F07	E8	INX		GET NXT DIGIT
1043	1F08	E8	INX		
1044	1F09	2D 40 17	AND	SAD	INPUT SEGMENTS
1045	1F0C	88	DEY		
1046	1F0D	D0 F5	BNE	AK1	

CARD #	LDC	CODE	CARD			
1047				;		
1048	1F0F	A0 07			LDY	#\$07
1049	1F11	8C 42 17			STY	SBD
1050				;		
1051	1F14	09 80			DRA	#\$80
1052	1F16	49 FF			EDR	#\$FF
1053	1F18	60			RTS	
1054				;		
1055				;	SUB	OUTPUT TO 7 SEGMENT DISPLAY
1056				;		
1057	1F19	A0 00	SCAND		LDY	#\$00 GET DATA SPECIFIED
1058	1F1B	B1 FA			LDA	(POINTL),Y BY POINT
1059	1F1D	85 F9			STA	INH SET UP DISPLAY BUFFER
1060	1F1F	A9 7F	SCANDS		LDA	#\$7F CHANGE SEG
1061	1F21	8D 41 17			STA	PADD TO OUTPUT
1062				;		
1063	1F24	A2 09			LDX	#\$09 INIT DIGIT NUMBER
1064	1F26	A0 03			LDY	#\$03 OUTPUT 3 BYTES
1065				;		
1066	1F28	B9 F8 00	SCAND1		LDA	INL,Y GET BYTE
1067	1F2B	4A			LSR	A GET MSD
1068	1F2C	4A			LSR	A
1069	1F2D	4A			LSR	A
1070	1F2E	4A			LSR	A
1071	1F2F	20 48 1F			JSR	CONVD OUTPUT CHAR
1072	1F32	B9 F8 00			LDA	INL,Y GET BYTE AGAIN
1073	1F35	29 0F			AND	#\$0F GET LSD
1074	1F37	20 48 1F			JSR	CONVD OUTPUT CHAR
1075	1F3A	88			DEY	SET UP FOR NXT BYTE
1076	1F3B	D0 EB			BNE	SCAND1
1077	1F3D	8E 42 17			STX	SBD ALL DIGITS OFF
1078	1F40	A9 00			LDA	#\$00 CHANGE SEG
1079	1F42	8D 41 17			STA	PADD TO INPUTS
1080	1F45	4C FE 1E			JMP	AK GET ANY KEY
1081				;		
1082				;		
1083				;		
1084				;		
1085	1F48	84 FC	CONVD		STY	TEMP SAVE Y
1086	1F4A	A8			TAY	USE CHAR AS INDEX
1087	1F4B	B9 E7 1F			LDA	TABLE,Y LOOK UP CONVERSION
1088	1F4E	A0 00			LDY	#\$00 TURN OFF SEGMENTS
1089	1F50	8C 40 17			STY	SAD
1090	1F53	8E 42 17			STX	SBD OUTPUT DIGIT ENABLE
1091	1F56	8D 40 17			STA	SAD OUT PUT SEGMENTS
1092				;		
1093	1F59	A0 7F			LDY	#\$7F DELAY 500 CYCLES APPROX.
1094	1F5B	88	CONVD1		DEY	
1095	1F5C	D0 FD			BNE	CONVD1
1096				;		
1097	1F5E	E8			INX	GET NEXT DIGIT NUM
1098	1F5F	E8			INX	ADD 2



CARD #	LOC	CODE	CARD			
1099	1F60	A4 FC		LDY	TEMP	RESTORE Y
1100	1F62	60		RTS		
1101				;		
1102				;	SUB TO INCREMENT POINT	
1103				;		
1104	1F63	E6 FA	INCPT	INC	POINTL	
1105	1F65	D0 02		BNE	INCPT2	
1106	1F67	E6 FB		INC	POINTH	
1107	1F69	60	INCPT2	RTS		
1108				;		
1109				;	GET KEY FROM KEY BOARD	
1110				;	RETURN WITH A=KEY VALUE	
1111				;	A GT. 15 THEN ILLEGAL OR NO KEY	
1112				;		
1113				;		
1114	1F6A	A2 21	GETKEY	LDX	#\$21	START AT DIGIT 0
1115	1F6C	A0 01	GETKEY5	LDY	#\$01	GET 1 ROW
1116	1F6E	20 02 1F		JSR	ONEKEY	
1117	1F71	D0 07		BNE	KEYIN	A=0 NO KEY
1118	1F73	E0 27		CPX	#\$27	TEST FOR DIGT 2
1119	1F75	D0 F5		BNE	GETKEY5	
1120	1F77	A9 15		LDA	#\$15	15=NO KEY
1121	1F79	60		RTS		
1122	1F7A	A0 FF	KEYIN	LDY	#\$FF	
1123	1F7C	0A	KEYIN1	ASL	A	SHIFT LEFT
1124	1F7D	B0 03		BCS	KEYIN2	UNTIL Y=KEY NUM
1125	1F7F	C8		INY		
1126	1F80	10 FA		BPL	KEYIN1	
1127	1F82	8A	KEYIN2	TXA		
1128	1F83	29 0F		AND	#\$0F	MASK MSD
1129	1F85	4A		LSR	A	DIV BY 2
1130	1F86	AA		TAX		
1131	1F87	98		TYA		
1132	1F88	10 03		BPL	KEYIN4	
1133	1F8A	18	KEYIN3	CLC		
1134	1F8B	69 07		ADC	#\$07	MULT (X-1) TIMES A
1135	1F8D	CA	KEYIN4	DEX		
1136	1F8E	D0 FA		BNE	KEYIN3	
1137	1F90	60		RTS		
1138				;		
1139				;	SUB TO COMPUTE CHECK SUM	
1140				;		
1141	1F91	18	CHK	CLC		
1142	1F92	65 F7		ADC	CHKSUM	
1143	1F94	85 F7		STA	CHKSUM	
1144	1F96	A5 F6		LDA	CHKHI	
1145	1F98	69 00		ADC	#\$00	
1146	1F9A	85 F6		STA	CHKHI	
1147	1F9C	60		RTS		
1148				;		
1149				;	GET 2 HEX CHAR'S AND PACK	
1150				;	INTO INL AND INH	

CARD #	LOC	CODE	CARD		
1151			;	X PRESERVED	Y RETURNED = 0
1152			;	NON HEX CHAR	WILL BE LOADED AS NEAREST HEX EQU
1153			;		
1154	1F9D	20 5A 1E	GETBYT	JSR	GETCH
1155	1FA0	20 AC 1F		JSR	PACK
1156	1FA3	20 5A 1E		JSR	GETCH
1157	1FA6	20 AC 1F		JSR	PACK
1158	1FA9	A5 F8		LDA	INL
1159	1FAB	60		RTS	
1160			;		
1161			;	SHIFT CHAR IN A INTO	
1162			;	INL AND INH	
1163			;		
1164	1FAC	C9 30	PACK	CMP	#\$30 CHECK FOR HEX
1165	1FAE	30 1B		BMI	UPDAT2
1166	1FB0	C9 47		CMP	#\$47 NOT HEX EXIT
1167	1FB2	10 17		BPL	UPDAT2
1168	1FB4	C9 40	HEXNUM	CMP	#\$40 CONVERT TO HEX
1169	1FB6	30 03		BMI	UPDATE
1170	1FB8	18	HEXALP	CLC	
1171	1FB9	69 09		ADC	#\$09
1172	1FBB	2A	UPDATE	ROL	A
1173	1FBC	2A		ROL	A
1174	1FBD	2A		ROL	A
1175	1FBE	2A		ROL	A
1176	1FBF	A0 04		LDY	#\$04 SHIFT INTO I/O BUFFER
1177	1FC1	2A	UPDAT1	ROL	A
1178	1FC2	26 F8		ROL	INL
1179	1FC4	26 F9		ROL	INH
1180	1FC6	88		DEY	
1181	1FC7	D0 F8		BNE	UPDAT1
1182	1FC9	A9 00		LDA	#\$00 A=0 IF HEX NUM
1183	1FCB	60	UPDAT2	RTS	
1184			;		
1185	1FCC	A5 F8	OPEN	LDA	INL MOVE I/O BUFFER TO POINT
1186	1FCE	85 FA		STA	POINTL
1187	1FD0	A5 F9		LDA	INH TRANSFER INH- POINTH
1188	1FD2	85 FB		STA	POINTH
1189	1FD4	60		RTS	
1190			;		
1191			;		
1192			;	END OF SUBROUTINES	

```

CARD # LOC      CODE      CARD
1194
1195           ;
1196           ; TABLES
1197 1FD5 00      TOP      .BYTE $00,$00,$00,$00,$00,$00,$0A,$0D,'MIK'
1197 1FD6 00
1197 1FD7 00
1197 1FD8 00
1197 1FD9 00
1197 1FDA 00
1197 1FDB 0A
1197 1FDC 0D
1197 1FDD 4D 49 4B
1198 1FE0 20      .BYTE ' ', $13, 'RRE', ' ', $13
1198 1FE1 13
1198 1FE2 52 52 45
1198 1FE5 20
1198 1FE6 13
1199           ;
1200           ; TABLE HEX TO 7 SEGMENT
1201           ;      0 1 2 3 4 5 6 7
1202 1FE7 BF      TABLE .BYTE $BF,$86,$DB,$CF,$E6,$ED,$FD,$87
1202 1FE8 86
1202 1FE9 DB
1202 1FEA CF
1202 1FEB E6
1202 1FEC ED
1202 1FED FD
1202 1FEE 87
1203           ;
1204 1FEF FF      .BYTE $FF,$EF,$F7,$FC,$B9,$DE,$F9,$F1
1204 1FF0 EF
1204 1FF1 F7
1204 1FF2 FC
1204 1FF3 B9
1204 1FF4 DE
1204 1FF5 F9
1204 1FF6 F1

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CARD # LOC      CODE      CARD
1206
1207           ;
1208           ;
1209           ;
1210           ; INTERRUPT VECTORS
1211           ;
1212 1FF7          *=$1FFA
1213 1FFA 1C 1C    NMIENT .WORD NMIT
1214 1FFC 22 1C    RSTENT .WORD RST
1215 1FFE 1F 1C    IRQENT .WORD IRQT
1216           .END

```

## SYMBOL TABLE

SYMBOL	VALUE	LINE	DEFINED	CROSS-REFERENCES						
ACC	00F3	76	587	851						
ADDR	10BE	694	687							
ADDRM	10C8	701	673							
AK	1EFE	1037	1080							
AK1	1F04	1041	1046							
CHAR	00FE	90	950	951	952	959	984	994		
CHK	1F91	1141	734	738	741	748	808	814	899	902
CHKH	17E8	97	158	265	289	299	301			
CHKHI	00F6	82	730	755	782	799	819	1144	1146	
CHKL	17E7	96	156	262	288	297	298			
CHKSUM	00F7	83	729	758	783	801	821	1142	1143	
CHKT	194C	295	234	237	242	244	256	308		
CHT1	1982	336	344							
CHT2	198E	341	338							
CHT3	1991	342	340							
CLEAR	1064	645	803	836						
CLKKT	1747	65	*****							
CLKRDI	1747	66	355	361	378	384	498	505		
CLKRDT	1746	67	459	471						
CLK1T	1744	62	358	364	381	387	501	508		
CLK64T	1746	64	461	473						
CLK8T	1745	63	*****							
CNTH30	17F3	101	613	622	1010	1022				
CNTL30	17F2	100	625	1012	1024					
CONVD	1F48	1085	1071	1074						
CONVD1	1F5B	1094	1095							
CRLF	1E2F	908	640	785	829					
DATA	10A8	680	*****							
DATAM	10CC	704	675							
DATAM1	10CE	705	702							
DATAM2	10D0	706	699							
DATA1	10B0	686	698							
DATA2	10C3	697	692							
DEHALF	1EEB	1022	947	956						
DELAY	1ED4	1010	946	953	986	990	997	1003		
DETCPS	102A	612	*****							
DET1	1031	615	617							
DET2	1042	623	621							
DET3	103A	619	624							
DE2	1EDD	1013	1018	1027						
DE3	1EE5	1017	1015							
DE4	1EDE	1014	1029							
DUMP	1D42	778	873							
DUMPT	1800	121	*****							
DUMPT1	1814	131	134							
DUMPT2	1833	148	177							
DUMPT3	1854	163	166							
DUMPT4	1865	173	152							
DUMPV	1E01	873	867							
DUMPO	1D48	781	826							
DUMP1	1D4E	785	*****							

SYMBOL	VALUE	LINE	DEFINED	CROSS-REFERENCES							
DUMP2	1D86	811	817								
DUMP3	1DA6	826	824								
DUMP4	1D7A	805	792								
EAH	17F8	106	151	791							
EAL	17F7	105	149	789							
FEED	1E07	876	861								
FEED1	1E12	882	880								
GETBYT	1F9D	1154	732	736	739	746	754	757	770		
GETCH	1E5A	940	648	725	1154	1156					
GETK	1C8D	667	****								
GETKEY	1F6A	1114	667								
GETKES	1F6C	1115	1119								
GET1	1E60	943	945								
GET2	1E6D	948	955								
GET5	1E6A	947	627								
GET6	1E87	962	944								
GOEXEC	1DC8	841	711	865							
GOV	1CD9	711	679								
HEXALP	1FB8	1170	****								
HEXNUM	1FB4	1168	****								
HEXOUT	196F	323	314	316							
HEXTR	1E4C	928	922	924							
HEXTR1	1E55	933	931								
HEX1	1978	328	326								
ID	17F9	107	140	224	226						
INCPT	1F63	1104	708	749	815	939					
INCPT2	1F69	1107	1105								
INCVEB	19EA	397	176	258							
INCVE1	19F2	400	398								
INH	00F9	85	647	780	825	1059	1179	1187			
INITS	1E88	966	600	609							
INIT1	1E8C	969	636								
INL	00F8	84	646	779	823	885	1066	1072	1158	1178	1185
INTVEB	1932	281	123	185							
IRQENT	1FFE	1215	****								
IRQP27	1BFE	519	****								
IRQT	1C1F	604	1215								
IRQV	17FE	113	604								
KEYIN	1F7A	1122	1117								
KEYIN1	1F7C	1123	1126								
KEYIN2	1F82	1127	1124								
KEYIN3	1F8A	1133	1136								
KEYIN4	1F8D	1135	1132								
LOAD	1CE7	725	727	762	874						
LOADER	1D3E	771	759								
LOADE1	1D3B	770	756								
LOADS	1CEE	728	****								
LOADT	1873	183	231								
LOADT4	18B5	216	221								
LOADT5	18D7	233	225	228							
LOADT6	18EC	241	230								
LOADT7	18F8	247	239	259							
LOADT8	1915	261	250								
LOADT9	1929	270	252	263	266						





## INSTRUCTION COUNT

ADC	13
AND	9
ASL	7
BCC	4
BCS	5
BEQ	26
BIT	12
BMI	9
BNE	44
BPL	15
BRK	0
BVC	0
BVS	0
CLC	8
CLD	1
CLI	0
CLV	0
CMP	38
CPX	1
CPY	0
DEC	2
DEX	14
DEY	8
EOR	2
INC	7
INX	5
INY	2
JMP	31
JSR	115
LDA	108
LDX	29
LDY	25
LSR	22
NOP	0
ORA	6
FHA	5
FHP	0
FLA	5
FLP	0
ROL	18
RTI	1
RTS	28
SBC	5
SEC	3
SED	0
SEI	1
STA	81
STX	14
STY	7
TAX	3
TAY	3
TSX	1
TXA	3
TXS	2
TYA	4

# SYMBOLS = 204 (LIMIT = 400)

# BYTES = 1690 (LIMIT = 4096)

# LINES = 1242 (LIMIT = 1500)

# XREFS = 646 (LIMIT = 900)

STOP 0