



HP 13255

KEYBOARD MODULE

Manual Part No. 13255-91018

REVISED

DEC-20-78

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1.0 INTRODUCTION.

The Keyboard Module provides direct data entry into the terminal by the terminal operator. The 02640-60018 is the general lower level keyboard printed circuit assembly.

2.0 OPERATING PARAMETERS.

A summary of operating parameters for the Keyboard Module is contained in tables 1.0 through 6.4.

Table 1.0 Physical Parameters

Part Number	Nomenclature	Size (L x w x D) +/-0.100 Inches	Weight (Pounds)
02640-60018	Keyboard PCA	16.8 x 7.1 x 2.1	2.75
02645-60001	2645A Keyboard Assembly (Sample Top Level Assy)	N/A	N/A

Number of Backplane Slots Required: 1

Table 2.0 Reliability and Environmental Information

<p>Environmental: (X) HP Class B () Other:</p> <p>Restrictions: Type tested at product level</p>
<p>Failure Rate: 2.108 (percent per 1000 hours)</p>

Table 3.0 Power Supply and Clock Requirements - Measured
(At +/-5% Unless Otherwise Specified)

(Combined for Keyboard and Keyboard Interface PCA's)

+5 Volt Supply @ 600 mA	+12 Volt Supply @ 100 mA	-12 Volt Supply @ 80 mA	-42 Volt Supply @ mA
			NOT APPLICABLE
115 volts ac @ A		220 volts ac @ A	
NOT APPLICABLE		NOT APPLICABLE	
<p>Clock Frequency: MHz</p> <p>NOT APPLICABLE</p>			

Table 4.0 Jumper Definitions

PCA Designation	Function	
	In	Out
A through H	Jumpers A through H are located on the Keyboard Interface PCA and are applicable for software. (See table 6.2 for their interpretation.)	

Table 6.0 Module Bus Pin Assignments

Function	Value	Bus Signal
Performed: Output a column's previous state into the Keyboard PCA's input register	X	ADDR 15
Poll Bit: Not Applicable	X	ADDR 14
	X	ADDR 13
Module Address: (ADDR 11,10,9,4) = (0011)	X	ADDR 12
	0	ADDR 11
	0	ADDR 10
	1	ADDR 9
Function Specifier: ADDR 5 = 1	X	ADDR 8
	0	ADDR 7
	X	ADDR 6
	1	ADDR 5
	1	ADDR 4
	X	ADDR 3
	X	ADDR 2
	X	ADDR 1
	X	ADDR 0
	B7	BUS 7
	B6	BUS 6
	B5	BUS 5
	B4	BUS 4
	B3	BUS 3
	B2	BUS 2
	B1	BUS 1
	B0	BUS 0

1=Logical 1=Bus Low
0=Logical 0=Bus High
X=Don't Care

Table 6.1 Module Bus Pin Assignments

Function	Read switches in column	Value	Bus Signal
Performed:	"n" as determined by A3, A2, A1, and A0	X	ADDR 15
Poll Bit:	Not Applicable	X	ADDR 14
Module Address: (ADDR 11,10,9,4) = (0011)		X	ADDR 13
		X	ADDR 12
		0	ADDR 11
		0	ADDR 10
Function Specifier: ADDR 0,1,2,3 are used to specify which keyboard column is to be read. The column number specified by these bits must be less than 14 (decimal).		1	ADDR 9
		X	ADDR 8
		0	ADDR 7
		X	ADDR 6
		X	ADDR 5
		1	ADDR 4
		A3	ADDR 3
Data Bus Bit Interpretation: Each data bit is associated with a switch in a column. If the switch is depressed, the data bit is 1. (Refer to figure 1 for a cross-reference of key numbers to the physical switches on the keyboard.)		A2	ADDR 2
		A1	ADDR 1
		A0	ADDR 0
		B7	BUS 7
		B6	BUS 6
		B5	BUS 5
		B4	BUS 4
		B3	BUS 3
	B2	BUS 2	
	B1	BUS 1	
	B0	BUS 0	

1=Logical 1=Bus Low
0=Logical 0=Bus High
X=Don't Care

Column	Address	DATA BUS BIT										
A3	A2	A1	A0	B7	B6	B5	B4	B3	B2	B1	B0	
0	0	0	0	007	006	005	004	003	002	001	000	
0	0	0	1	017	016	015	014	013	012	011	010	
0	0	1	0	027	026	025	024	023	022	021	020	
0	0	1	1	037	036	035	034	033	032	031	030	
0	1	0	0	047	046	045	044	043	042	041	040	
0	1	0	1	057	056	055	054	053	052	051	050	
0	1	1	0	067	066	065	064	063	062	061	-	
0	1	1	1	077	076	075	074	073	072	071	070	
1	0	0	0	107	106	105	104	103	102	101	100	
1	0	0	1	117	116	115	114	113	112	111	110	
1	0	1	0	127	126	125	124	123	122	121	120	
1	0	1	1	137	136	-	134	133	132	131	130	
1	1	0	0	147	-	-	144	-	142	141	140	
1	1	0	1	157	-	-	154	-	152	151	150	



Table 6.2 Module Bus Pin Assignments

Function	Value	Bus Signal
Performed: Read Jumpers A through H on Keyboard Interface PCA	X	ADDR 15
Poll Bit: Not Applicable	X	ADDR 14
	X	ADDR 13
Module Address: (ADDR 11,10,9,4) = (0011)	X	ADDR 12
	0	ADDR 11
	0	ADDR 10
	1	ADDR 9
Function Specifier: ADDR 0,1,2,3 = (0111)	X	ADDR 8
	0	ADDR 7
	X	ADDR 6
	X	ADDR 5
	1	ADDR 4
	1	ADDR 3
	1	ADDR 2
Data Bus Bit Interpretation:	1	ADDR 1
	0	ADDR 0
B7 When set to 1, Jumper H is out	B7	BUS 7
	B6	BUS 6
	B5	BUS 5
B6 When set to 1, Jumper G is out	B4	BUS 4
	B3	BUS 3
	B2	BUS 2
	B1	BUS 1
B5 When set to 1, Jumper F is out	B0	BUS 0
	1=Logical 1=Bus Low 0=Logical 0=Bus High X=Don't Care	
B4 When set to 1, Jumper E is out		
B3 When set to 1, Jumper D is out		
B2 When set to 1, Jumper C is out		
B1 When set to 1, Jumper B is out		
B0 When set to 1, Jumper A is out		

Table 6.3 Module Bus Pin Assignments

Function Performed: (Refer to figure 1 for physical location of data comm switches and their positions.)		Value	Bus Signal
Poll Bit: Not Applicable		X	ADDR 15
Module Address: (ADDR 11,10,9,4) = (0011)		X	ADDR 14
Function Specifier: ADDR 0,1,2,3 = (1111)		X	ADDR 13
Data Bus Bit Interpretation:		X	ADDR 12
Switch 1		0	ADDR 11
Position	0 1	0	ADDR 10
B7	1 0	1	ADDR 9
B6	Not assigned, always 0	X	ADDR 8
Switch 2		0	ADDR 7
Position	0 1 2	X	ADDR 6
B5	0 0 1	X	ADDR 5
B4	0 1 0	1	ADDR 4
Switch 3		1	ADDR 3
Position	0 1 2 3 4 5 6 7	1	ADDR 2
B3	0 0 0 0 1 1 1 1	1	ADDR 1
B2	0 0 1 1 0 0 1 1	1	ADDR 0
B1	0 1 0 1 0 1 0 1		
B0	Not assigned, always 0		

1=Logical 1=Bus Low
0=Logical 0=Bus High
X=Don't Care

Table 6.4 Module Bus Pin Assignments

Function	Value	Bus Signal
Performed: Write LED latch and trigger alarm generator (Beep)	X	ADDR 15
Poll Bit: Not Applicable	X	ADDR 14
	X	ADDR 13
Module Address: (ADDR 11,10,9,4) = (0011)	X	ADDR 12
	0	ADDR 11
	0	ADDR 10
	1	ADDR 9
Function Specifier: ADDR 5 = 0	X	ADDR 8
	0	ADDR 7
	X	ADDR 6
	0	ADDR 5
	1	ADDR 4
	X	ADDR 3
	X	ADDR 2
Data Bus Bit Interpretation:	X	ADDR 1
	X	ADDR 0
B7 When Set, Beeper is triggered	B7	BUS 7
	B6	BUS 6
	B5	BUS 5
B6 When Set, LED #7 is turned on	B4	BUS 4
	B3	BUS 3
	B2	BUS 2
	B1	BUS 1
B5 When Set, LED #6 is turned on	B0	BUS 0
	1=Logical 1=Bus Low 0=Logical 0=Bus High X=Don't Care	
B4 When Set, LED #5 is turned on		
B3 When Set, LED #4 is turned on		
B2 When Set, LED #3 is turned on		
B1 When Set, LED #2 is turned on		
B0 When Set, LED #1 is turned on		

3.0 FUNCTIONAL DESCRIPTION. Refer to the switch location diagram (figure 1), block diagram (figure 2), schematic diagrams (figures 3 and 4), timing diagram (figure 5), component location diagrams (figures 6 and 7), and parts lists (02640-60018, and 02645-60001) and located in the appendix.

The Keyboard Module provides the communication link between the terminal operator and the terminal. All of the keyboard keys are arranged in a key matrix of 14 columns of eight key switches each. Two more columns are provided for reading the data comm switches and keyboard jumpers A through H.

The key matrix is constantly monitored by the processor, one column at a time. As each column is scanned, it appears to the processor as an 8-bit value where each bit represents one key switch in the column. Depressed keys are represented by a logic 1 and released keys by a logic 0. Key columns are monitored in discrete intervals. Therefore, the present state of each key must be compared to its previous state when last scanned in order for the processor to recognize when a key has just been depressed, is being held depressed, or has just been released. The previous state of each key is saved by the processor.

The keyboard logic is physically located on the Keyboard Interface and Keyboard PCA's. Connection between the two PCA's is accomplished by the 5-foot Keyboard Cable Assembly. As shown in the block diagram, the Keyboard Interface PCA consists of bus decoder logic circuits, option jumper network circuits, and an alarm generator. The Keyboard PCA consists of a column decoder, an 8 by 14 key matrix, ramp generator, differential comparator circuits, an output register (data taken by processor), an input register (receives previous state of the key switches from processor), data comm logic, and a LED register.

- 3.4 COLUMN DECODER - Keyboard PCA. The column decoder selects one column in the key matrix when binary address ADDR0 through ADDR3 is applied.
- 3.5 KEY MATRIX - Keyboard PCA.
 - 3.5.1 The key switches are arranged in a matrix of 8 rows and 14 columns. The matrix is scanned column by column, so that eight switches at a time are read.
 - 3.5.2 The key switch used is a LICON type consisting of a ferrite core, a drive wire, a sense wire, and two magnets. When the switch is in the undepressed state, the two magnets are in close proximity to the core, thus saturating the core and inhibiting the coupling of a signal from the drive wire to the sense wire. When the switch is depressed, two magnets are moved away from the core and a signal is coupled from the drive wire to the sense wire. All switches in one column are connected serially by drive lines and switches in one row are connected serially by sense lines. One side of the drive lines is connected to the column decoder (U5 and U7), and the other side to the ramp generator (to collector of Q2). Eight sense lines are connected to differential comparators on one side and are grounded on the other end. After the column decoder selects a column and the ramp generator is enabled, then drive current (80 milliamperes) flows through the selected column. Depressed keys in the selected column couple the drive signal to the sense line which is then applied to the differential comparator.

3.6 RAMP GENERATOR - Keyboard PCA.

3.6.1 When a RD . COL15 signal is applied to the ramp generator, the current is enabled into the selected column. The current rises linearly from 0 to 80 milliamperes in 80 nanoseconds.

3.6.2 The ramp generator is a combination of a Miller integrator (transistor Q1, resistor R35, and capacitor C5) and a current mirror (transistors Q3 and Q2). When the RD . COL15 signal is applied to the input, the collector of transistor Q1 falls to ground according to the transit time determined by R35 and C5. The collector current of Q1 rises linearly and is determined by resistors R39 and R36. Since the same base emitter voltage is applied to Q2 and Q3, the emitter current of Q2 "reflects" the current of Q3. This current flows through the selected column of the matrix. Nominally, the current rises from 0 to 80 milliamperes in 80 nanoseconds. The function of R37 (10 kilohms) is to bias the drive lines to ground when Q2 is off and no column is selected.

3.7 DIFFERENTIAL COMPARATORS - Keyboard PCA.

3.7.1 The eight sense lines out of the key matrix are fed into the eight differential comparators. Each depressed switch generates a pulse on the corresponding row when its column is scanned. Differential comparators translate this pulse into the required TTL level.

3.7.2 Differential comparators are MC1414 or equivalent. Sense lines are fed into the minus input and are terminated by a 200-ohm resistor. Threshold is determined by resistor network (47K, 47K, 1.2K) and the previous state held in the input register. When the previous state is "0", the threshold is set to 200 millivolts and when "1", it is 100 millivolts. The differential comparator timing is shown in figure 5. When the processor wants to read one column, it puts the binary address of the column on the terminal data bus and the column decoder selects the corresponding drive line for the column. Approximately 200 nanoseconds



after the column has been selected, the RD. COL15 signal comes true and turns on the ramp generator. This current is transformed into sense lines only on those switches that are depressed. The sense pulse is approximately 400 millivolts in amplitude and 80 nanoseconds wide at the base. Differential comparators set the corresponding bits in the output register.

- 3.8 **OUTPUT REGISTER - Keyboard PCA.** Outputs of the differential comparators set the corresponding bits in an 8-bit output register. Signals RD. COL15 and DATA OUT EN (on the Keyboard Interface PCA) enable the result of the selected column on the terminal data bus.
- 3.9 **INPUT REGISTER - Keyboard PCA.** Before a column is read, the previous state of that column is sent from the processor to the input register. Outputs of this register determine the threshold of the differential comparators. If the previous state of a switch was "0", the threshold is 200 millivolts; if it was "1", the threshold is 100 millivolts. This causes hysteresis in the key travel since the sense pulse amplitude is proportional to the key depression.
- 3.10 **DATA COMM LOGIC - Keyboard PCA.** The data communications logic contains a baud rate encoder and the keyboard data communications switches. Eight positions of the rotary BAUD RATE switch (Switch 3) are encoded into three binary bits. The 3-position PARITY switch (Switch 2), is encoded into two bits. The 2-position DUPLEX switch (Switch 1) uses one bit for detection. When column 15 is addressed, the RD. COL15 (U8, Pin 10) signal is decoded and the data comm byte is released to the terminal data bus. (Refer to table 6.3 for more details.)
- 3.11 **LED REGISTER - Keyboard PCA.** The LED register is loaded with seven data bits when a LED EN signal is decoded. Outputs of this latch drive seven LED indicators.



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TRIX

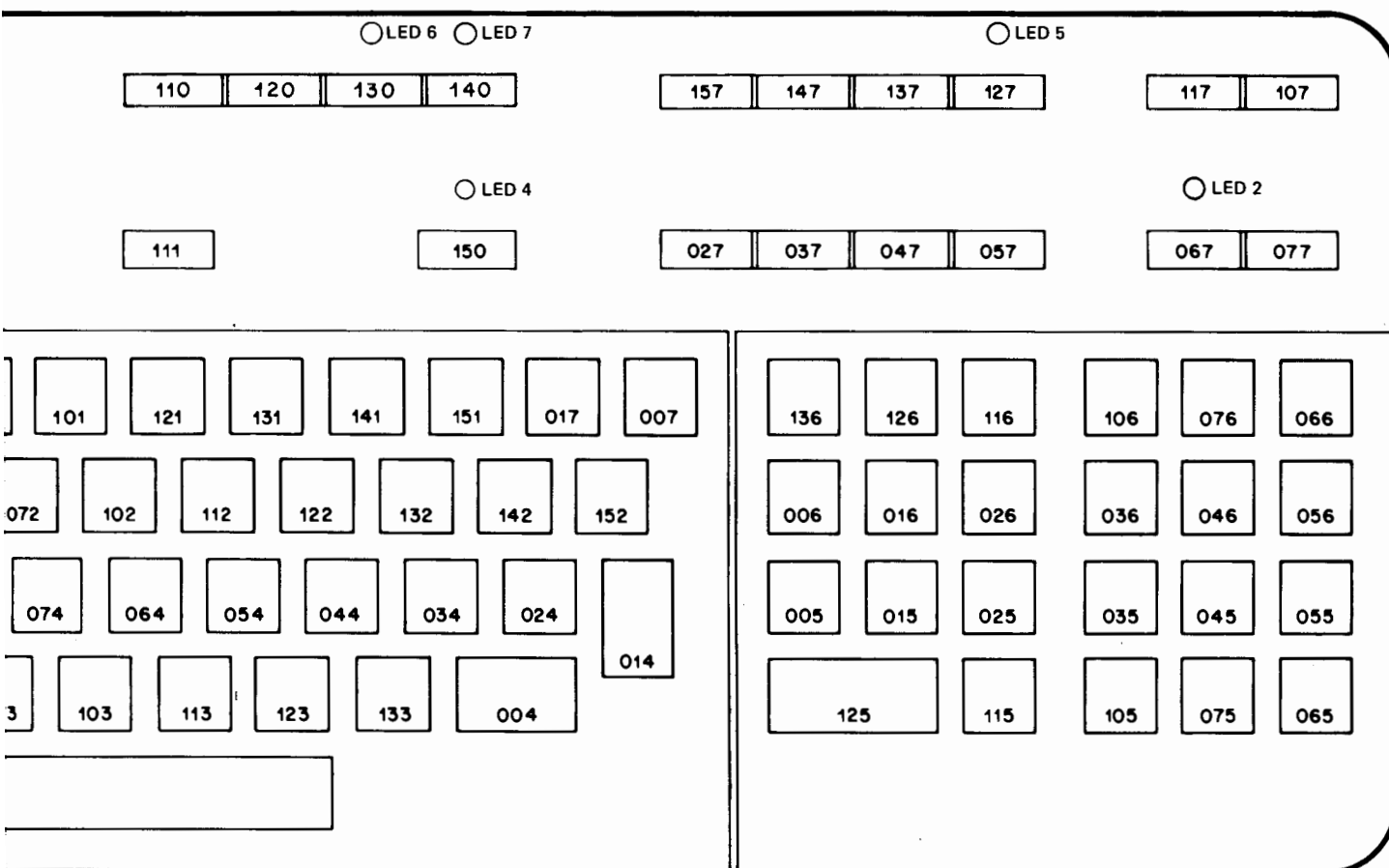
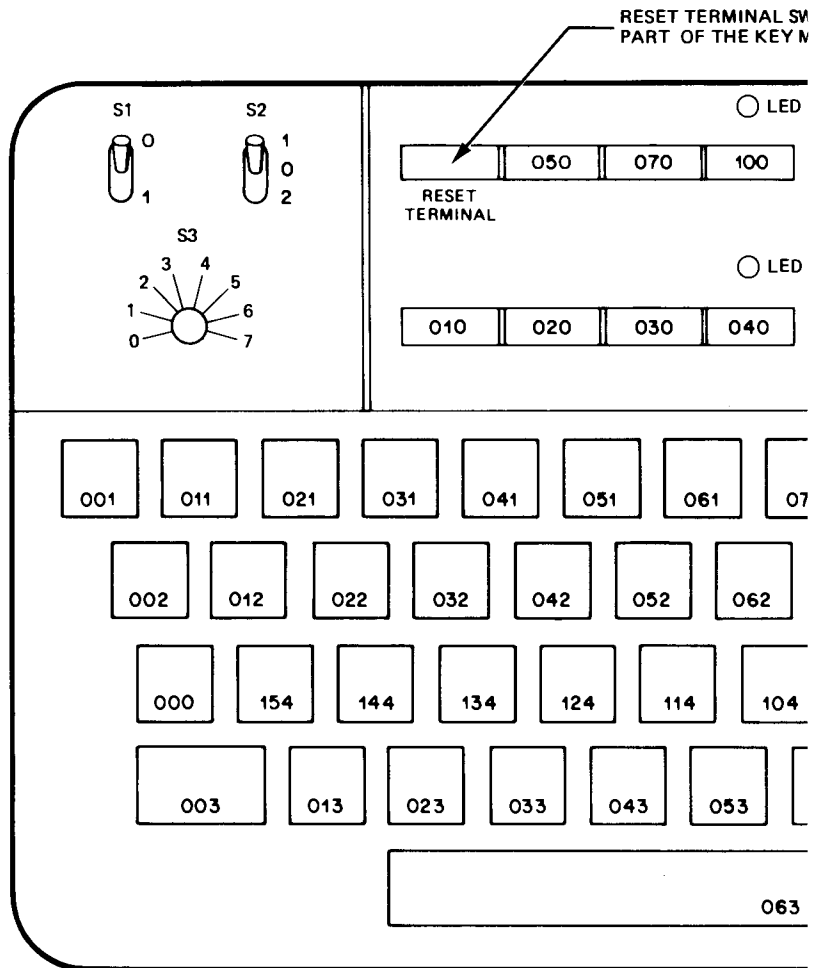


Figure 1
Keyboard PCA Switch Location Diagram
DEC-20-78 13255-91018



NOTE: ALL SWITCHES AND LED'S ARE SHOWN AS THEY ARE LOADED ON THE PCA.

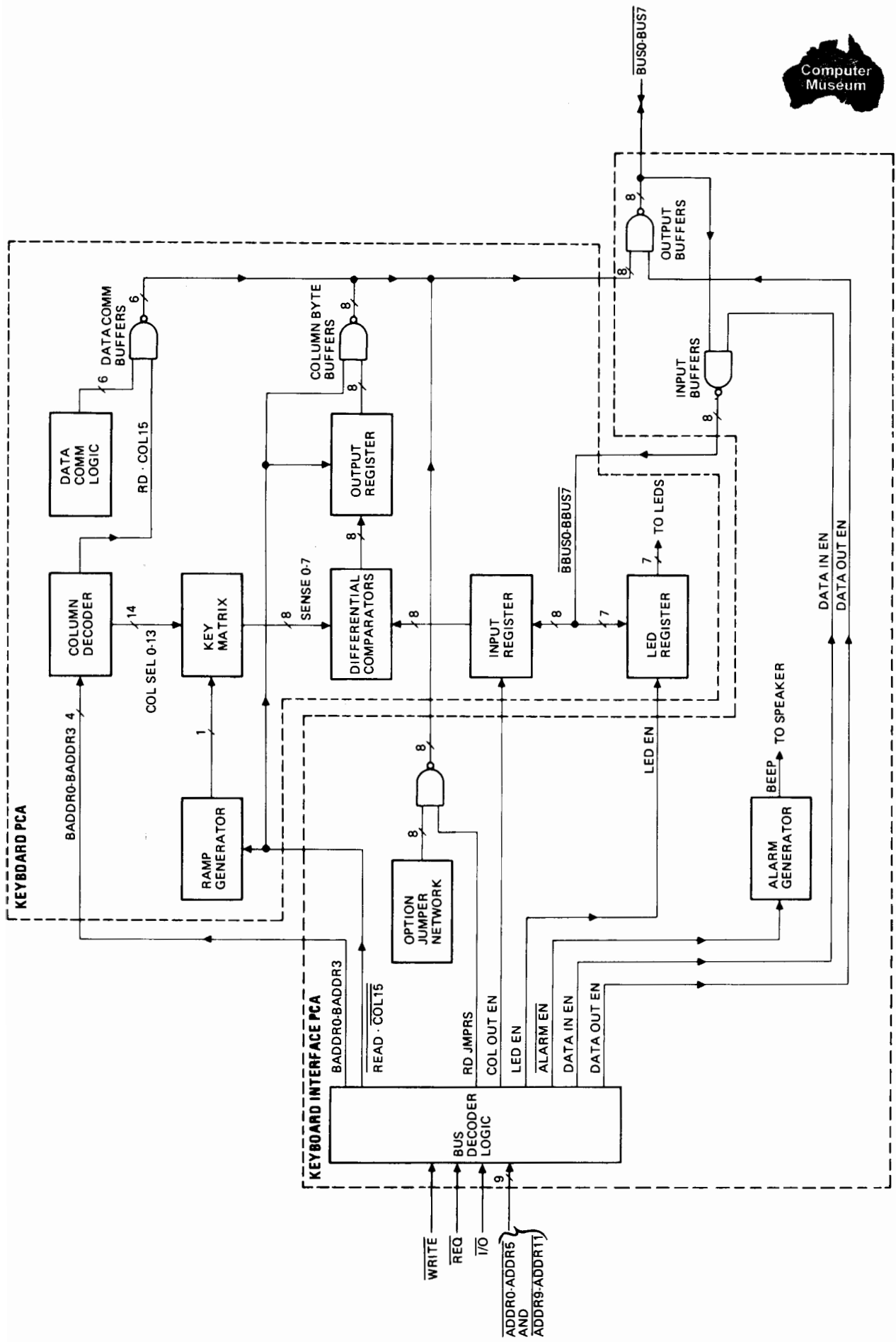


Figure 2
Keyboard Module Block Diagram
DEC-20-78

13255-91018

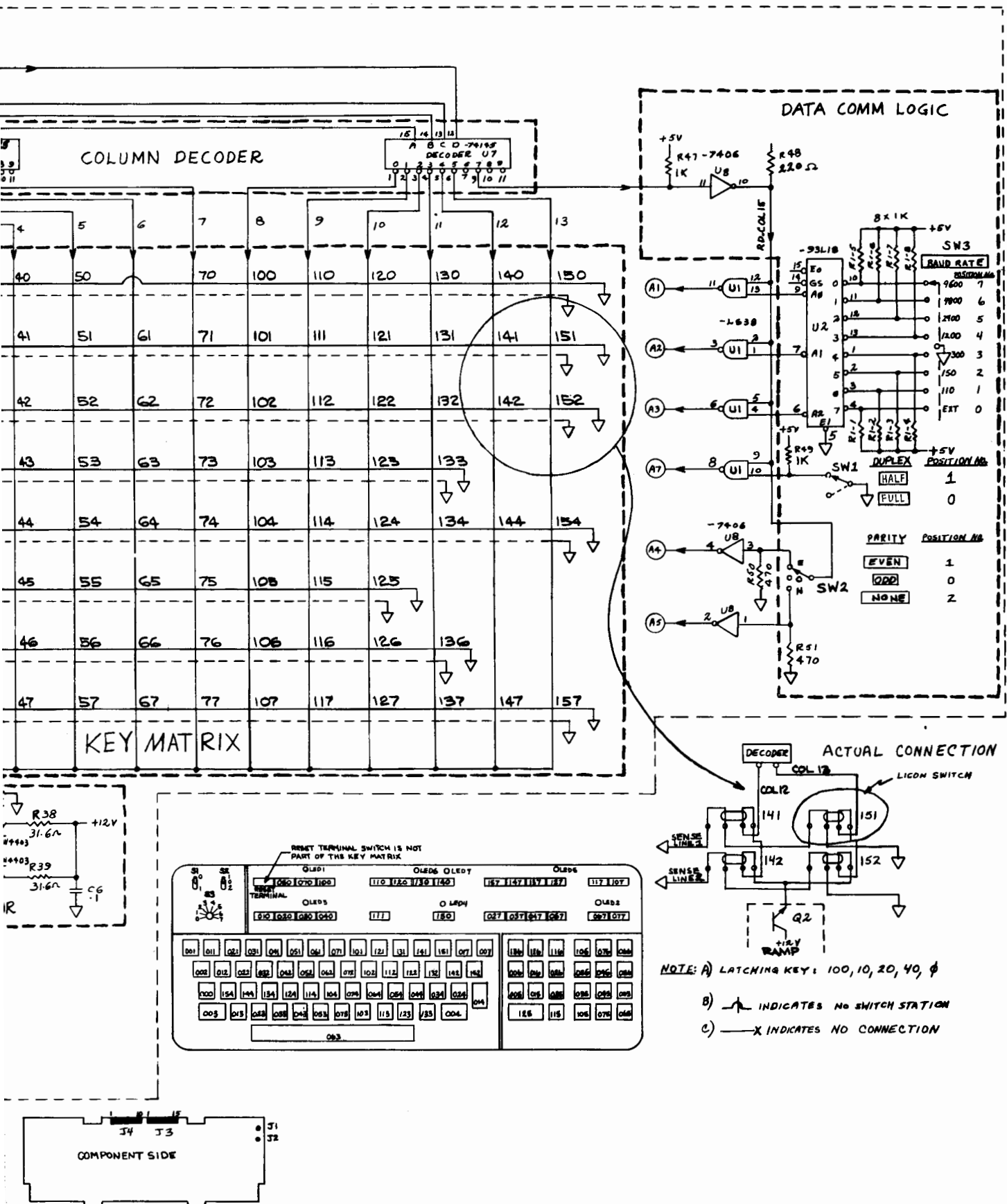
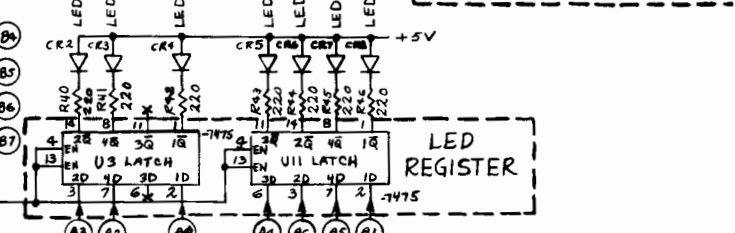
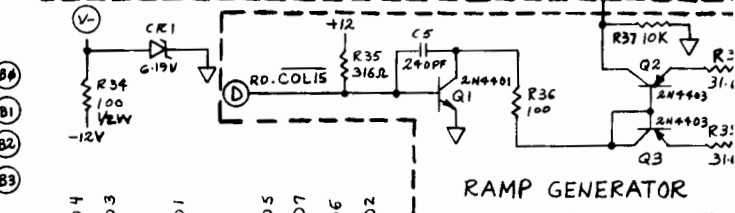
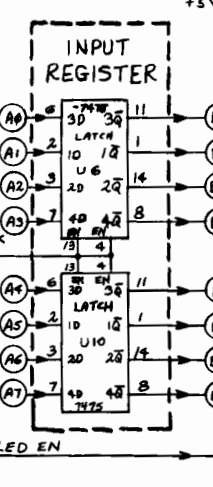
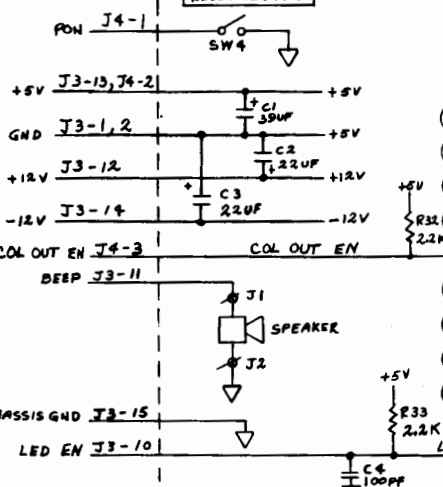
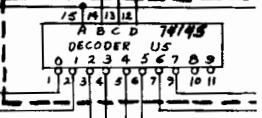
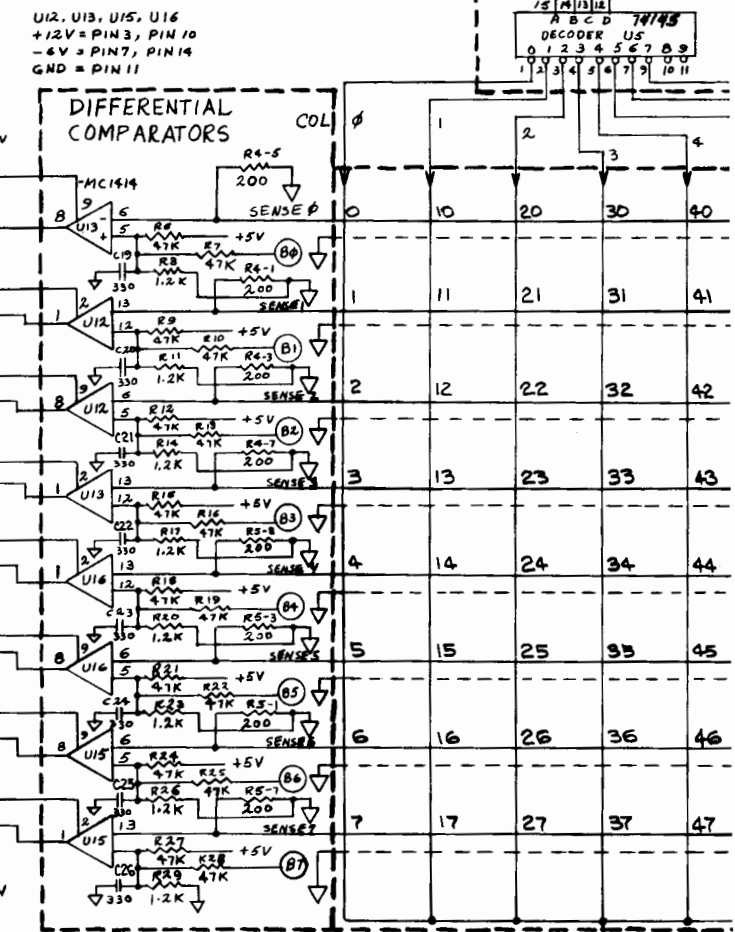
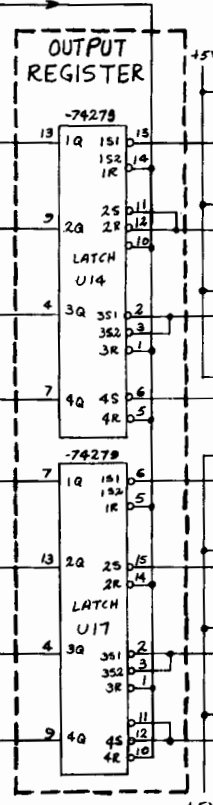
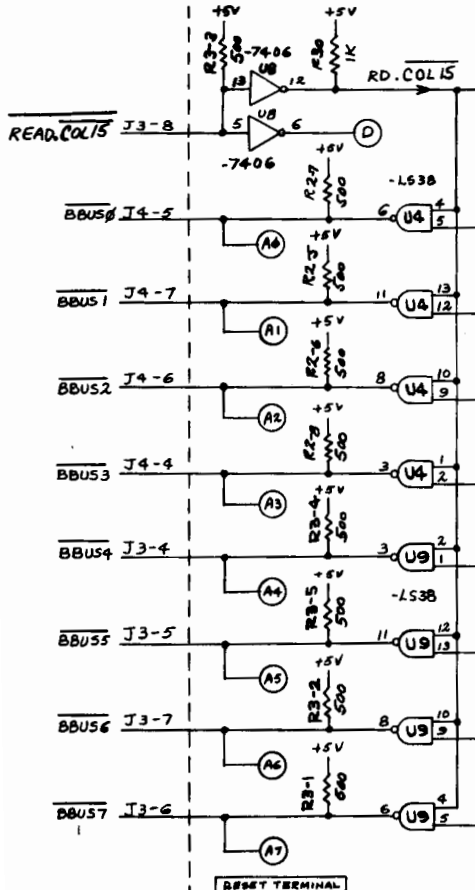
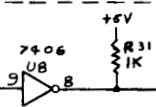
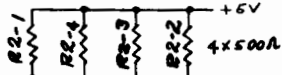


Figure 3
Keyboard PCA Schematic Diagram
DEC-20-78
13255-91018

To KEYBOARD
CABLE ASSY

BADDR3 J3-3
BADDR2 J4-9
BADDR1 J4-9
BADDR0 J4-10



U12, U13, U15, U16
+12V = PIN 3, PIN 10
-6V = PIN 7, PIN 14
GND = PIN 11

RAMP GENERATOR

LED REGISTER

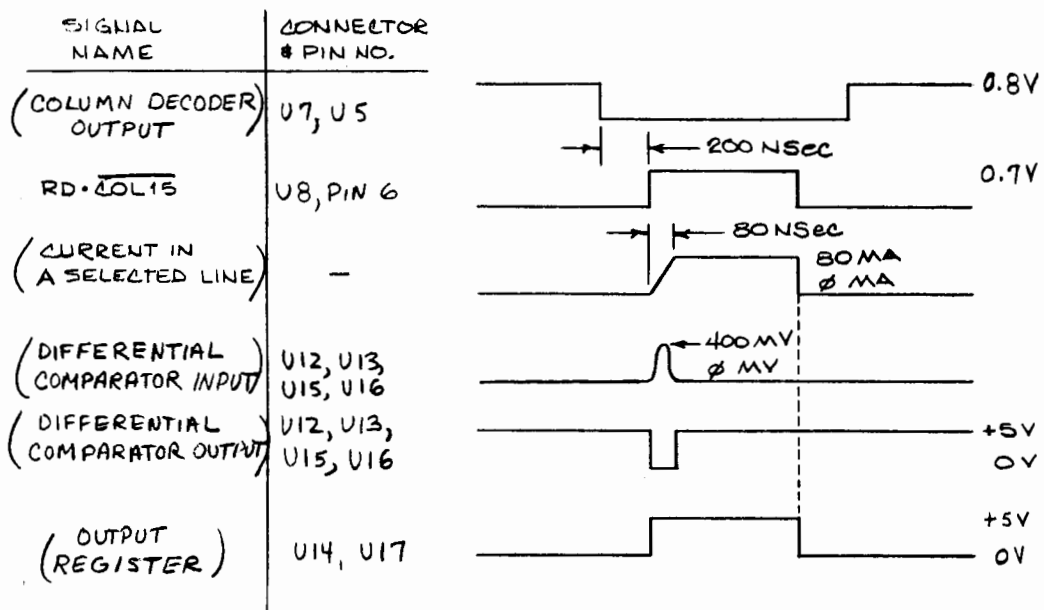


Figure 5
Differential Comparator Timing Diagram
DEC-20-78 13255-91018

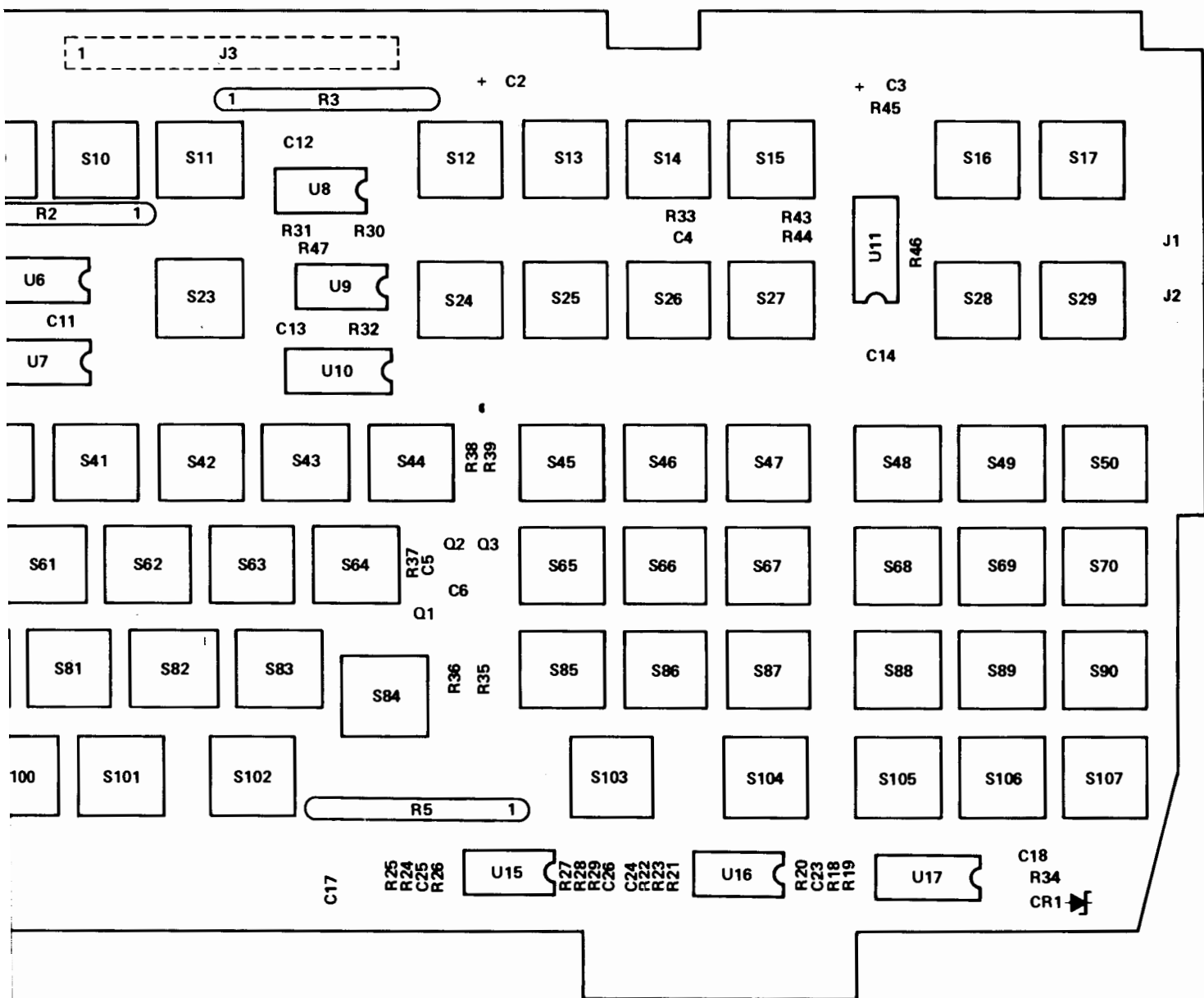

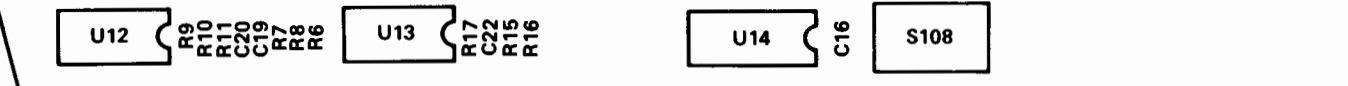
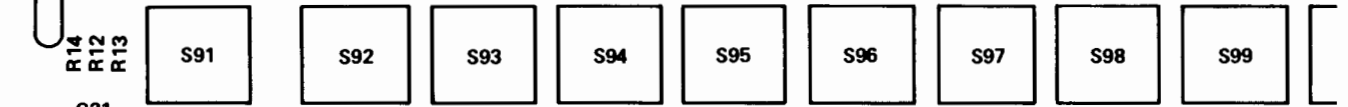
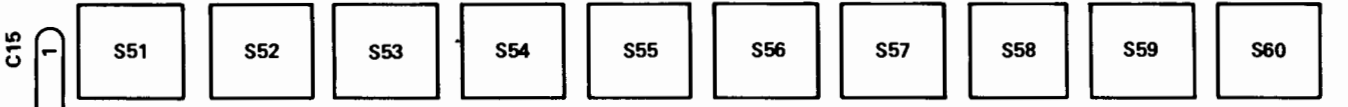
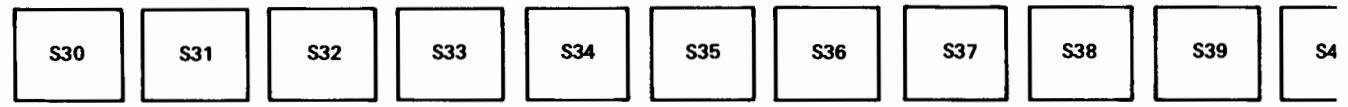
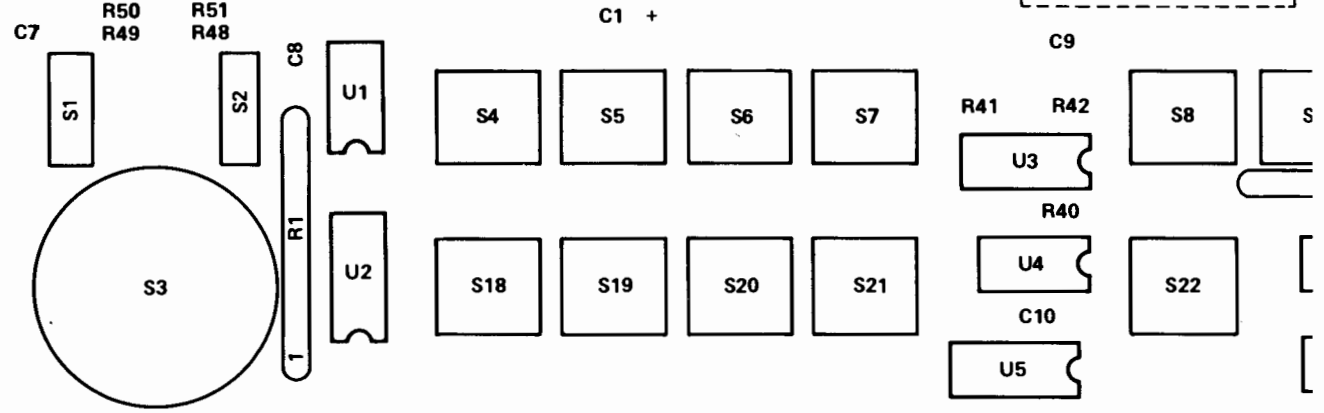


Figure 6
 Keyboard PCA Component Location Diagram
 DEC-20-78 13255-91018

 02640-60018 KEYBOARD
C-1707-42

1 J4





Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	02640-60018	0	1	KEYBOARD PRINTED CIRCUIT ASSEMBLY DATE CODE: C-1707-42	28480	02640-60018
C1	0180-0193	6	1	CAPACITOR-FXD 39UF+-10% 10VDC TA	56289	150U396X9010B2
C2	0180-0228	6	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150U226X9015B2
C3	0180-0228	6	0	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150U226X9015B2
C4	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
C5	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	72136	DM15F241J0300MV1CM
C6	0150-0121	5	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
C7	0160-2055	9	12	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C19	0160-3572	7	8	CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C20	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C21	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C22	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C23	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C24	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C25	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
C26	0160-3572	7		CAPACITOR-FXD 330PF +-10% 500VDC CER	28480	0160-3572
CR1	1902-0049	2	1	DIODE-ZNR 6.19V 5% 00-7 PD=.4W TC=+.022%	28480	1902-0049
E1	0360-0124	3	5	CONNECTOR-3GL CONT PIN .04-IN-88C-8Z RND	28480	0360-0124
E2	0360-0124	3		CONNECTOR-3GL CONT PIN .04-IN-88C-8Z RND	28480	0360-0124
E3	0360-0124	3		CONNECTOR-3GL CONT PIN .04-IN-88C-8Z RND	28480	0360-0124
E4	0360-0124	3		CONNECTOR-3GL CONT PIN .04-IN-88C-8Z RND	28480	0360-0124
E5	0360-0124	3		CONNECTOR-3GL CONT PIN .04-IN-88C-8Z RND	28480	0360-0124
J1				NOT ASSIGNED		
J2				NOT ASSIGNED		
J3	1251-3198	7	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-3198
J4	1251-3475	3	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-3475
Q1	1854-0467	5	1	TRANSISTOR NPN 2N4401 SI TO-92 PD=310MW	04713	2N4401
Q2	1853-0271	7	2	TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
Q3	1853-0271	7		TRANSISTOR PNP 2N4403 SI TO-92 PD=310MW	04713	2N4403
R1	0683-4735	4	16	RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R2	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R3	0683-1225	1	8	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R4	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R5	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R6	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R7	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R8	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R9	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R10	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R11	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R12	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R13	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R14	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R15	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R16	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R17	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R18	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R19	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R20	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R21	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R22	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R23	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R24	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R25	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R26	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R27	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R28	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
R29	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
R30	0683-1025	9	4	RESISTOR 1K 5% .25W FC TC=-400/+800	01121	CB1025

Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R31	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	C81025
R32	0683-2225	3	2	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	C82225
R33	0683-2225	5		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	C82225
R34	0686-1015	3	1	RESISTOR 100 5% .5W CC TC=0+529	01121	E81015
R35	0699-3402	1	1	RESISTOR 316 1% .5W F TC=0+100	28480	0698-3402
R36	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0+100	28480	0757-0198
R37	0683-1035	1	1	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	C81035
R38	0757-0180	2	2	RESISTOR 31.6 1% .125W F TC=0+100	28480	0757-0180
R39	0757-0180	2		RESISTOR 31.6 1% .125W F TC=0+100	28480	0757-0180
R40	0683-2215	1	8	RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R41	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R42	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R43	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R44	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R45	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R46	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R47	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	C81025
R48	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	C82215
R49	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	C81025
R50	0683-4715	0	2	RESISTOR 470 5% .25W FC TC=-400/+600	01121	C84715
R51	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	C84715
S#1	3101-1858	7	1	SWITCH-TGL SUBMIN SPDT .02A 20VAC/DC PC	28480	3101-1858
S#2	3101-1859	8	1	SWITCH-TGL SUBMIN SPDT .02A 20VAC/DC PC	28480	3101-1859
S#3	3100-3313	1	1	SWITCH-ROTARY 0.812 STRUT CTR SPCC; 6	28480	3100-3313
S#4	3101-1745	1	1	SWITCH-PB SPST-NO MOM .12A 28VAC	28480	3101-1745
S#5	3101-2137	7	98	SWITCH-PB SPST-NO MOM	28480	3101-2137
S#6	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#7	3101-2136	6	5	SWITCH-PB SPST-NO ALTNG	28480	3101-2136
S#8	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#9	3101-2136	6		SWITCH-PB SPST-NO ALTNG	28480	3101-2136
S#19	3101-2136	6		SWITCH-PB SPST-NO ALTNG	28480	3101-2136
S#20	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#21	3101-2136	6		SWITCH-PB SPST-NO ALTNG	28480	3101-2136
S#22	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#70	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#71	3101-2136	6		SWITCH-PB SPST-NO ALTNG	28480	3101-2136
S#72	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
S#108	3101-2137	7		SWITCH-PB SPST-NO MOM	28480	3101-2137
U1	1A20-1209	4	3	IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS38N
U2	1A20-0987	3	1	IC ENCOD TTL L B-INP	07263	93L18PC
U3	1A20-0301	5	4	IC LCH TTL D-TYPE 4-BIT	01295	SN7475N
U4	1A20-1209	4		IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS38N
U5	1A20-0491	4	2	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN74145N
U6	1A20-0301	5		IC LCH TTL D-TYPE 4-BIT	01295	SN7475N
U7	1A20-0491	4		IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN74145N
U8	1A20-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
U9	1A20-1209	4		IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS38N
U10	1A20-0301	5		IC LCH TTL D-TYPE 4-BIT	01295	SN7475N
U11	1A20-0301	5		IC LCH TTL D-TYPE 4-BIT	01295	SN7475N
U12	1A26-0051	4	4	COMPARATOR GP DUAL 14-DIP-P	01295	TL514CN
U13	1A26-0051	4		COMPARATOR GP DUAL 14-DIP-P	01295	TL514CN
U14	1A20-1089	8	2	IC LCH TTL QUAD	01295	SN74279N
U15	1A26-0051	4		COMPARATOR GP DUAL 14-DIP-P	01295	TL514CN
U16	1A26-0051	4		COMPARATOR GP DUAL 14-DIP-P	01295	TL514CN
U17	1A20-1089	8		IC LCH TTL QUAD	01295	SN74279N
MISCELLANEOUS PARTS						
	0380-0371	4	7	SPACER-RND .375-IN-LG .14-IN-ID	28480	0380-0371
	0380-0585	2	4	STANDOFF-RVT-ON .531-IN-LG 6-32TMD	00000	ORDER BY DESCRIPTION
	0470-0231	6		ADHESIVE LOCTITE 242 POLYESTER 1P BLE	05972	242
	1450-0528	3	7	LAMP SOCKET BIPIN-SKY BIPIN-TERM PC	28480	1450-0528
	2190-0027	6	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0027
	2190-0047	0	2	WASHER-LK 82 CTSK EXT T NO. 6 .142-IN-ID	28480	2190-0047
	2360-0117	6	1	SCREW-MACH 6-32 .375-IN-LG PAN-RO-POZI	00000	ORDER BY DESCRIPTION
	2360-0197	2	4	SCREW-MACH 6-32 .375-IN-LG PAN-RO-POZI	00000	ORDER BY DESCRIPTION
	2950-0052	9	2	NUT-MEX-DBL-CHAM 1/4-40-TMD .062-IN-THK	00000	ORDER BY DESCRIPTION
	2950-0121	3	1	NUT-MEX-DBL-CHAM 1/4-32-TMD .062-IN-THK	00000	ORDER BY DESCRIPTION
	3050-0099	7	2	WASHER-FL MTLG NO. 12 .25-IN-ID .5-IN-OD	28480	3050-0099
	5001-2817	0	1	GROUNDING PLATE	28480	5001-2817
	02640-00003	7	1	PLATE, SWITCH MOUNTING	28480	02640-00003

Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	02645-60023	2	1	KEYBOARD ASSEMBLY REF: 02640-60018	28480	02645-60023
	0370-2260	3	1	KEY CAP, 1)	28480	0370-2260
	0370-2261	4	1	KEY CAP, 2"	28480	0370-2261
	0370-2262	5	1	KEY CAP, 3#	28480	0370-2262
	0370-2263	6	1	KEY CAP, 4#	28480	0370-2263
	0370-2264	7	1	KEY CAP, 5X	28480	0370-2264
	0370-2265	8	1	KEY CAP, 6#	28480	0370-2265
	0370-2266	9	1	KEY CAP, 7"	28480	0370-2266
	0370-2267	0	1	KEY CAP, 8(28480	0370-2267
	0370-2268	1	1	KEY CAP, 9)	28480	0370-2268
	0370-2641	4	1	KEY CAP, 0	28480	0370-2641
	0370-2270	5	1	KEY CAP, A	28480	0370-2270
	0370-2271	6	1	KEY CAP, B	28480	0370-2271
	0370-2272	7	1	KEY CAP, C	28480	0370-2272
	0370-2273	8	1	KEY CAP, D	28480	0370-2273
	0370-2274	9	1	KEY CAP, E	28480	0370-2274
	0370-2275	0	1	KEY CAP, F	28480	0370-2275
	0370-2276	1	1	KEY CAP, G	28480	0370-2276
	0370-2277	2	1	KEY CAP, H	28480	0370-2277
	0370-2278	3	1	KEY CAP, I	28480	0370-2278
	0370-2279	4	1	KEY CAP, J	28480	0370-2279
	0370-2280	7	1	KEY CAP, K	28480	0370-2280
	0370-2281	8	1	KEY CAP, L	28480	0370-2281
	0370-2282	9	1	KEY CAP, M	28480	0370-2282
	0370-2283	0	1	KEY CAP, N	28480	0370-2283
	0370-2284	1	1	KEY CAP, O	28480	0370-2284
	0370-2285	2	1	KEY CAP, P	28480	0370-2285
	0370-2286	3	1	KEY CAP, Q	28480	0370-2286
	0370-2287	4	1	KEY CAP, R	28480	0370-2287
	0370-2288	5	1	KEY CAP, S	28480	0370-2288
	0370-2289	6	1	KEY CAP, T	28480	0370-2289
	0370-2290	9	1	KEY CAP, U	28480	0370-2290
	0370-2291	0	1	KEY CAP, V	28480	0370-2291
	0370-2292	1	1	KEY CAP, W	28480	0370-2292
	0370-2293	2	1	KEY CAP, X	28480	0370-2293
	0370-2294	3	1	KEY CAP, Y	28480	0370-2294
	0370-2295	4	1	KEY CAP, Z	28480	0370-2295
	0370-2296	5	1	KEY CAP, <	28480	0370-2296
	0370-2297	6	1	KEY CAP, >	28480	0370-2297
	0370-2298	7	1	KEY CAP, ?/	28480	0370-2298
	0370-0620	5	1	KEY CAP, 0	28480	0370-0620
	0370-2322	8	1	KEY CAP, DECIMAL POINT	28480	0370-2322
	0370-2312	6	1	KEY CAP, 1	28480	0370-2312
	0370-2313	7	1	KEY CAP, 2	28480	0370-2313
	0370-2314	8	1	KEY CAP, 3	28480	0370-2314
	0370-2315	9	1	KEY CAP, 4	28480	0370-2315
	0370-2316	0	1	KEY CAP, 5	28480	0370-2316
	0370-2317	1	1	KEY CAP, 6	28480	0370-2317
	0370-2318	2	1	KEY CAP, 7	28480	0370-2318
	0370-2319	3	1	KEY CAP, 8	28480	0370-2319
	0370-2320	6	1	KEY CAP, 9	28480	0370-2320
	0370-2324	0	1	KEY CAP, +)	28480	0370-2324
	0370-2325	1	1	KEY CAP, 1*	28480	0370-2325
	0370-2635	6	1	KEY CAP, RETURN	28480	0370-2635
	0370-2636	7	2	KEY CAP, SHIFT	28480	0370-2636
	0370-2637	8	1	KEY CAP, CNTL	28480	0370-2637
	0370-2638	9	1	KEY CAP, NEXT PAGE	28480	0370-2638
	0370-2639	0	1	KEY CAP, PREV PAGE	28480	0370-2639
	0370-2640	3	4	KEY CAP, ARROW	28480	0370-2640
	0370-2642	5	1	KEY CAP, HOME-UP ARROW	28480	0370-2642
	0370-2644	7	15	KEY CAP, FUNCTION, GRAY	28480	0370-2644
	0370-2894	9	1	KEY CAP, FUNCTION, GREEN	28480	0370-2894
	0370-2895	0	1	KEY CAP, FUNCTION, GOLD	28480	0370-2895
	0370-2898	3	1	KEY CAP, RESET, BLACK	28480	0370-2898
	0370-2646	9	1	KEY CAP, ESC	28480	0370-2646
	0370-2648	1	1	KEY CAP, =#	28480	0370-2648
	0370-2650	5	1	KEY CAP, - DEL	28480	0370-2650
	0370-2651	6	1	KEY CAP, BACKSLASH	28480	0370-2651
	0370-2652	7	1	KEY CAP, LEFT BRACKET/LEFT BRACE	28480	0370-2652
	0370-2653	8	1	KEY CAP, RIGHT BRACKET/RIGHT BRACE	28480	0370-2653
	0370-2654	9	1	KEY CAP, APPROX	28480	0370-2654
	0370-2655	0	1	KEY CAP, @*	28480	0370-2655
	0370-2656	1	1	KEY CAP, CLEAR TAB	28480	0370-2656
	0370-2657	2	1	KEY CAP, SET TAB	28480	0370-2657

Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0370-2658	3	1	KEY CAP, ROLL UP	28480	0370-2658
	0370-2659	4	1	KEY CAP, ROLL DOWN	28480	0370-2659
	0370-2765	3	1	KEY CAP, F1	28480	0370-2765
	0370-2766	4	1	KEY CAP, F2	28480	0370-2766
	0370-2767	5	1	KEY CAP, F3	28480	0370-2767
	0370-2768	6	1	KEY CAP, F4	28480	0370-2768
	0370-2769	7	1	KEY CAP, F5	28480	0370-2769
	0370-2770	0	1	KEY CAP, F6	28480	0370-2770
	0370-2771	1	1	KEY CAP, F7	28480	0370-2771
	0370-2772	2	1	KEY CAP, F8	28480	0370-2772
	0370-2877	8	1	KEY CAP, BACK SPACE	28480	0370-2877
	0370-3878	1	1	KEY CAP, TAB	28480	0370-3878
	0370-2982	6	1	KEY CAP, CLR DSPLY	28480	0370-2982
	0370-2991	7	1	KEY CAP, CONCENTRC BAR	28480	0370-2991
	0371-0213	4	1	KEY CAP, SPACE BAR	28480	0371-0213
	0403-0243	9	2	BUMPER FOOT-ADH MTG .38-IN-WD .25-IN-THK	28480	0403-0243
	0403-0285	9	4	BUMPER FOOT-ADH MTG 12.7-MM-WD	28480	0403-0285
	0470-0231	6	2	ADHESIVE LOCTITE 242 POLYESTER 1P BLE	05972	242
	1400-0054	5	2	CABLE CLAMP-HFCL .078-DIA .175-WD STL	28480	1400-0054
	1400-0440	3	1	CABLE TIE .062-1.75-DIA .184-WD NYL	28480	1400-0440
	1460-1562	8	1	SPRING-TRSN MUN BLK OXU	28480	1460-1562
	1530-1983	6	2		28480	1530-1983
	1990-0485	5	1	LED-VISIBLE LUM-INT#800UCD IF#30MA-MAX	28480	5082-4984
	1990-0486	6	5	LED-VISIBLE LUM-INT#1MCD IF#20MA-MAX	28480	5082-4684
	1990-0487	7	1	LED-VISIBLE LUM-INT#1MCD IF#20MA-MAX	28480	5082-4584
	2190-0918	4	8	WASHER-LK MLCL NO. 6 .141-IN-ID	28480	2190-0918
	2360-0193	8	2	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0201	9	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0203	1	5	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0066	8	6	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0066
	4040-1356	1	1	SWITCH-COVER	28480	4040-1356
	7120-1927	5	1	SERIAL TAG	28480	7120-1927
	7120-6925	3	1	KEYBOARD OVERLAY	28480	7120-6925
	9160-0233	0	1	LOUDSPEAKER	28480	9160-0233
	5001-2815	8	1	BUSHING, SPACEBAR	28480	5001-2815
	02640-40029	1	1	BASE, KEYBOARD	28480	02640-40029
	5001-2816	9	2	PLUNGER	28480	5001-2816
	02640-40030	4	1	COVER, KEYBOARD	28480	02640-40030
	02640-60018	0	1	KEYBOARD, PRINTED CIRCUIT ASSEMBLY	28480	02640-60018
	02640-60041	9	1	LOUDSPEAKER, CABLE ASSEMBLY	28480	02640-60041
	02640-60081	7	1	KEYBOARD, CABLE ASSEMBLY	28480	02640-60081