

LOCATION OBJECT CODE LINE SOURCE LINE

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1 "8085"
2 ;MONITOR I/O
3 ;
<0000> 4 DRA EQU 00H ;8755 DATA PORT A
<0001> 5 DRB EQU 01H ;8755 DATA PORT B
<0002> 6 DDRA EQU 02H ;8755 DATA DIRECTION PORT A
<0003> 7 DDRB EQU 03H ;8755 DATA DIRECTION PORT B
<0008> 8 CSR1 EQU 08H ;8155 DATA COMMAND/STATUS REG.
<000C> 9 TIMERL EQU 0CH ;8155 TIMER PORT LOW BYTE
<000D> 10 TIMERH EQU 0DH ;8155 TIMER PORT HIGH BYTE
11 ;
12 ;MONITOR RAM LOCATIONS
13 ;
<0000> 14 BEGIN EQU 0000H ;START OF MONITOR
<08FF> 15 USRCSR EQU 08FFH ;USER CSR IMAGE
<08FE> 16 DIGIT EQU 08FEH ;KB DECODE CHAR. STORAGE
<08FD> 17 DSPBFA EQU 08FDH ;DISPLAY ADDRESS BUFFER
<08FB> 18 DSPBFD EQU 08FBH ;DISPLAY DATA BUFFER
<08F3> 19 INBUFF EQU 08F3H ;INPUT BUFFER
<08F0> 20 HSAVE1 EQU 08F0H ;SAVE AREA 1 FOR M&L
<08EE> 21 HSAVE2 EQU 08EEH ;SAVE AREA 2 FOR M&L
<08EC> 22 HLDISP EQU 08ECH ;DISPLAY POINTER SAVE AREA
<08EB> 23 DGT CNT EQU 08EBH ;SAVE AREA FOR COUNTING DIGITS
<08EA> 24 DIGIT2 EQU 08EAH ;KB DECODE CHAR. STORAGE AREA
<08E8> 25 STKPT EQU 08E8H ;POINT TO TOP OF STACK IN S/S
<08E6> 26 BKSAVE EQU 08E6H ;POINT TO BOTTOM USER STACK
<08E2> 27 NBRKRG EQU 08E2H ;NO. OF BREAK POINTS & BUFFER
<08E1> 28 INTERF EQU 08E1H ;S/S INTERRUPT FLAG
<08C0> 29 STACK EQU 08C0H ;START OF STACK
30 ;
31 ;USER INTERRUPT VECTORS PUT JUMP ADDRESS HERE
32 ; FOR INTERRUPT VECTORS
33 ;
<08DC> 34 USER5 EQU 08DCH ; RST 7.5
<08D9> 35 USER4 EQU 08D9H ; RST 6.5
<08D6> 36 USER3 EQU 08D6H ; RST 6
<08D3> 37 USER2 EQU 08D3H ; RST 5.5 NOT SUPPORTED
38 ; IN HARDWARE
<08D0> 39 USER1 EQU 08D0H ; RST 5
40 ;
41 ;USER DEFINED VECTORS
42 ;
<08CC> 43 USERP EQU 08CCH ;INITIALIZED IN
<08C9> 44 USERL EQU 08C9H ;START OF MONITOR
<08C6> 45 USERR EQU 08C6H ;TO A JUMP TO COMMAND
46 ;
47 ;MONITOR INTERRUPT VECTORS
48 ;
<08CF> 49 RST1 EQU 08CFH ;USED FOR BREAK POINT
<08C3> 50 UTIMER EQU 08C3H ;INIT. TO A JUMP TO DISREG
51 ;
52 ;*****
53 ;* IF ANY CHANGES ARE MADE BEFORE 'DISREG' ROUTINE, *
54 ;* 2nd BYTE IN 'UMOVE' (038B) MUST BE CHANGED TO *
55 ;* REFLECT NEW LOCATION OF 'DISREG' ROUTINE. *
56 ;*****
57 ;

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58 ;RST-7 USED TO RETURN TO COMMAND MODE (WARM START)
59 ;RST-0 USED TO RETURN TO MONITOR (COLD START)
60 ;TRAP USED FOR S/S OR BY USER. (INSERT JUMP
61 ;INSTRUCTION AT UTIMER)
62 ;
63 ;COMMAND KEY DECODE HEX VALUE
64 ;
<0010> 65 X EQU 10H ;EXECUTE
<0011> 66 P EQU 11H ;USER DEFINED
<0012> 67 L1 EQU 12H ;USER DEFINED
<0017> 68 R EQU 17H ;USER DEFINED
<0013> 69 W EQU 13H ;WRITE/READ
<0014> 70 B1 EQU 14H ;BREAK POINT
<0015> 71 S EQU 15H ;SINGLE STEP
<0016> 72 D1 EQU 16H ;DISPLAY CPU REGS.
73 ;
74 ;MONITOR START A LOCATION 0 HEX
75 ;
76 ORG BEGIN
0000 3108C0 77 START LXI SP,STACK
0003 C30073 78 JMP INITIZ
0006 00 79 NOP
0007 00 80 NOP
0008 F5 81 INTB PUSH PSW ;SAVE ALL CPU REGS.
0009 C5 82 PUSH B ;ON INTERRUPT FROM
000A D5 83 PUSH D ;BREAK POINT
000B E5 84 PUSH H
000C 21FFFC 85 LXI H,0FFFC ;SAVE STACK POINTER
000F 39 86 DAD SP ;POINTING TO WHAT IT
0010 E5 87 PUSH H ;WOULD BE AT END OF STACK
0011 EB 88 XCHG
0012 20 89 RIM
0013 F5 90 PUSH PSW
0014 21000E 91 LXI H,000EH ;POINT H&L TO PROGRAM COUNTER
0017 39 92 DAD SP ;IN STACK
0018 CD0040 93 CALL MDDPC
94 ;
95 ;RESTORE ALL CPU REGS. ON RETURN FROM INTERRUPT
96 ; (BREAK POINT & SINGLE STEP)
97 ;
001B F1 98 RESREG POP PSW
001C 30 99 SIM
001D E1 100 POP H ;DUMMY POP FOR STACK POINTER
001E E1 101 POP H ;PLACED ON STACK
001F D1 102 POP D
0020 C1 103 POP B
0021 F1 104 POP PSW
0022 00 105 NOP
0023 C9 106 RET
0024 C308C3 107 INTSS JMP UTIMER ;VECTORED JUMP ON S/STEP
108 ;INTERRUPT
0027 00 109 NOP
002B C308D0 110 RST5 JMP USER1 ;FOR ALL USER OPERANDS
002B 00 111 NOP ;SEE USER INTERRUPT VECTORS
002C C308D3 112 RST5S JMP USER2
002F 00 113 NOP
0030 C308D6 114 RST6 JMP USER3

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LOCATION	OBJECT CODE	LINE	SOURCE LINE
0033	00	115	NOP
0034	C308D9	116	RST65 JMP USER4
0037	00	117	NOP
0038	C3008A	118	COM JMP COMMD ;WARM START ON RST-7
003B	00	119	NOP
003C	C308DC	120	RST75 JMP USER5
003F	00	121	NOP
		122	;
		123	;BREAK POINT ROUTINE
		124	;
0040	EB	125	MODPC XCHG
0041	2208E6	126	SHLD BKSAVE ;BACK-UP USER'S PC REG.
0044	EB	127	XCHG ;STORED IN STACK
0045	2208E8	128	SHLD STKPT
0048	2B	129	DCX H
0049	56	130	MOV D,M
004A	2B	131	DCX H
004B	5E	132	MOV E,M
004C	1B	133	DCX D
004D	73	134	MOV M,E
004E	23	135	INX H
004F	72	136	MOV M,D
0050	2B	137	DCX H
0051	2208EE	138	SHLD HSAVE2
0054	2108E2	139	LXI H,NOBKRG
0057	7E	140	MOV A,M ;DECREMENT NUMBER IN
0058	47	141	MOV B,A ;BREAK POINT COUNTER
0059	3D	142	DCR A
005A	77	143	MOV M,A ;RETURN USER'S INSTRUCTION
005B	23	144	INX H ;STORED IN BUFFER TO USER'S
005C	7E	145	MOV A,M ;PROGRAM
005D	EB	146	XCHG
005E	77	147	MOV M,A
005F	EB	148	XCHG
0060	1108E3	149	LXI D,NOBKRG+1
0063	23	150	STEP INX H ;MOVE STORED USER'S
0064	7E	151	MOV A,M ;INSTRUCTION
0065	EB	152	XCHG ;TO TOP OF BUFFER
0066	77	153	MOV M,A
0067	23	154	INX H
0068	05	155	DCR B
0069	C20063	156	JNZ STEP
006C	2A08E6	157	LHLD BKSAVE ;LOAD H&L WITH BOTTOM OF
006F	EB	158	XCHG ;STACK AND MOVE IT TO D&E
0070	C3030A	159	JMP DREG ;GO DISPLAY CPU REG.
		160	;
		161	;INITIALIZATION ROUTINE (COLD START)
		162	;
0073	3EFF	163	INITIZ MVI A,0FFH ;INITIALIZE 8755 I/O CHIP
0075	D303	164	OUT DDRB ;PORT A - BITS 4-7 ARE INPUTS
0077	3E07	165	MVI A,07H ;PORT B & PORT A - BITS 0-2
0079	D302	166	OUT DDRA ;ARE OUTPUT
007B	060C	167	MVI B,0CH
007D	1108C3	168	LXI D,UTIMER ;MOVE RST 7 (FF) TO USER
0080	21038B	169	LXI H,UMOVE ;DEFINED SUBROUTINES
0083	CD00E7	170	CALL MOVE
0086	AF	171	XRA A ;MOVE ZERO TO # OF BREAK POINTS

LOCATION	OBJECT CODE	LINE	SOURCE LINE	
0087	3208E2	172	STA NOBKRG	
		173	;	
		174	;COMMAND ROUTINE	
		175	;	
008A	3108C0	176	COMMD LXI SP,STACK	;OUTPUTS PROMPT INDICATION
008D	AF	177	XRA A	;AND SCANS KEYPAD FOR
008E	3208E1	178	STA INTERF	;COMMAND KEY
0091	CD00DF	179	CALL MOVE1	
0094	CD015B	180	CALL SCAN	
0097	FE13	181	CPI W	
0099	CA00F2	182	JZ WRITE	
009C	FE15	183	CPI S	
009E	CA0359	184	JZ SINSTP	
00A1	FE16	185	CPI D1	
00A3	CC02E0	186	CZ DISREG	
00A6	CA008A	187	JZ COMMD	
00A9	FE10	188	CPI X	
00AB	CA0265	189	JZ EXECUTE	
00AE	FE14	190	CPI B1	
00B0	CA027A	191	JZ BRKPT	
00B3	FE12	192	CPI L1	
00B5	CA08C9	193	JZ USERL	
00B8	FE11	194	CPI P	
00BA	CA08CC	195	JZ USERP	
00BD	FE17	196	CPI R	
00BF	CA08C6	197	JZ USERR	
00C2	0606	198	ERROR MVI B,06H	;IF NOT A COMMAND KEY
00C4	1108F8	199	LXI D,DSPBFD	;DISPLAY ERROR MESSAGE
00C7	2103AB	200	LXI H,ERRMAG	
00CA	7E	201	ERROR1 MOV A,M	;TOO MANY BREAK POINTS ENTERED
00CB	EB	202	XCHG	;DISPLAY ERROR MESSAGE
00CC	77	203	MOV M,A	
00CD	EB	204	XCHG	
00CE	23	205	INX H	
00CF	13	206	INX D	
00D0	05	207	DCR B	
00D1	C200CA	208	JNZ ERROR1	
00D4	CD015B	209	CHECK CALL SCAN	;WAIT FOR "X" KEY TO ESCAPE
00D7	FE10	210	CPI X	
00D9	C200D4	211	JNZ CHECK	
00DC	C3008A	212	JMP COMMD	
		213	;	
		214	;MOVE DATA ROUTINE	
		215	;	
00DF	0606	216	MOVE1 MVI B,06H	;MOVE PROMPT TO DISPLAY
00E1	1108F8	217	LXI D,DSPBFD	;BUFFER
00E4	2103A5	218	LXI H,SINEIN	
00E7	7E	219	MOVE MOV A,M	;WILL MOVE DATA FROM ONE
00E8	EB	220	XCHG	;AREA POINTED TO BY HAL
00E9	77	221	MOV M,A	;TO ANOTHER POINTED TO BY
00EA	EB	222	XCHG	;D&E. # BYTES TO MOVE IS
00EB	23	223	INX H	;IN REG. B
00EC	13	224	INX D	
00ED	05	225	DCR B	
00EE	C200E7	226	JNZ MOVE	
00F1	C9	227	RET	
		228	;	

LOCATION	OBJECT CODE	LINE	SOURCE LINE	
		229	;READ/WRITE ROUTINE	
		230	;	
00F2	CD02D9	231	WRITE	CALL ENTER ;DATA ENTERED VIA KEYPAD
00F5	CD01C9	232		CALL INPUT4 ;IS PLACED IN MEMORY AFTER
00F8	CD0144	233	NEXT	CALL DSDATA ;"X" KEY IS PRESSED AND
00FB	CD01E0	234		CALL INPUT2 ;MEMORY POINTER IS INCREMENTED
00FE	DA0111	235		JC REDO ;ONE LOCATION.
0101	3208EA	236	SECENT	STA DIGIT2
0104	CD01E0	237		CALL INPUT2
0107	D20101	238		JNC SECENT
010A	3A08EA	239		LDA DIGIT2
010D	2A08F0	240		LHLD HSAVE1 ;IF "X" KEY IS NOT PRESSED
0110	77	241		MOV M,A ;DATA MAY BE REENTERED FOR
0111	2108FD	242	REDO	LXI H,DSPBFA ;PRESENT LOCATION
0114	2208EC	243		SHLD HLDISP
0117	2A08F0	244		LHLD HSAVE1
011A	23	245		INX H
011B	2208F0	246		SHLD HSAVE1
011E	7C	247		MOV A,H
011F	CD012F	248		CALL HIFORM
0122	2A08F0	249		LHLD HSAVE1 ;ADDRESS AND DATA ENTERED
0125	7D	250		MOV A,L ;IS DISPLAYED ON LED'S
0126	CD012F	251		CALL HIFORM
0129	2A08F0	252		LHLD HSAVE1
012C	C300F8	253		JMP NEXT
		254	;	
		255	;The following subroutine will format a binary character in Acc.	
		256	;to a display character and then store it in the Display Buffer	
		257	;	
		258	;Enter the subroutine with character to be displayed in Acc. and	
		259	;storage location HLDISP pointing to the Display Buffer.	
		260	;	
		261	;Registers destroyed: A, H, L, and Flags	
		262	;	
012F	3208FE	263	HIFORM	STA DIGIT ;THIS SUBROUTINE WILL
0132	E6F0	264		ANI OF0H ;FORMAT A BINARY CHARACTER
0134	0F	265		RRC ;IN REG. A TO A DISPLAY
0135	0F	266		RRC ;CHARACTER AND THEN STORE IT
0136	0F	267		RRC ;IN THE DISPLAY BUFFER.
0137	0F	268		RRC
0138	CD024D	269		CALL CONHEX
013B	3A08FE	270		LDA DIGIT
013E	E60F	271		ANI OFH
0140	CD024D	272		CALL CONHEX
0143	C9	273		RET
		274	;	
		275	;The following subroutine will format the data pointed to by H&L	
		276	;and store it in the Display Buffer.	
		277	;	
		278	;Enter the subroutine with Registers H&L pointing to the data	
		279	;to be converted to a display character and storage locataion	
		280	;HLDISP pointing to the Display Buffer.	
		281	;	
		282	;Registers destroyed: A, H, L, and Flags	
		283	;	
0144	2208F0	284	DSDATA	SHLD HSAVE1 ;THIS DATA POINTED TO BY H&L
0147	7E	285		MOV A,M ;IS FORMATE BY THIS

LOCATION	OBJECT CODE	LINE	SOURCE LINE
0148	0F	286	RRC ;SUBROUTINE AND STORED
0149	0F	287	RRC ;IN THE DISPLAY BUFFER
014A	0F	288	RRC
014B	0F	289	RRC
014C	E60F	290	ANI 0FH
014E	CD024D	291	CALL CONHEX
0151	2A08F0	292	LHLD HSAVE1
0154	7E	293	MOV A,M
0155	E60F	294	ANI 0FH
0157	CD024D	295	CALL CONHEX
015A	C9	296	RET
		297 ;	
		298 ;SCAN KEYPAD & REFRESH DISPLAY	
		299 ;	
		300 ;The following subroutine will scan, debounce and decode keypad.	
		301 ;In addition it will display characters and refresh the LED display	
		302 ;	
		303 ;Enter the subroutine with display characters in the Display	
		304 ;Buffer. The subroutine will then display the characters on the	
		305 ;LED's. It will return when any key is pressed. When returning,	
		306 ;the binary representation of the key pressed is in Acc.	
		307 ;	
		308 ;Registers destroyed: All	
		309 ;	
015B	0E07	310 SCAN	MVI C,07H ;SET UP TO SCAN KEYPAD
015D	0D	311 SCAN1	DCR C
015E	CA015B	312	JZ SCAN
0161	CD016A	313	CALL SCAN2 ;SCAN ONE COLLUM
0164	C201BF	314	JNZ SCAN4 ;IF KEY PRESSED GO DEBOUNCE KEY,
0167	C3015D	315	JMP SCAN1 ;IF NOT, SCAN NEXT COLLUM
016A	79	316 SCAN2	MOV A,C ;SCANNING COLLUM AND OUTPUTING
016B	3D	317	DCR A ;DATA FROM DISPLAY BUFFER
016C	D300	318	OUT DRA ;TO LED DISPLAY
016E	1108F8	319	LXI D,DSPBFD
0171	83	320	ADD E
0172	5F	321	MOV E,A
0173	1A	322	LDAX D
0174	D301	323	OUT DRB
0176	CD01B1	324	CALL DELAY
0179	DB00	325 SCAN3	IN DRA ;CHECK FOR KEY PRESSED
017B	E6F0	326	ANI 0F0H
017D	2F	327	CMA
017E	E6F0	328	ANI 0F0H
0180	C9	329	RET
0181	112004	330 DELAY	LXI D,2004H ;DEBOUNCE DELAY & DISPLAY
0184	AF	331 TIME	XRA A ;REFRESHTIME
0185	1D	332	DCR E ;5MS DELAY
0186	C8	333	RZ
0187	15	334 LOOP	DCR D
018B	8A	335	CMR D
0189	CA0184	336	JZ TIME
018C	C30187	337	JMP LOOP
018F	3E00	338 SCAN4	MVI A,0H ;DEBOUNCE SUBROUTINE
0191	D301	339	OUT DRB
0193	CD04F0	340	CALL KDELAY
0196	CD04F0	341	CALL KDELAY
0199	CD0179	342	CALL SCAN3

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019C CA015B      343          JZ SCAN
019F 0R00       344 DECODE    IN DRA          ;READ KEYPAD & DECODE
01A1 4F         345          MOV C,A
01A2 CD0179     346 TEST      CALL SCAN3      ;WAIT UNTIL KEY IS RELEASED
01A5 C201A2     347          JNZ TEST
01AB CD0181     348          CALL DELAY
01AB CD0181     349          CALL DELAY
01AE 79         350          MOV A,C
01AF 2103B9     351          LXI H,INTBL
01B2 0E18       352          MVI C,018H
01B4 BE         353 DCODE1     CMP M           ;COMPARE KEY PRESSED WITH
01B5 CA01C2     354          JZ CHAR        ;INPUT TABLE
01B8 23         355          INX H
01B9 23         356          INX H
01BA 23         357          INX H
01BB 00         358          DCR C
01BC CA015B     359          JZ SCAN        ;KEY PRESSED NOT IN TABLE
01BF C301B4     360          JMP DCODE1
01C2 2B         361 CHAR      DCX H          ;GET HEX CHARACTER FROM TABLE
01C3 2B         362          DEX H
01C4 7E         363          MOV A,M
01C5 3208FE     364          STA DIGIT
01C8 C9         365          RET
366 ;
367 ;INPUT CHARACTERS FROM KEYPAD
368 ;
369 ;The following subroutine will input, display, and return with four
370 ;characters in Registers H&L. Four characters typed in on the
371 ;keypad are converted to display characters on the LED's. Also,
372 ;inputted characters are converted to binary and on return from
373 ;this subroutine the binary is in the H&L Registers
374 ;
375 ;No set up is required for entry.
376 ;
377 ;Registers destroyed: All
378 ;
01C9 2108FD     379 INPUT4     LXI H,DSPBFA   ;INPUT FOUR CHARACTERS
01CC 0604       380          MVI B,04H
01CE CD01FC     381          CALL INPUTI
01D1 CD020A     382 INPUTA     CALL INPUTC
01D4 FE10       383          CPI X          ;IF ANY COMMAND KEY PRESSED
01D6 D2008A     384          JNC COMMD     ;GO TO COMMAND ROUTINE
01D9 05         385          DCR B
01DA C201D1     386          JNZ INPUTA
01DD C3022A     387          JMP INFROM
388 ;
389 ;The following subroutine will input, display, and return with
390 ;two characters in Acc. Two characters typed in on the keypad
391 ;are converted to display characters and displayed on the LED's
392 ;Also, inputted characters are converted to binary and on return
393 ;from this subroutine, the binary is in Acc.
394 ;
395 ;No set up is required for entry.
396 ;
397 ;Registers destroyed: All
398 ;
01E0 2108F9     399 INPUT2     LXI H,DSPBFD+1

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LOCATION	OBJECT	CODE	LINE	SOURCE	LINE
01E3	6602		400	MVI B,02H	
01E5	CD01FC		401	CALL INPUTI	
01E8	CD020A		402	INPUTB	
				CALL INPUTC	
01EB	FE10		403	CPI X	;IF "X" IS PRESSED SET CARRY
01ED	CA01FA		404	JZ SETCY	;AND RETURN
01F0	D2008A		405	JNC COMMD	;ANY OTHER COMMAND KEY JUMP
01F3	05		406	DCR B	;TO COMMAND ROUTINE
01F4	C201E8		407	JNZ INPUTB	
01F7	C3022A		408	JMP INFROM	
01FA	37		409	SETCY	
				STC	
01FB	C9		410	RET	
01FC	2208EC		411	INPUI	SHLD HLDISP ;SET UP DISPLAY AND INPUT
01FF	2108F3		412	LXI H,INBUFF	;BUFFERS
0202	2208EE		413	SHLD HSAVE2	
0205	78		414	MOV A,B	
0206	3208EB		415	STA DGCNT	
0209	C9		416	RET	
020A	CD015B		417	INPUTC	CALL SCAN
020D	F5		418	PUSH PSW	
020E	78		419	MOV A,B	;CLEAR LED ON NEW ENTRY
020F	FE02		420	CPI 02H	
0211	C2021A		421	JNZ CONTIN	
0214	210000		422	LXI H,0H	
0217	2208F8		423	SHLD DSPRFD	
021A	F1		424	CONTIN	POP PSW
021B	2A08EE		425	LHLD HSAVE2	;INPUT & DISPLAY ENTERED DIGITS
021E	77		426	MOV H,A	;CONVERT HEX TO DISPLAY
021F	23		427	INX H	;CHARACTERS
0220	2208EE		428	SHLD HSAVE2	
0223	CD024D		429	CALL CONHEX	
0226	3A08FE		430	LDA DIGIT	
0229	C9		431	RET	
			432		
			433		;The following subroutine will convert the data in the input buffer
			434		;(INBUFF) from input characters to binary. This subroutine will
			435		convert either two or four characters, with character count
			436		stored in DGCNT.
			437		
			438		;Enter subroutine with characters to be converted in INBUFF
			439		;and character count in DGCNT.
			440		
			441		;The subroutine will convert two input characters into one byte in
			442		Acc., or four input characters into two bytes in Regs. H&L.
			443		
			444		;Registers destroyed: A, B, H, L, and Flags
			445		
022A	2108F3		446	INFROM	LXI H,INBUFF ;FORMAT SUBROUTINE
022D	3A08EB		447	LDA DGCNT	;THIS SUBROUTINE WILL CONVERT
0230	D601		448	SUI 01H	;DATA ENTERED FROM KEYPAD.
0232	47		449	MOV B,A	;FOUR KEY STROKES INTO
0233	7E		450	MOV A,M	;TWO BYTES OR TWO KEY
0234	07		451	RLC	;STROKES INTO ONE BYTE
0235	07		452	RLC	
0236	07		453	RLC	
0237	07		454	RLC	
0238	23		455	INX H	
0239	86		456	ADD M	



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023A	05	457	DCR B	;REG. B CONTAINS THE # OF
023B	08	458	RZ	;KEY STROKES
023C	77	459	MOV M,A	
023D	23	460	INX H	
023E	7E	461	MOV A,M	
023F	07	462	RLC	
0240	07	463	RLC	
0241	07	464	RLC	
0242	07	465	RLC	
0243	23	466	INX H	
0244	86	467	ADD M	
0245	2B	468	DCX H	
0246	2B	469	DCX H	
0247	2B	470	DCX H	
0248	77	471	MOV M,A	
0249	2A08F3	472	LHLD INBUFF	
024C	C9	473	RET	
		474		
		475	;This subroutine provides a search function of a three-dimensional	
		476	;table.	
		477		
		478	;Enter the subroutine with binary characters in Acc. and it will	
		479	;return with display characters in Acc. and in the Display Buffer.	
		480		
		481	;Storage location HLDISP must contain current location of the	
		482	;Display Buffer.	
		483		
		484	;Registers destroyed: A, H, L, and Flags	
		485		
024D	2103B7	486	CONHEX	LXI H,HEXTB ;THIS SUBROUTINE CONVERTS
0250	BE	487	CNHEX1	CMR M ;HEX TO A DISPLAY CHARACTER
0251	CA025A	488		JZ CNHEX2 ;AND STORES IT IN THE
0254	23	489		INX H ;DISPLAY BUFFER
0255	23	490		INX H
0256	23	491		INX H
0257	C30250	492		JMP CNHEX1
025A	23	493	CNHEX2	INX H
025B	7E	494		MOV A,M
025C	2A08EC	495		LHLD HLDISP
025F	77	496		MOV M,A
0260	2B	497		DCX H
0261	2208EC	498		SHLD HLDISP
0264	C9	499		RET
		500		
		501	;EXECUTE ROUTINE	
		502		
0265	CD0269	503	EXCUTE	CALL ENADDR
0268	E9	504		PCHL
0269	CD02D9	505	ENADDR	CALL ENTER ;ENTER FOUR CHARACTERS VIA
026C	CD01C9	506		CALL INPUT4 ;KEYPAD AND STORE IN IN H&L
026F	E5	507		PUSH H ;THEN TRANSFER H&L TO PC
0270	CD015B	508		CALL SCAN
0273	FE10	509		CPI X
0275	C2008A	510		JNZ CONMD ;JUMP TO COMMAND KEY OTHER
0278	E1	511		POP H ;IN ANY COMMAND KEY OTHER
0279	C9	512		RET ;THAN "X" IS PRESSED.
		513		

LOCATION	OBJECT CODE	LINE	SOURCE LINE
		514	;SET BREAK POINT ROUTINE
		515	;
027A	CD00DF	516	BRKPT CALL MOVE1 ;MOVE # OF BREAK POINTS
027D	2108E2	517	LXI H,NOBKRG ;PREVIOUSLY SET TO DISPLAY
0280	7E	518	MOV A,M
0281	47	519	MOV B,A ;IF THREE HAVE BEEN SET GO
0282	EB	520	XCHG ;DISPLAY OVER ERROR
0283	2108F9	521	LXI H,DSPBFD+1
0286	2208EC	522	SHLD HLDISP
0289	CD024D	523	CALL CONHEX
028C	214040	524	LXI H,4040H
028F	6F	525	MOV L,A
0290	2208F8	526	SHLD DSPBFD
0293	78	527	MOV A,B
0294	3C	528	INR A
0295	FE04	529	CPI 04H
0297	D202CE	530	JNC OVERR
029A	EB	531	XCHG
029B	85	532	ADD L
029C	6F	533	MOV L,A
029D	E5	534	PUSH H
029E	CD01C9	535	CALL INPUT4
02A1	7E	536	MOV A,M ;PUT RST 1 AT LOCATION
02A2	EB	537	XCHG ;SPECIFIED BY USER AND STORE
02A3	E1	538	POP H ;USER'S INSTRUCTION IN BREAK
02A4	77	539	MOV M,A ;POINT BUFFER
02A5	EB	540	XCHG
02A6	3ECF	541	MVI A,RST1
02A8	77	542	MOV M,A
02A9	3E79	543	MVI A,079H
02AB	3208F9	544	STA DSPBFD+1
02AE	3E54	545	MVI A,054H
02B0	3208F8	546	STA DSPBFD
02B3	E5	547	PUSH H
02B4	D5	548	PUSH D
02B5	CD015B	549	CALL SCAN
02B8	FE10	550	CPI X
02BA	CA02C4	551	JZ INCRMT
02BD	E1	552	POP H
02BE	7E	553	MOV A,M
02BF	E1	554	POP H
02C0	77	555	MOV M,A
02C1	C3027A	556	JMP BRKPT
02C4	3A08E2	557	LDA NOBKRG ;INCREMENT # OF BREAK POINTS
02C7	3C	558	INR A
02C8	3208E2	559	STA NOBKRG ;THEN RETURN TO COMMAND ROUTINE
02CB	C300BA	560	JMP COMMD
02CE	0606	561	MVI B,06H ;SUBROUTINE TO OUTPUT OVER
02D0	1108F8	562	LXI D,DSPBFD ;ERROR WHEN MORE THEN THREE
02D3	2103B1	563	LXI H,OVERMG ;BREAK POINTS ARE ENTERED
02D6	C300CA	564	JMP ERROR1
02D9	214040	565	LXI H,4040H ;ADDRESS PROMPT
02DC	2208F8	566	SHLD DSPBFD
02DF	C9	567	RET
		568	;
		569	;DISPLAY CPU REGISTER ROUTINE
		570	;

LOCATION OBJECT CODE LINE SOURCE LINE

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571 ;The following subroutine will display the CPU registers. Upon
572 ;entry, the Address portion of the LED display will show the
573 ;Program Counter contents.
574 ;On each depression of the "X" command key another register pair
575 ;will be displayed. Each register pair is indicated by a two-letter
576 ;designation in the Data portion of the LED display.
577 ;
02E0 F5      578 DISREG      PUSH PSW          ;SUBROUTINE TO SAVE ALL
02E1 3A08FF   579              LDA USRCSR       ;CPU REGISTERS
02E4 E63F     580              ANI 03FH
02E6 F640     581              ORI 040H
02E8 D308     582              OUT CSR1       ;TURN OFF 8155 TIMER
02EA C5       583              PUSH B
02EB D5       584              PUSH D
02EC E5       585              PUSH H
02ED 21FFFC   586              LXI H,OFFFC      ;SAVE SHACK POINTER
02F0 39       587              DAD SP          ;POINTING TO WHAT IT WOULD
02F1 E5       588              PUSH H          ;BE AT END OF STACK
02F2 EB       589              XCHG
02F3 20       590              RIM
02F4 F5       591              PUSH PSW
02F5 2100C    592              LXI H,000CH     ;POINT H&L TO PROGRAM COUNTER
02F8 39       593              DAD SP          ;IN STACK
02F9 2208EE   594              SHLD HSAVE2
02FC C0030A   595              CALL DREG       ;GO DISPLAY CPU REGISTERS
02FF 3A08E1   596              LDA INTERF     ;IF IN SINGLE STEP MODE
0302 FE00     597              CPI 0H         ;JUMP TO STIMER
0304 C20379   598              JNZ STIMER
0307 C3001B   599              JMP RESREG     ;IF NOT GO RESTORE REGISTER
030A EB       600 DREG          XCHG           ;DISPLAY CPU REGS. SUBROUTINE
030B AF       601              XRA A
030C 77       602              MOV M,A
030D EB       603              XCHG
030E 3E07     604              MVI A,07H
0310 F5       605              PUSH PSW
0311 2108FD   606              LXI H,DSPBFA
0314 2208EC   607              SHLD HLDISP
0317 2A08EE   608              LHLD HSAVE2
031A 23       609              INX H
031B C00144   610              CALL DSDATA
031E 2A08F0   611              LHLD HSAVE1
0321 2B       612              DCX H
0322 2208EE   613              SHLD HSAVE2
0325 C00144   614              CALL DSDATA
0328 210395   615              LXI H,NAMETR-2
032B F1       616              POP PSW
032C F5       617              PUSH PSW
032D 87       618              ADD A
032E 85       619              ADD L
032F 6F       620              MOV L,A
0330 3E00     621              MVI A,0H
0332 8C       622              ADC H
0333 67       623              MOV H,A
0334 1108F8   624              LXI D,DSPBFD
0337 0602     625              MVI B,02H
0339 C000E7   626              CALL MOVE
033C C0015B   627              CALL SCAN

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LOCATION	OBJECT CODE	LINE	SOURCE LINE
033F	FE15	628	CPI S
0341	CA0357	629	JZ SINSTP-2
0344	FE10	630	CPI X
0346	C2008A	631	JNZ COMND
0349	F1	632	POP PSW
034A	3D	633	DCR A
034B	C8	634	RZ
034C	2A08EE	635	LHLD HSAVE2
034F	2B	636	DCX H
0350	2B	637	DCX H
0351	2208EE	638	SHLD HSAVE2
0354	C30310	639	JMP DREG+6
0357	F1	640	POP PSW
0358	C9	641	RET
		642	;
		643	;SINGLE STEP ROUTINE
		644	;
0359	3E80	645	SINSTP MVI A,080H ;STEP THROUGH USER'S PROGRAM
035B	3208E1	646	STA INTERF ;FROM ADDRESS ENTERED
035E	CD0269	647	CALL ENADDR
0361	3E00	648	MVI A,0H
0363	D30D	649	OUT TIMERH
0365	3E5A	650	MVI A,5AH ;SET UP 8155 TIMER
0367	D30C	651	OUT TIMERL
0369	3A08FF	652	LDA USRCSR ;LOAD USER'S IMAGE OF 8155
036C	F6C0	653	ORI 0C0H ;CSR REG. AND START TIMER
036E	D308	654	OUT CSR1
0370	3E05	655	DELAY2 MVI A,05H ;DELAY SAME AMOUNT OF TIME
0372	3D	656	DCR A ;THAT IT WOULD TAKE TO
0373	C20372	657	JNZ DELAY2+2 ;RESTORE CPU REGISTER
0376	00	658	NOP
0377	00	659	NOP
0378	E9	660	PCHL ;GOTO USER'S PROGRAM
0379	3E00	661	STIMER MVI A,0H ;ENTER HERE TO SET 8155
037B	D30D	662	OUT TIMERH ;TIMER THEN STEP THROUGH USER'S
037D	3E5A	663	MVI A,05AH ;PROGRAM AND RESTORE USER'S
037F	D30C	664	OUT TIMERL ;CPU REGISTERS
0381	3A08FF	665	LDA USRCSR
0384	F6C0	666	ORI 0C0H ;START TIMER
0386	D308	667	OUT CSR1
0388	C3001B	668	JMP RESREG
038B	C3E02FF00	669	UMOVE DB 0C3H,0E0H,02H,0FFH,0H,0H
0391	FF0000FF00	670	DB 0FFH,0H,0H,0FFH,0H,0H
0397	D0B0F3EDB8	671	NAMETB DB 0D0H,0B0H,0F3H,0EDH,0B8H,0F6H,0F9H,0DEH
039F	89FCF1F7B9	672	DB 0B9H,0FCH,0F1H,0F7H,0B9H,0F3H
03A5	0000000000	673	SINEIN DB 0H,0H,0H,0H,0H,040H
03AB	0000005050	674	ERRNAG DB 0H,0H,0H,050H,050H,079H
03B1	4040505077	675	OVERNG DB 040H,040H,050H,050H,079H,03FH
03B7	00	676	HEXTB DB 0H ;ENTER HERE FOR HEX TABLE
03B8	3F	677	DESPTB DB 03FH ;ENTER HERE FOR DISPLAY TABLE
03B9	E1	678	INTBL DB 0E1H ;ENTER HERE FOR INPUT TABLE
03BA	0106E2025B	679	DB 01H,06H,0E2H,02H,05BH,0D2H,03H,04FH
03C2	8204667205	680	DB 0B2H,04H,066H,072H,05H,06DH,071H,06H
03CA	7DB10707D1	681	DB 07DH,0B1H,07H,07H,0D1H,08H,07FH,07DH
03D2	0967800A77	682	DB 09H,067H,0B0H,0AH,077H,0D0H,0BH,07CH
03DA	E00C397D0D	683	DB 0E0H,0CH,039H,07DH,0DH,05EH,0BDH,0EH
03E2	79D00F71ED	684	DB 079H,0DDH,0FH,071H,0EDH,010H,040H,0ECH

LOCATION	OBJECT CODE	LINE	SOURCE LINE
03EA	1173BC1238	685	DB 011H,073H,08CH,012H,038H,0DCH,013H,03EH
03F2	7C1476EB15	686	DB 07CH,014H,076H,0EBH,015H,030H,0DBH,016H
03FA	008817507B	687	DB 0H,0BBH,017H,050H,07BH
03FF	3830383520	688	DB 'B085 MONITOR V7.XX'
0411	3139383220	689	DB '1982 DONALD THOMPSON'
0425	4253425342	690	DB 'BSBSBSBSBSBSBSBS'
0435	41204C4F54	691	DB 'A LOT OF WORK'
		692 ;	
		693 ;	THE FOLLOWING IS NOT A 15MS DELAY
		694 ;	
		695	ORG BEGIN+04F0H
04F0	E5	696	KDELAY PUSH H
04F1	F5	697	PUSH PSW
04F2	210900	698	LXI H,0900H
04F5	2B	699	KD1 DCX H
04F6	7C	700	MOV A,H
04F7	B5	701	ORA L
04F8	C204F5	702	JNZ KD1
04FB	F1	703	POP PSW
04FC	E1	704	POP H
04FD	C9	705	RET
		706 ;	
		707 ;	MEMORY & I/O TEST
		708 ;	FOR THE MM-85 KIT
		709 ;	
		710 ;	The following subroutine will test 1K of RAM at location 1400H.
		711 ;	
		712 ;	No set up is required for entry.
		713 ;	
		714 ;	If an error is found the location is displayed by entry into
		715 ;	DISREG subroutine. P.C. will contain location, Acc. will contain
		716 ;	data from RAM and Reg. b will contain data that RAM failed on.
		717 ;	Upon successful completion of the subroutine LED TEST subroutine
		718 ;	will be called.
		719 ;	
		720	ORG BEGIN+0500H
0500	211400	721	MEMTEST LXI H,1400H
0503	1604	722	MVI D,04H
0505	0E80	723	NEXTA MVI C,00H
0507	3E00	724	MVI A,00H
0509	C30511	725	JMP START1
050C	3C	726	NEXT1 INR A
050D	0D	727	DCR C
050E	CA051E	728	JZ HERE
0511	77	729	START1 MOV M,A
0512	47	730	MOV B,A
0513	7E	731	MOV A,M
0514	8B	732	CMP B
0515	CA050C	733	JZ NEXT1
0518	CD02E0	734	CALL DISREG
051B	C30530	735	JMP LEDTEST
051E	23	736	HERE INX H
051F	AF	737	XRA A
0520	BD	738	CMP L
0521	C20505	739	JNZ NEXTA
0524	15	740	DCR D
0525	C20505	741	JNZ NEXTA

LOCATION	OBJECT CODE	LINE	SOURCE LINE
0528	C30530	742	JMP LEDTEST
		743 ;	
		744 ;	I/O TEST PROGRAM STARTS AT 0530 HEX
		745 ;	
		746 ;	The following subroutine will test the student I/O ports by turning
		747 ;	on every other LED.
		748 ;	
		749 ;	No set up is required for entry.
		750 ;	
		751 ;	Registers destroyed: A
		752 ;	
		753	ORG BEGIN+0530H
0530	CD00DF	754	LEDTEST CALL MOVE1
0533	CD02D9	755	CALL ENTER
0536	CD015B	756	CALL SCAN
0539	3E0F	757	MVI A,0FH
053B	D30B	758	OUT 0BH
053D	3FAA	759	HERE1 MVI A,0AAH
053F	D309	760	OUT 09H
0541	D30A	761	OUT 0AH
0543	D30B	762	OUT 0BH
0545	CD015B	763	CALL SCAN
0548	3E55	764	MVI A,055H
054A	D309	765	OUT 09H
054C	D30A	766	OUT 0AH
054E	D30B	767	OUT 0BH
0550	CD015B	768	CALL SCAN
0553	C3053D	769	JMP HERE1
		770 ;	
		771 ;	
		772 ;	THE FOLLOWING SUBROUTINES SUBMITTED BY B. KONIKKARA
		773 ;	OHIO INSTITUTE OF TECHNOLOGY
		774 ;	
		775 ;	This subroutine will display contents of Acc. in the data portion
		776 ;	of the LED display for approximately one second, then clear the
		777 ;	display and return.
		778 ;	
		779 ;	On entry the data to be displayed must be in Acc.
		780 ;	
		781 ;	Registers destroyed: none
		782 ;	
		783	ORG BEGIN+0560H
0560	F5	784	DISPLAY PUSH PSW
0561	C5	785	PUSH B
0562	D5	786	PUSH D
0563	E5	787	PUSH H
0564	CD05B2	788	CALL CLEAR ;CLEARS DISPLAY BUFFER
		789	;SEPERATES ACC. INTO LED
		790	;FORM. REG. B GETS HIGH NIBBLE
		791	;REG. C GETS LOW NIBBLE
0567	CD05BB	792	CALL SEPATE ;DISPLAY TIME LOOP COUNTER
056A	2680	793	MVI H,080H ;HIGH NIBBLE INTO ACC.
056C	78	794	BACK MOV A,B ;GET READY TO DISPLAY
056D	D301	795	OUT 0RB ;SECOND LED
056F	3E01	796	MVI A,1H
0571	D300	797	OUT 0RA
0573	CD0181	798	CALL DELAY ;LET IT BE SEEN

LOCATION	OBJECT CODE	LINE	SOURCE LINE
0576	79	799	MOV A,C ;LOW NIBBLE
0577	D301	800	OUT DRB
0579	97	801	SUB A
057A	D300	802	OUT DRA ;DISPLAY LOW NIBBLE
057C	CD0181	803	CALL DELAY
057F	25	804	DCR H
0580	C2056C	805	JNZ BACK ;DO IT 80 HEX TIMES
0583	97	806	SUB A
0584	D301	807	OUT DRB ;CLEAR DISPLAY
0586	E1	808	POP H
0587	D1	809	POP D
0588	C1	810	POP B
0589	F1	811	POP PSW
058A	C9	812	RET
		813 ;	
		814 ;SEPARATE SUBROUTINE	
		815 ;ACC. INTO B AND C	
		816 ;LED FORM	
		817 ;	
058B	F5	818	SEPARATE PUSH PSW
058C	47	819	MOV B,A
058D	E60F	820	ANI 0FH ;CLEAR LEFT NIBBLE
058F	CD024D	821	CALL CONHEX ;GET LED FORM
0592	4F	822	MOV C,A ;SAVE RIGHT LED NOBBLE IN C
0593	78	823	MOV A,B ;GET ORIGINAL #
0594	E6F0	824	ANI 0F0H ;CLEAR RIGHT NIBBLE
0596	0F	825	RRC
0597	0F	826	RRC
0598	0F	827	RRC ;MOVE LEFT NIBBLE
0599	0F	828	RRC ;INTO RIGHT NIBBLE
059A	CD024D	829	CALL CONHEX ;CONVERT TO LED FORM
059D	47	830	MOV B,A ;SAVE IN REG. B
059E	F1	831	POP PSW
059F	C9	832	RET
		833 ;	
		834 ;GET SUBROUTINE	
		835 ;	
		836 ;The following subroutine will display a decimal point on the	
		837 ;left-most LED digit. Then any key may be pressed and the value	
		838 ;of the key is returned in Acc.	
		839 ;	
		840 ;No set up is required for entry.	
		841 ;	
		842 ;Registers destroyed: A and Flags	
		843 ;	
05A0	C5	844	GET PUSH B
05A1	D5	845	PUSH D
05A2	E5	846	PUSH H
05A3	CD0582	847	CALL CLEAR
05A6	3E80	848	MVI A,080H ;MOVE DECIMAL POINT
05A8	3208FD	849	STA DSPBFA ;TO LAST LED IN DISPLAY
05AB	CD015B	850	CALL SCAN ;GO GET KEY
05AE	E1	851	POP H
05AF	D1	852	POP D
05B0	C1	853	POP B
05B1	C9	854	RET
		855 ;	

LOCATION	OBJECT CODE LINE	SOURCE LINE
		856 ;CLEAR SUBROUTINE
		857 ;
		858 ;The following subroutine will clear the LED display.
		859 ;
		860 ;No set up is required for entry.
		861 ;
		862 ;Registers destroyed: none
		863 ;
0582	E5	864 CLEAR           PUSH H
0583	210000	865                   LXI H,0H
0586	2208F8	866                   SHLD DSPBFD
0589	2208FA	867                   SHLD DSPBFD+2
05BC	2208FC	868                   SHLD DSPBFD+4
05BF	E1	869                   POP H
05C0	C9	870                   RET
		871 ;
		872 ;The following subroutine is a 500 micro second delay.
		873 ;
		874 ;No set up is required for entry.
		875 ;
		876 ;Registers destroyed: none
		877 ;
05C1	F5	878 FIVE00           PUSH PSW
05C2	3E60	879                   MVI A,060H       ;COUNTER
05C4	3D	880 AGAIN            DCR A
05C5	C205C4	881                   JNZ AGAIN
05C8	F1	882                   POP PSW
05C9	C9	883                   RET
		884 ;
		885 ;The following subroutine will produce a 1KHz tone on the SDD pin
		886 ;of the student I/O connector (Dip-B, Pin 14) for approximately
		887 ;half a second.
		888 ;
		889 ;No set up is required for entry.
		890 ;
		891 ;Registers destroyed: none
		892 ;
		893                   ORG BEGIN+05D0H
05D0	F5	894 BEEP             PUSH PSW
05D1	E5	895                   PUSH H
05D2	2670	896                   MVI H,070H
05D4	3EC0	897 TONE            MVI A,0C0H       ;SDD = 1
05D6	30	898                   SIM
05D7	CD05C1	899                   CALL FIVE00
05DA	3E40	900                   MVI A,040H       ;SDD = 0
05DC	30	901                   SIM
05DD	CD05C1	902                   CALL FIVE00
05E0	25	903                   DCR H
05E1	C205D4	904                   JNZ TONE
05E4	E1	905                   POP H
05E5	F1	906                   POP PSW
05E6	C9	907                   RET