MTR90-1 - H/Z-89 MONITOR   #09.02.01.
SPEED - ROTATIONAL SPEED TEST FOR H89 DISK DRIVE

Addr	Bytes	Line	Label	Op	Operand	Comment
006.240	041 371 006	2809	SPEED	LXI	H,MSG.SPD	OUTPUT SPEED MESSAGE
006.243	315 100 006	2810		CALL	TYPMSG	
006.246	076 000	2811		MVI	A,0	SET FLAG AT IOWRK FOR "WORKING" MESSAGE
006.250	062 002 040	2812		STA	IOWRK	
006.253	076 022	2813		MVI	A,ONDRO	TURN ON DRIVE ZERO
006.255	323 177	2814		OUT	OP.DC	
006.257	052 033 040	2815	SPEED1	LHLD	TICCNT	GET TICK COUNTER
006.262	174	2816		MOV	A,H	FORM TWO'S COMPLEMENT OF TICK COUNTER
006.263	057	2817		CMA		
006.264	127	2818		MOV	D,A	(D,E) = NEGATIVE TICK COUNTER
006.265	175	2819		MOV	A,L	
006.266	057	2820		CMA		
006.267	074	2821		INR	A	
006.270	137	2822		MOV	E,A	
006.271	322 275 006	2823		JNC	SPEED2	IF NO CARRY FROM LSB
		2824				
006.274	024	2825		INR	D	ELSE, INCREMENT MSB
006.275	001 000 000	2826	SPEED2	LXI	B,0	ZERO REV COUNTERS
006.300	333 177	2827	SPEED3	IN	IP.DS	INPUT DISK STATUS
006.302	346 001	2828		ANI	DS.HOLE	MASK FOR SECTOR/INDEX PULSES
006.304	312 300 006	2829		JZ	SPEED3	IF NO HOLE PRESENT
		2830	*			HOLE PRESENT, WAIT FOR IT TO LEAVE
		2831	*			
006.307	333 177	2833	SPEED4	IN	IP.DS	GET DISK STATUS
006.311	346 001	2834		ANI	DS.HOLE	GET HOLE PULSES
006.313	302 307 006	2835		JNZ	SPEED4	WAIT UNTIL HOLE IS GONE AND WE HAVE MEDIA
		2836				
006.316	004	2837		INR	B	INCREMENT HOLE COUNTER
006.317	170	2838		MOV	A,B	TEST FOR FIVE REVOLUTIONS
006.320	376 070	2839		CPI	56	
006.322	302 300 006	2840		JNZ	SPEED3	NOT FIVE, WAIT FOR MORE HOLES
		2841				
		2842	*			HAVE FIVE REVS, DISPLAY DIFFERENCE OF TICK COUNTER AND EXPECTED TIME DIF
		2843	*			
006.325	052 033 040	2844		LHLD	TICCNT	GET CURRENT TICK VALUE
006.330	031	2845		DAD	D	SUBTRACT START VALUE
006.331	021 214 376	2846		LXI	D,377377A-500+1+2000	SUBTRACT 500 FOR REVS, +2000 FOR OFFSET
006.334	031	2847		DAD	D	(H,L) = OFFSET RESULT
006.335	345	2848		PUSH	H	SAVE RESULT
006.336	041 062 007	2849		LXI	H,MSG.WRK	POINT TO "WORKING" MESSAGE
006.341	072 002 040	2850		LDA	IOWRK	GET "WORKING" FLAG
006.344	356 001	2851		XRI	1	INVERT LOWER BIT
006.346	062 002 040	2852		STA	IOWRK	SAVE NEW VALUE
006.351	302 357 006	2853		JNZ	SPEED5	IF TO DISPLAY "WORKING"
		2854				
006.354	041 100 007	2855		LXI	H,MSG.HSS	POINT TO "HOME", "SPACES", AND SPEED MSG
006.357	315 100 006	2856	SPEED5	CALL	TYPMSG	OUTPUT MESSAGE
006.362	341	2857		POP	H	GET TEST RESULT
006.363	315 305 005	2858		CALL	TOA.	OUTPUT RESULT TO CONSOLE
006.366	303 257 006	2859		JMP	SPEED1	PERFORM ANOTHER SAMPLE

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MTR90-1 - H/Z-89 MONITOR    #09.02.01.                              Unix H8ASM V1.4.1 5-Jul-80   Page  70
SPEED - ROTATIONAL SPEED TEST FOR H89 DISK DRIVE        MSG.SPD                     10:42:06  17-FEB-82


                    2861 **     MSG.SPD - SPEED TEST MESSAGE
                    2862 *
                    2863 *       "  Disk drive rotational speed test.
                    2864 *
                    2865 *
                    2866 *                   Drive speed = "
                    2867
006.371 033 105 012 2868 MSG.SPD DB    A.ESC,'E',A.LF
006.374 011 104 151 2869         DB    "  Disk drive rotational speed test.",A.CR,A.LF,A.LF,A.LF
007.041 011 011 104 2870         DB    "            Drive speed = '
007.061 000         2871         DB    0


                    2873 **     MSG.MRK - "WORKING" MESSAGE FOR SPEED TEST
                    2874 *
                    2875 *      DISPLAYS "WORKING" AT HOME POSITION AND RETURNS CURSOR TO SPEED =
                    2876
007.062 033 110     2877 MSG.MRK DB    A.ESC,'H'       CURSOR HOME
007.064 127 157 162 2878         DB    'Working'
007.073 033 131 043 2879         DB    A.ESC,'Y#>'     CURSOR ADDRESS OF SPEED = VALUE
007.077 000         2880         DB    0               END MESSAGE


                    2882 **     MSG.HSS - BLANKS "WORKING" MESSAGE
                    2883 *
                    2884
007.100 033 110     2885 MSG.HSS DB    A.ESC,'H'       CURSOR HOME
007.102 040 040 040 2886         DB    '   '           BLANKS
007.111 033 131 043 2887         DB    A.ESC,'Y#>'     CURSOR ADDRESS OF SPEED = VALUE
007.115 000         2888         DB    0               END MESSAGE
```

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MTR90-1 - H/Z-89 MONITOR          #09.02.01.                    Unix H8ASM V1.4.1  5-Jul-80   Page  71
DYMEM - DYNAMIC MEMORY TEST                                     10:42:07  17-FEB-82

                              2891  **        DYMEM - DYNAMIC MEMORY TEST
                              2892  *
                              2893  *         DYMEM TESTS THE DYNAMIC MEMORY IN THE H88/H89 BY PLACING
                              2894  *         A KNOWN PATTERN IN EACH DYNAMIC MEMORY CELL AND THEN
                              2895  *         PERFORMING A READ, INCREMENT, READ SEQUENCE WITH A DELAY
                              2896  *         BETWEEN EACH PASS OF THE TEST
                              2897  *
                              2898  *         ENTRY     NONE
                              2899  *
                              2900  *
                              2901  *         EXIT      ON RESET
                              2902  *
                              2903  *         USES      A,B,C,D,E,H,L,F,A',F',IX,IY
                              2904  *
                              2905
007.116  076 000             2906  DYMEM     MVI   A,0          MAKE SURE CLOCK AND SINGLE STEP ARE OFF
007.120  323 362             2907            OUT   H88.CTL
                              2908  *
                              2909  *         DETERMINE END OF MEMORY
                              2910  *
                              2911  *
007.122  041 000 040         2912  DYMEM1    LXI   H,START
007.125  076 001             2913            MVI   A,1
007.127  066 000             2914  DYMEM2    MVI   M,0          SET RAM TO ZERO
007.131  064                 2915            INR   M            SET MEMORY TO ONE
007.132  276                 2916            CMP   M            SEE IF (A) = ((H,L))
007.133  040 003             2917            JR    NZ,DYMEM3    IF NOT EQUAL, THE END OF RAM HAS BEEN REACHED
                              2918
007.135  043                 2919            INX   H            ELSE, POINT TO NEXT LOCATION IN RAM
007.136  030 367             2920            JR    DYMEM2
                              2921
                              2922
007.140  053                 2923  DYMEM3    DCX   H            POINT TO LAST GOOD LOCATION
007.141  353                 2924            XCHG               PUT ENDING ADDRESS IN D,E
007.142  041 303 007         2925            LXI   H,MSG.RAM    OUTPUT ENDING ADDRESS
                              2926  *
007.145  335 041             2927            LD    IX,DY3.3     RETURN ADDRESS
007.147  201 011             2928            DB    MI.LDXA,MI.LDXB
                              2929            DH    DY3.3
007.151  030 112             2930            JR    DYMSG
007.153  023                 2931  DY3.7     INX   D            (D,E) = LAST BYTE OF RAM + 1
                              2932
                              2933  *         TEST MEMORY
                              2934  *
007.154  006 001             2935            MVI   B,1          (B) = CONTENTS OF RAM AFTER SIZING
007.156  041 231 003         2936            LXI   H,MSG.PAS    OUTPUT PASS MESSAGE
                              2937  *
007.161  335 041             2938            LD    IX,DYMEM4    RETURN ADDRESS
007.163  167 007             2939            DB    MI.LDXA,MI.LDXB
                              2940            DH    DYMEM4
007.165  030 076             2941            JR    DYMSG
                              2942
007.167  041 000 040         2943  DYMEM4    LXI   H,START
007.172  176                 2944  DYMEM5    MOV   A,M          READ CURRENT CONTENTS
```

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MTR90-1 - H/Z-89 MONITOR        #09.02.01.
DYMEM - DYNAMIC MEMORY TEST

007.173  270            2947            CMP     B               SEE IF CORRECT CONTENTS STILL REMAIN
007.174  302 307 000    2948            JNZ     DYMEM9          FAILURE, SEE IF AT END OF RAM
                        2949
007.177  074            2950            INR     A               INCREMENT RAM
007.200  167            2951            MOV     M,A
007.201  276            2952            CMP     M               SEE IF WRITE WAS SUCCESSFUL
007.202  302 307 000    2953            JNZ     DYMEM9
                        2954
007.205  043            2955            INX     H               GET LSB AND TEST FOR REACHING END OF RAM
007.206  175            2956            MOV     A,L
007.207  273            2957            CMP     E               IF LSB NOT EQUAL
007.210  040 360        2958            JR      NZ,DYMEM5
                        2959
007.212  174            2960            MOV     A,H             CHECK LSB
007.213  272            2961            CMP     D
007.214  040 354        2962            JR      NZ,DYMEM5
                        2963
                        2964    *       HAVE REACHED END OF MEMORY!
                        2965    *       OUTPUT LAST VALUE TESTED
                        2966    *
                        2967
007.216  303 336 016    2968            JMP     DYMM5           HOW MANY TO BACK SPACE?
                        2969
007.221                 2970    DYME5.5 EQU     *
                        2971
                        2972    *
007.221  375 041        2973            LD      IY,DY5.53       RETURN ADDRESS
                                        DB      MI.LDYA,MI.LDYB
007.223  230 007        2974            DW      DY5.53
                        2975
007.225  303 143 003    2976            JMP     DYASC
                        2977
007.230  045            2978    DY5.53  DCR     H
007.231  040 366        2979            JR      NZ,DYME5.5
                        2980
007.233  004            2981            INR     B               SHOW NEXT PASS VALUE
007.234  170            2982            MOV     A,B             VALUE TESTED
                        2983
007.235  335 041        2984    *       LD      IX,DYMEM6       RETURN ADDRESS
                                        DB      MI.LDXA,MI.LDXB
007.237  273 000        2985            DW      DYMEM6
                        2986
                        2987
007.241  303 160 003    2988            JMP     DYBYT
                        2989
                        2990    **      !!THE DYNAMIC RAM TEST CONTINUES ELSEWARE!!  **
                        2991    *       !!AND THEN RETURNS TO HERE!!!!!!!!!!!!!!!!  **
                        2992
                        2993
007.244  041 000 000    2995    DY10.5  LXI     H,0             DELAY AND DING BELL AGAIN
007.247  006 002        2996            MVI     B,2             2 LOOPS
007.251  045            2997    DYMEM11 DCR     H
007.252  040 375        2998            JR      NZ,DYMEM11
                        2999
007.254  055            3000            DCR     L
007.255  040 372        3001            JR      NZ,DYMEM11
                        3002
```

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007.257  005            3003               DCR    B
007.260  040 367        3004               JR     NZ,DYMEM11
                        3005
007.262  303 252 013    3006               JMP    DYMEM10        AGAIN

                        3008  **  DYMSG - DYNAMIC RAM TEST MESSAGE OUTPUT ROUTINE
                        3009  *
                        3010  *     ENTRY  (H,L) = MESSAGE ADDRESS
                        3011  *            (IX) = RETURN ADDRESS
                        3012  *
                        3013  *     EXIT   TO (IX)
                        3014  *
                        3015  *     USES   A,H,L,F,IY
                        3016
                        3017
007.265  176            3018  DYMSG        MOV    A,M            GET MESSAGE BYTE
                        3019
007.266  375 041        3020  *            LD     IY,DYMSG.5     RETURN ADDRESS
                        3021               DB     MI.LDYA,MI.LDYB
007.270  275 007        3022               DW     DYMSG.5
                        3023
007.272  303 143 003    3024               JMP    DYASC          OUTPUT ASCII
                        3025
007.275  267            3026  DYMSG.5      ORA    A              SEE IF NULL TO END STRING
007.276  043            3027               INX    H              POINT TO NEXT CHARACTER
007.277  040 364        3028               JR     NZ,DYMSG       IF NOT DONE YET
                        3029
007.301  335 351        3030  *            JP     (IX)           RETURN TO CALLER
                        3031               DB     MI.JIXA,MI.JIXB

                        3033  **  MSG.RAM - RAM TEST MESSAGE
                        3034  *
                        3035
007.303  033 105        3036  MSG.RAM      DB     A.ESC,'E'
007.305  104 171 156    3037               DB     'Dynamic RAM test'
007.325  015 012 012    3038               DB     A.CR,A.LF,A.LF
007.330  011 040 114    3039               DB     LMA = '
007.340  000            3040               DB     0

                        3042  **  MSG.EQ - EQUALS MESSAGE
                        3043  *
                        3044
007.341  040 075 040    3045  MSG.EQ       DB     ' = '
007.344  000            3046               DB     0
                        3047
007.345  107 101 103    3048               DB     'GAC.'
```

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MTR90-1 - H/Z-89 MONITOR        #09.02.01.                    Unix H8ASM V1.4.1  5-Jul-80   Page   74
DYMEM - DYNAMIC MEMORY TEST                                   10:42:17  17-FEB-82

                        3050  **      VIEW3A - *VIEW* CONTINUED
                        3051  *
                        3052  *
007.351  315 032 011    3053  VIEW3A  CALL   VIEW8      GET BOUNDRIES
007.354  353            3054          XCHG
007.355  315 111 011    3055  VIEW3A. CALL   VIEW12     PRINT CRLF AND ADDRESS
007.360  303 055 001    3056          JMP    VIEW1      AND START NEXT LINE
                        3057
007.363  174            3058  VIEW4   MOV    A,H
007.364  270            3059          CMP    B          COMPARE BC AND DE
007.365  300            3060          RNZ
007.366  175            3061          MOV    A,L
007.367  271            3062          CMP    C
007.370  311            3063          RET
```

MTR90-1 - H/Z-89 MONITOR   #09.02.01.
ENTRY POINTS FOR HARDWARE TESTS

```
                        3066  **    ENTRY POINT FOR FLOPPY DISK ROTATIONAL SPEED TEST
                        3067  *
000.001                 3068        ERRMI  10000A-6-*   MUST BE SIX BYTES BEFORE END
007.372                 3069        ORG    10000A-6
                        3070
007.372 303 240 006     3071  ESPEED JMP    SPEED

                        3073  **    ENTRY POINT FOR DYNAMIC MEMORY TEST
                        3074  *
000.000                 3075        ERRNZ  10000A-3-*   MUST BE THREE BYTES BEFORE END
                        3076
007.375 303 032 016     3077  EDYMEM JMP    MEMORY.

                        3079  **    Z47X - EXTENSION TO Z47 ROUTINE
                        3080  *
010.000 315 063 006     3082  Z47X   CALL   OUT.        SEND RESET COMMAND
                        3083
010.003 315 104 010     3084         CALL   WDN         WAIT FOR HIM TO WAKE UP
010.006 332 171 002     3085         JC     NODEV       ERROR WAITING FOR DONE
                        3086
000.001                 3087         IF     .DEBUG
                        3088         MVI    A,1
                        3089         STA    DBFLG       FLAG PAST THE RESET
                        3090         ENDIF
                        3091
010.011 315 142 010     3092  Z47X.  CALL   RRDY
010.014 332 171 002     3093         JC     NODEV
010.017 315 142 010     3094         CALL   RRDY
010.022 332 171 002     3095         JC     NODEV
                        3096
000.001                 3097         IF     .DEBUG
                        3098         MVI    A,2
                        3099         STA    DBFLG       FLAG THRU RRDY
                        3100         ENDIF
                        3101
010.025 072 061 041     3102         LDA    AIO.UNI     (A)=UNIT NUMBER
010.030 107             3103         MOV    B,A
010.031 257             3104         XRA    A
010.032 315 155 012     3105         CALL   BITS        SET UNIT BIT MASK
010.035 245             3106         ANA    L
010.036 040 351         3107         JR     NZ,Z47X.    CHECK AGAINST READY FLAGS
                        3108
000.001                 3109         IF     .DEBUG
                        3110         MVI    A,8
                        3111         STA    DBFLG
                        3112         ENDIF
                        3113
010.040 076 002         3114         MVI    A,DD.RAS    FLAG PAST READ
010.042 315 027 006     3115         CALL   COM         READ AUX STAT
```

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MTR90-1 -  H/Z-89 MONITOR          #09.02.01.                    Unix H8ASM V1.4.1 5-Jul-80   Page  76
ENTRY POINTS FOR HARDWARE TESTS                                  10:42:19  17-FEB-82

010.045  171          3116        MOV   A,C
010.046  315 023 006  3117        CALL  DAT
010.051  315 067 001  3118        CALL  PIN
010.054  332 171 002  3119        JC    NODEV        PREMATURE DONE
                      3120
000.001               3121        IF    .DEBUG
                      3122        MVI   A,9
                      3123        STA   DBFLG        FLAG PAST RAS
                      3124        ENDIF
                      3125
                      3126  *     SET TRANSFER COUNT TO 9 SECTORS
                      3127
010.057  076 003      3128        MVI   A,DD.LSC
010.061  315 027 006  3129        CALL  COM          SEND 'LOAD COUNT'
                      3130
010.064  257          3131        XRA   A
010.065  315 023 006  3132        CALL  DAT          SEND HIGH ORDER BYTE
                      3133
010.070  076 012      3134        MVI   A,10
010.072  315 023 006  3135        CALL  DAT          SEND LOW ORDER BYTE
                      3136
010.075  315 104 010  3137        CALL  WDN          WAIT FOR DONE, THEN EXIT
010.100  332 171 002  3138        JC    NODEV
                      3139
010.103  311          3140        RET
                      3141
                      3142  **    WDN   - WAIT FOR DONE
                      3143  *
                      3144  *     WDN waits for the done bit to be set.
                      3145  *
                      3146  *     time-out is in effect at this point
                      3147  *
                      3148  *     ENTRY: NONE
                      3149  *
                      3150  *     EXIT:  PSW    'C' SET IF ERROR
                      3151  *                  'C' CLEAR IF DONE
                      3152  *
                      3153  *     USES:  PSW
                      3154  *
                      3155
010.104  363          3156  WDN         DI
010.105  305          3157        PUSH  B            SAVE BC
010.106  001 000 175  3158        LXI   B,WDNA
                      3159
010.111  013          3160  WDN1        DCX   B
010.112  170          3161        MOV   A,B
010.113  261          3162        ORA   C
010.114  067          3163        STC
010.115  050 020      3164        JR    Z,WDN2       IF TIMED-OUT
                      3165
010.117  315 170 006  3166        CALL  IN.
010.122  346 040      3167        ANI   S.DON
010.124  050 363      3168        JR    Z,WDN1       IF NOT DONE YET
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MTR90-1 - H/Z-89 MONITOR        #09.02.01.                    Unix H8ASM V1.4.1 5-Jul-80   Page  77
ENTRY POINTS FOR HARDWARE TESTS                                     10:42:20 17-FEB-82

                      3169
010.126  315 170 006  3170        CALL  IN.
010.131  346 001      3171        ANI   S.ERR     S.ERR VALID ONLY IF S.DON SET
010.133  067          3172        STC
010.134  040 001      3173        JR    NZ,WDN2   IF ERROR BIT SET
                      3174
010.136  247          3175        ANA   A         CLEAR CARRY
                      3176
010.137  301          3177  WDN2  POP   B
010.140  373          3178        EI
010.141  311          3179        RET             ALL OK.
                      3180
175.000               3181  WDNA  EQU   32000     TIME OUT COUNTER


                      3183 **   RRDY  - CHECK DEVICE READY
                      3184 *
                      3185 *    RRDY RETURNS THE DEVICE READY BITS IN
                      3186 *    THE L REGISTER. BITS "ON" INDICATE
                      3187 *    UNIT NOT READY.
                      3188 *
010.142  076 020      3189  RRDY  MVI   A,DD.RRDY
010.144  315 027 006  3190        CALL  COM
                      3191
                      3192
010.147  315 067 001  3193        CALL  PIN
                      3194
000.001               3195        IF    .DEBUG
                      3196        MVI   A,3         FLAG PAST PIN
                      3197        STA   DBFLG
                      3198        ENDIF
                      3199
010.152  157          3200        MOV   L,A
010.153  303 104 010  3201        JMP   WDN


                      3203 **   COM2 - *COM* ROUTINE CONTINUATION
                      3204 *
                      3205 *    OUTPUT COMMAND TO 47 AND THEN DELAY
                      3206 *
                      3207
010.156  315 140 006  3208  COM2  CALL  OUT1.       SEND COMMAND BYTE
010.161  076 040      3209        MVI   A,40Q
010.163  247          3210        ANA   A           CLEARY 'Z'
                      3211
010.164  075          3212  COM3  DCR   A
010.165  302 164 010  3213        JNZ   COM3        SHORT DELAY
                      3214
010.170  311          3215        RET
```

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MTR90-1 -  H/Z-89 MONITOR          #09.02.01.              Unix H8ASM V1.4.1  5-Jul-80      Page  78
ENTRY POINTS FOR HARDWARE TESTS                            10:42:24  17-FEB-82

                                  3217        **    VIEW5 - *VIEW* CONTINUED
                                  3218        *
                                  3219        *     VIEW5 DOES THE ASCII PORTION OF THE *VIEW* ROUTINE
                                  3220        *
                                  3221
010.171  315 316 010             3222  VIEW5    CALL  PCFA         POSITION CURSOR FOR ASCII
010.174  176                     3223  VIEW5A   MOV   A,M          GET A BYTE
010.175  247                     3224           ANA   A            CHECK PARITY
010.176  372 241 010             3225           JM    VIEW7
010.201  376 177                 3226           CPI   177Q
010.203  312 212 010             3227           JZ    VIEW5.
010.206  376 040                 3228           CPI   ' '          PRINTABLE?
010.210  060 012                 3229           JR    NC,VIEW6     YES
010.212  345                     3230  VIEW5.   PUSH  H
010.213  041 024 011             3231           LXI   H,VEW.NPC    NON-PRINTABLE CHARACTER
010.216  315 100 006             3232           CALL  TYPMSG
010.221  341                     3233           POP   H
010.222  030 003                 3234           JR    VIEW6.
010.224  315 302 003             3235  VIEW6    CALL  MCC          PRINT IT
010.227  315 363 007             3236  VIEW6.   CALL  VIEW4
010.232  310                     3237           RZ                 IF LAST BYTE DONE
010.233  315 340 003             3238           CALL  VIEW3.       CHECK FOR END
010.236  040 334                 3239           JR    NZ,VIEW5A    NO, DO MORE
010.240  311                     3240           RET
                                 3241
010.241  346 177                 3242  VIEW7    ANI   177Q         STRIP PARITY
010.243  365                     3243           PUSH  PSW          SAVE IT
010.244  076 033                 3244           MVI   A,33Q
010.246  315 302 003             3245           CALL  MCC
010.251  076 160                 3246           MVI   A,'p'        GO TO REVERSE VIDEO
010.253  315 302 003             3247           CALL  MCC
010.256  361                     3248           POP   PSW
010.257  376 177                 3249           CPI   177Q
010.261  312 270 010             3250           JZ    VIEW7A
010.264  376 040                 3251           CPI   ' '
010.266  060 012                 3252           JR    NC,VIEW7.
010.270  345                     3253  VIEW7A   PUSH  H
010.271  041 024 011             3254           LXI   H,VEW.NPC
010.274  315 100 006             3255           CALL  TYPMSG
010.277  341                     3256           POP   H
010.300  030 003                 3257           JR    VIEW7..
010.302  315 302 003             3258  VIEW7.   CALL  MCC          PRINT IT
010.305  076 033                 3259  VIEW7..  MVI   A,33Q
010.307  315 302 003             3260           CALL  MCC
010.312  076 161                 3261           MVI   A,'q'        EXIT REVERSE VIDEO
010.314  030 306                 3262           JR    VIEW6        AND FINISH UP
                                 3263
010.316  345                     3264  PCFA     PUSH  H
010.317  315 112 015             3265           CALL  CHKRAD
010.322  041 017 011             3266           LXI   H,PCF.MO     ASSUME OCTAL
010.325  312 333 010             3267           JZ    PCFAA
010.330  041 012 011             3268           LXI   H,PCF.MH     WAS HEX
010.333  315 100 006             3269  PCFAA    CALL  TYPMSG
010.336  341                     3270           POP   H
010.337  076 001                 3271           MVI   A,1          Skip 1 space per letter
                                 3272
```

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Address	Bytes	Line	Label	Op	Operand	Comment
010.341	345	3273	PCFA.	PUSH	H	
010.342	305	3274		PUSH	B	
010.343	107	3275		MOV	B,A	B=SKIP COUNT
010.344	315 112 015	3276		CALL	CHKRAD	
010.347	312 357 010	3277		JZ	PCFA1	
		3278				
010.352	076 360	3279		MVI	A,11110000B	MASK FOR HEX
010.354	303 361 010	3280		JMP	PCFA2	
		3281				
010.357	076 370	3282	PCFA1	MVI	A,11111000B	MASK FOR OCTAL
		3283				
010.361	245	3284	PCFA2	ANA	L	MASK LOW ORDER, RESULT IN A
		3285				
010.362	275	3286	PCFA3	CMP	L	
010.363	312 007 011	3287		JZ	PCFA4	IF A=L, DONE
010.366	055	3288		DCR	L	
010.367	365	3289		PUSH	PSW	
010.370	305	3290		PUSH	B	
010.371	076 040	3291	PCFA3.	MVI	A,' '	
010.373	315 302 003	3292		CALL	MCC	
010.376	005	3293		DCR	B	
010.377	302 371 010	3294		JNZ	PCFA3.	
		3295				
011.002	301	3296		POP	B	
011.003	361	3297		POP	PSW	
011.004	303 362 010	3298		JMP	PCFA3	PRINT (B) SPACES AND CHECK AGAIN
		3299				
011.007	301	3300	PCFA4	POP	B	
011.010	341	3301		POP	H	
011.011	311	3302		RET		
		3303				
011.012	033 131 001	3304	PCF.MH	DB	33Q,'Y',1,54+31,0	Hex Version
011.017	033 131 001	3305	PCF.MO	DB	33Q,'Y',1,40+31,0	Octal Version
		3306				
011.024	033 106 136	3307	VEW.NPC	DB	33Q,'FA',33Q,'G',0	ESC,GRAPHICS,i,ESC,NO-GRAPHICS
		3309	**			VIEW8 - GET BOUNDRIES
		3310	*			
		3311	*			VIEW8 GETS THE BOUNDRIES OF THE *VIEW* COMMAND
		3312	*			
		3313				
011.032	315 012 015	3314	VIEW8	CALL	IROC	GET CHARACTER OR RETURN
011.035	040 012	3315		JR	NZ,VIEW8A	
		3316				
011.037	052 072 040	3317		LHLD	VEWHLD	GET LAST ON
011.042	043	3318		INX	H	START AT NEXT ONE
011.043	353	3319		XCHG		
011.044	001 000 000	3320		LXI	B,0	SET LENGTH TO 0
011.047	030 003	3321		JR	VIEW8B	
		3322				
011.051	315 073 016	3323	VIEW8A	CALL	GETBND.	'C' IS SET, FIRST CHARACTER IN A
		3324				
011.054	151	3325	VIEW8B	MOV	L,C	

```
ENTRY POINTS FOR HARDWARE TESTS

011.055  140         3326          MOV   H,B
011.056  042 072 040 3327         SHLD   VEWHLD          SAVE LAST
                     3328

011.061  170         3329          MOV   A,B
011.062  261         3330          ORA   C               LAST = 0
011.063  300         3331          RNZ                   NO, OK
011.064  041 177 000 3332          LXI   H,200Q-1        ADD 177Q TO VALUE
011.067  031         3333          DAD   D               HL = DE + 177Q
                     3334

011.070  315 112 015 3335          CALL  CHKRAD
011.073  050 006     3336          JR    Z,VIEW8.
                     3337

011.075  325         3338          PUSH  D
011.076  021 200 000 3339          LXI   D,200Q
011.101  031         3340          DAD   D               ADD IN ANOTHER
011.102  321         3341          POP   D
                     3342

011.103  042 072 040 3343 VIEW8.  SHLD   VEWHLD          UPDATE END ADDRESS
011.106  115         3344          MOV   C,L
011.107  104         3345          MOV   B,H
011.110  311         3346          RET

                     3348 **      VIEW12 - Print address and position cursor
                     3349 *
                     3350
011.111             3351 VIEW12 EQU *
011.111  315 064 015 3352          CALL  TOA             NUMBER OF ASCII FOR BYTES
011.114  315 112 015 3353          CALL  CHKRAD
011.117  312 127 011 3354          JZ    VIEW3B
011.122  076 003     3355          MVI   A,3
011.124  303 131 011 3356          JMP   VIEW3C
011.127  076 004     3357 VIEW3B  MVI    A,4
011.131  315 341 010 3358 VIEW3C  CALL   PCFA.           SKIP TO START ON SCREEN
011.134  311         3359          RET

                     3361 **      CKAUTO - CHECK FOR AUTO BOOT
                     3362 *
                     3363 *       CKAUTO IS ENTERED DURING THE MONITOR LOOP TO CHECK
                     3364 *       IF THE AUTO BOOT SWITCH IS SET.
                     3365 *
                     3366 *
                     3367 *       THIS ROUTINE WAS MOVED FROM UP FRONT TO MAKE ROOM
                     3368 *
011.135  333 362     3370 CKAUTO  IN    H88.SW
011.137  346 200     3371          ANI   H88S.AT         CHECK SWITCH
011.141  050 007     3372          JR    Z,CHAI2         NOT AUTO BOOT
011.143  041 123 041 3373          LXI   H,AUTO8
011.146  276         3374          CMP   M               HAVE WE BEEN HERE BEFORE?
011.147  302 243 004 3375          JNZ   ATB             NO, DO AUTO BOOT
```

```
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ENTRY POINTS FOR HARDWARE TESTS                     10:42:43  17-FEB-82

                       3376
011.152 041 062 014    3377  CHAT2  LXI   H,MSG.PR
011.155 303 354 000    3378         JMP   MTR.15        RETURN TO MOITOR LOOP

                       3380  **     DYMEM EXTENSION
                       3381  *
011.160 353            3382  DY9.3  XCHG
011.161 174            3383         MOV   A,H
                       3384  *
                       3385         LD    IX,DY9.4
011.162 335 041        3386         DB    MI.LDXA,MI.LDXB
011.164 171 011        3387         DW    DY9.4
011.166 303 160 003    3388         JMP   DYBYT
                       3389
011.171 175            3390  DY9.4  MOV   A,L
                       3391  *
                       3392         LD    IX,DY9.5
011.172 335 041        3393         DB    MI.LDXA,MI.LDXB
011.174 315 003        3394         DW    DY9.5
                       3395
011.176 303 160 003    3396         JMP   DYBYT
                       3397  *      ANOTHER EXTENSION!
                       3398  *
                       3399
011.201 172            3400  DY3.3  MOV   A,D
                       3401         LD    IX,DY3.5
011.202 335 041        3402         DB    MI.LDXA,MI.LDXB
011.204 211 011        3403         DW    DY3.5
                       3404
011.206 303 160 003    3405         JMP   DYBYT
                       3406
011.211 173            3407  DY3.5  MOV   A,E
                       3408         LD    IX,DY3.7
011.212 335 041        3409         DB    MI.LDXA,MI.LDXB
011.214 153 007        3410         DW    DY3.7
011.216 303 160 003    3411         JMP   DYBYT

                       3413  **     H37 - ENTRY POINT TO BOOT FROM H37
                       3414  *
                       3415
011.221 257            3416  H37    XRA   A
011.222 323 171        3417         OUT   DK.INT        SET FLIP LATCH
                       3418
011.224 076 320        3419         MVI   A,FDC.FI
011.226 323 172        3420         OUT   FD.CMD        SET NOT BUSY
                       3421
011.230 076 001        3422         MVI   A,1
011.232 315 053 000    3423         CALL  DLY           DLY 2 MILLISECONDS
                       3424
011.235 333 172        3425         IN    FD.STAT       CLEAR INTERRUPTS
```

```
011.237  041 145 012   3426        LXI   H,MYINT            SET INTERRUPT RUTINE
011.242  042 051 040   3427        SHLD  UIVEC+9+1
011.245  076 303       3428        MVI   A,MI.JMP
011.247  062 050 040   3429        STA   UIVEC+9
                       3430
                       3431
011.252  072 061 041   3432        LDA   AIO.UNI
011.255  306 004       3433        ADI   4
011.257  107           3434        MOV   B,A
011.260  257           3435        XRA   A
011.261  315 155 012   3436        CALL  BITS               GET DEVICE CODE
                       3437
011.264  366 015       3438        ORI   CON.MO+CON.EI+CON.MFM
011.266  323 170       3439        OUT   DK.CON
011.270  107           3440        MOV   B,A
011.271  305           3441        PUSH  B
                       3442
011.272  373           3443        EI                       Insure interrupts on
                       3444
011.273  076 226       3445        MVI   A,150              300MS ON DELAY
011.275  315 053 000   3446        CALL  DLY
                       3447
011.300  041 335 011   3448        LXI   H,H371
011.303  042 067 040   3449        SHLD  BLKICW             SET RETURN ADDRESS
011.306  076 003       3450        MVI   A,FDC.RST+FDF.S30
011.310  323 172       3451        OUT   FD.CMD
                       3452
011.312  001 377 377   3453        LXI   B,-1               ABOUT 5 SECONDS
011.315  026 004       3454        MVI   D,4                DOUBLED.
011.317  013           3455  H37.  DCX   B
011.320  170           3456        MOV   A,B
011.321  261           3457        ORA   C
011.322  040 373       3458        JR    NZ,H37.            IF BC>0
                       3459
011.324  025           3460        DCR   D
011.325  040 370       3461        JR    NZ,H37.            IF D>0
                       3462
011.327  076 320       3463        MVI   A,FDC.FI
011.331  323 172       3464        OUT   FD.CMD
                       3465
011.333  030 132       3466        JR    H373               TIMED OUT
                       3467
011.335  041 356 011   3468  H371  LXI   H,H371B            LOOP RETURN ADDRESS
011.340  042 067 040   3469        SHLD  BLKICW             NUMBER OF TRACKS TO STEP
011.343  076 012       3470        MVI   A,10
011.345  323 173       3471        OUT   FD.DAT             SET TRACK NUMBER TO 10
011.347  076 023       3472        MVI   A,FDC.SEK+FDF.S30
011.351  323 172       3473        OUT   FD.CMD
011.353  303 353 011   3474        JMP   *                  Wait for interrupt
                       3475  *     Return here after doing seek
                       3476
011.356  041 373 011   3477  H371B LXI   H,H371C
011.361  042 067 040   3478        SHLD  BLKICW
011.364  076 003       3479        MVI   A,FDC.RST+FDF.S30
011.366  323 172       3480        OUT   FD.CMD
```

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MTR90-1 - H/Z-89 MONITOR    #09.02.01.
ENTRY POINTS FOR HARDWARE TESTS

011.370  303 370 011   3482         JMP   *
                       3483
                       3484   * Here after final RESTORE
                       3485
011.373  346 004       3486  H371C  ANI   FDS.TKO        Be sure track zero switch on
011.375  050 070       3487         JR    Z,H373         If not there
                       3488
                       3489   * Over track zero, Wait for head to settle
                       3490
011.377  001 200 014   3491         LXI   B,3200         40 mS DELAY
012.002  013           3492  H371.  DCX   B
012.003  170           3493         MOV   A,B
012.004  261           3494         ORA   C
012.005  040 373       3495         JR    NZ,H371.       ALLOW HEAD SETTLE TIME
                       3496
012.007  301           3497         POP   B
012.010  170           3498         MOV   A,B            (A) = Device Control Bits
012.011  366 002       3499         ORI   CON.DRQ        Turn on DRQ interrupt
012.013  107           3500         MOV   B,A
012.014  305           3501         PUSH  B              save device control bits
012.015  323 170       3502         OUT   DK.CON         READY FOR TRANSFERS
                       3503
012.017  315 075 012   3504         CALL  READT          Read a track
012.022  301           3505         POP   B
012.023  365           3506         PUSH  PSW            SAVE RETURN STATUS
012.024  170           3507         MOV   A,B
012.025  346 373       3508         ANI   377Q-CON.MFM   OFF DBL DENSITY
012.027  107           3509         MOV   B,A
012.030  361           3510         POP   PSW
012.031  040 012       3511         JR    NZ,H372        IF READ FAILURE
                       3512
012.033  041 200 335   3513         LXI   H,-USERFMA     HL = Bytes Read
012.036  031           3514         DAD   D
012.037  174           3515         MOV   A,H
012.040  376 011       3516         CPI   2048+256/256   See if 2.25K
012.042  322 201 016   3517         JNC   EUC            If got it all
                       3518
012.045  170           3519  H372   MOV   A,B
012.046  323 170       3520         OUT   DK.CON
                       3521
012.050  315 075 012   3522         CALL  READT          TRY SINGLE DENSITY
012.053  040 012       3523         JR    NZ,H373        IF FAILURE
                       3524
012.055  041 200 335   3525         LXI   H,-USERFMA     HL = Bytes Read
012.060  031           3526         DAD   D
012.061  174           3527         MOV   A,H
012.062  376 011       3528         CPI   2048+2^6/256   See if 2.25K
012.064  322 201 016   3529         JNC   EUC            More than 2.25K read, is ok
                       3530
012.067  257           3531  H373   XRA   A
012.070  323 170       3532         OUT   DK.CON         TURN OFF DEVICE
012.072  303 171 002   3533         JMP   NODEV
                       3534
012.075  076 001       3535  READT  MVI   A,CON.ST
012.077  323 171       3536         OUT   DK.INT
012.101  323 172       3537         OUT   FD.SEC
```

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000.000              3538         ERRNZ  CON.ST-1
012.103  257         3539         XRA    A
012.104  323 171     3540         OUT    DK.INT
000.000              3541         ERRNZ  CON.CD
                     3542
012.106  041 134 012 3543         LXI    H,READT2
012.111  042 067 040 3544         SHLD   BLKICM      SET RETURN ADDRESS
012.114  041 126 012 3545         LXI    H,READT1
012.117  021 200 042 3546         LXI    D,USERFWA
012.122  076 234     3547         MVI    A,FDC.RDS+FDF.DLF+FDF.MKF+FDF.SLF
012.124  323 172     3548         OUT    FD.CMD
                     3549
012.126  166         3550  READT1 HLT
012.127  333 173     3551         IN     FD.DAT       *TIME DEPENDENT*
012.131  022         3552         STAX   D
012.132  023         3553         INX    D
012.133  351         3554         PCHL
                     3555
012.134  365         3556  READT2 PUSH   PSW
012.135  076 010     3557         MVI    A,CON.MD
012.137  323 170     3558         OUT    DK.CON
012.141  361         3559         POP    PSW
012.142  346 254     3560         ANI    FDS.NRD+FDS.LDT+FDS.CRC+FDS.RTE
012.144  311         3561         RET
                     3562
                     3563  ***  MYINT - H37 Interrupt Routine
                     3564  *
                     3565  *  This routine is entered when a level 4 interrupt
                     3566  *  is recieved from the H37 Hardware.
                     3567  *
                     3568  *  Control is passed to the address in BLKICM
                     3569  *
                     3570  *  ENTRY:  NONE    (From disk routine via level 4 interrupt)
                     3571  *
                     3572  *  EXIT:   PSW  =  Status byte from controller
                     3573  *          HL   =  Return address to routine
                     3574  *
                     3575
012.145  333 172     3576  MYINT  IN     FD.STAT
012.147  341         3577         POP    H
012.150  052 067 040 3578         LHLD   BLKICM
012.153  373         3579         EI
012.154  351         3580         PCHL
012.155              3581         XTEXT  BITS

                     3583X **  BITS  -  BIT SET
                     3584X *
                     3585X *  BITS SETS THE SPECIFIED BIT IN THE ACCUMULATOR.
                     3586X *
                     3587X *  ENTRY:  A  = ORIGINAL A
                     3588X *          B  = NUMBER OF BIT TO SET ( 7=HIGH,...,0=LOW )
                     3589X *
                     3590X *  EXIT:   A  = ORIGINAL A  WITH BIT(B) SET
```

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MTR90-1 - H/Z-89 MONITOR       #09.02.01.                          Unix H8ASM V1.4.1  5-Jul-80    Page  85
ENTRY POINTS FOR HARDWARE TESTS                                                 10:42:58  17-FEB-82

                      3591X   *             USES:  PSM
                      3592X   *
                      3593X   *
                      3594X
012.155 305           3595X   BITS   PUSH   B
                      3596X
012.156 365           3597X          PUSH   PSM
012.157 076 200       3598X          MVI    A,10000000B
012.161 004           3599X          INR    B
012.162 007           3600X   BITS1  RLC
012.163 005           3601X          DCR    B
012.164 302 162 012   3602X          JNZ    BITS1
                      3603X
012.167 117           3604X          MOV    C,A
012.170 361           3605X          POP    PSM
012.171 261           3606X          ORA    C
                      3607X
012.172 301           3608X          POP    B
012.173 311           3609X          RET
                      3610X   **     H67 - BOOT H67
                      3611X   *
                      3612X   *  The section of this code most likely to 'HANG' because
                      3613X   *  of no controller is timed using the BC register pair
                      3614X   *  for approximately 3 seconds.
                      3615X   *
                      3616X
012.174 076 020       3617X   H67    MVI    A,BC.RST
012.176 315 140 006   3618X          CALL   OUT1.         RESET THE CONTROLLER
                      3619X
012.201 076 004       3620X          MVI    A,4
012.203 315 053 000   3621X          CALL   DLY
                      3622X
012.206 041 062 041   3623X          LXI    H,AIO.DIR     SCRATCH AREA FOR CDB
012.211 066 000       3624X          MVI    M,D.TDR       TEST FOR READY
012.213 016 005       3625X          MVI    C,5
012.215 043           3626X   H671   INX    H
012.216 066 000       3627X          MVI    M,0           FILL CDB WITH 0
012.220 015           3628X          DCR    C
012.221 040 372       3629X          JR     NZ,H671
                      3630X
012.223 315 365 012   3631X          CALL   H67UNI        GET UNIT NUMBER
012.226 062 063 041   3632X          STA    AIO.DIR+1     SET THE LUN
                      3633X
012.231 315 376 012   3634X   H671.  CALL   GETCON        CHECK READY
012.234 060 012       3635X          JR     NC,H672       IF DRIVE IS READY
                      3636X
012.236 312 171 002   3637X          JZ     NODEV         IF WAS TIME-OUT PROBLEM
                      3638X
012.241 076 377       3639X          MVI    A,377Q
012.243 315 053 000   3640X          CALL   DLY           WAIT ABOUT 1/2 SECOND
012.246 030 361       3641X          JR     H671.
                      3642X
012.250 041 062 041   3643X   H672   LXI    H,AIO.DIR     RECAL THE DRIVE
012.253 066 001       3644X          MVI    M,D.REC
                      3645X
012.255 315 376 012   3646X          CALL   GETCON        DO THE RECAL
```

ENTRY POINTS FOR HARDWARE TESTS

Address	Bytes	Line	Label	Op	Operand	Comment
012.260	332 171 002	3647		JC	NODEV	ERROR IN RECAL
		3648	*			Now cause the drive to step out 10 tracks
		3649	*			
		3650				
012.263	072 061 041	3651		LDA	AIO.UNI	Only for the hard disk
012.266	247	3652		ANA	A	
012.267	302 330 012	3653		JNZ	H673	If unit = 1, is 8" floppy
		3654				
012.272	041 062 041	3655		LXI	H,AIO.DIR	
012.275	066 013	3656		MVI	M,D.SEK	HL over logical address 0
012.277	043	3657		INX	H	
012.300	043	3658		INX	H	
012.301	066 007	3659		MVI	M,7	Seek block (7*256)
		3660				
012.303	315 376 012	3661		CALL	GETCON	Do the seek
012.306	332 171 002	3662		JC	NODEV	If error doing Seek
		3663				
012.311	041 062 041	3664		LXI	H,AIO.DIR	
012.314	066 001	3665		MVI	M,D.REC	
012.316	043	3666		INX	H	
012.317	043	3667		INX	H	
012.320	066 000	3668		MVI	M,0	Do another Recal
012.322	315 376 012	3669		CALL	GETCON	
012.325	332 171 002	3670		JC	NODEV	
		3671				
012.330	041 062 041	3672	H673	LXI	H,AIO.DIR	SET UP READ COMMAND
012.333	066 010	3673		MVI	M,D.REA	
012.335	043	3674		INX	H	HL = LUN
012.336	043	3675		INX	H	
012.337	043	3676		INX	H	
012.340	043	3677		INX	H	
012.341	066 012	3678		MVI	M,10	SET 10 SECTOR READ
012.343	043	3679		INX	H	
012.344	066 200	3680		MVI	M,080H	CONTROL BYTE
		3681				
012.346	315 365 012	3682		CALL	H67UNI	
012.351	062 063 041	3683		STA	AIO.DIR+1	SET LUN TO READ
		3684				
012.354	315 376 012	3685		CALL	GETCON	
012.357	332 171 002	3686		JC	NODEV	IF READ ERROR
012.362	303 201 016	3687		JMP	EUC	ENTER USER CODE
		3688				
012.365	072 061 041	3689	H67UNI	LDA	AIO.UNI	(A)=UNIT NUMBER
012.370	017	3690		RRC		
012.371	017	3691		RRC		
012.372	017	3692		RRC		
012.373	346 140	3693		ANI	ST.LUN	MOVE IT INTO PLACE
012.375	311	3694		RET		
		3695				
012.376	363	3696	GETCON	DI		GET CONTROLLER ATTENTION
		3697				
012.377	001 377 377	3698		LXI	B,65535	ABOUT 5 SECONDS FOR RESPONSE
013.002	026 002	3699		MVI	D,2	3 BYTE COUNTER (D,B,C)
		3700				
013.004	315 150 006	3701	GTCON	CALL	IN1.	GET BUSS STATUS
013.007	346 010	3702		ANI	BS.BSY	

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ENTRY POINTS FOR HARDWARE TESTS                      BITS            10:43:07 17-FEB-82

013.011  050 012              JR    Z,GTCON1     WAIT FOR BUSY TO LEAVE
3703

013.013  013          DCX   B                    COUNT DOWN
3705
013.014  170          MOV   A,B
3706
013.015  261          ORA   C
3707
013.016  040 364      JR    NZ,GTCON             NO TIMEOUT YET
3708

013.020  025          DCR   D                    DEC 3RD BYTE
3710
013.021  040 361      JR    NZ,GTCON
3711

013.023  067          STC                        INDICATE ERROR
3713
013.024  311          RET
3714

013.025  076 100      GTCON1  MVI   A,BC.SEL     OUTPUT TO (PRIM)
3716
013.027  315 140 006          CALL  OUT1.
3717

013.032  315 150 006  CBUSY   CALL  IN1.
3719
013.035  346 010              ANI   BS.BSY       WAIT FOR CONTROLLER
3720
013.037  040 007              JR    NZ,CBUSY1
3721

013.041  013          DCX   B                    CONTINUE COUNTING
3723
013.042  170          MOV   A,B
3724
013.043  261          ORA   C
3725
013.044  040 364      JR    NZ,CBUSY
3726
013.046  067          STC                        TIMED OUT
3727
013.047  311          RET
3728

013.050  076 002      CBUSY1  MVI   A,BC.EDT
3730
013.052  315 140 006          CALL  OUT1.
3731
         *  HAVE CONTROLLER, SEND HIM COMMAND
         *

013.055  041 062 041  OUTCOM  LXI   H,AIO.DIR    FWA OF COMMAND BUFFER
3735

013.060  315 150 006  COMREQ  CALL  IN1.
3737
013.063  117          MOV   C,A
3738
013.064  247          ANA   A
3739
013.065  362 060 013          JP    COMREQ       WAIT FOR REQUEST BIT
3740
000.000                       ERRNZ 200Q-BS.REQ
3741

013.070  346 020      ANI   BS.COM               COMMAND DONE, SEND DATA
3743
013.072  050 077      JR    Z,TFDATA
3744

013.074  171          MOV   A,C                  (A)=BUSS STATUS BYTE
3746
013.075  346 100      ANI   BS.DTD               CHECK DIRECTION
3747
013.077  050 007      JR    Z,GETST              IF DONE, GET STATUS
3748

013.101  176          MOV   A,M                  (A)=COMMAND BYTE
3750
013.102  315 063 006          CALL  OUT.         SEND OUT DATA
3751
013.105  043          INX   H                    BUMP POINTER
3752
013.106  030 350      JR    COMREQ               CONTINUE SENDIG BYTES
3753
         *  GET STATUS - COMPLETION BYTE SHOULD BE ZEROS AND
         *  STATUS BYTE SHOULD BE ZERO IN 2 LS BITS
         *

013.110  315 150 006  GETST   CALL  IN1.
3758
```

Line	Address	Bytes	Label	Op	Operand	Comment
3759	013.113	346 320		ANI	BS.REQ+BS.DTD+BS.COM	
3760	013.115	376 220		CPI	BS.REQ+BS.COM	
3761	013.117	040 367		JR	NZ,GETST	WAIT FOR CONTROLLER
3762						
3763	013.121	315 170 006		CALL	IN.	/2.1b/
3764	013.124	117		MOV	C,A	[C]=STATUS BYTE
3765	013.125	062 070 041		STA	AIO.DIR+6	
3766						
3767	013.130	315 150 006	GETCPT	CALL	IN1.	
3768	013.133	107		MOV	B,A	
3769	013.134	062 071 041		STA	AIO.DIR+7	
3770						
3771	013.137	346 340		ANI	BS.REQ+BS.DTD+BS.MTY+BS.COM	
3772	013.141	376 240		CPI	BS.REQ+BS.MTY+BS.COM	
3773	013.143	040 363		JR	NZ,GETCPT	WAIT FOR MESSAGE
3774	013.145	062 072 041		STA	AIO.DIR+8	SAVE BYTES FOR DEBUG
3775						
3776	013.150	373		EI		
3777						
3778	013.151	315 170 006		CALL	IN.	[A]=COMPLETION BYTE
3779	013.154	267		ORA	A	CHECK COMPLETION
3780	013.155	067		STC		
3781	013.156	300		RNZ		SHOULD BE ZERO
3782						
3783	013.157	171		MOV	A,C	
3784	013.160	346 003		ANI	00000011B	CHECK FOR ERRORS
3785	013.162	067		STC		
3786	013.163	300		RNZ		IF A BIT IS SET
3787						
3788	013.164	170		MOV	A,B	
3789	013.165	346 002		ANI	00000010B	
3790	013.167	067		STC		
3791	013.170	300		RNZ		IF INTERFACE ERROR
3792						
3793	013.171	257		XRA	A	CLEAR CARRY
3794	013.172	311		RET		
3795						
3796	013.173	041 200 042	TFDATA	LXI	H,USERFMA	HL = LOAD ADDRESS
3797						
3798	013.176	315 150 006	TFREQ	CALL	IN1.	
3799	013.201	117		MOV	C,A	
3800	013.202	346 200		ANI	BS.REQ	
3801	013.204	050 370		JR	Z,TFREQ	WAIT FOR REQUEST
3802						
3803	013.206	171		MOV	A,C	
3804	013.207	346 020		ANI	BS.COM	
3805	013.211	040 275		JR	NZ,GETST	IF DONE, CHECK STATUS
3806						
3807	013.213	315 170 006		CALL	IN.	GET DATA BYTE
3808	013.216	167		MOV	M,A	
3809	013.217	043		INX	H	
3810	013.220	030 354		JR	TFREQ	CONTINUE UNTIL DONE

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ENTRY POINTS FOR HARDWARE TESTS                              10:43:16 17-FEB-82

                     3812  **      FEDEV - FUTURE EXPANSION DEVICE
                     3813  *
                     3814  *       CURRENTLY, FEDEV JUST PRINTS "UNKNOWN DEVICE"
                     3815  *
                     3816
013.222 041 233 013  3817  FEDEV   LXI   H,MSG.FE
013.225 315 100 006  3818          CALL  TYPMSG
013.230 303 177 002  3819          JMP   NDDEV1         ENTER COMMON RECOVERY CODE
                     3820
013.233 077 125 156  3821  MSG.FE  DB    'Unkown Device',0

                     3823  **      DYMEM10 - DYNAMIC RAM TEST CONTINUED
                     3824  *
                     3825
013.252 076 007      3826  DYMEM10 MVI   A,A.BEL
013.254 375 041      3827          DB    MI.LDYA,MI.LDYB
013.256 244 007      3828          DW    DYIO.5
                     3829
013.260 303 143 003  3830          JMP   DYASC

                     3832  **      CCL - CHECK COMMAND LINE
                     3833  *
                     3834  *       CCL CHECKS TO SEE IF THE USER WISHES TO PASS A COMMAND
                     3835  *       TO THE BOOT ROUTINE. IF THE USER SIMPLY TYPES A CARRIAGE
                     3836  *       RETURN, THEN NO COMMAND LINE IS PRESENT AND (SP) = 42.200
                     3837  *       OTHERWISE THE COMMAND LINE IS PUSHED ONTO THE STACK ALA HDOS
                     3838  *       AND THE BOOT ROUTINES CAN DO WITH AS THEY SEE FIT.
                     3839  *
                     3840  *       ENTRY:  NONE
                     3841  *
                     3842  *       EXIT:  (SP)  =    42.200       NO COMMAND LINE
                     3843  *              (SP)  <>   42.200
                     3844  *                             COMMAND ON STACK TERMINATED WITH 000Q
                     3845  *
                     3846  *
                     3847  *       USES:  SP
                     3848  *
                     3849
013.263 062 000 040  3850  CCL     STA   START          SAVE UNIT NUMBER
013.266 042 002 040  3851          SHLD  IOWRK          SAVE DEVICE ADDRESS
013.271 061 200 042  3852          LXI   SP,42200A      SET STACK
                     3853
013.274 041 062 041  3854          LXI   H,AIO.DIR
013.277 016 035      3855          MVI   C,PRIM-AIO.DIR-1    (C) = MAXIMUM ALLOWABLE LENGTH
                     3856
                     3857  *       GET 1ST CHARACTER
                     3858
013.301 315 262 003  3859  CCL1    CALL  RCC            READ KEYBOARD
013.304 376 015      3860          CPI   A.CR           IS HE DONE?
013.306 050 017      3861          JK    Z,CCL3
```

CCL

Address	Bytes	Label	Op	Operand	Comment
013.310	376 072		CPI	':'	COMMAND LINE FOLLOWS
013.312	050 027		JR	Z,CCL4	
013.314	376 040		CPI	' '	ALLOW A SPACE
013.316	050 002		JR	Z,CCL2	
013.320	076 007		MVI	A,A.BEL	
013.322	315 302 003	CCL2	CALL	WCC	ECHO CHARACTER
013.325	030 352		JR	CCL1	
		*			JUST A CARRIAGE RETURN, NO COMMAND
013.327	315 370 005	CCL3	CALL	WCR.	ECHO CRLF
013.332	052 002 040	CCL3.	LHLD	IOWRK	RESTORE REGISTERS
013.335	072 000 040		LDA	START	
013.340	303 360 001		JMP	BOOT6	RETURN TO CALLER
		*			HAD ':', COMMAND LINE FOLLOWS
013.343	315 302 003	CCL4	CALL	WCC	ECHO THE CHARACTER
013.346	315 262 003	CCL5	CALL	RCC	GET NEXT
013.351	376 015		CPI	A.CR	
013.353	050 013		JR	Z,CCL6	IF END OF LINE
013.355	167		MOV	M,A	SAVE CHARACTER
013.356	043		INX	H	
013.357	015		DCR	C	
013.360	040 361		JR	NZ,CCL4	IF NOT TOO MANY
013.362	014		INR	C	RESET COUNTER
013.363	053		DCX	H	IGNORE IT
013.364	076 007		MVI	A,A.BEL	BEEP
013.366	030 353		JR	CCL4	
		*			END OF COMMAND LINE
013.370	315 370 005	CCL6	CALL	WCR.	
013.373	066 000		MVI	M,0	NUL TERMINATER
013.375	353		XCHG		(DE)=LWA OF COMMAND
013.376	041 000 000		LXI	H,0	
014.001	071		DAD	SP	HL = STACK
014.002	053		DCX	H	HL = LWA OF COMMAND LINE (NULL BYTE)
		*			MOVE COMMAND INTO STACK AREA
014.003	363		DI		NO CLOCK INTERRUPTS
014.004	032	CCL7	LDAX	D	DE = COMMAND BYTE
014.005	167		MOV	M,A	MOVE IT IN
014.006	053		DCX	H	
014.007	033		DCX	D	
014.010	042 067 040		SHLD	BLKICW	BUMP POINTERS
014.013	041 061 041		LXI	H,AIO.DIR-1	SAVE FOR A SECOND
014.016	174		MOV	A,H	AM I DONE?
014.017	272		CMP	D	
014.020	040 004		JR	NZ,CCL8	NO
014.022	175		MOV	A,L	
014.023	273		CMP	E	
014.024	050 005		JR	Z,CCL9	YES, FINISH UP

```
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                                          CCL

014.026  052 067 040   3918  CCL8    LHLD  BLKICH
014.031  030 351       3919          JR    CCL7
                       3920
                       3921  *       FINISHED WITH COMMAND LINE, (BLKICH)=FWA-1
                       3922
014.033  052 067 040   3923  CCL9    LHLD  BLKICH
014.036  043           3924          INX   H
014.037  371           3925          SPHL
014.040  030 270       3926          JR    CCL3.   AND GO BACK


                       3928  **      BSMSG - BOOT SECONDARY MESSAGE
                       3929  *
                       3930
014.042  040 123 104   3931  BSMSG   DB    ' SO',0


                       3933  **      ERRMSG - GENERAL ERROR MESSAGE
                       3934
014.046  077 102 157   3935  ERRMSG  DB    '?Boot Error',0


                       3937  **      MSG.PR - Prompt Message
                       3938  *
014.062  015 012 040   3939  MSG.PR  DB    A.CR,A.LF,' H: ',0
```

```
                       3942  **        RADIX - ASSIGN DEFAULT RADIX
                       3943  *
                       3944  *         RADIX SETS THE SYSTEM RADIX TO OCTAL OR HEX
                       3945  *
                       3946
014.072 041 203 014    3947  RADIX   LXI   H,MSG.RAD
014.075 315 100 006    3948          CALL  TYPMSG        COMPLETE NAME
                       3949
014.100 315 262 003    3950  RADIX1  CALL  RCC           READ CHARACTER
014.103 315 223 015    3951          CALL  MCU           MAP TO UPPER
014.106 376 117        3952          CPI   'O'
014.110 050 017        3953          JR    Z,RADIX2
014.112 376 110        3954          CPI   'H'
014.114 050 026        3955          JR    Z,RADIX3
014.116 376 015        3956          CPI   A.CR
014.120 050 036        3957          JR    Z,RADIX4
014.122 076 007        3958          MVI   A,A.BEL
014.124 315 302 003    3959          CALL  MCC
014.127 030 347        3960          JR    RADIX1
                       3961
                       3962  *        SET OCTAL RADIX
                       3963
014.131 041 211 014    3964  RADIX2  LXI   H,RAD.OCT
014.134 315 100 006    3965          CALL  TYPMSG
014.137 257            3966          XRA   A
014.140 062 071 040    3967          STA   RADFLG        SET FLAG
014.143 311            3968          RET
                       3969
                       3970  *        SET HEX RADIX
                       3971
014.144 041 217 014    3972  RADIX3  LXI   H,RAD.HEX
014.147 315 100 006    3973          CALL  TYPMSG
014.152 076 001        3974          MVI   A,1
014.154 062 071 040    3975          STA   RADFLG
014.157 311            3976          RET
                       3977
                       3978  *        SHOW CURRENT SETTING
                       3979
014.160 041 211 014    3980  RADIX4  LXI   H,RAD.OCT
014.163 315 112 015    3981          CALL  CHKRAD        ASSUME OCTAL
014.166 050 003        3982          JR    Z,RADIX5      WAS OCTAL
014.170 041 217 014    3983          LXI   H,RAD.HEX
                       3984
014.173 076 015        3985  RADIX5  MVI   A,A.CR
014.175 315 370 005    3986          CALL  MCR.          PRINT CRLF
014.200 303 100 006    3987          JMP   TYPMSG        TYPE NAME
                       3988
                       3989  *        MESSAGES
                       3990
014.203 141 144 151    3991  MSG.RAD DB    'adix ',0
014.211 117 143 164    3992  RAD.OCT DB    'Octal',0
014.217 110 145 170    3993  RAD.HEX DB    'Hexadecimal',0
```

```
                     3996 **      INPUT - PORT INPUT
                     3997 *
                     3998 *     INPUT INPUTS THE VALUE FROM THE SPECIFIED
                     3999 *     PORT NUMBER. THIS VALUE IS THEN PRINTED
                     4000 *
                     4001 INPUT
014.233 041 327 014  4002        LXI   H,MSG.INP
014.236 315 100 006  4003        CALL  TYPMSG        FINISH COMMAND
                     4004 *
                     4005 *     GET DESIRED PORT NUMBER
                     4006 *
014.241 041 120 041  4007        LXI   H,PRIM
014.244 247          4008        ANA   A             CLEAR CARRY
014.245 315 036 015  4009        CALL  IOB           GET PORT
                     4010
                     4011 *     READ DATA FROM THAT PORT
                     4012 *
014.250 315 170 006  4013        CALL  IN.           GET DATA AT (PRIM)
                     4014 *
                     4015 *     NOW PRINT RESULT
                     4016 *
014.253 365          4017        PUSH  PSW
014.254 076 015      4018        MVI   A,A.CR
014.256 315 370 005  4019        CALL  WCR.          PRINT CRLF
014.261 361          4020        POP   PSW
014.262 303 077 015  4021        JMP   TOB           TYPE THE BYTE


                     4023 **      OUTPUT - PORT OUTPUT
                     4024 *
                     4025 *     OUTPUT SENDS DATA OUT THE DESIRED PORT
                     4026 *     IN KEEPING WITH THE TAPE LOAD/DUMP ROUTINES, THE
                     4027 *     PORT NUMBER IS SPECIFIED FIRST, FOLLOEWD BY A HYPHEN
                     4028 *     AND FOLLWED BY DATA:
                     4029 *
                     4030 *         OUTPUT AAA,DDD<CR>
                     4031 *
014.265 041 332 014  4032 OUTPUT  LXI   H,MSG.OUT
014.270 315 100 006  4033        CALL  TYPMSG
                     4034
                     4035
014.273 041 003 040  4036        LXI   H,IOWRK+1     STORE INFO IN IOWRK
014.276 026 054      4037        MVI   D,'-'         TERMINATE PORT BY HYPHEN
014.300 247          4038        ANA   A             CLEAR CARRY
                     4039
014.301 315 023 015  4040 3100   CALL  IOA           INPUT ADDRESS
                     4041
014.304 072 002 040  4042        LDA   IOWRK         (A)=PORT NUMBER
014.307 062 120 041  4043        STA   PRIM          SAVE IT
                     4044
014.312 247          4045        ANA   A
014.313 041 002 040  4046        LXI   H,IOWRK       GET DATA
014.316 315 036 015  4047        CALL  IOB           GET BYTE AND <CR>
                     4048
```

```
014.321 072 002 040  4049          LDA   IOWRK             GET DATA IN (A)
014.324 303.063 006  4050
                     4051          JMP   OUT.              OUT (PRIM) WITH (A)

                     4053  **  MSG.XXX - INPUT/OUTPUT MESSAGES
                     4054  *
                     4055
014.327 156 040 000  4056  MSG.INP DB    'n ',0
014.332 165 164 040  4057  MSG.OUT DB    'ut ',0
014.336 015 012 012  4058  MSG.ERR DB    A.CR,A.LF,A.LF,'Error a ',0

                     4060  **  SUBM1O - SUBSTITUE PREFIX
                     4061  *
                     4062
014.352 315 112 015  4063  SUBM1O  CALL  CHKRAD
014.355 040 014      4064          JR    NZ,SUBM11
014.357 346 007      4065          ANI   00000111B         GET BINARY VALUE
014.361 137          4066          MOV   E,A               SAVE PARTIAL
014.362 176          4067          MOV   A,M               GET CURRENT
014.363 007          4068          RLC
014.364 007          4069          RLC
014.365 007          4070          RLC                     MAKE ROOM FOR NEW CHARACTER
014.366 346 370      4071          ANI   11111000B         TOSS PREVIOUS LSB
014.370 263          4072  SUBM1O. ORA   E                 ADD NEW
014.371 167          4073          MOV   M,A               SAVE NEW TOTAL
014.372 311          4074          RET
014.373 315 234 015  4075  SUBM11  CALL  CHC               CONVERT IT TO HEX
014.376 346 017      4076          ANI   00001111B
015.000 137          4077          MOV   E,A
015.001 176          4078          MOV   A,M
015.002 007          4079          RLC
015.003 007          4080          RLC
015.004 007          4081          RLC
015.005 007          4082          RLC
015.006 346 360      4083          ANI   11110000B
015.010 030 356      4084          JR    SUBM1O.
```

MTR90-1 - H/Z-89 MONITOR   #09.02.01.
IOA, IOB, TOA, TOB, IROC PREFIXES

```
                     4087 **      PREFIXES
                     4088 *
                     4089 *       THESE ROUTINES ARE PREFIXES TO THE IOA, IOB
                     4090 *       TOA, AND TOB ROUTINES. THESE PREFIXES DETERMINE
                     4091 *       THE PROPER BASE TO USE, AND TRANSFER CONTROL
                     4092 *       TO THE NEEDED ROUTINES
                     4093 *
                     4094
015.012 315 112 015  4095 IROC  CALL  CHKRAD
015.015 312 140 005  4096       JZ    IROCO
015.020 303 326 015  4097       JMP   IROCH
                     4098
015.023 365          4099 IOA   PUSH  PSW
015.024 315 112 015  4100       CALL  CHKRAD    CHECK RADIX
015.027 302 244 015  4101       JNZ   IHA
015.032 361          4102       POP   PSW       SAVE CARRY FLAG
015.033 303 062 003  4103       JMP   IOAO
                     4104
015.036 365          4105 IOB   PUSH  PSW
015.037 315 112 015  4106       CALL  CHKRAD
015.042 302 123 015  4107       JNZ   IHB
015.045 361          4108       POP   PSW
015.046 303 066 003  4109       JMP   IOBO
                     4110
015.051 365          4111 IOC   PUSH  PSW
015.052 315 112 015  4112       CALL  CHKRAD
015.055 302 214 015  4113       JNZ   IHC
015.060 361          4114       POP   PSW
015.061 303 266 005  4115       JMP   IOCO
                     4116
015.064 365          4117 TOA   PUSH  PSW
015.065 315 112 015  4118       CALL  CHKRAD
015.070 302 001 016  4119       JNZ   THA
015.073 361          4120       POP   PSW
015.074 303 300 005  4121       JMP   TOAO
                     4122
015.077 365          4123 TOB   PUSH  PSW
015.100 315 112 015  4124       CALL  CHKRAD
015.103 302 350 015  4125       JNZ   THB
015.106 361          4126       POP   PSW
015.107 303 322 005  4127       JMP   TOBO
                     4128
                     4129 *       CHECK CURRENT RADIX
                     4130
015.112 305          4131 CHKRAD PUSH  B
015.113 107          4132       MOV   B,A
015.114 072 071 040  4133       LDA   RADFLG
015.117 247          4134       ANA   A
015.120 170          4135       MOV   A,B
015.121 301          4136       POP   B
015.122 311          4137       RET
```

```
                      4139        **     HEX ROUTINES
                      4140        *      THESE ROUTINES ARE THE HEX EQUIVELANT OF THE
                      4141        *      OCTAL ROUTINES PREFIXED ABOVE
                      4142        *
                      4143        *
                      4144        *      NOTE: THESE ROUTINES ARE ENTERED WITH PSW ON THE STACK
                      4145        *
                      4146
                      4147
015.123 066 000       4148  IHB    MVI   M,0            CLEAR RESULT
015.125 361           4149         POP   PSW
015.126 324 262 003   4150  IHB1   CNC   RCC
                      4151
                      4152        *      CHECK FOR VALIDITY
                      4153
015.131 315 173 015   4154         CALL  CCH            CHECK CHARACTER FOR VALID HEX
015.134 060 013       4155         JR    NC,IHB2
015.136 376 015       4156         CPI   A.CR           RETURN?
015.140 310           4157         RZ                   YES, DONE
015.141 247           4158         ANA   A              INSURE CARRY OFF
015.142 076 007       4159         MVI   A,A.BEL
015.144 315 302 003   4160         CALL  WCC
015.147 030 355       4161         JR    IHB1
                      4162
                      4163        *      HAVE A VALID HEX CHARACTER
                      4164
015.151 315 302 003   4165  IHB2   CALL  WCC            CONVERT HEX CHARACTER
015.154 315 234 015   4166         CALL  CHC
015.157 137           4167         MOV   E,A
015.160 176           4168         MOV   A,M            GET VALUE SO FAR
015.161 007           4169         RLC                  MOVE UP NIBBLE
015.162 007           4170         RLC
015.163 007           4171         RLC
015.164 007           4172         RLC
015.165 346 360       4173         ANI   11110000B      THROW AWAY LAST
015.167 263           4174         ORA   E
015.170 167           4175         MOV   M,A            SET NEW NIBBLE
015.171 030 333       4176         JR    IHB1
                      4177        **     CHECK FOR VALID HEX CHARACTER
                      4178        *
                      4179        *      CCH CHECKS (A) FOR HEX VALIDITY
                      4180        *      'C' IS SET IF INVALID
                      4181        *
015.173 315 223 015   4182  CCH    CALL  MCU            MAP TO UPPER
015.176 376 060       4183         CPI   '0'
015.200 330           4184         RC                   IF LESS THAN ZERO
015.201 376 072       4185         CPI   '9'+1
015.203 077           4186         CMC
015.204 320           4187         RNC
015.205 376 101       4188         CPI   'A'            BETWEEN 0 AND 9
015.207 330           4189         RC
015.210 376 107       4190         CPI   'F'+1          LOWER CASE IS NOT VALID
015.212 077           4191         CMC
015.213 311           4192         RET
```

```
MTR90-1 - H/Z-89 MONITOR       #09.02.01.
IOA, IOB, TOA, TOB, IROC PREFIXES

                  4195  **        IHC - INPUT HEX CHARACTER
                  4196  *
                  4197
                  4198  IHC
015.214 361       4199        POP   PSW
015.215 315 262 003            CALL  RCC      GET CHARACTER
015.220 303 173 015  4200      JMP   CCH      CHECK FOR VALID HEX

                  4202  **        MCU - MAP CASE TO UPPER
                  4203  *
                  4204
015.223 376 141   4205  MCU   CPI   'a'       LESS THAN 'A'
015.225 330       4206        RC
015.226 376 173   4207        CPI   'z'+1
015.230 320       4208        RNC
015.231 346 137   4209        ANI   01011111B
015.233 311       4210        RET
```

```
                          4213  **          CONVERT HEX TO BINARY
                          4214  *
                          4215  *    CHC CONVERTS THE ASCII CHARACTER IN (A) INTO
                          4216  *    IT'S 4BIT HEX EQUIVELANT
                          4217  *
                          4218
015.234  326 060          4219  CHC   SUI    '0'
015.236  376 012          4220        CPI    9+1
015.240  330              4221        RC                    IF DONE
015.241  326 007          4222        SUI    7              CONVERT A - F
015.243  311              4223        RET
                          4224
                          4225  *          INPUT HEX ADDRESS
015.244  361              4226  IHA   POP    PSW
015.245  305              4227  IHA.  PUSH   B
015.246  102              4228        MOV    B,D            B = DELIMITER
015.247  345              4229        PUSH   H
015.250  041 000 000      4230        LXI    H,0
015.253  324 262 003      4231        CNC    RCC
015.256  315 173 015      4232  IHA1  CALL   CCH            CHECK FOR HEX
015.261  070 016          4233        JR     C,IHA3         IF NOT, CHECK DELIMITER
015.263  315 302 003      4234        CALL   MCC            CONVERT IT
015.266  315 234 015      4235        CALL   CHC
015.271  051              4236        DAD    H
015.272  051              4237        DAD    H
015.273  051              4238        DAD    H
015.274  051              4239        DAD    H              HL = HL + 16
015.275  205              4240        ADD    L
015.276  157              4241        MOV    L,A
015.277  030 352          4242        JR     IHA1           MOVE IN NEW NIBBLE
                          4243
                          4244
015.301  270              4245  IHA3  CMP    B
015.302  050 010          4246        JR     Z,IHA4
015.304  076 007          4247        MVI    A,A.BEL
015.306  315 302 003      4248        CALL   MCC            IF VALID DELIMITER
015.311  247              4249        ANA    A
015.312  030 337          4250        JR     IHA1
                          4251
                          4252  *          END OF INPUT
015.314  315 302 003      4253  IHA4  CALL   MCC            PRINT DELIMITER
015.317  353              4254        XCHG
015.320  341              4255        POP    H
015.321  162              4256        MOV    M,D
015.322  053              4257        DCX    H
015.323  163              4258        MOV    M,E
015.324  301              4259        POP    B
015.325  311              4260        RET
                          4261
                          4262  *          IROC REPLACEMENT
                          4263
015.326  315 262 003      4264  IROCH CALL   RCC
015.331  376 015          4265        CPI    A.CR
015.333  310              4266        RZ                    IF CARRIAGE RETURN
                          4267
                          4268
```