```
015.334  315 173 015  4269          CALL    CCH
015.337  077          4270          CMC
015.340  330          4271          RC                      IF VALID
                       4272
015.341  076 007      4273          MVI     A,A.BEL
015.343  315 302 003  4274          CALL    WCC
015.346  030 356      4275          JR      IROCH
                       4276
                       4277  *       TYPE BYTE REPLACEMENT
                       4278
015.350  361          4279  THB     POP     PSW
015.351  365          4280  THB1    PUSH    PSW
015.352  346 360      4281          ANI     11110000B
015.354  017          4282          RRC
015.355  017          4283          RRC
015.356  017          4284          RRC
015.357  017          4285          RRC                     DO HIGH NIBBLE FIRST
015.360  315 366 015  4286          CALL    THB2
015.363  361          4287          POP     PSW
015.364  346 017      4288          ANI     00001111B
                       4289
                       4290  *       THB1 - TYPE NIBBLE
                       4291
015.366  306 060      4292  THB2    ADI     '0'
015.370  376 072      4293          CPI     '9'+1
015.372  070 002      4294          JR      C,THB3
015.374  306 007      4295          ADI     7
015.376  303 302 003  4296  THB3    JMP     WCC
                       4297  *       THA - TYPE HEX ADDRESS
                       4298
016.001  361          4299  THA     POP     PSW
016.002  076 015      4300          MVI     A,A.CR
016.004  315 370 005  4301          CALL    WCR.
                       4302
016.007  174          4303  THA1    MOV     A,H
016.010  315 351 015  4304          CALL    THB1
016.013  175          4305          MOV     A,L
016.014  315 351 015  4306          CALL    THB1
016.017  076 040      4307          MVI     A,' '
016.021  303 302 003  4308          JMP     WCC


                       4310  **      MEMORY - MEMORY DIAGNOSTIC
                       4311  *
                       4312  *       MEMORY IS THE PREFACE TO THE MEMORY
                       4313  *       DIAGNOSTIC UTILTIY
                       4314  *
016.024  041 043 016  4315  MEMORY  LXI     H,MSG.MEM
016.027  315 100 006  4316          CALL    TYPMSG
016.032  072 071 040  4317  MEMORY. LDA     RADFLG
                       4318  *       EXX
016.035  331          4319          DB      MI.EXX
016.036  157          4320          MOV     L,A
                       4321  *       EXX
```

```
016.037  331           4322           DB      MI.EXX
016.040  303 116 007   4323           JMP     DYMEM
                       4324
016.043  145 163 164   4325  MSG.MEM  DB      'est Memory',A.CR,A.LF,0


                       4327  **       GETBND - GET BOUNDRIES
                       4328  *
                       4329  *        GETBND GETS THREE ADDRESS BOUNDRIES, RETURNING
                       4330  *        THE FIRST IN HL, THE SECOND IN DE AND THE THIRD
                       4331  *        IN BC.
                       4332  *
                       4333
016.060  041 003 040   4334  GETBND   LXI     H,IOWRK+1
016.063  026 054       4335           MVI     D,',
016.065  315 023 015   4336           CALL    IOA             GET FIRST
                       4337
016.070  052 002 040   4338           LHLD    IOWRK
016.073  345           4339  GETBND.  PUSH    H               ENTRY POINT FOR DE,BC ONLY
                       4340
016.074  041 003 040   4341           LXI     H,IOWRK+1
016.077  026 054       4342           MVI     D,',
016.101  315 023 015   4343           CALL    IOA
                       4344
016.104  052 002 040   4345           LHLD    IOWRK           SAVE SECOND
016.107  345           4346           PUSH    H
016.110  303 024 001   4347           JMP     GETBND1         CONTINUE ELSEWHERE


                       4349  **       INTOX0 - EXTENSION TO INTOX
                       4350  *
                       4351  *        INTOX0 CLEANS UP SOME OF THE RAM CELLS
                       4352  *
                       4353
016.113  257           4354  INTOX0   XRA     A
016.114  062 071 040   4355           STA     RADFLG
016.117  041 377 377   4356           LXI     H,-1
016.122  042 072 040   4357           SHLD    VEWHLD
016.125  001 200 076   4358           LXI     B,16000
016.130  303 050 004   4359           JMP     INITOX1


                       4361  **       BOOT7 - EXTENSION TO BOOT ROUTINE
                       4362  *
                       4363  *        THIS ROUTINE HANDLES BOOTING FROM DEVICE
                       4364  *        ZERO WITH COMMAND LINES
                       4365  *
                       4366
016.133  376 040       4367  BOOT7    CPI     ' '
016.135  050 007       4368           JR      Z,BOOT71        TYPED SPACE, MUST WANT COMMAND LINE
```

```
016.137  376 072        4369          CPI     ':'
016.141  050 012        4370          JR      Z,BOOT72        TYPE :, HERE COMES COMMAND
016.143  376 060        4371          CPI     '0'
016.145  311            4372          RET                     OTHERWISE, MAYBE UNIT NUMBER
016.146  315 302 003    4373  BOOT71  CALL    MCC
016.151  257            4374          XRA     A               ENTER CCL AS UNIT 0
016.152  303 263 013    4375          JMP     CCL
                        4376
                        4377  *       HE ALREADY STARTED THE COMMAND LINE, LETS CATCH UP!
                        4378
016.155  257            4379  BOOT72  XRA     A
016.156  062 000 040    4380          STA     START           SAVE UNIT NUMBER
016.161  042 002 040    4381          SHLD    IOWRK           SAVE DEVICE ADDRESS
016.164  061 200 042    4382          LXI     SP,42200A       SET UP STACK
016.167  041 062 041    4383          LXI     H,AIO.DIR
016.172  016 035        4384          MVI     C,PRIM-AIO.DIR-1
016.174  076 072        4385          MVI     A,':'           ECHO THE COLON
016.176  303 343 013    4386          JMP     CCL4            CONTINUE FROM HERE


                        4388  **      EUC - ENTER USER CODE
                        4389  *
                        4390  *       EUC ENTERS THE USER BOOT CODE, AFTER RE-VECTORING
                        4391  *       THE CLOCK INTERRUPT REQUEST VECTORS
                        4392  *
                        4393  *       THE H17 RAM CONSTANTS ETC. ARE ALSO MOVED IN
                        4394  *
                        4395
016.201  001 130 000    4396  EUC     LXI     B,BOOTAL                SET THE COUNT TO MOVE IN CONSTANTS AND VECTORS
016.204  021 132 037    4397          LXI     D,BOOTA                 SET THE SOURCE ADDRESS
016.207  041 110 040    4398          LXI     H,D.CON                 SET THE DESTINATION ADDRESS
016.212  315 252 030    4399          CALL    $MOVE                   MOVE IT
                        4400
                        4401  *       ENTRY POINT FROM H17 (CONSTANTS ALREADY MOVED IN)
                        4402
016.215  363            4403  EUC.    DI                              STOP CLOCK
016.216  041 031 034    4404          LXI     H,CLOCK17               LOAD CLOCK ROUTINE ADDRESS
016.221  042 040 040    4405          SHLD    UIVEC+1                 SET IT INTO VECTOR LOCATION
016.224  373            4406          EI
                        4407
                        4408  *       Zero out H67 operating system info
                        4409
000.000                 4410          ERRNZ   S.OSZ-S.OSI-2           MUST BE CONTIGUOUS BYTES
016.225  041 126 041    4411          LXI     H,S.OSI
016.230  006 005        4412          MVI     B,1+1+3
016.232  315 212 031    4413          CALL    $ZERO                   Zero area
                        4414
016.235  303 200 042    4415          JMP     USERFWA                 GOTO BOOT CODE
```

```
                        4417  **      DYBYTX
                        4418  *
                        4419  *       DYBYTX DETERMINES WHETHER TO OUPUT THE BYTE
                        4420  *       IN HEX OR OCTAL. IF IN OCTAL WE MUST REPLACE
                        4421  *       THE CODE WE PATCHED TO GET US HERE.
                        4422  *
                        4423  *       ENTRY:  (A) = BYTE OF TO OUTPUT
                        4424  *
                        4425
016.240  117          4426  DYBYTX  MOV     C,A             SAVE BYTE
                        4427  *       EXX
016.241  331          4428          DB      MI.EXX
016.242  175          4429          MOV     A,L             GET RADIX FLAG
                        4430  *       EXX
016.243  331          4431          DB      MI.EXX
016.244  247          4432          ANA     A               'Z' SET IF OCTAL
016.245  171          4433          MOV     A,C             RESTORE A
016.246  040 012       4434          JR      NZ,DYBYTH       IF IN HEX
                        4435
016.250  117          4436  DYBYTO  MOV     C,A
016.251  346 300       4437          ANI     11000000B
016.253  007          4438          RLC
016.254  007          4439          RLC
016.255  346 003       4440          ANI     000000011B
016.257  303 163 003   4441          JMP     DYBYT.1         FINISH UP OLD OCTAL ROUTINE
                        4442
                        4443  *       IS HEX
                        4444
016.262  117          4445  DYBYTH  MOV     C,A
016.263  346 360       4446          ANI     11110000B
016.265  017          4447          RRC
016.266  017          4448          RRC
016.267  017          4449          RRC
016.270  017          4450          RRC             MOVE DOWN HIGH HALF
016.271  346 017       4451          ANI     000011111B
016.273  306 060       4452          ADI     '0'
016.275  376 072       4453          CPI     '9'+1
016.277  070 002       4454          JR      C,DYBYTH1
016.301  306 007       4455          ADI     7
016.303  375 041       4456  DYBYTH1 DB      MI.LDYA,MI.LDYB
016.305  312 016       4457          DW      DYBYTH2         SET RETURN ADDRESS
016.307  303 143 003   4458          JMP     DYASC
                        4459
016.312  171          4460  DYBYTH2 MOV     A,C
016.313  346 017       4461          ANI     000011111B
016.315  306 060       4462          ADI     '0'
016.317  376 072       4463          CPI     '9'+1
016.321  070 002       4464          JR      C,DYBYTH3
016.323  306 007       4465          ADI     7
016.325  375 041       4466  DYBYTH3 DB      MI.LDYA,MI.LDYB
016.327  334 016       4467          DW      DYBYTH4
016.331  303 143 003   4468          JMP     DYASC
                        4469
                        4470  *       JP      (IX)
                        4471
016.334  335 351       4472  DYBYTH4 DB      MI.JIXA,MI.JIXB
```

```
                                4474  **      DYMM5
                                4475  *
                                4476  *       DETERMINE NUMBER OF BACKSPACES
                                4477  *       TO TYPE FOR EACH CHARACTER OUTPUT
                                4478  *
                                4479
016.336  331                    4480  DYMM5   DB      MI.EXX
016.337  175                    4481          MOV     A,L
016.340  331                    4482          DB      MI.EXX
016.341  247                    4483          ANA     A
016.342  076 010                4484          MVI     A,A.BKS
016.344  046 003                4485          MVI     H,3
016.346  312 221 007            4486          JZ      DYME5.5
016.351  045                    4487          DCR     H
016.352  303 221 007            4488          JMP     DYME5.5


                                4490  **      CONVERT - BASE CONVERSION
                                4491  *
                                4492  *       CONVERT CONVERTS THE INPUT IN THE OPPOSITE
                                4493  *       RADIX AND CHANGES IT TO THE CURRENT RADIX
                                4494  *
                                4495
016.355  041 014 017            4496  CONVERT LXI     H,MSG.CON
016.360  315 100 006            4497          CALL    TYPMSG
016.363  041 003 040            4498          LXI     H,IOWRK+1
016.366  026 015                4499          MVI     D,A.CR
016.370  315 112 015            4500          CALL    CHKRAD
016.373  050 005                4501          JR      Z,CONV.O                IF OCTAL
                                4502
016.375  315 062 003            4503  CONV.H  CALL    IOAO
017.000  030 003                4504          JR      CONV.E
                                4505
017.002  315 245 015            4506  CONV.O  CALL    IHA.
                                4507
017.005  052 002 040            4508  CONV.E  LHLD    IOWRK
017.010  353                    4509          XCHG
017.011  303 064 015            4510          JMP     TOA
                                4511
017.014  157 156 166            4512  MSG.CON DB      'onvert ',0
```

```
                          4515  ***     H17X - H17 Extension routine
                          4516  *
                          4517  *       H17x is the extension to the H17 Abort command
                          4518  *
                          4519
017.024  315 366 033      4520  H17X    CALL    R.ABORT
                          4521
                          4522  *       Step the head out 10 tracks
                          4523
017.027  315 044 002      4524          CALL    R.SDP           Set up device
017.032  076 012          4525          MVI     A,10
017.034  062 240 040      4526          STA     D.TT            Set target track to 10
017.037  315 166 040      4527          CALL    D.SDT           Seek Desired track
                          4528
017.042  303 366 033      4529          JMP     R.ABORT         Abort and return
```

```
                        4532  **      MTRA - COMMAND DESCRIPTOR TABLE
                        4533  *
                        4534  *       THIS TABLE CONTAINS THE SINGLE LETTER COMMANDS
                        4535  *       UNDERSTOOD BY MTR90. THE ENTRIES IN THIS TABLE
                        4536  *       CONSIST OF A SINGLE LETTER (THE COMMAND KEY) FOLLOWED
                        4537  *       BY A WORD ADDRESS OF THE ROUTINE.
                        4538  *
                        4539  *       NOTE: THIS TABLE WAS MOVED FROM UP FRONT BECAUSE
                        4540  *             OF SIZE CONSIDERATIONS
                        4541  *
                        4542
017.045                 4543  MTRA    EQU     *
017.045  107            4544          DB      'G'             *GO*
017.046  146 001        4545          DW      GO88
                        4546
017.050  123            4547          DB      'S'             *SUBSTITUTE*
017.051  370 004        4548          DW      SUBM
                        4549
017.053  120            4550          DB      'P'             *PROGRAM COUNTER*
017.054  103 001        4551          DW      PCA
                        4552
017.056  102            4553          DB      'B'             *BOOT*
017.057  256 004        4554          DW      BOOT
                        4555
017.061  111            4556          DB      'I'             *INPUT*
017.062  233 014        4557          DW      INPUT
                        4558
017.064  117            4559          DB      'O'             *OUTPUT*
017.065  265 014        4560          DW      OUTPUT
                        4561
017.067  122            4562          DB      'R'             *RADIX*
017.070  072 014        4563          DW      RADIX
                        4564
017.072  124            4565          DB      'T'
017.073  024 016        4566          DW      MEMORY          *TEST RAM*
                        4567
017.075  126            4568          DB      'V'             *VIEW*
017.076  044 001        4569          DW      VIEW
                        4570
017.100  103            4571          DB      'C'
017.101  355 016        4572          DW      CONVERT
000.012                 4573  MTRAL   EQU     *-MTRA/3        NUMBER OF ENTRIES       /JWT  790507/


                        4575  **      BT170, BT174 - BOOT TABLES
                        4576  *
                        4577  *       THESE TABLES DEFINE DEVICE DEPENDENT INFORMATION USED
                        4578  *       TO DETERMINE WHICH DEVICE IS TO BE BOOTED FROM
                        4579  *
                        4580  *       THE ORGANIZATION OF THE TWO TABLES IS IDENTICAL:
                        4581  *
                        4582  *       BYTE 1          -       PORT NUMBER OF THESE DEVICES
                        4583  *
                        4584  *       BYTE 2          -       DEVICE 0 TMFG
```

```
                        4585  *       BYTE 3          -               MAX UNITS
                        4586  *       BYTE 4,5        -               BOOT CODE ADDRESS
                        4587  *
                        4588  *       BYTE 6          -       DEVICE 1 TMFG
                        4589  *       BYTE 7          -               MAX UNITS
                        4590  *       BYTE 8,9        -               BOOT CODE ADDRESS
                        4591  *
                        4592  *       etc., etc., etc. THRU DEVICE 3
                        4593  *
                        4594  *       NO END-OF-TABLE CHECK IS MADE, THEREFORE, 4 ENTRIES
                        4595  *       MUST EXIST PER TABLE
                        4596  *
                        4597
017.103  174           4598  BT174   DB      174Q            PORT ADDRESS
017.104                 4599  BT174E  EQU     *
                        4600
017.104  000           4601  BTH174  DB      0               TMFG = 0
017.105  063           4602          DB      '3'             MAX UNIT = 3
017.106  207 002       4603          DW      H17             BOOT ADDRESS
                        4604
017.110  001           4605  BTH474  DB      1
017.111  064           4606          DB      '4'
017.112  372 001       4607          DW      Z47
                        4608
017.114  000           4609  BTH674  DB      0
017.115  064           4610          DB      '4'
017.116  174 012       4611          DW      H67
                        4612
017.120  000           4613  BTHFE4  DB      0
017.121  061           4614          DB      '1'
017.122  222 013       4615          DW      FEDEV
                        4616
000.004                 4617  BT174L  EQU     *-BT174E/4      INSURE ALL ENTRIES FILLED
000.000                 4618          ERRNZ   BT174L-4
                        4619
017.124  170           4620  BT170   DB      170Q            PORT ADDRESS
017.125                 4621  BT170E  EQU     *
                        4622
017.125  000           4623  BTH370  DB      0
017.126  064           4624          DB      '4'
017.127  221 011       4625          DW      H37
                        4626
017.131  001           4627  BTH470  DB      1
017.132  064           4628          DB      '4'
017.133  372 001       4629          DW      Z47
                        4630
017.135  000           4631  BTH670  DB      0
017.136  064           4632          DB      '4'
017.137  174 012       4633          DW      H67
                        4634
017.141  000           4635  BTHFE0  DB      0
017.142  061           4636          DB      '1'
017.143  222 013       4637          DW      FEDEV
                        4638
000.004                 4639  BT170L  EQU     *-BT170E/4
000.000                 4640          ERRNZ   BT170L-4
```

```
000.233                 4642            ERRMI   20000A-*        MUST NOT EXCEED 4K BYTES
```

```
                    4645  **      THE FOLLOWING ARE CONTROL CELLS AND FLAGS USED BY THE KEYSET
                    4646  *       MONITOR.
                    4647
040.000             4648          ORG     40000A          8192
040.000             4649  START   DS      2               DUMP STARTING ADDRESS
040.002             4650  IOWRK   DS      2               IN OR OUT INSTRUCTION
040.004             4651  PRSRAM  EQU     *               FOLLOWING CELLS INITIALIZED FROM ROM
040.004             4652          DS      1               RET
                    4653
040.005             4654  REGI    DS      1               INDEX OF REGISTER UNDER DISPLAY
040.006             4655  DSPROT  DS      1               PERIOD FLAG BYTE
040.007             4656  DSPMOD  DS      1               DISPLAY MODE
                    4657
040.010             4658  .MFLAG  DS      1               USER FLAG OPTIONS
                    4659  *                               SEE *U0.XXX* BITS DESCRIBED AT FRONT
                    4660
040.011             4661  CTLFLG  DS      1               FRONT PANEL CONTROL BITS
040.012             4662  REFIND  DS      1               REFRESH INDEX (0 TO 7)
000.007             4663  PRSL    EQU     *-PRSRAM        END OF AREA INITIALIZED FROM ROM
                    4664
040.013             4665  FPLEDS  EQU     *               FRONT PANEL LED PATTERNS
040.013             4666  ALEDS   DS      1               ADDR 0
040.014             4667          DS      1               ADDR 1
040.015             4668          DS      1               ADDR 2
                    4669
040.016             4670          DS      1               ADDR 3
040.017             4671          DS      1               ADDR 4
040.020             4672          DS      1               ADDR 5
                    4673
040.021             4674  DLEDS   DS      1               DATA 0
040.022             4675          DS      1               DATA 1
040.023             4676          DS      1               DATA 2
                    4677
040.024             4678  ABUSS   DS      2               ADDRESS BUSS
040.026             4679  RCCA    DS      1               RCC SAVE AREA
040.027             4680  CRCSUM  DS      2               CRC-16 CHECKSUM
040.031             4681  TPERRX  DS      2               TAPE ERROR EXIT ADDRESS
040.033             4682  TICCNT  DS      2               CLOCK TIC COUNTER
                    4683
040.035             4684  REGPTR  DS      2               REGISETR CONTENTS POINTER
                    4685
040.037             4686  UIVEC   DS      0               USER INTERRUPT VECTORS
040.037             4687          DS      3               JUMP TO CLOCK PROCESSOR
040.042             4688          DS      3               JUMP TO SINGLE STEP PROCESSOR
040.045             4689          DS      3               JUMP TO I/O 3
040.050             4690          DS      3               JUMP TO I/O 4
040.053             4691          DS      3               JUMP TO I/O 5
040.056             4692          DS      3               JUMP TO I/O 6
040.061             4693          DS      3               JUMP TO I/O 7
                    4694
                    4695  **      H88/H89 RAM USAGE BEYOND THAT OF H8MTRF
                    4696  *
040.064             4697  NMIRET  DS      2
040.066             4698  DATA    DS      1               OUTPUT TO 3620 DATA SAVE
040.067             4699  BLKICW  DS      2               H37 INTERRUPT RETURN ADDRESS
040.071             4700  RADFLG  DS      1               RADIX FLAG
```

```
    040.072             4701  VEHHLD  DS      2
    000.001             4702          IF      .DEBUG
                        4703  DBFLG   DS      1           FOR DEBUG RESULTS
                        4704          ENDIF
    040.074             4705  MEML    EQU     *
    001.024             4706          ERRMI   41120A-MEML
    041.120             4707          ORG     41120A
    041.120             4708  PRIM    DS      1           PRIMARY DEVICE ADDR. PORT
    041.121             4709  TMFG    DS      1           TIMER INTERRUPT FLAG, =1 FOR Z47, =0 FOR H17
    041.122             4710  MYCNT   DS      1           COUNTER FOR TIMER INTERRUPT
    041.123             4711  AUTOB   DS      1           AUTO BOOT FLAG
    041.124             4712  STK     DS      2           STACK POINTER FOR RE-BOOT
                        4713
    041.126             4714          END
Assembly complete
  4714 statements
     0 errors detected
22422 bytes free
```

$MOVE	030252	745E	1636	4399										
$ZERO	031212	747E	1685	4413										
.	000004	910S	1065S	1386S	2119S	2120								
.DEBUG	000001	1E	1484	1496	1503	3087	3097	3109	3121	3195	4702			
.MFLAG	040010	1065	1107	1176	1182	1617	1692	4658L						
.UIVEC	040037	748E												
3100	014301	4040L												
A.BEL	000007	155E	1124	1216	1420	2378	2398	2424	2466	2635	3826	3866	3889	
		3958	4159	4247	4273									
A.BKS	000010	156E	4484											
A.CR	000015	158E	1231	1316	1337	1410	1852	1924	2349	2375	2395	2415	2515	
		2569	2581	2869	3038	3860	3881	3939	3956	3985	4018	4058	4156	4266
		4300	4325	4499										
A.DEL	000177	160E	1974	2298										
A.ESC	000033	159E	2868	2877	2879	2885	2887	3036						
A.LF	000012	157E	1924	1924	2573	2868	2869	2869	3038	3038	3939	4058	4058	
		4325												
A.STX	000002	154E												
A.SYN	000026	153E												
ABUSS	040024	1262	4678L											
AC.DLY	000156	810E												
AIO.CGN	041047	710L												
AIO.CHA	041116	725L												
AIO.CNT	041111	721L												
AIO.CSI	041050	711L												
AIO.DDA	041041	706E												
AIO.DES	041055	715L												
AIO.DEV	041057	716L												
AIO.DIR	041062	719L	3623	3632	3643	3655	3664	3672	3683	3735	3765	3769	3774	
		3854	3855	3910	4383	4384								
AIO.DTA	041053	714L												
AIO.EOF	041113	723L												
AIO.EOM	041112	722L												
AIO.FLG	041043	707L												
AIO.GRT	041044	708L												
AIO.LGN	041051	712L												
AIO.LSI	041052	713L												
AIO.SPG	041046	709L												
AIO.TFP	041114	724L												
AIO.UNI	041061	717L	1448	1475	1539	3102	3432	3651	3689					
AIO.VEC	041040	705L												
ALARM	002136	1186	1571E											
ALARMB	002166	1572	1597L											
ALEDS	040013	4666L												
AS.0DD	000100	369E												
AS.1DD	000040	370E												
AS.S1A	000020	371E												
AS.SLM	000003	372E												
ATB	004243	2244L	3375											
AUTO8	041123	2106	3373	4711L										
AUTO80	001205	1350L	2247											
BASE	000170	459E												
BC.EDT	000002	470E	3730											
BC.IE	000040	468E												
BC.RST	000020	469E	3617											
BC.SEL	000100	467E	3716											
BITS	012155	3105	3436	3595L										

BITS1	012162	3600L	3602									
BLKICH	040067	1249	2033	3449	3469	3479	3544	3578	3909	3918	3923	4699L
BOOT	004256	2260L	4554									
BOOT.P	000001	684E										
BOOT.SY	000002	685E										
BOOT0	001342	1352	1441L									
BOOT0.	001337	1411	1439L									
BOOT2	002324	1694L	1701									
BOOT5	001350	1415	1445L									
BOOT6	001360	1443	1448L	3875								
BOOT7	016133	1412	4367L									
BOOT71	016146	4368	4373L									
BOOT72	016155	4370	4379L									
BOOTA	037132	744E	1634	4397								
BOOTAL	000130	743E	1633	4396								
BOOTX	004275	2248	2266L									
BR19.2	004103	2115L										
BR96	004101	2114L										
BRTAB	004101	2067	2112E	2120								
BS.BSY	000010	482E	3702	3720								
BS.COM	000020	481E	3743	3759	3760	3771	3772	3804				
BS.DAT	000000	480E										
BS.DTD	000100	475E	3747	3759	3771							
BS.HID	000001	485E										
BS.IN	000000	476E										
BS.INT	000004	483E										
BS.LMB	000040	478E										
BS.MTY	000020	479E	3771	3772								
BS.OUT	000100	477E										
BS.PE	000002	484E										
BS.REQ	000200	474E	3741	3759	3760	3771	3772	3800				
BSEC	001326	1431E										
BSMSG	014042	1432	3931L									
BT170	017124	1734	4620L									
BT170E	017125	4621E	4639									
BT170L	000004	4639E	4640									
BT174	017103	1717	1727	4598L								
BT174E	017104	4599E	4617									
BT174L	000004	4617E	4618									
BTH174	017104	4601L										
BTH370	017125	4623L										
BTH470	017131	4627L										
BTH474	017110	4605L										
BTH670	017135	4631L										
BTH674	017114	4609L										
BTHFE0	017141	4635L										
BTHFE4	017120	4613L										
C.DSYN	000375	244E										
CB.CLI	000100	166E	201	958	1181	2219						
CB.MTL	000040	165E	1051	1104	1181	1388						
CB.SPK	000200	167E	958	1181	1577							
CB.SSI	000020	164E	958	1051	1181	1373	1384	2219				
CBUSY	013032	3719L	3726									
CBUSY1	013050	3721	3730L									
CCH	015173	4154	4183L	4200	4233	4269						
CCL	013263	1447	3850L	4375								
CCL1	013301	3859L	3868									

CCL2	013322	3865	3867L										
CCL3	013327	3861	3872L										
CCL3.	013332	3873L	3926										
CCL4	013343	3863	3879L	3886	3890	4386							
CCL5	013346	3880L											
CCL6	013370	3882	3894L										
CCL7	014004	3905L	3919										
CCL8	014026	3913	3918L										
CCL9	014033	3916	3923L										
CDB.H84	000001	627E											
CDB.H85	000000	626E											
CHAT2	011152	3372	3377L										
CHC	015234	4075	4166	4219L	4236								
CHKRAD	015112	2022	3265	3276	3335	3353	3981	4063	4095	4100	4106	4112	4118
		4124	4131L	4500									
CKAUTO	011135	1199	3370L										
CLASS0	000000	499E	509	510	511	512	513	514	515	516	517	518	519
		520											
CLASS1	000040	500E	524										
CLASS6	000300	501E	528										
CLASSM	000340	497E											
CLK4	000270	1111	1134E										
CLOCK	000201	894	895	1093L									
CLOCK17	034031	749E	2322	4404									
COM	006027	2610E	2691	3115	3129	3191							
COM1	006031	2597	2612L										
COM2	010156	2617	3208L										
COM3	010164	3212L	3213										
COMREQ	013060	3737L	3740	3753									
CON.CD	000000	324E	3541										
CON.DRQ	000002	313E	3499										
CON.DS0	000020	316E											
CON.DS1	000040	317E											
CON.DS2	000100	318E											
CON.DS3	000200	319E											
CON.EI	000001	312E	3438										
CON.MFM	000004	314E	3438	3508									
CON.MO	000010	315E	3438	3557									
CON.ST	000001	325E	3535	3538									
CONV.E	017005	4504	4508L										
CONV.H	016375	4503L											
CONV.O	017002	4501	4506L										
CONVERT	016355	4496L	4572										
CRCSUM	040027	4680L											
CTLFLG	040011	910	1097	1102	1107	1182	1372	1375	1386	1582	2127	2625	4661L
CUI1	000165	1066L	1123	1135									
D.CON	040110	574L	1635	4398									
D.CPB	000040	524E											
D.CTF	000005	514E											
D.DAT	000171	340E											
D.FBS	000007	516E											
D.FFD	000300	528E											
D.FOR	000004	513E											
D.FT	000006	515E											
D.OECNT	040264	758E	1538										
D.RAM	040240	577L	1683										
D.RAML	000037	746E	1684										

D.REA	000010	517E	3673				
D.REC	000001	510E	3644	3665			
D.RSE	000003	512E					
D.RSY	000002	511E					
D.SDP	040206	752E	1642				
D.SDT	040166	753E	4527				
D.SEK	000013	520E	3656				
D.STA	000170	339E	340				
D.TDR	000000	509E	3624				
D.TT	040240	754E	4526				
D.VEC	040130	576L					
D.WPS	000011	518E					
D.WRI	000012	519E					
DAT	006023	2595E	2693	2695	3117	3132	3135
DATA	040066	2107	2227	4698L			
DD.BOOT	000000	378L					
DD.CPY	000013	389L					
DD.OS	000202	413L					
DD.FRM0	000014	390L					
DD.FRM1	000015	391L					
DD.FRM2	000016	392L					
DD.FRM3	000017	393L					
DD.LSC	000003	381L	3128				
DD.RAD	000004	382L					
DD.RAS	000002	380L	3114				
DD.RDBL	000205	416L					
DD.REA	000005	383L					
DD.REAB	000007	385L	2690				
DD.ROL	000203	414L					
DD.RRDY	000020	394L	3190				
DD.RST	000001	379L					
DD.SDC	000200	411L					
DD.SPF0	000020	400L					
DD.SPF1	000021	401L					
DD.SPF2	000022	402L					
DD.SPF3	000023	403L					
DD.SPF4	000024	404L					
DD.SPF5	000025	405L					
DD.ST	000201	412L					
DD.WDLB	000210	419L					
DD.WRD	000011	387L					
DD.WRDB	000012	388L					
DD.WRI	000006	384L					
DD.WRIB	000010	386L					
DD.WTBL	000206	417L					
DD.WTDL	000207	418L					
DD.WTL	000204	415L					
DEV1.	002377	1720	1730L				
DEV170	002355	1714L					
DEV174	002367	1710	1724L				
DEV2	003006	1718	1728	1736	1740L		
DEVICE	002273	1351	1408	1677E			
DF.CLR	000376	595E					
DF.DI	000040	220E					
DF.DS0	000002	216E					
DF.DS1	000004	217E					
DF.DS2	000010	218E					

DF.EMP	000377	594E								
DF.HD	000001	210E								
DF.MD	000020	219E								
DF.SD	000010	213E								
DF.ST	000100	221E								
DF.TO	000002	211E								
DF.WG	000001	215E								
DF.WP	000004	212E								
DF.WR	000200	222E								
DIR.ALD	000025	610L								
DIR.CLU	000015	603L								
DIR.CRD	000023	609L								
DIR.EXT	000010	598L								
DIR.FGN	000020	606L								
DIR.FLG	000016	604L								
DIR.LGN	000021	607L								
DIR.LSI	000022	608L								
DIR.NAM	000000	597L								
DIR.PRO	000013	599L								
DIR.VER	000014	600L								
DIRELEN	000027	612E	719							
DIRIDL	000015	601E								
DK.CON	000170	255E	3439	3502	3520	3532	3558			
DK.INT	000171	256E	3417	3536	3540					
DK.PORT	000170	248E	250	251	252	253	254	255	256	
DLEDS	040021	4674L								
DLY	000053	948L	3423	3446	3621	3640				
DM.MR	000000	171E								
DM.MW	000001	172E								
DM.RR	000002	173E								
DM.RW	000003	174E								
DOD	003122	1837L								
DP.DC	000177	208E	1618	1686						
DS.HOLE	000001	2803E	2828	2834						
DSPMOD	040007	4656L								
DSPROT	040006	4655L								
DY10.5	007244	2995L	3828							
DY3.3	011201	2929	3400L							
DY3.5	011211	3403	3407L							
DY3.7	007153	2932L	3410							
DY5.53	007230	2974	2978L							
DY9.3	011160	1157	3382L							
DY9.4	011171	3386	3390L							
DY9.5	003315	1999L	3394							
DY9.8	003330	2004	2008L							
DYASC	003143	1865E	1892	1905	1915	2976	3024	3830	4458	4468
DYASC1	003144	1868L	1870							
DYBYT	003160	1885L	2014	2988	3388	3396	3405	3411		
DYBYT.1	003163	1886L	4441							
DYBYT.2	003174	1890	1894L							
DYBYT.4	003213	1903	1907L							
DYBYT.6	003227	1913	1917E							
DYBYTH	016262	4434	4445L							
DYBYTH1	016303	4454	4456L							
DYBYTH2	016312	4457	4460L							
DYBYTH3	016325	4464	4466L							
DYBYTH4	016334	4467	4472L							

DYBYTO	016250	4436L						
DYBYTX	016240	1885	4426L					
DYME5.5	007221	2970E	2979	4486	4488			
DYMEM	007116	2906L	4323					
DYMEM1	007122	2912L						
DYMEM10	013252	2012	3006	3826L				
DYMEM11	007251	2997L	2998	3001	3004			
DYMEM2	007127	2914L	2920					
DYMEM3	007140	2917	2923L					
DYMEM4	007167	1148	2941	2945L				
DYMEM5	007172	2946L	2958	2962				
DYMEM6	000273	1142L	2986					
DYMEM7	000276	1143L	1146					
DYMEM9	000307	1152L	2948	2953				
DYMM5	016336	2968	4480L					
DYMSG	007265	1158	2006	2931	2943	3018L	3028	
DYMSG.5	007275	3022	3026L					
EDYMEM	007375	3077L						
EIXIT	034027	756E	1696	1698				
ERPTCNT	000012	757E	1537					
ERRMSG	014046	1615	3935L					
ERROR	000322	1005	1128	1175E	1619	1975		
ESPEED	007372	3071L						
EUC	016201	1515	3517	3529	3687	4396L		
EUC.	016215	1662	4403L					
FD.CMD	000172	251E	3420	3451	3464	3473	3481	3548
FD.DAT	000173	254E	3471	3551				
FD.SEC	000172	253E	3537					
FD.STAT	000172	250E	3425	3576				
FD.TRK	000173	252E						
FDC.FI	000320	273E	3419	3463				
FDC.RDA	000300	269E						
FDC.RDS	000200	266E	3547					
FDC.RDT	000340	270E						
FDC.RST	000000	260E	3450	3480				
FDC.SEK	000020	261E	3472					
FDC.STI	000100	263E						
FDC.STO	000140	264E						
FDC.STP	000040	262E						
FDC.WTS	000240	267E						
FDC.WTT	000360	271E						
FDF.DDM	000001	292E						
FDF.DLF	000004	290E	3547					
FDF.HLB	000010	278E						
FDF.MRF	000020	288E	3547					
FDF.S12	000001	282E						
FDF.S20	000002	283E						
FDF.S30	000003	284E	3450	3472	3480			
FDF.S6	000000	281E						
FDF.SLF	000010	289E	3547					
FDF.SS1	000002	291E						
FDF.UTR	000020	277E						
FDF.VRF	000004	279E						
FDS.BSY	000001	308E						
FDS.CRC	000010	303E	3560					
FDS.DRQ	000002	307E						
FDS.HLD	000040	298E						

FDS.IND	000002	306E						
FDS.LDT	000004	305E	3560					
FDS.NRD	000200	296E	3560					
FDS.RNF	000020	302E						
FDS.RTE	000040	299E	3560					
FDS.SEK	000020	301E						
FDS.TKO	000004	304E	3486					
FDS.WPV	000100	297E						
FDS.WTF	000040	300E						
FEDEV	013222	3817L	4615	4637				
FPLEDS	040013	4665E						
GETBND	016060	4334L						
GETBND.	016073	3323	4339L					
GETBND1	001024	1230L	4347					
GETCON	012376	3634	3646	3661	3669	3685	3696L	
GETCPT	013130	3767L	3773					
GETST	013110	3748	3758L	3761	3805			
GO	001222	1340	1362L					
GO.	000063	958L	1362	2270				
GO88	001146	1327L	4545					
GO88.1	001177	1330	1339L					
GTCON	013004	3701L	3708	3711				
GTCON1	013025	3703	3716L					
H17	002207	1632E	4603					
H17A	002237	1650L	1652					
H17X	017024	1656	4520L					
H37	011221	3416L	4625					
H37.	011317	3455L	3458	3461				
H371	011335	3448	3468L					
H371.	012002	3492L	3495					
H371B	011356	3468	3478L					
H371C	011373	3478	3486L					
H372	012045	3511	3519L					
H373	012067	3466	3487	3523	3531L			
H67	012174	3617L	4611	4633				
H671	012215	3626L	3629					
H671.	012231	3634L	3641					
H672	012250	3635	3643L					
H673	012330	3653	3672L					
H67UNI	012365	3631	3682	3689L				
H88.CTL	000362	129E	2061	2229	2907			
H88.SW	000362	133E	1708	1714	1724	2068	2098	3370
H88B.CK	000002	130E	2060					
H88B.SS	000001	131E						
H88S.0	000014	139E						
H88S.4	000003	141E	1744					
H88S.AT	000200	134E	3371					
H88S.BR	000100	135E	2069					
H88S.DV	000020	137E	1709					
H88S.M	000040	136E	2099					
HORN	002140	1576L	2637					
HRN0	002143	950	1579L					
HRN2	002160	1590L	1591					
HRNX	006045	1593	2625L					
IHA	015244	4101	4227L					
IHA.	015245	4228L	4506					
IHA1	015253	4232L	4243	4250				

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IHA3    015301  4234    4245L
IHA4    015314  4246    4254L
IHB     015123  4107    4148L
IHB1    015126  4150L   4161    4176
IHB2    015151  4155    4165L
IHC     015214  4113    4198L
IN.     006170  1276    2613    2750E   3166    3170    3763    3778    3807    4013
IN.1    006174  2732    2753L
IN1.    006150  1281    2727E   3701    3719    3737    3758    3767    3798
INIT    000073   881     883     980L    984
INIT0   000000   879L
INIT0.0 000003   880L    2108
INITOX  004000   879     2060L
INITOX1 004050  2091L    2092    2094    4359
INIT1   000107   993L    998
INIT2   000117  1000L
INPUT   014233  4002L    4557
INTOX0  016113  2090    4354L
INT1    000010   888E
INT2    000020   904E
INT3    000030   923L
INT4    000040   930L
INT5    000050   937L
INT6    000060   955L
INT7    000070   964L
INTXIT  000172  1075L    1105    1377
IOA     015023  1232    1317    1338    2350    4040    4099L   4336    4343
IOA1    005166  1796    2440L
IOA2    005176  2445L   2460    2469
IOA3    005230  2447    2462L
IOA4    005245  2463    2473L
IOA0    003062  1796L   4103    4503
IOB     015036  4009    4047    4105L
IOB1    003070  1812L   1819    1848    1855
IOB1.5  003126  1830    1845L
IOB2    003135  1817    1852L
IOB0    003066  1811L   4109
IOC     015051  2359    2386    4111L
IOC.    005271  2446    2499L
IOCO    005266  2498L   4115
IOWRK   040002  1230    1234    2348    2812    2850    2852    3851    3873    4036    4042    4046    4049
                4334    4338    4341    4345    4381    4498    4508    4650L
IP.DS   000177  2799E   2827    2833
IP.PAD  000360   123E
IP.TPC  000371   146E
IP.TPD  000370   148E
IROC    015012  1306    1310    1329    2345    2426    3314    4095L
IROC1   005156  2419    2424L
IROCH   015326  4097    4265L   4275
IROCO   005140  2414L   4096
LRA     003047  1779L
LRA.    003052  1116    1300    1334    1780L   2246    2264
LSA.2   000037   505E
LUNM    000140   504E
M.INI   242355   333E
M.OUTI  243355   334E
MCU     015223  3951    4183    4205L
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MEML	040074	4705E	4706										
MEMORY	016024	4315L	4566										
MEMORY.	016032	2100	3077	4317L									
MI.ANI	000346	183E											
MI.EXAF	000010	190E	1416	1418	1424	1678	1716	1726	1730	1733	1743	1867	1873
		2304	2317	2320									
MI.EXX	000331	111E	4319	4322	4428	4431	4480	4482					
MI.HLT	000166	178E	1122										
MI.IN	000333	180E	2199	2208									
MI.JIXA	000335	191E	1919	3031	4472								
MI.JIXB	000351	192E	1919	3031	4472								
MI.JIYA	000375	193E	1876										
MI.JIYB	000351	194E	1876										
MI.JMP	000303	185E	1694	3429									
MI.LDA	000072	182E											
MI.LDXA	000335	186E	1156	2003	2011	2928	2940	2985	3385	3393	3402	3409	
MI.LDXB	000041	187E	1156	2003	2011	2928	2940	2985	3385	3393	3402	3409	
MI.LDYA	000375	188E	1889	1902	1912	2973	3021	3827	4456	4466			
MI.LDYB	000041	189E	1889	1902	1912	2973	3021	3827	4456	4466			
MI.LXID	000021	184E											
MI.OUT	000323	181E	2196	2215									
MI.RET	000311	179E	2052										
MSG.BT	006234	2260	2777L										
MSG.CON	017014	4496	4512L										
MSG.EQ	007341	2000	3045L										
MSG.ERR	014336	1153	4058L										
MSG.FE	013233	3817	3821L										
MSG.GO	006165	1327	2740L										
MSG.HSS	007100	2855	2885L										
MSG.INP	014327	4002	4056L										
MSG.MEM	016043	4315	4325L										
MSG.OUT	014332	4033	4057L										
MSG.PAS	003231	1924L	2937										
MSG.PC	006214	1297	2771L										
MSG.PR	014062	3377	3939L										
MSG.RAD	014203	3947	3991L										
MSG.RAM	007303	2925	3036L										
MSG.SPD	006371	2809	2868L										
MSG.SUB	006201	2343	2765L										
MSG.VEH	002113	1245	1558L										
MSG.WRK	007062	2849	2877L										
MTR	000344	1193E	1389										
MTR.15	000354	1200L	3378										
MTR.2	000357	1202L	1218										
MTR.3	000371	1207L	1214										
MTR.4	001014	1209	1220L										
MTR1	000345	1196E	1197										
MTRA	017045	1204	4543E	4573									
MTRAL	000012	1205	4573E										
MYCNT	041122	1688	2309	4710L									
MYINT	012145	3427	3576L										
NB7	001317	1417	1424L										
NBOOT	001261	1407L	2265										
NBOOTO	001262	1408L	1435										
NMI	004116	1044	2168L										
NMI0.5	004154	2186	2189	2194L									
NMI1	004173	2181	2206L										

NMI1.5	004206	2209	2215L										
NMI2	004212	2218L											
NMI2.2	004225	2225	2227L										
NMI2.5	004236	2192	2197	2200	2216	2233L							
NMI3	004237	2204	2213	2235L									
NMIENT	000146	1044L											
NMIRET	040064	2169	2176	4697L									
NODEV	002171	1452	1510	1614E	1661	2299	2313	3085	3093	3095	3119	3138	3533
		3637	3647	3662	3670	3686							
NODEV1	002177	1617L	3819										
NOISE	006053	1597	2635L										
ONDRO	000022	2807E	2813										
OP.CTL	000360	124E	1098	1374	1385								
OP.DC	000177	2798E	2814										
OP.DIG	000360	125E											
OP.SEG	000361	126E											
OP.TPC	000371	147E											
OP.TPD	000370	149E											
OPCOOM	000037	503E											
OUT.	006063	2647E	3082	3751	4051								
OUT.1	006070	2651L	2717										
OUT1.	006140	2712E	3208	3618	3717	3731							
OUTCOM	013055	3735L											
OUTPUT	014265	4033L	4560										
OVL.IN	000001	651E											
OVL.NUM	000014	653E											
OVL.RES	000002	652E											
OVL.UCS	000200	654E											
PCA	001103	1297L	4551										
PCA1	001137	1307	1315L										
PCF.MH	011012	3268	3304L										
PCF.MO	011017	3266	3305L										
PCFA	010316	3222	3264L										
PCFA.	010341	3273L	3358										
PCFA1	010357	3277	3282L										
PCFA2	010361	3280	3284L										
PCFA3	010362	3286L	3298										
PCFA3.	010371	3291L	3294										
PCFA4	011007	3287	3300L										
PCFAA	010333	3267	3269L										
PIN	001067	1275E	1278	2697	3118	3193							
PRIM	041120	1741	2650	2715	2729	2752	3855	4007	4043	4384	4708L		
PRSL	000007	880	4663E										
PRSRAM	040004	880	4651E	4663									
PRSROM	003371	2045E	2104										
R.ABORT	033366	750E	4520	4529									
R.READ	034077	751E	1660										
R.SOP	002044	1536E	1641	1649	4524								
R.SOP1	002063	1542	1544L										
RAD.HEX	014217	3972	3983	3993L									
RAD.OCT	014211	3964	3980	3992L									
RADFLG	040071	3967	3975	4133	4317	4355	4700L						
RADIX	014072	3947L	4563										
RADIX1	014100	3950L	3960										
RADIX2	014131	3953	3964L										
RADIX3	014144	3955	3972L										
RADIX4	014160	3957	3980L										

RADIX5	014173	3982	3985L										
RCC	003262	1202	1409	1812	1966E	2414	2445	2498	2568	3859	3880	3950	4150
		4199	4232	4265									
RCC1	003262	1968L	1970										
RCC2	003270	1972L											
RCCA	040026	4679L											
RCK	003260	1945E											
RD2	006126	2697L	2702										
RDBLCK	006111	1501	2690L										
READT	012075	3504	3522	3535L									
READT1	012126	3545	3550L										
READT2	012134	3543	3556L										
REFIND	040012	4662L											
REGI	040005	1779	4654L										
REGPTR	040035	1055	1184	1782	4684L								
RESET	002011	1484L											
RETRY	002036	1528L	2318										
RI.BST	000001	463E											
RI.CON	000001	462E											
RI.DAT	000000	461E											
ROMBOOT	030000	569E											
RRDY	010142	3092	3094	3190L									
S.BAUD	040344	628L											
S.BDA	041120	727L											
S.BOOTF	041034	683L											
S.CACC	041006	667L											
S.CDB	040343	625L											
S.CFWA	040352	635L											
S.CODE	041007	668L											
S.DCS	041033	681L											
S.DDDTA	040366	646L											
S.DDGRP	040364	643L											
S.DDLDA	040360	641L											
S.DDLEN	040362	642L											
S.DDOPC	040370	647L											
S.DFWA	040354	636L											
S.DIREA	041016	675L											
S.DLINK	040346	633L											
S.DON	000040	343E	1277	2611	3167								
S.DTR	000200	345E	1277	2596									
S.ERR	000001	342E	3171										
S.FASER	041013	674L											
S.FCI	041021	676L											
S.GRT0	024000	565E											
S.GRT1	025000	566E											
S.GRT2	026000	567E											
S.GUP	041027	678L											
S.IEN	000100	344E											
S.INT	040343	579L	621										
S.JUMPS	041010	672L											
S.MOUNT	041032	680L											
S.OFWA	040350	634L											
S.OSI	041126	731L	4410	4411									
S.OSN	041004	663L											
S.OSO	041127	732L											
S.OSZ	041130	733L	4410										
S.OVLE	041000	660L											

S.OVLFL	040371	656L											
S.OVLS	040376	659L											
S.OVSTK	041035	689L											
S.RFHA	040356	637L											
S.SCI	041024	677L											
S.SCR	041121	728L											
S.SDD	041010	673L											
S.SOVR	041146	581L	583										
S.SSN	041002	662L											
S.SW0	000002	347E											
S.SW1	000004	348E											
S.SW2	000010	349E											
S.SW3	000020	350E											
S.UCSF	040372	657L											
S.UCSL	040374	658L											
S.VAL	040277	578L											
SAE	001063	1262L											
SAVALL	000132	892	908	1022L									
SAVALLR	000151	1046	1048E	2129									
SAVALLX	004105	1037	2124E										
SB.BTO	000001	364E											
SB.CRC	000010	361E											
SB.DLD	000040	359E											
SB.ILC	000002	363E											
SB.LTO	000004	362E											
SB.NRF	000020	360E											
SB.UNR	000200	357E											
SB.WPD	000100	358E											
SC.ACE	000350	809E	1868	1874	1968	1972	1989	1994	2066	2078	2081	2083	2085
		2292	2296										
SC.UART	000372	770E											
SDP3	036073	755E	1544										
SEC.M	000037	440E											
SID.0	000000	433E											
SID.1	000200	434E											
SID.M	000200	436E											
SINCR	004000	986E	988	989									
SPEED	006240	2809L	3071										
SPEED1	006257	2815L	2859										
SPEED2	006275	2823	2826L										
SPEED3	006300	2827L	2829	2840									
SPEED4	006307	2833L	2835										
SPEED5	006357	2853	2856L										
SSIZ.M	004000	444E											
SST1	001235	959	1375L										
SSTEP	001225	1370E											
ST.ERR	000002	491E											
ST.LUN	000140	489E	3693										
ST.PER	000001	492E											
ST.SPR	000034	490E											
STACK	042200	585E											
STACKL	001032	583E											
START	040000	989	2912	2945	3850	3874	4380	4649L					
START1	001265	1409L	1422										
STK	041124	1471	1512	1528	4712L								
STPRTN	001244	911	1383E										
SUBM	004370	2343L	4548										

SUBM1	005013	2353L	2366	2373					
SUBM10	014352	2385	4063L						
SUBM10.	014370	4072L	4084						
SUBM11	014373	4064	4075L						
SUBM2	005027	2359L	2380						
SUBM3	005042	2365L	2390						
SUBM4	005046	2363	2368L						
SUBM5	005053	2371L	2393						
SUBM6	005062	2369	2375L						
SUBM7	005075	2360	2382L						
SUBM8	005077	2384L	2387						
SUBM9	005105	2386L	2400						
SYDD	040130	575E							
TO.DNR	000004	536E							
TO.DNS	000005	537E							
TO.MDS	000007	539E							
TO.NIS	000001	533E							
TO.NSC	000002	534E							
TO.NST	000000	532E							
TO.NTO	000006	538E							
TO.WFT	000003	535E							
T1.BBF	000011	552E							
T1.CDE	000010	551E							
T1.DMNF	000003	546E							
T1.DTE	000006	549E							
T1.FE	000012	553E							
T1.ID	000000	543E							
T1.IDNF	000002	545E							
T1.RNF	000004	547E							
T1.SKE	000005	548E							
T1.UDE	000001	544E							
T1.WP	000007	550E							
T2.IDA	000001	558E							
T2.IFN	000002	559E							
T2.ILC	000000	557E							
TFDATA	013173	3744	3796L						
TFREQ	013176	3798L	3801	3810					
THA	016001	4119	4299L						
THA1	016007	4303L							
THB	015350	4125	4279L						
THB1	015351	4280L	4304	4306					
THB2	015366	4286	4292L						
THB3	015376	4294	4296L						
TICCNT	040033	1093	1095	1586	1687	2305	2815	2844	4682L
TMFG	041121	1753	2301	2309	4709L				
TMOUT	004304	1703	2291E						
TMOUT1	004347	2314L	2316						
TMOUT2	004363	2307	2315	2320L					
TMOUT3	004365	2319	2322L						
TMOUT4	004323	2294	2301L						
TOA	015064	1309	2353	3352	4117L	4510			
TOA.	005305	2518L	2858						
TOAD	005300	2515L	4121						
TOB	015077	1550	2355	4021	4123L				
TOB1	005332	2542L	2550						
TOBO	005322	2519	2521	2535L	4127				
TPERRX	040031	4681L							

TYPMSG	006100	1200	1246	1298	1328	1433	1616	2261	2344	2670L	2676	2810	2856
		3232	3255	3269	3818	3948	3965	3973	3987	4003	4034	4316	4497
UC.2SB	000004	835E											
UC.5BW	000000	831E											
UC.6BW	000001	832E											
UC.7BW	000002	833E											
UC.8BW	000003	834E	2082										
UC.BI	000020	854E											
UC.CTS	000020	863E											
UC.DCS	000001	859E											
UC.DDR	000002	860E											
UC.DLA	000200	840E	2065										
UC.DR	000001	850E	1969	2293									
UC.DRL	000010	862E											
UC.DSR	000040	864E											
UC.DTR	000001	843E											
UC.EDA	000001	821E											
UC.EPS	000020	837E											
UC.FE	000010	853E											
UC.IID	000006	828E											
UC.IIP	000001	827E											
UC.LOO	000020	847E											
UC.MSI	000010	824E											
UC.OR	000002	851E											
UC.OU1	000004	845E											
UC.OU2	000010	846E											
UC.PE	000004	852E											
UC.PEN	000010	836E											
UC.RI	000100	865E											
UC.RLS	000200	866E											
UC.RSI	000004	823E											
UC.RTS	000002	844E											
UC.SB	000100	839E											
UC.SKP	000040	838E											
UC.TER	000004	861E											
UC.THE	000040	855E	1869	1990									
UC.TRE	000002	822E											
UC.TSE	000100	856E											
UCI.ER	000020	792E											
UCI.IE	000002	794E											
UCI.IR	000100	790E											
UCI.RE	000004	793E											
UCI.RO	000040	791E											
UCI.TE	000001	795E											
UDR	000000	767E											
UF.FCT	000100	237E											
UF.RDA	000001	234E											
UF.ROR	000002	235E											
UF.RPE	000004	236E											
UF.TBM	000200	238E											
UIVEC	040037	923	930	937	955	964	1069	1390	1693	1704	3428	3430	4405
		4686L											
UMI.16X	000002	785E											
UMI.1B	000100	775E											
UMI.1X	000001	784E											
UMI.2B	000300	777E											
UMI.64X	000003	786E											

UMI.HB	000200	776E						
UMI.L5	000000	780E						
UMI.L6	000004	781E						
UMI.L7	000010	782E						
UMI.L8	000014	783E						
UMI.PA	000020	779E						
UMI.PE	000040	778E						
UNT.0	000000	424E						
UNT.1	000040	425E						
UNT.2	000100	426E						
UNT.3	000140	427E						
UNT.M	000140	429E						
UO.CLK	000001	203E	1067	1691				
UO.DDU	000002	202E	1178					
UO.HLT	000200	200E	1109					
UO.NFR	000100	201E	1178					
UP.DP	000174	228E						
UP.FC	000175	229E						
UP.SC	000176	231E						
UP.SR	000176	232E						
UP.ST	000175	230E						
UR.DLL	000000	816E	2081					
UR.DLM	000001	818E	2078					
UR.IER	000001	820E	2085					
UR.IIR	000002	826E						
UR.LCR	000003	830E	2066	2083				
UR.LSR	000005	849E	1868	1968	1989	2292		
UR.MCR	000004	842E						
UR.MSR	000006	858E						
UR.RBR	000000	812E	1972	2296				
UR.THR	000000	814E	1874	1994				
USERFWA	042200	586E	1494	1657	3513	3525	3546	3796 4415
USR	000001	768E						
USR.FE	000040	799E						
USR.OE	000020	800E						
USR.PE	000010	801E						
USR.RXR	000002	803E						
USR.TXE	000004	802E						
USR.TXR	000001	804E						
VEW.NPC	011024	3231	3254	3307L				
VEWHLD	040072	3317	3327	3343	4357	4701L		
VIEW	001044	1245L	4569					
VIEW1	001055	1249L	3056					
VIEW12	011111	3055	3351E					
VIEW2	002066	1250	1549L	2579				
VIEW3	006000	1556	2579L					
VIEW3.	003340	1555	2021L	3238				
VIEW3.A	003352	2024	2026L					
VIEW3A	007351	1247	3053L					
VIEW3A.	007355	2582	3055L					
VIEW3B	011127	3354	3357L					
VIEW3C	011131	3356	3358L					
VIEW4	007363	1553	3058L	3236				
VIEW5	010171	2034	3222L					
VIEW5.	010212	3227	3230L					
VIEW5A	010174	3223L	3239					
VIEW6	010224	3229	3235L	3262				

VIEW6.	010227	3234	3236L											
VIEW7	010241	3225	3242L											
VIEW7.	010302	3252	3258L											
VIEW7..	010305	3257	3259L											
VIEW7A	010270	3250	3253L											
VIEW8	011032	3053	3314L											
VIEW8.	011103	3336	3343L											
VIEW8A	011051	3315	3323L											
VIEW8B	011054	3321	3325L											
VIEW9	003355	1554	2033L	2580										
W.RES	000002	352E	1489											
WCC	003302	1125	1127	1217	1220	1421	1445	1552	1823	1988L	2357	2371	2379	
		2384	2399	2425	2449	2467	2473	2524	2547	2555	2572	2574	2636	2674
		3235	3245	3247	3258	3260	3292	3867	3879	3959	4160	4165	4235	4248
		4254	4274	4296	4308	4373								
WCC1	003303	1989L	1991											
WCR	005361	2568L	2570											
WCR.	005370	1339	1439	2516	2572L	3872	3894	3986	4019	4301				
WDN	010104	2698	3084	3137	3156L	3201								
WDN1	010111	3160L	3168											
WDN2	010137	3164	3173	3177L										
WDNA	175000	3158	3181E											
WHD	036235	740E	1651											
WNH	036271	741E	1650											
WRONG	001310	1413	1419E	1427										
WTDON1	006032	2613L	2615											
Z47	001372	1468E	4607	4629										
Z47A	001376	1473E	1530											
Z47X	010000	1490	3082L											
Z47X.	010011	3092L	3107											

21374 bytes free

Appendix B

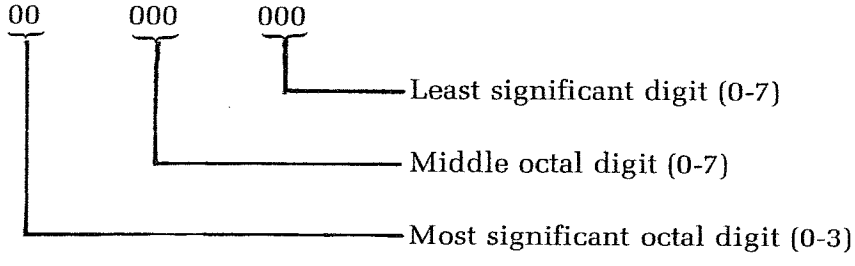
Octal Definitions

Binary numbers are converted to either hexadecimal or octal numbers for display, depending on the current radix setting. This section describes binary to octal conversion. For a description of binary to hexadecimal and octal to hexadecimal conversion, see Appendix C.

The following table shows binary to octal conversion.

BINARY NUMBER	OCTAL DIGIT
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

Each 8-bit byte is displayed as three octal digits as shown below. The octal numbers lie in the range 000 to 377 for binary numbers in the range 00000000 to 11111111.



Since there are only eight bits in a byte, the most significant octal digit only represents two bits and is therefore displayed as 0 to 3. If you inadvertantly enter the octal digits 4 through 7 as the most significant digit, the most significant two bits will be interpreted in modulus 4. That is to say, entering the octal digits 4 through 7 will cause MTR-90 to interpret the digits as 0 through 3, respectively.

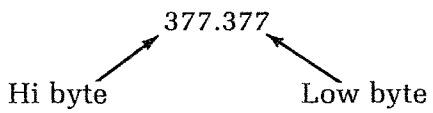
Also note that 16-bit numbers, such as memory addresses and certain register contents, are made up of two eight-bit binary numbers. The two groups of eight-bit numbers can be represented by two groups of three octal numbers in the range of 000 to 377. This representation of 16-bit binary numbers is known as offset octal or **split octal**. Where the current radix setting is octal, split octal is used consistently for displays of 16-bit numbers.

Split octal should not be confused with octal. For example:

```
11  111 111   11  111 111     A 16-bit binary number
 |   |   |    |   |   |
 3   7   7    3   7   7       Split octal representation (377 377)

 1  111 111  111 111 111      A 16-bit binary number
 |   |   |    |   |   |
 1   7   7    7   7   7       True octal representation (177777)
```

The lower representation shows true octal representation of a 16-bit binary number. True octal representation is rarely used in standard Zenith Data Systems software. Occasionally, you will see split octal numbers printed with a decimal point separating the upper and lower bytes. For example:



Note that 001.000 follows 000.377.

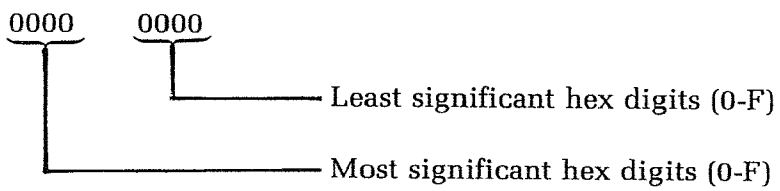
Appendix C

Hexadecimal Definitions

If the radix setting is hexadecimal, all display addresses are given in hexadecimal. The following table shows binary to hexadecimal conversion.

BINARY NUMBER	HEX DIGIT
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

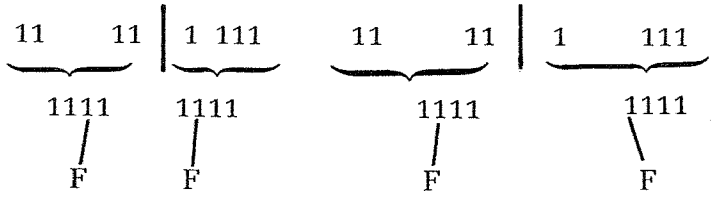
Each byte is displayed as two hexadecimal digits as shown below. Hexadecimal numbers lie in the range 00 to FF for binary numbers 00000000 to 11111111.



Converting Split Octal to Hexadecimal

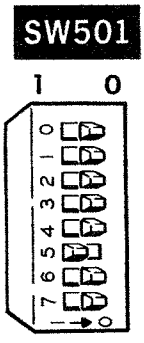
To convert a split octal number to hexadecimal, first convert the split octal number to binary. In split octal representation, each of the two bytes of a sixteen-bit number are converted independently to octal. Thus, the most significant split octal digit only represents two bits. The following illustrates the conversion to binary of the split octal value 377.377:

Having converted the split octal number to binary, regroup the bits into nybbles, then convert to hexadecimal. For example:



Appendix D

SW501 Switch Settings



DIP Switch SW501, located on the lower right of the Z-89/90 CPU logic circuit board, incorporates eight individual bits (0-7) which may be set to either one or zero. These switch settings perform the following functions:

SWITCH SECTION 7 6 5 4 3 2 1 0	DESCRIPTION
	Selects the device located at port 07CH (174Q). The settings of these two sections are:
X X X X X X 0 0 -	Hard-sectored 5.25-inch disk
X X X X X X 0 1 -	H/Z-47
X X X X X X 1 0 -	H/Z-67 hard disk/floppy
X X X X X X 1 1 -	No device
	Selects the device located at port 078H (170Q). The settings of these two sections are:
X X X X 0 0 X X -	Soft-sectored 5.25-inch disk
X X X X 0 1 X X -	H/Z-47
X X X X 1 0 X X -	H/Z-67 Winchester disk-floppy
X X X X 1 1 X X -	No device
	Determines whether the primary boot device is at port 07CH (174Q) or at 078H (170Q). The port not configured as primary becomes the secondary device.
X X X 0 X X X X -	Primary boot from device at 07CH (174Q)
X X X 1 X X X X -	Primary boot from device at 078H (170Q)
	Disables/enables memory diagnostic on power up.
X X 0 X X X X X -	Initiate memory test on power up
X X 1 X X X X X -	Disable memory test on power up
	Sets console (H/Z-19) baud rate.
X 0 X X X X X X -	Sets console baud rate at 9600
X 1 X X X X X X -	Sets console baud rate at 19,200 (not currently supported)
	Selects type of boot process
0 X X X X X X X -	Normal boot (normal)
1 X X X X X X X -	Auto boot on power up or reset (not recommended)

Appendix E

CPU Jumpers

MEMORY JUMPERS

The memory decode ROM is located at U517. An older ROM (#442-42) allowed for a maximum or 48K of memory. A newer ROM allows for up to 64K of memory. Memory jumpers should be set as follows:

Older CPU boards have four jumpers.

When you are using the old ROM (#444-42):

	JJ501	JJ502	JJ503	JJ504
16K	0	0	0	0 (or B)
32K	1	0	0	0 (or B)
64K	0	1	0	0 (or B)

When you are using the new ROM (#444-66):

16K	0	0	**	0 (or B)
32K	1	0	**	0 (or B)
48K	0	1	**	0 (or B)
64K*	1	1	**	0 (or B)

* Requires WH-88-16 Accessory Board

** A jumper is required between the center pin of JJ503 and pin 17 of P509 — or P4 of WH-88-16 (which connects to pin 17 of P509). This jumper was permanently installed on some boards.

Newer CPU boards have three jumpers.

They also have the newer decoder ROM, and the jumper wire is part of the circuit foils. These boards should not be used with the old ROM (#444-42). The jumpers are set as follows:

	JJ501	JJ502	JJ503
16K	0	0	0 (or B)
32K	1	0	0 (or B)
48K	0	1	0 (or B)
64K	1	1	0 (or B)

SECONDARY ADDRESS DECODER — U516

MTR-90 requires the use of IC #444-83 at location U516 on the left-hand side of the CPU circuit board. Four nearby jumpers (JJ505, JJ506, JJ507, and JJ508 on older units; or JJ504, JJ505, JJ506, and JJ507 on newer units) must be set as follows:

Older Units	JJ505	JJ506	JJ507	JJ508
Newer Units	JJ504	JJ505	JJ506	JJ507
	1	*	1	1 (or B)

* MTR-90 requires a jumper (#134-1159) from the center pin of JJ506 (or JJ505) to pin 14 of P508.