```
0000                    0010 ********************************************
0000                    0020 *   EXATRON STANDALONE RELOCATING LOADER    *
0000                    0030 *   VERSION 1.0                 10-31-78    *
0000                    0040 ********************************************
0000                    0050 *
0000                    0060 * WRITTEN BY:  CHARLIE PACK
0000                    0070 *              25470 ELENA ROAD
0000                    0080 *              LOS ALTOS HILLS, CA.  94022
0000                    0090 *              (415) 941-0495  EVENINGS
0000                    0100 *
0000                    0110 * PARAMETERS ARE ENTERED THROUGH SENSE
0000                    0120 * SWITCHES AS FOLLOWS:
0000                    0130 * BITS 7654 = LOAD ADDRESS (4K BOUNDARY)
0000                    0140 *   PROGRAM WILL BE LOADED AT 0400H OFFSET
0000                    0150 *   FROM BEGINNING OF 4K BLOCK.
0000                    0160 * BITS 3210 = ADDRESS OF ESF CONTROLLER BOARD
0000                    0170 *   (4K BOUNDARY)
0000                    0180 * FOR EXAMPLE: SENSE SWITCHES SET TO 10011010
0000                    0190 * WILL LOAD PROGRAM AT 9400H AND LINK TO ESF
0000                    0200 * UTILITY AT 0A000H.
0000                    0210 *
0000                    0220 * RETURN CODES
0000                    0230 *
0000                    0240 RC7    EQU   07H    CAN'T AUTOSTART
0000                    0250 RC8    EQU   08H    BAD MEMORY
0000                    0260 RC9    EQU   09H    BAD SENSE SWITCH VALUE
0000                    0270 RC10   EQU   0AH    CONTROL CODE ERROR
0000                    0280 RC11   EQU   0BH    UNKNOWN EXTERNAL REFERENCE
0000                    0290 RC12   EQU   0CH    UNEXPECTED END OF FILE
0000                    0300 *
0000                    0310 * ENTRY POINTS TO ESF UTILITY (RELATIVE TO ZERO)
0000                    0320 *
0000                    0330 ESFUT  EQU   0
0000                    0340 ECAT   EQU   ESFUT+008H CATALOG ROUTINE
0000                    0350 EGET   EQU   ESFUT+00BH "GET" ROUTINE
0000                    0360 ESAV   EQU   ESFUT+00EH "SAVE" ROUTINE
0000                    0370 ECER   EQU   ESFUT+011H "CERTIFY" ROUTINE
0000                    0380 EWTP   EQU   ESFUT+014H "WIND TAPE" ROUTINE
0000                    0390 *
0000                    0400 * OTHER EQUATES
0000                    0410 *
0000                    0420 SYMLN  EQU   5      SYMBOL LENGTH
0000                    0430 PSW    EQU   6      PROGRAM STATUS WORD
0000                    0440 SP     EQU   6      STACK POINTER
0000
```

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0000 F3                    0450 *
0000 C3 0B 00 AO           0460 START DI     ;     AUTOSTART ENTRY POINT
0001                       0470       JMP    CHKSW
0004                       0480 *
0004 F3                    0490 RSTRT DI     ;     RE-START ENTRY POINT
0005 DB FF                 0500       IN     0FFH
0007 47                    0510       MOV    B,A   B=SENSE SWITCH DATA
0008 C3 14 00              0520       JMP    INFCB
000B                       0530 *
000B 06 AB                 0540 CHKSW MVI    B,0ABH DEFAULT PARAMETERS
000D DB FF                 0550       IN     0FFH  INPUT SENSE SWITCH PORT
000F FE FF                 0560       CPI    0FFH  ARE SENSE SWITCHES INSTALLED?
0011 C2 11 00              0570 WAIT  JNZ    WAIT  YES, WAIT HERE FOR USER TO
0014                       0580 *                    ENTER PARAMETER VALUES
0014                       0590 *                    INTO SENSE SWITCHES.
0014                       0600 *
0014 31 EF 02              0610 INFCB LXI    SP,MNSTK LOAD STACK POINTER
0017 AF                    0620       XRA    A     INITIALIZE FCB
0018 21 F3 02              0630       LXI    H,FCB
001B 77                    0640       MOV    M,A   FCBRC=0
001C 23                    0650       INX    H
001D 36 45                 0660       MVI    M,'E' FCBOP
001F 23                    0670       INX    H
0020 77                    0680       MOV    M,A   FCBFP=0
0021 23                    0690       INX    H
0022 77                    0700       MOV    M,A   FCBID=0
0023 23                    0710       INX    H
0024 36 52                 0720       MVI    M,'R' FCBTY
0026 67                    0730       MOV    H,A
0027 6F                    0740       MOV    L,A   HL=0
0028 22 FA 02              0750       SHLD   FCBEN
002B 22 F1 02              0760       SHLD   ERTEN
002E 2B                    0770       DCX    H     HL=0FFFFH
002F 22 F8 02              0780       SHLD   FCBBG
0032 22 FC 02              0790       SHLD   FCBAS
0035 22 FE 02              0800       SHLD   FCBER
0038 22 EF 02              0810       SHLD   ERTPG
003B                       0820 *
003B 78                    0830       MOV    A,B   ACC.=SENSE SWITCH DATA
003C E6 F0                 0840       ANI    0F0H  MASK BITS 7654
003E C6 04                 0850       ADI    4     FOR OFFSET OF 0400H
0040 67                    0860       MOV    H,A
0041 2E 00                 0870       MVI    L,0   HL=LOAD ADDRESS
0043 22 F8 02              0880       SHLD   FCBBG   SAVE IT IN FCBBG
0046
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0046 78                  0890 *
0047 E6 0F               0900       MOV   A,B    ACC.=SENSE SWITCH DATA
0049 17                  0910       ANI   0FH    MASK BITS 3210
004A 17                  0920       RAL   ;      SHIFT INTO LEFT NYBBLE
004B 17                  0930       RAL
004C 17                  0940       RAL
004D FE 80               0950       RAL
004F DA C6 01            0960       CPI   80H    UPPER 32K SPECIFIED?
0052                     0970       JC    BADSW    YES
0052                     0980 *
0052                     0990 * ACC. NOW HAS HIGH ADDRESS BYTE OF CONTROLLER.
0052                     1000 * THIS NEXT ROUTINE RELOCATES THE ENTRY POINT
0052                     1010 * TABLE TO POINT TO THE ESF UTILITY ROUTINES.
0052                     1020 * IT ALSO RELOCATES THE INSTRUCTION LABELLED
0052                     1030 * "CESFG" AND THEN CALLS THE ESF "GET" UTILITY.
0052                     1040 *
0052 0E 07               1050       MVI   C,SYMLN+2 LENGTH OF TABLE ELEMENT
0054 11 D5 02            1060       LXI   D,ENTEN ENDING ADDR OF TABLE
0057 21 B8 02            1070       LXI   H,ENTBG+SYMLN+1 BEGINNING ADDR
005A 77                  1080 RENT  MOV   M,A    REPLACE HIGH ADDRESS BYTE
005B 06 00               1090       MVI   B,0
005D 09                  1100       DAD   B      POINT TO NEXT BYTE
005E 47                  1110       MOV   B,A    SAVE REPLACEMENT BYTE
005F EB                  1120       XCHG
0060 CD 07 02            1130       CALL  ADCMP CHECK IF PAST END
0063 EB                  1140       XCHG
0064 78                  1150       MOV   A,B    RESTORE REPLACEMENT BYTE
0065 DA 5A 00            1160       JC    RENT   LOOP UNTIL DONE
0068                     1170 *
0068 32 71 00            1180       STA   CESFG+2 RELOCATE "CESFG" INSTRUCTION
006B 21 F3 02            1190       LXI   H,FCB HL=&FCB
006E 40                  1200       MOV   B,B    LOADER CONTROL BYTE
006F CD 0B 00 B0         1210 CESFG CALL  EGET   CALL ESF "GET" UTILITY
0072 DA D2 01            1220       JC    ABORT    JUMP IF ANY ERRORS
0075
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                        1230 *
0075                    1240 * FIND EXTERNAL REFERENCE TABLE
0075                    1250 *
0075 2A F8 02           1260 FIND   LHLD   FCBBG
0078 EB                 1270        XCHG           DE=PROGRAM COUNTER
0079 1A                 1280        LDAX   D       LOAD FIRST PROGRAM BYTE
007A                    1290 *
007A CD 0D 02           1300 FINDL  CALL   OPCTL   GET FUNCTION (1-15) IN ACC.
007D FE 05              1310        CPI    5
007F DA 8D 00           1320        JC     CTL11
0082 CA 9A 00           1330        JZ     CTL15
0085 FE 0D              1340        CPI    13
0087 CA A9 00           1350        JZ     CTL1D
008A C3 E4 00           1360        JMP    INCT2
008D                    1370 *
008D 06 00              1380 CTL11  MVI    B,0     TYPE 1,2,3,4
008F 4F                 1390        MOV    C,A
0090 0D                 1400        DCR    C
0091 CD D8 01           1410        CALL   ADDBC   POINT TO END OF INSTR.
0094 DA F1 00           1420        JC     END1E
0097 C3 D9 00           1430        JMP    NEXT1
009A                    1440 *
009A CD EA 01           1450 CTL15  CALL   GETAD   TYPE 5 - GET COUNT IN BC
009D DA F1 00           1460        JC     END1E
00A0 CD D8 01           1470        CALL   ADDBC   POINT TO END OF DATA
00A3 DA F0 00           1480        JC     END1C
00A6 C3 D9 00           1490        JMP    NEXT1
00A9                    1500 *
00A9 2A EF 02           1510 CTL1D  LHLD   ERTBG
00AC 23                 1520        INX    H
00AD 7C                 1530        MOV    A,H
00AE B5                 1540        ORA    L       HAS AN EXTERNAL REFERENCE
00AF 2B                 1550        DCX    H         TABLE ALREADY BEEN FOUND?
00B0 C2 E4 00           1560        JNZ    INCT2     YES - ERROR
00B3 CD EA 01           1570        CALL   GETAD   GET COUNT IN BC
00B6 DA F1 00           1580        JC     END1E     JUMP IF END OF PROGRAM
00B9 04                 1590        INR    B
00BA 05                 1600        DCR    B       IS COUNT > 255?
00BB C2 C4 00           1610        JNZ    CT1D2     YES
00BE 79                 1620        MOV    A,C
00BF FE 05              1630        CPI    SYMLN   IS COUNT >= SYMBOL LENGTH?
00C1 DA E2 00           1640        JC     INCT1     NO - ERROR
00C4 CD F4 01           1650 CT1D2  CALL   GETCH   POINT TO FIRST BYTE OF TABLE
00C7 DA F0 00           1660        JC     END1C     JUMP IF END OF PROGRAM
00CA 62                 1670        MOV    H,D
00CB 6B                 1680        MOV    L,E     SAVE BEGINNING
00CC 22 EF 02           1690        SHLD   ERTBG     ADDRESS OF EXTERNAL REF. TABLE
00CF 0B                 1700        DCX    B
00D0 CD D8 01           1710        CALL   ADDBC   POINT TO END OF TABLE
00D3 DA E9 00           1720        JC     END1A     JUMP IF PAST END OF PROGRAM
00D6 22 F1 02           1730        SHLD   ERTEN   SAVE ENDING ADDR OF TABLE
00D9 CD F4 01           1740 NEXT1  CALL   GETCH   GET NEXT CONTROL CODE
00DC DA F6 00           1750        JC     RELOC     JUMP IF END OF PROGRAM
00DF C3 7A 00           1760        JMP    FINDL
00E2
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                        1770 *
00E2 1B                 1780 INCT1 DCX   D
00E3 1B                 1790       DCX   D
00E4 3E 0A              1800 INCT2 MVI   A,RC10 ERROR CODE
00E6 C3 CB 01           1810       JMP   SAVER
00E9                    1820 *
00E9 2A FA 02           1830 END1A LHLD  FCBEN
00EC 22 F1 02           1840       SHLD  ERTEN SAVE ENDING ADDR OF TABLE
00EF 1B                 1850       DCX   D
00F0 1B                 1860 END1C DCX   D     POINT BACK TO COUNT FIELD
00F1 3E 0C              1870 END1E MVI   A,RC12 ERROR CODE
00F3 C3 CB 01           1880       JMP   SAVER
00F6                    1890 *
00F6                    1900 * RE-LOCATE ADDRESS CONSTANTS AND RESOLVE
00F6                    1910 * EXTERNAL REFERENCES.  AN ADDRESS CONSTANT
00F6                    1920 * IS AN EXTERNAL REFERENCE IF ITS RELOCATED
00F6                    1930 * VALUE FALLS INSIDE THE EXTERNAL REFERENCE
00F6                    1940 * TABLE.
00F6                    1950 *
00F6 2A F8 02           1960 RELOC LHLD  FCBBG
00F9 EB                 1970       XCHG        DE=PROGRAM COUNTER
00FA 1A                 1980       LDAX  D     GET FIRST PROGRAM BYTE
00FB                    1990 *
00FB CD 0D 02           2000 RLOOP CALL  OPCTL GET FUNCTION (1-15) IN ACC.
00FE FE 02              2010       CPI   2
0100 CA A8 01           2020       JZ    CTL22
0103 FE 03              2030       CPI   3
0105 CA 38 01           2040       JZ    CTL23
0108 FE 04              2050       CPI   4
010A CA 29 01           2060       JZ    CTL24
010D FE 05              2070       CPI   5
010F CA 1A 01           2080       JZ    CTL25
0112 FE 0D              2090       CPI   13
0114 CA 1A 01           2100       JZ    CTL2D
0117 C3 AE 01           2110       JMP   CTL21
011A                    2120 *
011A                    2130 CTL2D EQU   $
011A CD EA 01           2140 CTL25 CALL  GETAD GET COUNT IN BC
011D DA B4 01           2150       JC    DONE    JUMP IF END OF PROGRAM
0120 CD D8 01           2160       CALL  ADDBC POINT TO END OF DATA
0123 DA B4 01           2170       JC    DONE    JUMP IF PAST END OF PGM
0126 C3 AE 01           2180       JMP   CTL21
0129                    2190 *
0129 CD F4 01           2200 CTL24 CALL  GETCH GET INSTR. CODE
012C DA B4 01           2210       JC    DONE    JUMP IF END OF PROGRAM
012F CD EA 01           2220       CALL  GETAD NON-RELOC. DATA TO BC
0132 DA B4 01           2230       JC    DONE    JUMP IF END OF PROGRAM
0135 C3 AE 01           2240       JMP   CTL21
0138
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                        2250 *
0138 CD EA 01           2260 CTL23 CALL  GETAD GET ADDR IN BC
013B DA B4 01           2270       JC    DONE    JUMP IF PAST END OF PGM
013E 2A F8 02           2280       LHLD  FCBBG ADD BEGIN. ADDR TO
0141 09                 2290       DAD   B       ADDRESS IN INSTRUCTION
0142                    2300 *
0142 D5                 2310       PUSH  D
0143 EB                 2320       XCHG
0144 2A EF 02           2330       LHLD  ERTBG IS RE-LOCATED ADDRESS
0147 CD 07 02           2340       CALL  ADCMP   BELOW EXTERNAL REF. TABLE?
014A EB                 2350       XCHG
014B D1                 2360       POP   D
014C DA 8B 01           2370       JC    CT23D   YES, ADDR NOT AN EXTERNAL
014F D5                 2380       PUSH  D
0150 EB                 2390       XCHG
0151 2A F1 02           2400       LHLD  ERTEN
0154 EB                 2410       XCHG        IS RE-LOCATED ADDRESS
0155 CD 07 02           2420       CALL  ADCMP   ABOVE EXTERNAL REF. TABLE?
0158 D1                 2430       POP   D
0159 DA 8B 01           2440       JC    CT23D   YES, ADDR NOT AN EXTERNAL
015C                    2450 *
015C D5                 2460       PUSH  D     (SP)=PROGRAM COUNTER
015D EB                 2470       XCHG        DE=ADDR OF EXTERNAL NAME
015E 21 B2 02           2480       LXI   H,ENTBG ADDR OF ENTRY POINT TABLE
0161 D5                 2490 CT23A PUSH  D
0162 E5                 2500       PUSH  H
0163 06 00              2510       MVI   B,0
0165 0E 05              2520       MVI   C,SYMLN
0167 09                 2530       DAD   B     POINT TO RIGHTMOST BYTE OF
0168 23                 2540       INX   H       ENTRY POINT TABLE ELEMENT
0169 11 D4 02           2550       LXI   D,ENTEN-1
016C CD 07 02           2560       CALL  ADCMP ADDRESS COMPARE  DE VS. HL
016F E1                 2570       POP   H     RESTORE ADDR OF EP TABLE ELEMENT
0170 D1                 2580       POP   D     RESTORE ADDR OF EXTERNAL NAME
0171 DA A0 01           2590       JC    CT23G JUMP IF PAST END OF EP TABLE
0174                    2600 *
0174 D5                 2610       PUSH  D
0175 E5                 2620       PUSH  H     NOTE - REG. C STILL HAS SYMLN
0176 1A                 2630 CT23B LDAX  D     COMPARE EXTERNAL NAME TO
0177 BE                 2640       CMP   M       NAME IN ENTRY POINT TABLE
0178 C2 98 01           2650       JNZ   CT23F   JUMP IF NOT MATCHED
017B 23                 2660       INX   H
017C 13                 2670       INX   D
017D 0D                 2680       DCR   C
017E C2 76 01           2690       JNZ   CT23B
0181                    2700 *
0181 7E                 2710       MOV   A,M   NAMES MATCH - SET HL=(HL)
0182 23                 2720       INX   H
0183 66                 2730       MOV   H,M
0184 6F                 2740       MOV   L,A   HL=ADDR OF EXTERNAL SUBRTNE
0185 D1                 2750       POP   D
0186 D1                 2760       POP   D     CLEAN UP THE STACK
0187 D1                 2770       POP   D     DE=PROGRAM COUNTER
0188 C3 8F 01           2780       JMP   CT23E
018B
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                        2790 *
018B 2A F8 02           2800 CT23D LHLD  FCBBG ADD RE-LOCATION FACTOR TO
018E 09                 2810       DAD   B       ADDRESS IN INSTRUCTION
018F 1B                 2820 CT23E DCX   D
0190 7D                 2830       MOV   A,L   SET (DE-1)=HL - STORES
0191 12                 2840       STAX  D       NEW INSTR. ADDRESS
0192 13                 2850       INX   D
0193 7C                 2860       MOV   A,H
0194 12                 2870       STAX  D
0195 C3 AE 01           2880       JMP   CTL21
0198                    2890 *
0198 E1                 2900 CT23F POP   H     HL=POINTER TO EP TABLE
0199 D1                 2910       POP   D     DE=ADDR OF EXTERNAL NAME
019A 0E 07              2920       MVI   C,SYMLN+2
019C 09                 2930       DAD   B     POINT HL TO NEXT ELEMENT
019D C3 61 01           2940       JMP   CT23A
01A0                    2950 *
01A0 D1                 2960 CT23G POP   D     DE=PROGRAM COUNTER
01A1 1B                 2970       DCX   D
01A2 1B                 2980       DCX   D
01A3 3E 0B              2990       MVI   A,RC11 ERROR RETURN CODE
01A5 C3 CB 01           3000       JMP   SAVER
01A8                    3010 *
01A8 CD F4 01           3020 CTL22 CALL  GETCH GET NEXT PROGRAM BYTE
01AB DA B4 01           3030       JC    DONE    JUMP IF END OF PGM
01AE CD F4 01           3040 CTL21 CALL  GETCH GET NEXT CTL CODE
01B1 D2 FB 00           3050       JNC   RLOOP   LOOP BACK IF NOT END
01B4 2A F8 02           3060 DONE  LHLD  FCBBG HL=STARTING ADDR
01B7 7E                 3070       MOV   A,M   ACC.=FIRST BYTE OF PROGRAM
01B8 FE F3              3080       CPI   0F3H  CHECK FOR VALID PROGRAM ID
01BA 3E 07              3090       MVI   A,RC7 ERROR RETURN CODE
01BC C2 CF 01           3100       JNZ   ERROR   JUMP IF NOT VALID PGM ID
01BF 3E FF              3110       MVI   A,0FFH SHOW ZERO RETURN CODE IN
01C1 D3 FF              3120       OUT   0FFH   DATA LIGHTS OF IMSAI 8080
01C3 E9                 3130       PCHL  ;     JUMP TO PROGRAM
01C4 00 00              3140       DW    0     SPACE FOR PATCH
01C6                    3150 *
01C6 3E 09              3160 BADSW MVI   A,RC9 ERROR RETURN CODE
01C8 C3 CF 01           3170       JMP   ERROR
01CB EB                 3180 SAVER XCHG  ;     DE=ERROR ADDR
01CC 22 FE 02           3190       SHLD  FCBER SAVE ERROR ADDR IN FCB
01CF 32 F3 02           3200 ERROR STA   FCBRC SAVE RETURN CODE IN FCB
01D2 2F                 3210 ABORT CMA   ;     SHOW ERROR RETURN CODE IN
01D3 D3 FF              3220       OUT   0FFH  DATA LIGHTS OF IMSAI 8080
01D5 C3 D5 01           3230 HALT  JMP   HALT  AND SOFT HALT
01D8
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                        3240 *
01D8                    3250 * ADD VALUE IN BC TO PROGRAM COUNTER IN DE.
01D8                    3260 * EXIT: BC PRESERVED; HL=NEW PGM COUNTER
01D8                    3270 *   CARRY FLAG OFF = DE IS ALSO NEW PGM CTR
01D8                    3280 *   CARRY FLAG SET = NEW PROGRAM COUNTER IS
01D8                    3290 *      BEYOND END OF PROGRAM; DE UNCHANGED
01D8                    3300 *
01D8 60                 3310 ADDBC MOV   H,B
01D9 69                 3320       MOV   L,C
01DA 19                 3330       DAD   D      HL=NEW PGM CTR
01DB D8                 3340       RC             RETURN IF PAST FFFF
01DC D5                 3350       PUSH  D
01DD EB                 3360       XCHG
01DE 2A FA 02           3370       LHLD  FCBEN
01E1 EB                 3380       XCHG
01E2 CD 07 02           3390       CALL  ADCMP PAST END OF PGM?
01E5 D1                 3400       POP   D
01E6 D8                 3410       RC             RETURN IF YES
01E7 54                 3420       MOV   D,H
01E8 5D                 3430       MOV   E,L      ELSE, DE=NEW PGM CTR
01E9 C9                 3440       RET
01EA                    3450 *
01EA                    3460 * GET 2-BYTE ADDR OR COUNT IN BC.
01EA                    3470 *
01EA CD F4 01           3480 GETAD CALL  GETCH
01ED 4F                 3490       MOV   C,A
01EE D8                 3500       RC
01EF CD F4 01           3510       CALL  GETCH
01F2 47                 3520       MOV   B,A
01F3 C9                 3530       RET
01F4
```

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                        3540 *
01F4                    3550 * GET NEXT PROGRAM BYTE IN ACC.
01F4                    3560 * ENTRY: DE = PROGRAM COUNTER
01F4                    3570 *         BC, HL = DON'T CARE
01F4                    3580 * EXIT: BC, HL PRESERVED
01F4                    3590 *   CARRY FLAG OFF = DE INCREMENTED;
01F4                    3600 *      ACC. HAS NEXT PROGRAM BYTE
01F4                    3610 *   CARRY FLAG SET = DE POINTS TO LAST
01F4                    3620 *      BYTE OF PROGRAM; ACC. DESTROYED
01F4                    3630 *
01F4 E5                 3640 GETCH PUSH  H
01F5 2A FA 02           3650       LHLD  FCBEN
01F8 CD 07 02           3660       CALL  ADCMP AT LAST BYTE OF PROGRAM?
01FB E1                 3670       POP   H
01FC D2 03 02           3680       JNC   GETCX   YES
01FF AF                 3690       XRA   A       NO, RE-SET CARRY
0200 13                 3700       INX   D     INCR. PROGRAM COUNTER
0201 1A                 3710       LDAX  D     PROGRAM BYTE TO ACC.
0202 C9                 3720       RET
0203 F6 FF              3730 GETCX ORI   0FFH
0205 37                 3740       STC          SET CARRY FLAG
0206 C9                 3750       RET
0207                    3760 *
0207                    3770 * COMPARE CONTENTS OF D-E WITH CONTENTS OF H-L.
0207                    3780 * RESULT IS SHOWN BY CARRY AND ZERO FLAGS.
0207                    3790 * CARRY FLAG IS SET TO 1 IF H-L > D-E.
0207                    3800 *
0207 7A                 3810 ADCMP MOV   A,D
0208 BC                 3820       CMP   H     D:H
0209 C0                 3830       RNZ
020A 7B                 3840       MOV   A,E
020B BD                 3850       CMP   L     E:L
020C C9                 3860       RET
020D
```

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                        3870 *
020D                    3880 * THIS ROUTINE GETS THE LENGTH OF AN INSTRUC-
020D                    3890 * TION (1, 2, OR 3), OR A VALUE WHICH CORRES-
020D                    3900 * PONDS TO A LOADER CONTROL BYTE.
020D                    3910 * AT ENTRY: OP CODE OR CTL BYTE IN ACCUM.
020D                    3920 *           BC, DE, HL = DON'T CARE.
020D                    3930 * AT EXIT:  ACCUMULATOR HAS A VALUE FROM 1 TO 15.
020D                    3940 *           BC, DE, HL PRESERVED.
020D                    3950 *
020D E5                 3960 OPCTL PUSH  H
020E C5                 3970       PUSH  B
020F 21 2F 02           3980       LXI   H,OPTBL
0212 B7                 3990       ORA   A      RE-SET CARRY
0213 1F                 4000       RAR   ;      A=A/2, CARRY FLAG IS REMAINDER
0214 F5                 4010       PUSH  PSW    SAVE REMAINDER
0215 4F                 4020       MOV   C,A
0216 06 00              4030       MVI   B,0
0218 09                 4040       DAD   B      ADD OFFSET
0219 F1                 4050       POP   PSW    RESTORE CARRY FLAG
021A 7E                 4060       MOV   A,M
021B DA 27 02           4070       JC    OPCT3 CARRY SET=TAKE RIGHT NYBBLE
021E E6 F0              4080       ANI   0F0H    ELSE TAKE LEFT NYBBLE
0220 0F                 4090       RRC
0221 0F                 4100       RRC
0222 0F                 4110       RRC
0223 0F                 4120       RRC
0224 C3 29 02           4130       JMP   OPCTX
0227 E6 0F              4140 OPCT3 ANI   0FH
0229 C1                 4150 OPCTX POP   B
022A E1                 4160       POP   H
022B C9                 4170       RET
022C                    4180 *
022C                    4190 * THIS TABLE HAS ONE NYBBLE FOR EACH OF 256
022C                    4200 * POSSIBLE OP CODES, BEGINNING WITH ZERO AND
022C                    4210 * INCREMENTING THROUGH HEX FF.
022C                    4220 * NOTE - BYTE PAIRS REVERSED DURING ASSEMBLY!
022C                    4230 *
022C 49                 4240       DB    49H   LOADER CONTROL BYTES
022D A6 00              4250       DW    MODEN-OPTBL
022F 13 11              4260 OPTBL DW    01113H   00-03
0231 11 21              4270       DW    02111H   04-07
0233 F1 11              4280       DW    011F1H   08-0B
0235 11 21              4290       DW    02111H   0C-0F
0237 F3 11              4300       DW    011F3H   10-13
0239 11 21              4310       DW    02111H   14-17
023B F1 11              4320       DW    011F1H   18-1B
023D 11 21              4330       DW    02111H   1C-1F
023F F3 31              4340       DW    031F3H   20-23
0241 11 21              4350       DW    02111H   24-27
0243 F1 31              4360       DW    031F1H   28-2B
0245 11 21              4370       DW    02111H   2C-2F
0247 F3 31              4380       DW    031F3H   30-33
0249 11 21              4390       DW    02111H   34-37
024B F1 31              4400       DW    031F1H   38-3B
024D 11 21              4410       DW    02111H   3C-3F
024F
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```
                        4420 *
024F 41 11              4430        DW      01141H      40-43
0251 11 11              4440        DW      01111H      44-47
0253 15 11              4450        DW      01115H      48-4B
0255 11 11              4460        DW      01111H      4C-4F
0257 11 F1              4470        DW      0F111H      50-53
0259 11 11              4480        DW      01111H      54-57
025B 11 1F              4490        DW      01F11H      58-5B
025D 11 11              4500        DW      01111H      5C-5F
025F 11 11              4510        DW      01111H      60-63
0261 D1 11              4520        DW      011D1H      64-67
0263 11 11              4530        DW      01111H      68-6B
0265 1F 11              4540        DW      0111FH      6C-6F
0267 11 11              4550        DW      01111H      70-73
0269 11 11              4560        DW      01111H      74-77
026B 11 11              4570        DW      01111H      78-7B
026D 11 1F              4580        DW      01F11H      7C-7F
026F                    4590 *
026F 11 11              4600        DW      01111H      80-83
0271 11 11              4610        DW      01111H      84-87
0273 11 11              4620        DW      01111H      88-8B
0275 11 11              4630        DW      01111H      8C-8F
0277 11 11              4640        DW      01111H      90-93
0279 11 11              4650        DW      01111H      94-97
027B 11 11              4660        DW      01111H      98-9B
027D 11 11              4670        DW      01111H      9C-9F
027F 11 11              4680        DW      01111H      A0-A3
0281 11 11              4690        DW      01111H      A4-A7
0283 11 11              4700        DW      01111H      A8-AB
0285 11 11              4710        DW      01111H      AC-AF
0287 11 11              4720        DW      01111H      B0-B3
0289 11 11              4730        DW      01111H      B4-B7
028B 11 11              4740        DW      01111H      B8-BB
028D 11 11              4750        DW      01111H      BC-BF
028F                    4760 *
028F 11 33              4770        DW      03311H      C0-C3
0291 31 21              4780        DW      02131H      C4-C7
0293 11 3F              4790        DW      03F11H      C8-CB
0295 33 21              4800        DW      02133H      CC-CF
0297 11 32              4810        DW      03211H      D0-D3
0299 31 21              4820        DW      02131H      D4-D7
029B 1F 32              4830        DW      0321FH      D8-DB
029D 3F 21              4840        DW      0213FH      DC-DF
029F 11 31              4850        DW      03111H      E0-E3
02A1 31 21              4860        DW      02131H      E4-E7
02A3 11 31              4870        DW      03111H      E8-EB
02A5 3F 21              4880        DW      0213FH      EC-EF
02A7 11 31              4890        DW      03111H      F0-F3
02A9 31 21              4900        DW      02131H      F4-F7
02AB 11 31              4910        DW      03111H      F8-FB
02AD 3F 21              4920        DW      0213FH      FC-FF
02AF
```

```
                                4930 *
02AF                            4940 * ENTRY POINT TABLE FOR ESF UTILITY VERSION 3.
02AF                            4950 *
02AF 6D                         4960 SETAD DB    06DH  LOADER CONTROL BYTES
02B0 23 00                      4970       DW    ENTEN-ENTBG
02B2                            4980 *
02B2                            4990 ENTBG EQU   $
02B2 45 43 41 54                5000       ASC   'ECAT '
     20
02B7 08 00 B0                   5010       DW    ECAT
02B9 45 47 45 54                5020       ASC   'EGET '
     20
02BE 0B 00 B0                   5030       DW    EGET
02C0 45 53 41 56                5040       ASC   'ESAV '
     20
02C5 0E 00 B0                   5050       DW    ESAV
02C7 45 43 45 52                5060       ASC   'ECER '
     20
02CC 11 00 B0                   5070       DW    ECER
02CE 45 57 54 50                5080       ASC   'EWTP '
     20
02D3 14 00 B0                   5090       DW    EWTP
02D5                            5100 ENTEN EQU   $
02D5                            5110 MODEN EQU   $
02D5                            5120 *
02D5                            5130 * SYSTEM WORK AREA
02D5                            5140 *
02D5                            5150 RAM   EQU   START+0300H-1 TOP OF WORK AREA
02D5                            5160 MNSTK EQU   RAM-16 TOP OF STACK + 1
02D5                            5170 ERTBG EQU   RAM-16 BEGIN. ADDR OF E.R. TABLE
02D5                            5180 ERTEN EQU   RAM-14 ENDING ADDR OF E.R. TABLE
02D5                            5190 FCB   EQU   RAM-12 FILE CONTROL BLOCK
02D5                            5200 FCBRC EQU   FCB+00 RETURN CODE
02D5                            5210 FCBOP EQU   FCB+01 OPTION CODE
02D5                            5220 FCBFP EQU   FCB+02 FILE POSITION
02D5                            5230 FCBID EQU   FCB+03 FILE ID
02D5                            5240 FCBTY EQU   FCB+04 FILE TYPE
02D5                            5250 FCBBG EQU   FCB+05 BEGIN. ADDR
02D5                            5260 FCBEN EQU   FCB+07 ENDING ADDR
02D5                            5270 FCBAS EQU   FCB+09 AUTOSTART
02D5                            5280 FCBER EQU   FCB+11 DATA ERROR ADDR
02D5
```

```
                        5290 *

ABORT   01D2    1220
ADCMP   0207    1130 2340 2420 2560 3390 3660
ADDBC   01D8    1410 1470 1710 2160
BADSW   01C6    0970
CESFG   006F    1180
CHKSW   000B    0470
CT1D2   00C4    1610
CT23A   0161    2940
CT23B   0176    2690
CT23D   018B    2370 2440
CT23E   018F    2780
CT23F   0198    2650
CT23G   01A0    2590
CTL11   008D    1320
CTL15   009A    1330
CTL1D   00A9    1350
CTL21   01AE    2110 2180 2240 2880
CTL22   01A8    2020
CTL23   0138    2040
CTL24   0129    2060
CTL25   011A    2080
CTL2D   011A    2100
DONE    01B4    2150 2170 2210 2230 2270 3030
ECAT    0008    5010
ECER    0011    5070
EGET    000B    1210 5030
END1A   00E9    1720
END1C   00F0    1480 1660
END1E   00F1    1420 1460 1580
ENTBG   02B2    1070 2480 4970
ENTEN   02D5    1060 2550 4970
ERROR   01CF    3100 3170
ERTBG   02EF    0810 1510 1690 2330
ERTEN   02F1    0760 1730 1840 2400
ESAV    000E    5050
ESFUT   0000
EWTP    0014    5090
FCB     02F3    0630 1190
FCBAS   02FC    0790
FCBBG   02F8    0780 0880 1260 1960 2280 2800 3060
FCBEN   02FA    0750 1830 3370 3650
FCBER   02FE    0800 3190
FCBFP   02F5
FCBID   02F6
FCBOP   02F4
FCBRC   02F3    3200
FCBTY   02F7
FIND    0075
FINDL   007A    1760
```

```
GETAD    01EA      1450 1570 2140 2220 2260
GETCH    01F4      1650 1740 2200 3020 3040 3480 3510
GETCX    0203      3680
HALT     01D5      3230
INCT1    00E2      1640
INCT2    00E4      1360 1560
INFCB    0014      0520
MNSTK    02EF      0610
MODEN    02D5      4250
NEXT1    00D9      1430 1490
OPCT3    0227      4070
OPCTL    020D      1300 2000
OPCTX    0229      4130
OPTBL    022F      3980 4250
PSW      0006      4010 4050
RAM      02FF
RC10     000A      1800
RC11     000B      2990
RC12     000C      1870
RC7      0007      3090
RC8      0008
RC9      0009      3160
RELOC    00F6      1750
RENT     005A      1160
RLOOP    00FB      3050
RSTRT    0004
SAVER    01CB      1810 1880 3000
SETAD    02AF
SP       0006      0610
START    0000
SYMLN    0005      1050 1070 1630 2520 2920
WAIT     0011      0570

FCHK

A      3000  6920
```

```
GET06   00F3    1590
GET07   00F6    1610
GET08   0125    1730 1760
GET09   0145    1960
GETID   00C6    1420
GETTY   009D    1300 1350 1370
INASC   FF3E    0600 1100 1210 2290 2400
INPHX   FE74    1410 2480
INVAS   01F9    2740
MONTR   FC23    1980 2880 3600
MSEND   0400    4240 4600
MSOU2   0272    1040 1060 2040 2060 2860 3540
MSOUT   026F    1470 2520 2540 2910 3440
NOAST   011C    1780
OUTBL   FF15    0760 1830 1890 3020 3140 3240 3300 3390 3590 4150
OUTCH   FFBA    0630 1180 1390 2380 2460 3750
OUTHX   FEE6    3660 3700 3790 3960 3980
OUTNL   FF31    0740 0920 1670 1790 1840 1900 1920 2790 3000 3360 3500
                3580
OUTSP   FF24    3680 3720 3770 3810 3850 3890 3930
PANIC   FF59    0980 3350
PART1   FC00
PART2   0000
RAM     FBFF
RC2     0002    3210
RC5     0005    3190
SAVE    016E    0510
SAVE2   0176    2330 2350
SAVE3   018D    2310
SAVE4   0190    2420 2440
SAVE5   01A3    2490
SAVE6   01D9    2680
SAVE7   01DC    2700
START   0000    0540 0580
SYSMA   0374    1820 2900 4420
SYSMC   0384    3130 4420 4460
SYSMD   039E    1020 2020 2840 3530 4460 4480
SYSME   03A3    3290 4480 4500
SYSMF   03B8    4500 4520
SYSMI   03C8    1450 2500 4520 4540
SYSMO   03D8    2050 4540 4560
SYSMS   03E2    3010 4560 4580
SYSMT   03F3    3380 4580 4600
UTIM1   0313    4090 4250 4280
UTIM2   0326    1050 3230 4280 4300
UTIM3   0335    4300 4320
UTIM4   0342    4320 4340
UTIM5   034F    3430 4340 4360
UTIM6   035F    4360 4380
UTIM7   0373    4380
WAIT    FF01    0730 1630 2750 2990 3490
WTP     025F    0530

FCHK

A     3000  6B62
```