IDENTIFICATION
---------------

PRODUCT CODE:   MAINDEC-8E-D0JB-D

PRODUCT NAME:   RANDOM JMP-JMS TEST

DATE CREATED:   DECEMBER 10, 1970

MAINTAINER:     DIAGNOSTIC GROUP

AUTHOR:         BRUCE HANSEN

1. ABSTRACT
   -------

   THIS IS A DIAGNOSTIC PROGRAM TO TEST THE JMS INSTRUCTION OF THE
   PDP-8E. RANDOM FROM AND TO ADDRESSES ARE SELECTED FOR EACH
   TEST. THE JMP INSTRUCTION IS TESTED IN THAT EACH TEST REQUIRES
   A JMP TO REACH THE JMS.

2. REQUIREMENTS
   ------------

2.1 EQUIPMENT
    ---------

    PDP-8E EQUIPPED WITH TELETYPE.

2.2 STORAGE
    -------

    LOCATIONS 0200-0574

    THE BINARY LOADER MUST BE STORED IN THE LAST MEMORY PAGE.

2.3 PRELIMINARY PROGRAMS
    --------------------

    IT IS ASSUMED THAT MAINDEC-8E-D0AA AND MAINDEC-8E-D0BA HAVE
    BEEN RUN SUCCESSFULLY.

3. LOADING PROCEDURE
   -----------------

3.1 METHOD
    ------

    USE THE STANDARD BINARY LOADER

4. STARTING PROCEDURE
   ------------------

4.1 CONTROL SWITCH SETTINGS
    -----------------------

    SR0(0)   HALT ON ERROR
    SR1(1))  HOLD THE FROM ADDRESS CONSTANT
    SR2(0))  SELECT RANDOM FROM ADDRESSES
    SR3(1))  HOLD THE TO ADDRESS CONSTANT
    SR3(0)   SELECT RANDOM TO ADDRESSES

4.2 STARTING ADDRESS
    ----------------

    0200

    RESTART ADDRESS - 0215

4.3 OPERATOR ACTION
        ---------------

    A.  SET SR TO 0200 AND PRESS LOAD ADDRESS.

    B.  IF IT IS DESIRED TO SET EITHER SR2 OR SR3, THE FROM OR TO
        ADDRESS MAY BE SPECIFIED BY ENTERING THE ADDRESS INTO THE
        LOCATIONS SHOWN BELOW

            FROM = LOCATION 133
            TO   = LOCATION 131

        IF SR2 OR SR3 IS SET AFTER THE PROGRAM HAS BEEN STARTED, THE
        LAST ADDRESS TAKEN FROM THE RANDOM NUMBER GENERATOR IS USED
        REPEATEDLY.

    C.  PRESS CLEAR, AND THEN CONT.

5.  OPERATING PROCEDURE
    -------------------

    SAME AS SECTION 4.

6.  ERRORS
    ------

6.1 ERROR HALTS
    -----------

    ALL UNUSED MEMORY LOCATIONS ARE LOADED WITH HLT INSTRUCTIONS.
    IF THE PROGRAM EXECUTES ONE OF THESE BACKGROUND HLTS, IT IS
    PROBABLE THAT THE INTERRUPT FAILED TO OCCUR FOLLOWING THE JMS
    INSTRUCTION.  THE FROM AND TO ADDRESS MAY BE CHECKED AT ANY
    TIME TO LOCATE THE TEST JMS INSTRUCTIONS.

6.2 ERROR PRINTOUTS
    ---------------

    F XXXX  TO YYYY

    (TO) = MMMM

    (NNNN) = RRRR

6.2.1 EXPLANATION
      -----------

    (FROM) F XXXX:  XXXX = ADDRESS OF JMS INSTRUCTION BEING TESTED.

    (TO) TO YYYY:  YYYY = ADDRESS THAT THE JMS INSTRUCTION IS GOING
    TO.

    (TO) = MMMM: MMMM = THE CONTENTS OF THE ADDRESS TO.  THIS SHOULD
    EQUAL XXXX + 1.

    (NNNN) = RRRR:  NNNN IS THE ADDRESS MINUS ONE THAT WAS STORED IN
    LOCATION 0000 DURING THE INTERRUPT.  RRRR IS THE CONTENT OF
    ADDRESS NNNN.

5.

EXAMPLES
--------

A.  THE FOLLOWING IS A FORCED ERROR PRINTOUT WHERE NO ERROR
    OCCURRED.

        F 5236 TO 6354

        (TO) = 5237

        (6354) = 5237

THE TEST JMS INSTRUCTION WAS IN LOCATION 5236.  THE JMS WAS
TRYING TO JUMP TO LOCATION 6354.  THE CONTENTS OF TO (LOCATION
6354) WAS 5237.  THIS IS CORRECT SINCE THE PC IS STORED ON A
JMS INSTRUCTION.

TO GAIN ANY KNOWLEDGE FROM THE THIRD LINE OF THE PRINTOUT, THE
USER MUST UNDERSTAND THE SEQUENCE OF EVENTS WHEN A JMS INSTRUCTION
IS FOLLOWED BY AN INTERRUPT.  AS AN END RESULT OF THIS SEQUENCE,
THE ADDRESS OF THE LOCATION FOLLOWING THE CELL WHERE THE PC IS
STORED IS PLACED INTO CELL 0.  TO DERIVE THIS THIRD LINE OF THE
PRINTOUT, THE ADDRESS IN CELL 0 IS DECREMENTED BY ONE AND PRINTED
ON THE TELETYPE; THEN THE CONTENTS OF THAT ADDRESS ARE PRINTED.

B.  THE FOLLOWING IS A TYPICAL ERROR PRINTOUT.

        F 5236 TO 6354

        (TO) = 7402

        (4354) = 5237

LINE 1 IS AGAIN SIMPLY A STATEMENT OF THE PROBLEM.  LINE 2 SAYS
THAT THE CONTENTS OF LOCATION 6354 ARE NOT 5237 AS THEY SHOULD
BE, BUT ARE 7402 INSTEAD.  7402 IS A HLT INSTRUCTION.  SINCE
MEMORY IS FILLED WITH A BACKGROUND OF HLT ORDERS, IT IS EVIDENT
THAT THE PC WAS NOT STORED IN LOCATION 6354 DURING THE JMS.

LINE 3 OF THE PRINTOUT REVEALS WHERE THE PC WAS STORED.  SINCE
ON THE INTERRUPT 4355 WAS STORED IN LOCATION ZERO AND (4354)
CONTAINS THE CORRECTLY STORED PC, 5237, IT IS APPARENT THAT A
JUMP ERROR OCCURRED.  THE JMS INSTRUCTION SHOULD HAVE JUMPED TO
6354, BUT IT ACTUALLY JUMPED TO 4354.  BIT 1 WAS LOST.

C. THE FOLLOWING IS ANOTHER TYPICAL ERROR PRINTOUT.

    F 5236 TO 6354

    (TO) = 7237

    (6354) = 7237

LINE 1 IS AGAIN SIMPLY A STATEMENT OF THE PROBLEM.  LINE 2 SAYS
THAT THE CONTENTS OF LOCATION 6354 ARE NOT 5237 AS EXPECTED, BUT
ARE INSTEAD 7237.  SINCE THE CONTENTS ARE NOT A HLT ORDER, 7402,
IT IS EVEDENT THAT THE PC WAS STORED HERE, BUT THE NUMBER
STORED WAS WRONG.  COMPARING THE GOOD (5237), AND THE BAD (7237),
IT IS APPARENT THAT BIT 1 WAS "PICKED UP" DURING THE STORE PC
OPERATION OF THE JMS INSTRUCTION.

ERROR RECOVERY
----- --------

THE PROGRAM CONTINUES TESTING FOLLOWING AN ERROR PRINTOUT.  WHEN
ENOUGH INFORMATION HAS BEEN GATHERED FROM THE ERROR PRINTOUS, A
FROM AND TO ADDRESS IS SELECTED FOR USE IN THE SCOPE MODE LOOP.
ENTER THE CHOSEN ADDRESSES INTO PROPER LOCATIONS (SEE SECTION
4.3.B).  ENTER 5534 INTO LOCATION 1 AND RESTART THE PROGRAM WITH
SR2 AND SR3 SET.

THE SCOPE MODE LOOP IS:

        LOCATION          CODING

        0000
        0001              JMP 1 FROM1

        XXXX              A, ION

        XXXX              JMS 1 TO

        0134              FROM 1 A

TO DISCONTINUE THE SCOPE MODE LOOP, RESTORE THE ORIGINAL CONTENTS
(7200) OF LOCATION 1 AND RESTART.

7.  RESTRICTIONS
    ------------

    (NONE)

8.  MISCELLANEOUS
    -------------

6.3

8.1 EXECUTION TIME
    --------- ----

    4,726 RANDOM TESTS/SECOND

9.  PROGRAM DESCRIPTION
    ------- -----------

    THE JMS INSTRUCTION IS CHECKED THROUGH USE OF THE INTERRUPT
    FUNCTION.  A RANDOM NUMBER GENERATOR SELECTS A FROM AND A TO
    ADDRESS.  AN ION INSTRUCTION IS THEN PLACED AT FROM -1 AND THE
    JMS INSTRUCTION AT FROM.  THE PROGRAM JUMPS TO THE ADDRESS
    SPECIFIED BY TO.  AFTER EXECUTING THE ION AND JMS INSTRUCTIONS,
    AN INTERRUPT OCCURS STARTING THE PROGRAM COUNTER AT LOCATION 1.
    A CHECKING ROUTINE LOCATED HERE VERIFIES THAT THE OPERATION WAS
    SUCCESSFUL BEFORE STARTING THE NEXT TEST.

    RANDOM ADDRESSES ARE RESTRICTED AS FOLLOWS:  Ø6ØØ<RANDOM A
    ADDRESS8<76ØØ

    THE AREA BETWEEN Ø6ØØ AND 76ØØ IS FILLED WITH HLT INSTRUCTIONS
    IN CASE THE INTERRUPT FAILS.

    "JB" IS PRINTED AFTER EVERY 61,ØØØ TESTS.

```
                    /RANDOM JMP-JMS TEST
                    /SR0(0)=HALT ON ERROR
                    /SR2(1)=FIXED FROM
                    /SR3(1)=FIXED TO
                    /SPREAD HALTS THROUGH MEMORY
                    /BETWEEN THE LIMLO AND LIMHI
                    /LIMITS

0200                *200

0200  4157  BEGIN,  JMS PATCH      /CLA
0201  1140          TAD LIMLO
0202  7041          CIA
0203  3131          DCA TO
0204  1155  GON,    TAD HALT
0205  3531          DCA I TO
0206  1131          TAD TO
0207  7001          IAC
0210  3131          DCA TO
0211  1131          TAD TO
0212  1141          TAD LIMHI
0213  7640          SZA CLA
0214  5204          JMP GON
0215  1045          TAD M15
0216  3044          DCA CT1
0217  3043          DCA CT

                    /CHECK FOR FIXED FROM
0220  7604  LOOP,   LAS
0221  7004          RAL
0222  7006          RTL
0223  7630          SZL CLA
0224  5246          JMP LOOP1-6

                    /GET RANDOM FROM
0225  1136  GETRAN, TAD RANUM
0226  7104          RAL CLL
0227  7430          SZL
0230  1137          TAD THREE
0231  3136          DCA RANUM
0232  1136          TAD RANUM
0233  7510          SPA
0234  5241          JMP .+5
0235  1140          TAD LIMLO
0236  7710          SPA CLA
0237  5225          JMP GETRAN
0240  5244          JMP .+4
0241  1141          TAD LIMHI
0242  7700          SMA CLA
0243  5225          JMP GETRAN

0244  1136          TAD RANUM
```

```
0245 3133        DCA FROM
0246 1133        TAD FROM
0247 7001        IAC
0250 3135        DCA FRMP1
0251 7040        CMA
0252 1133        TAD FROM
0253 3134        DCA FROM1

                 /CHECK FOR FIXED TO

0254 7604 LOOP1, LAS
0255 7006        RTL
0256 7006        RTL
0257 7630        SZL CLA
0260 5302        JMP CRSCK-3

                 /GET RANDOM TO

0261 1136 GTRAN1, TAD RANUM
0262 7104        RAL CLL
0263 7430        SZL
0264 1137        TAD THREE
0265 3136        DCA RANUM
0266 1136        TAD RANUM
0267 7510        SPA
0270 5275        JMP .+5
0271 1140        TAD LIMLO
0272 7710        SPA CLA
0273 5261        JMP GTRAN1
0274 5300        JMP .+4
0275 1141        TAD LIMHI
0276 7700        SMA CLA
0277 5261        JMP GTRAN1
0300 1136        TAD RANUM
0301 3131        DCA TO
0302 1131        TAD TO
0303 7001        IAC
0304 3132        DCA TOP1
0305 1133 CRSCK, TAD FROM
0306 7041        CIA
0307 1131        TAD TO
0310 7650        SNA CLA
0311 5220        JMP LOOP

                 /BRING UP THE FLAG

0312 7040        CMA
0313 6041        TSF
0314 6046        TLS
0315 6041        TSF
0316 5315        JMP .-1

                 /PLACE THE INSTRUCTIONS
```

```
0317   7200           CLA
0320   1142           TAD ITON
0321   3534           DCA I FROM1
0322   1156           TAD JMP1
0323   3533           DCA I FROM
0324   3000           DCA 0

                /GO DO IT
0325   5534           JMP I FROM1
0326   7402           HLT

                /PRINTOUT SUBROUTINE
0327   0000   TYPAC,  0
0330   3146           DCA SAVE+3
0331   1146           TAD SAVE+3
0332   7012           RTR
0333   7010           RAR
0334   3145           DCA SAVE+2
0335   1145           TAD SAVE+2
0336   7012           RTR
0337   7010           RAR
0340   3144           DCA SAVE+1
0341   1144           TAD SAVE+1
0342   7012           RTR
0343   7010           RAR
0344   3143           DCA SAVE
0345   5727           JMP I TYPAC

                /SUCCESS PRINTOUT
0346   1044   SUP,    TAD CT1
0347   7001           IAC
0350   3044           DCA CT1
0351   1044           TAD CT1
0352   7640           SZA CLA
0353   5442           JMP I ALOOP
0354   1373           TAD AMSG2
0355   3127           DCA WORK
0356   1127   LP1,    TAD WORK
0357   7001           IAC
0360   3127           DCA WORK
0361   1527           TAD I WORK
0362   6046           TLS
0363   6041           TSF
0364   5363           JMP .-1
0365   1046           TAD M302
0366   7640           SZA CLA
0367   5356           JMP LP1
0370   1045           TAD M15
0371   3044           DCA CT1
0372   5442           JMP I ALOOP
```

```
0373  0373    AMSG2,  .
0374  0215            215             /CR
0375  0212            212             /LF
0376  0312            312             /J
0377  0302            302             /B

0000  0000    *0
0001  0001            JMP 1           /FOR SCOPE MODE INSERT
0002  0002            2               /JMP I FROM 1 (5534) IN LOC1
0003  0003            3               /GET STORED ADDRESS
0004  0000            0
0005  0000            0
0006  7041            CIA
0007  1135            TAD FRMP1
0010  7640            SZA CLA
0011  5551            JMP I AER       /ADDRESS STORED IN (TO) WRONG
0012  1132            TAD TOP1
0013  7041            CIA
0014  1000            TAD 0
0015  7640            SZA CLA
0016  5551            JMP I AER       /ADDRESS STORED IN (0) WRONG
0017  1155    RETURN, TAD HALT
0020  3533            DCA I FROM
0021  1155            TAD HALT
0022  3531            DCA I TO
0023  7040            CMA
0024  1000            TAD 0
0025  3000            DCA 0
0026  1155            TAD HALT
0027  3400            DCA I 0
0030  1155            TAD HALT
0031  3534            DCA I FROM1
0032  7001            IAC
0033  1043            TAD CT
0034  3043            DCA CT
0035  1043            TAD CT
0036  7640            SZA CLA
0037  5442            JMP I ALOOP
0040  5441            JMP I .+1
0041  0346            SUP

0042  0220    ALOOP,  LOOP
0043  0000    CT,     0
0044  0000    CT1,    0
0045  7763    M15,    -15
0046  7476    M302,   -302

0047  0215    MSG1,   215             /CR
0050  0212            212             /LF
0051  0212            212             /LF
0052  0306            306             /F = FROM
0053  0240            240             /SPACE
0054  0000    INS1,   0               /X ADDRESS OF JMS INSTRUCTION
```

```
0055   0000   INS2,    0        /X
0056   0000   INS3,    0        /X
0057   0000   INS4,    0        /X
0060   0240            240      /SPACE
0061   0324            324      /T
0062   0317            317      /O
0063   0240            240      /SPACE
0064   0000   INS5,    0        /X
0065   0000   INS6,    0        /X
0066   0000   INS7,    0        /X
0067   0000   INS8,    0        /X
0070   0215            215      /CR
0071   0212            212      /LF
0072   0377            377      /RUBOUT
0073   0250            250      /(
0074   0324   MSG2,    324      /T
0075   0317            317      /O
0076   0251            251      /)
0077   0240            240      /SPACE
0100   0275            275      /=
0101   0240            240      /SPACE
0102   0000   INS9,    0        /X  STORED ADDRESS
0103   0000   INS10,   0        /X  S/B FRMP1
0104   0000   INS11,   0        /X
0105   0000   INS12,   0        /X
0106   0215            215      /CR
0107   0212            212      /LF
0110   0377            377      /RUBOUT
0111   0250            250      /(
0112   0000   MSG3,    0        /X  ADDRESS-1 STORED
0113   0000   INS13,   0        /X  IN LOC 0 AT INTERRUPT
0114   0000   INS14,   0        /X
0115   0000   INS15,   0        /X
0116   0251            251      /)
0117   0240            240      /SPACE
0120   0275            275      /=
0121   0240            240      /SPACE
0122   0000   INS16,   0        /X  CONTENTS OF ABOVE
0123   0000   INS17,   0        /X  ADDRESS
0124   0000   INS18,   0        /X
0125   0000   INS19,   0        /X
0126   0207   WORK,    207      /END MARK
0127   0000   M207,    0
0130   7571            -207

              /CONSTANTS

0131   0000   TO,      0
0132   0000   TOP1,    0
0133   0000   FROM,    0
0134   0000   FROM1,   0
0135   0000   FRMP1,   0
0136   2525   RANUM,   2525
0137   0003   THREE,   3
```

```
0140  7200  LIMLO,  -600
0141  0200  LIMHI,  -7600
0142  6001  ITON,   ION
0143  0000  SAVE,   0
0144  0000          0
0145  0000          0
0146  0000          0
0147  0007  MSK7,   7
0150  0260  TW6,    260
0151  0400  AER,    ER
0152  0327  ATYP,   TYPAC
0153  0330  ATYP1,  TYPAC+1

0154  0047  AMSG1,  MSG1

0155  7402  HALT,   HLT
0156  4531  JMP1,   JMS I TO

0157  0000  PATCH,  0          /RESTORE THEN GO AWAY
0160  3000          DCA 0
0161  1172          TAD X1
0162  3001          DCA 1
0163  1173          TAD X2
0164  3002          DCA 2
0165  1174          TAD X3
0166  3003          DCA 3
0167  1175          TAD X4
0170  3576          DCA I X5
0171  5557          JMP I PATCH

0172  7200  X1,     CLA
0173  1531  X2,     TAD I TO
0174  5006  X3,     JMP 6
0175  7200  X4,     CLA
0176  0200  X5,     200

0400          *400

0400  1204  ER,     TAD .+4
0401  3552          DCA I ATYP
0402  1133          TAD FROM
0403  5553          JMP I ATYP1          /TAD I TO
0404  0405          .+1
0405  1143          TAD SAVE
0406  0147          AND MSK7
0407  1150          TAD TW6
0410  3054          DCA INS1
0411  1144          TAD SAVE+1
0412  0147          AND MSK7
0413  1150          TAD TW6
0414  3055          DCA INS2
0415  1145          TAD SAVE+2
0416  0147          AND MSK7
```

```
0417  1150    TAD TW6
0420  3056    DCA INS3
0421  1146    TAD SAVE+3
0422  0147    AND MSK7
0423  1150    TAD TW6
0424  3057    DCA INS4

0425  1231    TAD .+4
0426  3552    DCA I ATYP
0427  1131    TAD TO
0430  5553    JMP I ATYP1
0431  0432    .+1
0432  1143    TAD SAVE
0433  0147    AND MSK7
0434  1150    TAD TW6
0435  3064    DCA INS5
0436  1144    TAD SAVE+1
0437  0147    AND MSK7
0440  1150    TAD TW6
0441  3065    DCA INS6
0442  1145    TAD SAVE+2
0443  0147    AND MSK7
0444  1150    TAD TW6
0445  3066    DCA INS7
0446  1146    TAD SAVE+3
0447  0147    AND MSK7
0450  1150    TAD TW6
0451  3067    DCA INS8
0452  1256    TAD .+4
0453  3552    DCA I ATYP
0454  1531    TAD I TO
0455  5553    JMP I ATYP1
0456  0457    .+1

0457  1143    TAD SAVE
0460  0147    AND MSK7
0461  1150    TAD TW6
0462  3102    DCA INS9
0463  1144    TAD SAVE+1
0464  0147    AND MSK7
0465  1150    TAD TW6
0466  3103    DCA INS10
0467  1145    TAD SAVE+2
0470  0147    AND MSK7
0471  1150    TAD TW6
0472  3104    DCA INS11
0473  1146    TAD SAVE+3
0474  0147    AND MSK7
0475  1150    TAD TW6
0476  3105    DCA INS12
0477  7040    CMA
0500  1000    TAD 0
0501  3000    DCA 0

0502  1306    TAD .+4
```

```
0503   3552        DCA I ATYP
0504   1000        TAD Ø ATYP1
0505   5553        JMP I ATYP1
0506   0507        .+1
0507   1143        TAD SAVE
0510   0147        AND MSK7
0511   1150        TAD TW6
0512   3112        DCA MSG3
0513   1144        TAD SAVE+1
0514   0147        AND MSK7
0515   1150        TAD TW6
0516   3113        DCA INS13
0517   1145        TAD SAVE+2
0520   0147        AND MSK7
0521   1150        TAD TW6
0522   3114        DCA INS14
0523   1146        TAD SAVE+3
0524   0147        AND MSK7
0525   1150        TAD TW6
0526   3115        DCA INS15
0527   1333        TAD .+4
0530   3552        DCA I ATYP
0531   1400        TAD I Ø
0532   5553        JMP I ATYP1
0533   0534        .+1
0534   1143        TAD SAVE
0535   0147        AND MSK7
0536   1150        TAD TW6
0537   3122        DCA INS16
0540   1144        TAD SAVE+1
0541   0147        AND MSK7
0542   1150        TAD TW6
0543   3123        DCA INS17
0544   1145        TAD SAVE+2
0545   0147        AND MSK7
0546   1150        TAD TW6
0547   3124        DCA INS18
0550   1146        TAD SAVE+3
0551   0147        AND MSK7
0552   1150        TAD TW6
0553   3125        DCA INS19

0554   1154   TYPE,   TAD AMSG1
0555   3127        DCA WORK
0556   1527        TAD I WORK
0557   6046        TLS
0560   6041        TSF
0561   5360        JMP .-1
0562   7201        CLA IAC
0563   1127        TAD WORK
0564   3127        DCA WORK
0565   1527        TAD I WORK
0566   1130        TAD M207
0567   7640        SZA CLA
```

```
0570   9356        JMP TYPE
0571   7604        LAS
0572   7700        8MA CLA
0573   7402        HLT          /HALT ON ERROR
0574   5017        JMP RETURN
```

S

```
0000    11111111    11111111    11111111    11111111    11111111    11111111    11111111
0100    11111111    11111111    11111111    11111111    11111111    11111111    11111111

2200    11111111    11111111    11111111    11111111    11111111    11111111    11111111
2300    11111111    11111111    11111111    11111111    11111111    11111111    11111111

0400    11111111    11111111    11111111    11111111    11111111    11111111    11111111
0500    11111111    11111111    11111111    11111111    11111111    11111111    11111000

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700
```

```
4000
4100

4200
4300

4400
4500

4600
4700

5000
5100

5200
5300

5400
5500

5600
5700

6000
6100

6200
6300

6400
6500

6600
6700

7000
7100

7200
7300

7400
7500

7600
7700
```

| Symbol | Address | | Symbol | Address |
|--------|---------|--|--------|---------|
| A      | 0151 | | RANUM  | 0136 |
| AL..   | 0042 | | RETURN | 0017 |
| AMSG1  | 0154 | | SAVE   | 0143 |
| AMSG2  | 0373 | | SUP    | 0346 |
| ATYP   | 0152 | | THREE  | 0137 |
| ATYP1  | 0153 | | TO     | 0131 |
| BEGIN  | 0200 | | TOP1   | 0132 |
| CRSCK  | 0305 | | TW6    | 0150 |
| CT     | 0043 | | TYPAC  | 0327 |
| CT1    | 0244 | | TYPE   | 0556 |
| ER     | 0400 | | WORK   | 0127 |
| FRMP1  | 0135 | | X1     | 0172 |
| FROM   | 0133 | | X2     | 0173 |
| FROM1  | 0134 | | X3     | 0174 |
| GETRAN | 0225 | | X4     | 0175 |
| GON    | 0204 | | X5     | 0176 |
| GTRAN1 | 0261 | |        |      |
| HALT   | 0155 | |        |      |
| INS1   | 0054 | |        |      |
| INS10  | 0103 | |        |      |
| INS11  | 0104 | |        |      |
| INS12  | 0105 | |        |      |
| INS13  | 0113 | |        |      |
| INS14  | 0114 | |        |      |
| INS15  | 0115 | |        |      |
| INS16  | 0122 | |        |      |
| INS17  | 0123 | |        |      |
| INS18  | 0124 | |        |      |
| INS19  | 0125 | |        |      |
| INS2   | 0055 | |        |      |
| INS3   | 0056 | |        |      |
| INS4   | 0057 | |        |      |
| INS5   | 0064 | |        |      |
| INS6   | 0065 | |        |      |
| INS7   | 0066 | |        |      |
| INS8   | 0067 | |        |      |
| INS9   | 0102 | |        |      |
| ITON   | 0142 | |        |      |
| JMP1   | 0156 | |        |      |
| LIMHI  | 0141 | |        |      |
| LIMLO  | 0140 | |        |      |
| LOOP   | 0220 | |        |      |
| LOOP1  | 0254 | |        |      |
| LP1    | 0356 | |        |      |
| M15    | 0045 | |        |      |
| M207   | 0130 | |        |      |
| M302   | 0046 | |        |      |
| MSG1   | 0047 | |        |      |
| MSG2   | 0074 | |        |      |
| MSG3   | 0112 | |        |      |
| MSK7   | 0147 | |        |      |
| PATCH  | 0157 | |        |      |