IDENTIFICATION

Product Code: MAINDEC-08-DO7B-D

Product Name: Random ISZ Test

Date Created: March 25, 1968

Maintainer: Diagnostic Group

Author: R. Green

1. ABSTRACT

This program is written to test the ISZ instruction of the PDP-8. An ISZ instruction is placed in a FROM location, and a TO location contains the OPERAND. Part 1 of the program selects FROM, TO, and OPERAND from a random number generator, with the option of holding any or all constant. Part 2 uses a fixed set of FROM, TO, and OPERAND numbers.

2. REQUIREMENTS

2.1 Equipment

One PDP-8 equipped with Teletype.

2.2 Storage

This program uses locations $0000 - 7600_8$. The Binary Loader must be stored in the last memory page.

2.3 Preliminary Programs

MAINDEC-08-D01(n), MAINDEC-08-D02(n), and MAINDEC-08-D03(n)

3. LOADING PROCEDURE

The standard Binary Loader is used.

4. STARTING PROCEDURE

4.1 Switch Settings

SR0 = Halt on error   N/

SR1 = Eliminate error printouts N/

SR3 = Fixed FROMS (1)
      Random FROMS (0) Y

SR4 = Fixed TOS (1)
      Random TOS (0) Y

SR5 = Fixed OPERAND (1)
      Random OPERAND (0)

SR9 = Do one ISZ only

SR11= Do part 2 (1)→SR3, 4, 5 must be 0s.
      Do part 1 (0)

1

4.2　　Starting Address

37

4.3　　Operator Action

a.　Set SR (SWITCH REGISTER) to 0037 and press LOAD ADDRESS.

b.　Set SR to desired mode of operation; for most runs, SR9 = 1 allows the most testing in the least amount of time.

For fixed FROM, TO, or OPERAND usage, the fixed number may be selected and entered into the memory locations shown below:

FROM　　　= 0002

TO　　　　= 0020

OPERAND = 0021

c.　Push START.

5.　　OPERATING PROCEDURE

Same as paragraph 4.

6.　　ERRORS

6.1　　Error Halts and Description

C (PC)	Cause
0002	Peripheral interrupt
0254	Halt on error. SR0 = 1

6.2　　Error Printouts

F　xxxx　　T　yyyy

0　ZZZZ　F　mmmm　R　nnnn　NS

6.2.1　　Printout Explanation

(FROM)	F xxxx	– The ISZ instruction in location xxxx failed.
(TO)	T yyyy	– The operand address of the ISZ instruction was yyyy.
(OPERAND)	0 ZZZZ	– The starting count in the ISZ loop was ZZZZ.
(FAILED)	F mmmm	– The failure occurred trying to ISZ the number mmmm.
(RESULT)	R nnnn	– The result of this ISZ was nnnn.
	NS	– No skip occurred.
	S,	– Indicates a skip.

2

6.2.2   Examples

    a.   The following is a typical error printout.

        F 3003 T 5470

        0 3705 F 4777 R 5000 S

        Line 1 of the printout is a statement of the problem. It says that located at 3003
    is an ISZ instruction incrementing an operand stored in location 5470.

        Line 2 of the printout gives information for error analysis. 3705 was the initial
    operand, 4777 was the operand being incremented when the error occurred, and 5000
    is the operand following the failing increment. The S indicates that the increment
    resulted in a skip. The error here is obviously that the skip should not have occurred.

    b.   The following is another typical error printout.

        F 3003 T 5470

        0 3705 F 4777 R 5020 NS

        This is identical to example (a) except that a different type error has occurred. The
    result of incrementing 4777 should be 5000, not 5020.

6.3   Error Recovery

    The program continues on, following an error printout unless SR0 = 1. After a halt on error,
push CONTINUE to resume testing.

    When errors exist, a failing condition chosen from those typed out must be used with the scope
mode. For the scope mode, perform the following steps:

    a.   Stop the program.

    b.   Insert chosen FROM into location 0002.

    c.   Insert chosen TO into location 0020

    d.   Insert chosen failing OPERAND into location 0021

    e.   Restart program with control switches 1, 3, 4, 5, and 9 set to 1.

    NOTE: By setting SR0 the program halts following the error printout.
The operator may at this time set switches 1, 3, 4, 5 and 9 and push CONTINUE.
The program enters a scope mode using the failing conditions just printed.

7.   RESTRICTIONS

7.1   Starting Restrictions

    None

7.2   Operating Restrictions

The interrupt is enabled during program operation. Any attached device, which might cause spurious interrupts, must be disabled.

8.   MISCELLANEOUS

8.1   Execution Time

SR9 = 0. 11,000 ISZ operations/second.

SR9 = 1. 3,500 ISZ operations/second

9.   PROGRAM DESCRIPTION

The test loop is shown below:

```
         ┌──────────────────────────────┐
         │                              │
    ┌────▼─────────┐          ┌──────────┴──────┐
    │   JMP FROM   │          │  SET UP NEXT TEST │
    └────┬─────────┘          └─────────▲────────┘
         │                              │
         │                         NO ERROR
FROM ┌───▼──────┐                       │
     │  ISZ TO  │               ┌───────┴──────┐
     ├──────────┤               │    CHECK     │
     │  JMP B   │──────────────►│  ISZ RESULTS │
     ├──────────┤            ┌─►│              │
     │  JMP C   │────────────┘  └──────┬───────┘
     └──────────┘                      │
                                     ERROR
  TO ┌──────────┐                      │
     │ OPERAND  │                      ▼
     └──────────┘
```
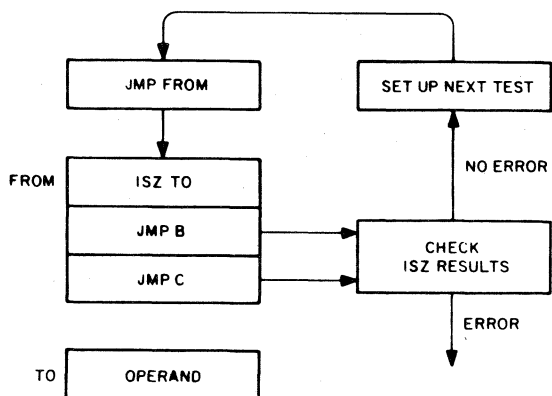
Part 1 of the program uses a random number generator to select the FROM, TO, and OPERAND numbers. Once selected, the OPERAND is incremented until it reaches zero. Each ISZ is checked by duplicating ISZ with TAD, IAC, DCA. Each iteration is also checked for the proper skip or no-skip condition.

Part 2 of the program is actually part 1, with the random number generator replaced by a fixed number generator. Sequencing of events is as follows, (note: 621_8 <MEMORY TEST AREA< 7600_8):

a.   FROM = 621 TO = 624 Test a set of 24 selected OPERANDS.

To save time it is suggested that SR9 = 1, so that the ISZ is performed on each OPERAND only once instead of incrementing it until the ISZ instruction skips.

b.   FROM = 621 TO = 625 Repeat the set of OPERANDS used in (a) above.

This sequence continues until TO reaches the upper limit of the memory test area. FROM is then incremented by 1 and the process is repeated. When FROM reaches the upper limit of the memory test area, the test is complete.

Ideally, it is desirable to ISZ every location from every other location in the test area and, in doing so, use all 24 of the selected worst case operands for each set of addresses. This is what Part 2 does, but it takes many days to complete the test. It is for this reason that the program uses the random number generator system of Part 1. Part 2 is an additional feature of the program with very limited use.

A 07 is printed after each group of 32,000 tests.

```
                              /PDP-8S ISZ TEST
                              /
                              /CONSTANTS AND VARIABLES
            0000              *0
0000  0000                        0
0001  5001                        JMP 1              /PERIPHERAL INTERRUPT
0002  0002              FRMLOC,   2                  /ISZ TEST INSTRUCTION LOCATION
0003  0003              LIMLO,    3                  /LOW LIMIT TEST AREA
0004  0200              LIMHI,    -7600              /HIGH LIMIT TEST AREA
0005  0547              ASUC,     SUC
0006  7771              M7,       -7
0007  0007              MSK7,     0007               /OCTAL CONVERSION MASK
0010  0000              WORK,     0                  /IR0
0011  0000              WORK1,    0                  /IR1
0012  7401              M377,     -377
0013  3607              NUM,      3607               /THE RANDOM NUMBER LOCATION
0014  0003              THREE,    3

0015  2420              ISZ1,     ISZ I TOLOC        /MOVING ISZ
0016  5115              JMP1,     JMP BACK                 /TEST INSTRUCTION
0017  5140              JMP2,     JMP BAKBRN         /GROUP,
0020  0000              TOLOC,    0                  /LOCATION TO BE ISZ'D
0021  0000              PATRN,    0                  /STARTING ISZ PATTERN
0022  0000              BEFOR,    0                  /FAILING PATTERN BEFORE FAILING ISZ
0023  0000              AFTER,    0                  /PREDICTED RESULTS OF EACH ISZ
0024  0004              K4,       4                  /SWITCH REGISTER MASKS
0025  0400              K0400,    0400
0026  0200              K0200,    0200
0027  0100              K0100,    0100
0030  0000              NOTE,     0                  //'S=ERROR WITH NO SKIP
0031  0260              PRINT,    INF1-1             /0'S=ERROR WITH SKIP
0032  0200              AERR1,    ERR1
0033  0205              AERR2,    ERR2
0034  0413              APDR,     PDR
0035  1013              ITADNM,   TAD NUM
0036  0600              ATFCLF,   TFCLF
```

```
                        /SR0=HALT AFTER ERROR PRINTOUT
                        /SR1=NO PRINTOUTS
                        /SR3 = HOLD FROM CONSTANT
                        /SR4 = HOLD TO CONSTANT
                        /SR5 = HOLD PATTERN CONSTANT
                        /SR9 = DO ONE ISZ ONLY
                        /SR11 = DO PART 2
                        /
                        /

                        /PROGRAM START
0037   4440             START,  JMS I  ,+1        /ION
0040   0614                     PATCH             /LAS
0041   0014                     AND THREE
0042   7640                     SZA CLA           /SKIP IF PART 1
0043   5425                     JMP I K0400       /GO TO PART 2
0044   1035                     TAD ITAUNM
0045   3164                     DCA RANUM+1
                                /CHECK FOR FIXED PATTERN
0046   7604             CHEK1,  LAS
0047   0027                     AND K0100
0050   7440                     SZA
0051   5054                     JMP CHEK2
```

```
                                    /SELECT THE PATTERN
0052  4163          SELPAT,   JMS RANUM
0053  3021                    DCA PATRN

                                    /CHECK FOR FIXED TO
0054  7604          CHEK2,    LAS
0055  0026                    AND K0200
0056  7640                    SZA CLA
0057  5064                    JMP CHEK3

                                    /SELECT THE TO LOCATION
0060  4163          SELTO,    JMS RANUM
0061  3020                    DCA TOLOC
0062  1020                    TAD TOLOC
0063  4150                    JMS LIMTST

                                    /CHECK FOR FIXED FROM
0064  7604          CHEK3,    LAS
0065  0025                    AND K0400
0066  7640                    SZA CLA
0067  5074                    JMP PLCINT

                                    /SELECT THE FROM LOCATION
0070  4163          SELFRM,   JMS RANUM
0071  3002                    DCA FRMLOC
0072  1002                    TAD FRMLOC
0073  4150                    JMS LIMTST

                                    /PLACE FROM INSTRUCTIONS
0074  7240          PLCINT,       CLA CMA
0075  1002                    TAD FRMLOC
0076  3010                    DCA WORK
0077  1015                    TAD ISZ1
0100  3410                    DCA I WORK
0101  1016                    TAD JMP1
0102  3410                    DCA I WORK
0103  1017                    TAD JMP2
0104  3410                    DCA I WORK
```

```
                                    /DEPOSIT PATTERN IN TO LOCATION
0105  1021                TAD PATRN
0106  3420                DCA I TOLOC

                                    /STORE PREDICTED ISZ RESULT
0107  1021                TAD PATRN
0110  3022                DCA BEFOR
0111  1022       LUP1,    TAD BEFOR
0112  7001                IAC
0113  3023                DCA AFTER
0114  5405                JMP I ASUC

                                    /RETURN FOR NO SKIP CONDITION
0115  7604       BACK,    LAS
0116  7004                RAL
0117  7710                SPA CLA
0120  5131                JMP LAS1
0121  1420                TAD I TOLOC
0122  7041                CIA
0123  1023                TAD AFTER
0124  7640                SZA CLA
0125  5432                JMP I AERR1     /ERROR IN ISZ OPERATION
0126  1420                TAD I TOLOC
0127  7650                SNA CLA
0130  5432                JMP I AERR1     /ERROR IN ISZ SKIP DETECTION
0131  7604       LAS1,    LAS
0132  0024                AND K4
0133  7440                SZA            /SKIP IF NOT ONE ISZ (SR9)
0134  5046                JMP CHEK1
0135  7001                IAC
0136  1022                TAD BEFOR
0137  5110                JMP LUP1=1

                                    /RETURN FOR SKIP CONDITION
0140  7604       BAKBRN,  LAS
0141  7004                RAL
0142  7710                SPA CLA
0143  5046                JMP CHEK1
0144  1420                TAD I TOLOC
0145  7640                SZA CLA        /SKIP IF TO LOCATION OK
0146  5433                JMP I AERR2     /ERROR IN ISZ LOCATION
0147  5046                JMP CHEK1

                 /TEST HIGH-LOW LIMITS

0150  0000       LIMTST,  0
0151  7510                SPA
0152  5157                JMP .+5
0153  1003                TAD LIMLO
0154  7700                SMA CLA
0155  5550                JMP I LIMTST
0156  5164                JMP RANUM+1
0157  1004                TAD LIMHI
0160  7700                SMA CLA
```

```
0161  5164                    JMP RANUM+1
0162  5550                    JMP I LIMTST
```

```
                                    /RANDOM NUMBER GENERATOR
0163  0000            RANUM,   0
0164  1013                     TAD NUM
0165  7104                     RAL CLL
0166  7430                     SZL
0167  1014                     TAD THREE
0170  3013                     DCA NUM
0171  1013                     TAD NUM          /AC=NEW RANDOM NUMBER
0172  5563                     JMP I RANUM

0173  0333            A1,      SKPDAT
0174  0334            A2,      SKPDAT+1
0175  1000            K1000,   1000
0176  0000            KP,      0
0177  0000            CT,      0
```

```
        0203              *200
                                  /ERROR ROUTINE 1
0200    1341      ERR1,    TAD SKPDAT+6
0201    3333               DCA SKPDAT
0202    7040               CMA
0203    3030               DCA NOTE
0204    5207               JMP KPGO

                                  /ERROR ROUTINE 2
0205    1332      ERR2,    TAD SKPDAT-1
0206    3333               DCA SKPDAT
0207    1342      KPGO,    TAD SKPDAT+7
0210    3334               DCA SKPDAT+1
0211    1002               TAD FRMLOC
0212    3010               DCA WORK
0213    1371               TAD A3
0214    4343               JMS SETUP

0215    1020               TAD TOLOC
0216    3010               DCA WORK
0217    1372               TAD A4
0220    4343               JMS SETUP

0221    1021               TAD PATRN
0222    3010               DCA WORK
0223    1373               TAD A5
0224    4343               JMS SETUP
0225    1022               TAD BEFOR
0226    3010               DCA WORK
0227    1374               TAD A6
0230    4343               JMS SETUP

0231    1420               TAD I TOLOC
0232    3010               DCA WORK
0233    1375               TAD A7
0234    4343               JMS SETUP

                                  /TTY PRINT ROUTINE
0235    6002      TTY,     IOF
0236    1031               TAD PRINT
0237    3010               DCA WORK
0240    1410               TAD I WORK
0241    6046               TLS
0242    6041               TSF
0243    5242               JMP .-1
0244    1012               TAD M377
0245    7640               SZA CLA
0246    5240               JMP TTY+3
0247    6042               TCF
0250    6001               ION
0251    7604               LAS
0252    7710               SPA CLA
0253    7402               HLT            /HALT AFTER ERROR (SR0)
```

```
0254   1030        TAD NOTE
0255   7650        SNA CLA
0256   5046        JMP CHEK1
0257   3030        DCA NOTE
0260   5131        JMP LAS1        /RETURN TO NO SKIP ROUTINE
```

```
                                      /ERROR PRINT OUT LINE 1
0261   0306              INF1,   306              /F     FROM (INSTRUCTION LOCATION)
0262   0240                      240              /SPACE
0263   0000              INDATA, 0                /X        LOCATION
0264   0000                      0                /X
0265   0000                      0                /X
0266   0000                      0                /X
0267   0240                      240              /SPACE
0270   0240                      240              /SPACE
0271   0324                      324              /T     TO (OPERAND ADDRESS)
0272   0240                      240              /SPACE
0273   0000              ONDATA,  0               /X        ADDRESS
0274   0000                       0               /X
0275   0000                       0               /X
0276   0000                       0               /X
0277   0215                      215              /CR
0300   0212                      212              /LF
0301   0215                      215              /CR
0302   0215                      215              /CR

                                      /ERROR PRINTOUT LINE 2
0303   0317                      317              /O     OPERAND (STARTING COUNT)
0304   0240                      240              /SPACE
0305   0000              STDATA,  0               /X        PATTERN
0306   0000                       0               /X
0307   0000                       0               /X
0310   0000                       0               /X
0311   0240                      240              /SPACE
0312   0240                      240              /SPACE
0313   0306                      306              /F     FAILING COUNT
0314   0240                      240              /SPACE
0315   0000              FLDATA,  0               /X        PATTERN BEFORE FAILING IS2
0316   0000                       0               /X
0317   0000                       0               /X
0320   0000                       0               /X
0321   0240                      240              /SPACE
0322   0240                      240              /SPACE
0323   0322                      322              /R     RESULT AFTER FAILURE
0324   0240                      240              /SPACE
```

```
0325    0222        RSDATA,  0           /X        PATTERN AFTER FAILING ISZ
0326    0002                 0           /X
0327    0000                 0           /X
0330    0000                 0           /X
0331    0240                 240         /SPACE
0332    0240                 240         /SPACE
0333    0316        SKPDAT,  316         /N        NO
0334    0323                 323         /S        SKIP
0335    0215                 215         /CR
0336    0212                 212         /LF
0337    0212                 212         /LF
0340    0377                 377         /RUBOUT
0341    0316                 316         /N
0342    0323                 323         /S

0343    0000        SETUP,   0
0344    3011                 DCA WORK1
0345    1010                 TAD WORK
0346    7006                 RTL
0347    7006                 RTL
0350    4363                 JMS MORSU
0351    7012                 RTR
0352    7012                 RTR
0353    7012                 RTR
0354    4363                 JMS MORSU
0355    7012                 RTR
0356    7010                 RAR
0357    4363                 JMS MORSU
0360    4363                 JMS MORSU
0361    7200                 CLA
0362    5743                 JMP I SETUP
0363    0000        MORSU,   0
0364    0007                 AND MSK7
0365    1376                 TAD TW6
0366    3411                 DCA I WORK1
0367    1010                 TAD WORK
0370    5763                 JMP I MORSU

                            /PAGE 1 CONSTANTS
0371    0262        A3,      INDATA-1
0372    0272        A4,      ONDATA-1
0373    0304        A5,      STDATA-1
0374    0314        A6,      FLDATA-1
0375    0324        A7,      RSDATA-1
0376    0260        TW6,     0260
```

```
                                /PART 2 INITIALIZATION ROUTINE
          0400                  *400
0400  1003                          TAD LIMLO
0401  7041                          CIA
0402  3510                          DCA FROM              /LOW LIMIT TO FROM
0403  1003                          TAD LIMLO
0404  7040                          CMA
0405  3511                          DCA TO
0406  1346                          TAD A0
0407  3313                          DCA PATCYC
0410  1314                          TAD INST1
0411  3164                          DCA RANUM+1

0412  5046                          JMP CHEK1             /GO TO PAGE 0 START

                                /PATH DECISION ROUTINE
0413  1163                  PDR,    TAD RANUM
0414  7041                          CIA
0415  1305                          TAD GFROM
0416  7650                          SNA CLA       /SKIP IF NOT REQUESTING FROM
0417  5303                          JMP FRUT              /GO TO FROM ADDRESS ROUTINE

0420  1163                          TAD RANUM
0421  7041                          CIA
0422  1306                          TAD GTO
0423  7650                          SNA CLA       /SKIP IF NOT REQUESTING TO
0424  5301                          JMP TORUT             /GO TO TO ADDRESS ROUTINE
0425  5226                          JMP PRUT              /GO TO PATTERN ROUTINE
```

```
                                     /SELECT PATTERN AND OTHER THINGS
0426   1713              PROT,   TAD I PATCYC
0427   3312                      DCA PATT
0430   1512                      TAD PATT
0431   7450                      SNA              /NO SKIP IF END OF PATTERN TABLE
0432   5240                      JMP .+6          /END PATTERN TABLE LOOK AROUND
0433   7201                      CLA IAC
0434   1313                      TAD PATCYC
0435   3313                      DCA PATCYC
0436   1512                      TAD PATT
0437   5563                      JMP I RANUM      /RETURN, AC=NEW PATTERN
                                 /
0440   1545                      TAD AK7776
0441   3313                      DCA PATCYC       /RESTOR START ADDRESS OF PATT, TABLE
0442   7001                      IAC
0443   1311                      TAD TO
0444   3311                      DCA TO           /INCREMENT TO
0445   1311                      TAD TO
0446   7041                      CIA
0447   1310                      TAD FROM
0450   7640                      SZA CLA          /SKIP IF TO = FROM
0451   5255                      JMP .+4
0452   1311                      TAD TO
0453   1014                      TAD THREE
0454   3311                      DCA TO           /SKIP AROUND FROM
0455   1311                      TAD TO
0456   7500                      SMA
0457   5276                      JMP GOUT
0460   1004                      TAD LIMHI
0461   7710                      SPA CLA          /SKIP IF END TEST AREA
0462   5276                      JMP GOUT
0463   7201                      CLA IAC
0464   1310                      TAD FROM
0465   3310                      DCA FROM                     /ADVANCE FROM
0466   1003                      TAD LIMLO
0467   7041                      CIA
0470   3311                      DCA TO           /RESET TO ADDRESS
0471   1310                      TAD FROM
0472   1004                      TAD LIMHI
0473   7640                      SZA CLA
0474   5276                      JMP GOUT
0475   5200                      JMP 400
0476   7200              GOUT,   CLA
0477   1312                      TAD PATT
0500   5563                      JMP I RANUM
```

```
                                        /SELECT TO ROUTINE
0501  1311                    TOTO,     TAD TO
0502  5565                              JMP I RANUM

                                        /SELECT FROM ROUTINE
0503  1312                    FROT,     TAD FROM
0504  5565                              JMP I RANUM

                                        /PAGE 3 CONSTANTS
0505  0071                    GFROM,    SELFRM+1              /STORED RETURN ADDRESS WHEN
                                                             /RANDOM FROM IS REQUESTED
0506  0061                    GTO,      SELTO+1     /STORED RETURN ADDRESS WHEN
                                                    /RANDOM TO IS REQUESTED
0507  0053                    GPAT,     SELPAT+1             /STORED RETURN ADDRESS WHEN
                                                             /RANDOM PATTERN IS REQUESTED
0510  0000                    FROM,     0          /CURRENT FROM ADDRESS
0511  0000                    TO,       0          /CURRENT TO ADDRESS
0512  0000                    PATT,     0          /CURRENT PATTERN
0513  0000                    PATCYC,   0          /CURRENT PATTERN ADDRESS
0514  5434                    INST1,    JMP I APDR
0515  7776                    K7776,    7776
0516  7775                              7775
0517  7773                              7773
0520  7767                              7767
0521  7757                              7757
0522  7737                              7737
0523  7677                              7677
0524  7577                              7577
0525  7377                              7377
0526  6777                              6777
0527  5777                              5777
0530  3777                              3777
0531  0001                              0001
0532  0003                              0003
0533  0007                              0007
0534  0017                              0017
0535  0037                              0037
0536  0077                              0077
0537  0177                              0177
0540  0377                              0377
0541  0777                              0777
0542  1777                              1777
0543  3777                    K3777,    3777
0544  0000                              0
0545  0515                    AK7776,   K7776
0546  0544                    A0,       K3777+1
```

```
0547   1177      SUC,     TAD CT
0550   7001               IAC
0551   3177               DCA CT
0552   1177               TAD CT
0553   7640               SZA CLA
0554   5436               JMP I AIFULF
0555   1176               TAD KP
0556   1175               TAD K1000
0557   3176               DCA KP
0560   1176               TAD KP
0561   7640               SZA CLA
0562   5436               JMP I ATFULF

0563   6002               IOF
0564   1575               TAD ZERO
0565   3573               DCA I A1
0566   1576               TAD SVN
0567   3574               DCA I A2
0570   1374               TAD INF2
0571   3010               DCA WORK
0572   5773               JMP I .+1
0573   7602               7602
0574   0332      INF2,    SKPUAT-1
0575   0260      ZERO,    260
0576   0267      SVN,     267
```

```
        0600                    *600

                        /CHECK FOR TO=FROM CONFLICT

0600    1020            TFCLF,  TAD TULOC
0601    7041                    CIA
0602    1002                    TAD FRMLOC
0603    7450                    SNA
0604    5054                    JMP CHEK2
0605    7001                    IAC
0606    7450                    SNA
0607    5054                    JMP CHEK2
0610    7001                    IAC
0611    7650                    SNA CLA
0612    5054                    JMP CHEK2
0613    5402                    JMP I FRMLOC

0614    0000            PATCH,  0               /RESTORE THEN GO AWAY
0615    3000                    DCA 0
0616    1232                    TAD X
0617    3001                    DCA 1
0620    1233                    TAD X1
0621    3002                    DCA 2
0622    1234                    TAD X2
0623    3003                    DCA 3
0624    1235                    TAD X3
0625    3037                    DCA START
0626    1236                    TAD X4
0627    3040                    DCA START+1
0630    6001                    ION
0631    5614                    JMP I PATCH

0632    7402            X,      7402
0633    0000            X1,     0
0634    7157            X2,     7157
0635    6001            X3,     ION
0636    7604            X4,     LAS

        7602                    *7602
7602    1410                    TAD I WORK
7603    6046                    TLS
7604    6041                    TSF
7605    5204                    JMP .-1
7606    1012                    TAD M377
7607    7640                    SEA CLA
7610    5202                    JMP .-6
7611    5217                    JMP OVR

        7617                    *7617
7617    6042            OVR,    TCF
7620    6001                    ION
7621    5436                    JMP I ATFCLF

                        $
```

SYMBOL TABLE

```
AERR1     0032
AERR2     0033
AFTER     0023
AK7/76    0545
APDR      0034
ASUC      0005
ATFCLF    0036
A0        0546
A1        0173
A2        0174
A3        0371
A4        0372
A5        0373
A6        0374
A7        0375
BACK      0115
BAKBRN    0140
BEFOR     0022
CHEK1     0046
CHEK2     0054
CHEK3     0064
C1        0177
ERR1      0200
ERR2      0205
FLOATA    0315
FRMLOC    0002
FROM      0510
FRUT      0503
GFROM     0505
GOUT      0476
GPAT      0507
GTO       0506
INDATA    0263
INF1      0261
INF2      0574
INST1     0514
ISZ1      0015
ITADNM    0035
JMP1      0016
JMP2      0017
KP        0176
KPGO      0207
K0100     0027
K0200     0026
K0400     0025
K1000     0175
K3777     0543
K4        0024
K7776     0515
LAS1      0131
LIMHI     0004
LIMLO     0003
LIMTST    0150
```

SYMBOL TABLE

```
LUP1        0111
MURSU       0363
MSK7        0007
MS77        0012
M7          0006
NUTE        0050
NUM         0013
ONDATA      0273
OVR         7617
PATCH       0614
PATCYC      0513
PATRN       0021
PATT        0512
PUR         0413
PLCINT      0074
PRINT       0031
PRUT        0426
RANUM       0163
RSDATA      0325
SELFRM      0070
SELPAT      0052
SELTO       0060
SETUP       0343
SKPDAT      0333
START       0037
STDATA      0305
SUC         0547
SVN         0576
TRCLF       0600
THREE       0014
TU          0511
TULOC       0020
TURUT       0501
TIY         0235
TW6         0376
WORK        0010
WORK1       0011
X           0632
X1          0633
X2          0634
X3          0635
X4          0636
ZERU        0575
```

SYMBOL TABLE

```
FRMLOC    0002
LIMLO     0003
LIMHI     0004
ASUC      0005
M/        0006
MSK7      0007
WORK      0010
WORK1     0011
MS7/      0012
NUM       0013
THREE     0014
ISZ1      0015
JMP1      0016
JMP2      0017
TOLOC     0020
PATRN     0021
BEFOR     0022
AFTER     0023
K4        0024
K0400     0025
K0200     0026
K0100     0027
NOTE      0030
PRINT     0031
AERR1     0032
AERR2     0033
APDR      0034
ITADNM    0035
ATFCLF    0036
START     0037
CHEK1     0046
SELPAT    0052
CHEK2     0054
SELTO     0060
CHEK3     0064
SELFRM    0070
PLCINT    0074
LUP1      0111
BACK      0115
LAS1      0131
BAKBRN    0140
LIMTST    0150
RANUM     0163
A1        0173
A2        0174
K1000     0175
KP        0176
CT        0177
ERR1      0200
ERR2      0205
KPGO      0207
TTY       0235
INF1      0261
```

SYMBOL TABLE

INDATA	0263
ONDATA	0273
STDATA	0305
FLDATA	0315
RSDATA	0325
SKPDAT	0333
SETUP	0343
MORSU	0363
A3	0371
A4	0372
A5	0373
A6	0374
A7	0375
TW6	0376
PUR	0413
PRUT	0426
GOUT	0476
TORUT	0501
FRUT	0503
GFROM	0505
GTO	0506
GPAT	0507
FROM	0510
TO	0511
PATT	0512
PATCYC	0513
INST1	0514
K7776	0515
K3777	0543
AK7776	0545
A0	0546
SUC	0547
INF2	0574
ZERO	0575
SVN	0576
TFCLF	0600
PATCH	0614
X	0632
X1	0633
X2	0634
X3	0635
X4	0636
OVR	7617

THERE ARE NO ERRORS