IDENTIFICATION

Product Code: MAINDEC-08-DO7B-D

Product Name: Random ISZ Test

Date Created: March 25, 1968

Maintainer: Diagnostic Group

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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

SR1 = Eliminate error printouts

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

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

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)

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.

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

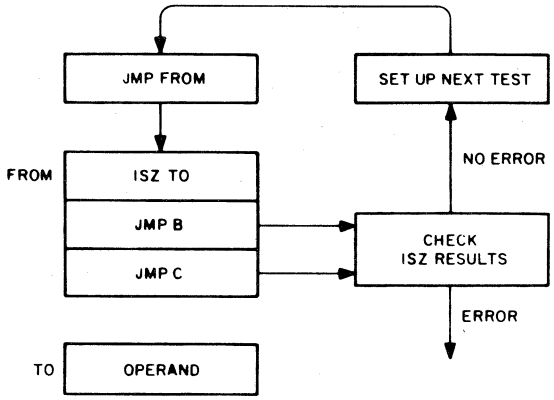
8.1 Execution Time

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

SR9 = 1. 3,500 ISZ operations/second

9. PROGRAM DESCRIPTION

The test loop is shown below:



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  7450                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
```

```
0200                    *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 ISZ
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
```

```
Ø325  ØØØØ          RSDATA, Ø               /X        PATTERN AFTER FAILING ISZ
Ø326  ØØØØ                  Ø               /X
Ø327  ØØØØ                  Ø               /X
Ø33Ø  ØØØØ                  Ø               /X
Ø331  Ø24Ø                  24Ø             /SPACE
Ø332  Ø24Ø                  24Ø             /SPACE
Ø333  Ø316          SKPDAT, 316             /N        NO
Ø334  Ø323                  323             /S        SKIP
Ø335  Ø215                  215             /CR
Ø336  Ø212                  212             /LF
Ø337  Ø212                  212             /LF
Ø34Ø  Ø377                  377             /RUBOUT
Ø341  Ø316                  316             /N
Ø342  Ø323                  323             /S

Ø343  ØØØØ          SETUP,  Ø
Ø344  3Ø11                  DCA WORK1
Ø345  1Ø1Ø                  TAD WORK
Ø346  7ØØ6                  RTL
Ø347  7ØØ6                  RTL
Ø35Ø  4363                  JMS MORSU
Ø351  7Ø12                  RTR
Ø352  7Ø12                  RTR
Ø353  7Ø12                  RTR
Ø354  4363                  JMS MORSU
Ø355  7Ø12                  RTR
Ø356  7Ø1Ø                  RAR
Ø357  4363                  JMS MORSU
Ø36Ø  4363                  JMS MORSU
Ø361  72ØØ                  CLA
Ø362  5743                  JMP I SETUP
Ø363  ØØØØ          MORSU,  Ø
Ø364  ØØØ7                  AND MSK7
Ø365  1376                  TAD TW6
Ø366  3411                  DCA I WORK1
Ø367  1Ø1Ø                  TAD WORK
Ø37Ø  5763                  JMP I MORSU

                            /PAGE 1 CONSTANTS
Ø371  Ø262          A3,     INDATA-1
Ø372  Ø272          A4,     ONDATA-1
Ø373  Ø3Ø4          A5,     STDATA-1
Ø374  Ø314          A6,     FLDATA-1
Ø375  Ø324          A7,     RSDATA-1
Ø376  Ø26Ø          TW6,    Ø26Ø
```

```
                        /PART 2 INITIALIZATION ROUTINE
     0400               *400
0400 1003                       TAD LIMLO
0401 7041                       CIA
0402 3310                       DCA FROM                /LOW LIMIT TO FROM
0403 1003                       TAD LIMLO
0404 7040                       CMA
0405 3311                       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               PUR,    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 TURUT               /GO TO TO ADDRESS ROUTINE
0425 5226                       JMP PRUT                /GO TO PATTERN ROUTINE
```

```
                        /SELECT PATTERN AND OTHER THINGS
0426  1713      PRJT,   TAD I PATCYC
0427  3312              DCA PATT
0430  1312              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  1312              TAD PATT
0437  5563              JMP I RANUM     /RETURN, AC=NEW PATTERN
                        /
0440  1345              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      TOROT,  TAD TO
0502  5563              JMP I RANUM

                        /SELECT FROM ROUTINE
0503  1312      FROT,   TAD FROM
0504  5563              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 CI
0550  7001                  IAC
0551  3177                  DCA CI
0552  1177                  TAD CI
0553  7640                  SZA CLA
0554  5436                  JMP I ATFCLF
0555  1176                  TAD KP
0556  1175                  TAD K1000
0557  3176                  DCA KP
0560  1176                  TAD KP
0561  7640                  SZA CLA
0562  5436                  JMP I ATFCLF

0563  6002                  IOF
0564  1375                  TAD ZERO
0565  3573                  DCA I A1
0566  1376                  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,   SKPDAT-1
0575  0260          ZERO,   260
0576  0267          SVN,    267
```

```
      0600              *600

                        /CHECK FOR TO=FROM CONFLICT

0600  1020             TFCLF,  TAD TOLOC
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                     SZA 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
AK7776	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
FLDATA	0315
FRMLOC	0002
FROM	0510
FRUT	0503
GFROM	0505
GUUT	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

LOP1	0111
MORSU	0363
MSK7	0007
MS77	0012
M7	0006
NOTE	0030
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
STDATA	0305
SUC	0547
SVN	0576
TFCLF	0600
THREE	0014
TO	0511
TOLOC	0020
TORUT	0501
TTY	0235
TW6	0376
WORK	0010
WORK1	0011
X	0632
X1	0633
X2	0634
X3	0635
X4	0636
ZERO	0575

SYMBOL TABLE

FRMLOC	0002
LIMLO	0003
LIMHI	0004
ASUC	0005
M7	0006
MSK7	0007
WORK	0010
WORK1	0011
M377	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
TU	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