IDENTIFICATION

Product Code: Maindec 08-D1GB-D

Product Name: PDP-8, 8I, 8S Extended Memory Control

Date Created: May 5, 1968

Maintainer: Diagnostics Group

1. Abstract

This program tests the Extended Memory Control logic for proper operation. It may be used with a PDP-8, 8I, or 8S equipped with a minimum of 4K of extended memory. The program exercises and tests the control IOT's; the ability to reference all fields from field 0; program interrupt and interrupt inhibit; auto-indexing in each field, and a special test for the PDP-8I which tests the presence of a false memory pulse when a non-existent memory field is referenced.

Errors encountered during running will result in a program halt. The halt locations are labeled, and the error may be identified by referencing the program listing or table of error halts.

2. Requirements

2.1 Equipment

A standard PDP-8, 8I or 8S equipped with an Extended Memory Control, and at least 4K of extended memory.

2.2 Storage

The program requires 1726(8) locations of code memory. The program must reside in memory field 0 only.

2.3 Preliminary Programs

All programs for a basic PDP-8, 8I or 8S must have been previously run successfully.

3. Loading Procedure

3.1 Method

The program must be loaded with the Binary loader.

a. Turn off the Teletype reader.

b. Set the SWITCH REGISTER to 7777.

c. Press LOAD ADDRESS, and then START.

d. Place the program tape in the reader and turn on the reader.

e. When the program has been loaded, stop the computer, turn off the reader, and remove the tape.

4. Starting Procedure

4.1 Starting Addresses

The starting address is 0200(8).

4.2 Control Switch Settings

SR 8 must be on a 1 if a PDP-8I is being used. Otherwise, on a 0 for a PDP-8 or 8S.

SR 9, 10 and 11 must contain an octal value equal to the number of EXTENDED memory fields available (1 to 7 octal). Note that field 0 is not to be included in this value.

4.3 Operator Action

With the program in memory, set the SWITCH REGISTER to 0200 octal.

Press LOAD ADDRESS.

Set SR 8 to a 1 if a PDP-8I is being used. Otherwise, set SR 8 to a 0.

Place the octal number of EXTENDED memory fields available in SR 9, 10 and 11. This value may vary from 1 to 7 only.

Press START.

The program will run until an error is detected, or stopped by the operator.

The TTY bell is rung once after one complete pass of the program.

5. Operating Procedure

See section 4.2

5.2 Subroutine Abstracts

Refer to the program listing for descriptions of each test, and the method of testing.

5.3 Operator Action

See section 4.3

6. Errors

6.1 Error Halts and Description

Table of Error Halts

C (MA)	Tag	Description
	CDF and RDF Tests	
206	E 1	CDF 0 or RDF failed.
217	E 2	CDF 7 or RDF failed.
234	E 3	CDF 1 or RDF failed.
245	E 4	CDF 2 or RDF failed.
262	E 5	CDF 3 or RDF failed.
273	E 6	CDF 4 or RDF failed.
310	E 7	CDF 5 or RDF failed.
321	E 8	CDF 6 or RDF failed.
	DF, IB and SF Tests	
341	E 9	RIB or ION failed.
351	E 10	DF not cleared, or no interrupt.
360	E 11	RIB or SF failed. (DF 1)
410	E 12	DF not cleared, or no interrupt.
417	E 13	RIB or SF failed. (DF 2)
427	E 14	DF not cleared, or no interrupt.
436	E 15	RIB or SF failed. (DF 3)
452	E 16	DF not cleared, or no interrupt.
~~442~~ 461	E 17	RIB or SF failed. (DF 4)

471	E 18	DF not cleared or no interrupt.
500	E 19	RIB or SF failed. (DF 5)
514	E 20	DF not cleared, or no interrupt.
523	E 21	RIB or SF failed. (DF 6)
533	E 22	DF not cleared, or no interrupt.
542	E 23	RIB or SF failed. (DF 7)

DCA I and TAD I Tests

653	E 24	DCA I or TAD I to an extended field failed. The DF indicators equal the current field under test. The AC contains the data as read from location 7000 of the extended field. The halt occurred due to the data read and the current data field not being equal. Each extended field should contain its field number in location 7000.

CIF, IB and SF Tests

Program interrupt is enabled for these tests. A CIF is issued, followed by an ION and a JMP. The IF should always equal 0, because of the interrupt occurring after the JMP instruction. A HLT is in location 1 of each intended field in case the IF does get set. The TTY flag is used for interrupts.

710	E 25	No interrupt, or inhibit interrupt failed.
717	E 26	CIF 1. The IB or SF failed. The AC = C(IB).
733	E 27	No interrupt or inhibit interrupt failed.
742	E 28	CIF 2. The IB or SF failed. The AC = C(IB).
756	E 29	No interrupt or inhibit interrupt failed.
765	E 30	CIF 3. The IB or SF failed. The AC = C(IB).
1004	E ~~24~~ 31	No interrupt, or inhibit interrupt failed.
1013	E 32	CIF 4. The IB or SF failed. The AC = C(IB).

1027	E 33	No interrupt, or inhibit interrupt failed.
1036	E 34	CIF 5. The IB or SF failed. The AC = C(IB).
1052	E 35	No interrupt, or inhibit interrupt failed.
1061	E 36	CIF 6. The IB or SF failed. The AC = C(IB).
1075	E 37	No interrupt, or inhibit interrupt failed.
1104	E 38	CIF 7. The IB or SF failed. The AC = C(IB).

Interrupt Inhibit Test

A subroutine is placed in each extended field to ensure that program interrupt is inhibited after a CIFIOT, and is enabled after a JMP instruction. The routine is in one field at a time; the contents of all other extended fields will equal 0000. The routine is described on the program listing as the "Extended Field Test Routine," and is tagged EXFLD.

The test routine is entered at location 1174 in the extended field. This location contains a CIF XX IOT, where XX equals the extended field number. Location 1175 contains an ION IOT. Locations 1176 to 7776 contain all 0's. Location 7777 contains a JMP I 12. The routine, therefore, issues a CIF, ION, and JMP I 12 sequence. Program interrupt should be inhibited until after the JMP I 12 at location 7777. An error halt occurs in field 0 if an interrupt occurs between locations 1176 and 7777. Location 12 contains 1175 (E 40 in field 0), and will auto-index to 1176.

1175	E 40	CIF or interrupt failed. The DF and IF should equal an extended field.
1203	E 41	The DF was not cleared after the interrupt. All other functions worked properly.
1221	E 42	RMF or SF failed. The SF register should have saved the extended field number after interrupt. The AC = C(I.B.) after an RMF.
1235	E 43	All functions worked, but the PC did not equal location E 40 + 1 after the interrupt in the extended field failed. The AC = contents of location 0, field 0.
4	E 44	Location 4 in the extended field. The interrupt went to this field instead of field 0, or the JMP I 12 at location 7777 was not executed. Also,

		make sure interrupt was enabled in location 1175 in the extended field.
10	E 45	Location 10 in the extended field. The JMP 1 12 at location 7777 was not executed, or interrupt failed.
~~1422~~1420	E 45A	No program interrupt occurred. Press CONTINUE to ~~try~~ try again.
7ØØØ	-	Memory field 1 halt. An interrupt in field Ø was followed by a CIF 1Ø IOT, and then an RMF. The RMF should have restored the IB to field Ø. The SF and IB were OR'd together, resulting in the IF being set to field 1, after the JMP instruction at location 143Ø. Restart from 14ØØ to repeat the test.

Auto-Index Test

The subroutine labeled "Auto-Index Test" on the listing is placed in each extended field. Auto-index registers 10 through 17 in each field are tested. All of memory not occupied by the subroutine in set to 0. The error halts tagged E 46 through E 53 will occur in the extended field if an auto-index register fails. The DF and IF indicators will display the current field being tested.

~~1524~~1522	E 46	Index register 10 failed.
~~1527~~1525	E 47	Index register 11 failed.
~~1532~~1530	E 48	Index register 12 failed.
~~1535~~1533	E 49	Index register 13 failed.
~~1540~~1536	E 50	Index register 14 failed.
~~1543~~1541	E 51	Index register 15 failed.
~~1546~~1544	E 52	Index register 16 failed.
~~1551~~1547	E 53	Index register 17 failed.

Non-Existent Memory Test

This is the last test performed, and is included for PDP-8I's only. The test makes sure that a false memory done pulse in generated when the DF is set to a non-existent memory field. If the PDP-8I being used is equipped with the maximum of 32 K of

code memory, the program automatically skips this test and restarts at location 200. SR 8 on a 0 will cause the program to always skip this test.

The test also makes certain that the correct data is deposited in the AC when a non-existent field is referenced. This data must always equal 0000 or 7777 octal, depending on the number of extended fields existing. For example, if the PDP-8I is equipped with fields 0, 1, 2 and 3, any reference with a TAD I to fields 4 through 7 should result with 7777 octal in the AC. If equipped with fields 0, 1 and 2, a TAD I to field 3 should result with 0000 octal in the AC, and referencing 4 through 7 will result with 7777 octal in the AC. In other words, referencing the lowest order non-existent field, when the total number available is add, will result with 0000 in the AC. Referencing all other non-existent fields will result with 7777 in the AC. When the total number available is even, referencing any non-existent field will result with 7777 in the AC.

The only legal halts in this test, are at locations 1700 and 1725. If the computer halts at any other location, the false memory done pulse probably was not generated.

The false memory done pulse is not generated when a CIF to a non-existent field is attempted.

1700	E 54	All 0's should have been deposited in the AC, or an existing field was referenced. Make sure the proper value is in SR 9-11. The number of extended fields available must be in SR 9-11.
1725	E 57	All 1's should have been deposited in the AC, or an existing field was referenced. Make sure the proper value is in SR 9-11.

6.2 Error Recovery

Press CONTINUE to repeat the failing test. Place a NOP in the error halt location to loop on a failing test. Restart from 1400 after a halt at 7000 in field 1.

7. Restrictions

7.1 Starting Restrictions

None

7.2 Operating Restrictions

The number of extended memory fields available must be in SR 9-11 before starting from location 200.

8. Miscellaneous

8.1 Execution Time

Running time is dependent on the amount of extended memory for testing, and on whether the processor being used is a PDP-8, 8I or 8S. The TTY bell will ring once for each pass of the program.

9. Program Description

The program exercises all IOT's associated with the Extended Memory Control logic, plus the ability to reference extended fields from field 0, and vice-versa. Each test is looped 4096 times before initiating the next test. A switch option is provided to skip or execute a non-existent memory test for the PDP-8I.

The individual test routines and error halts are commented on the program listing as an aid to trouble-shooting. Section 6 contains a Table of Error Halts which also may be referenced.

10. Listing

```
                        /
                        /PDP-8, 8I EXTENDED MEMORY CONTROL TEST,  PLACE NUMBER
                        /OF EXTENDED 4K FIELDS AVAILABLE IN SR9 TO 11, (UP TO 7)
                        /IF USING AN 8I, PLACE SR8 ON A 1, OTHERWISE LEAVE 0.
                        /START PROGRAM AT 200
                        /
                        /CONSTANTS
                        /
      6201              CDF=6201
      6202              CIF=6202
      6214              RDF=6214
      6224              RIF=6224
      6244              RMF=6244
      6234              RIB=6234
      0001              *1
                        /
0001  5001                      JMP 1
0002  0002                      0002
0003  0003                      0003
                        /
      0020              *20
                        /
0020  5400              JMPI0,  JMP I 0
0021  2000              ISZ0,   ISZ 0
0022  1742              XTFLG,  TFLG
0023  1734              XSTKS,  NSTKS
0024  1112              XRMF,   TRMF
0025  1321              XRANS,  TRANS
0026  1432              XAUTO,  TAUTO
0027  0000              LOOP,   0
0030  0000              NDF,    0
0031  0000              STKS,   0
0032  0000              DAT,    0
0033  0000              NOSTAK, 0
0034  0000              NOFLD,  0
0035  1174              KE40M,  E40-1
0036  1175              KE40,   E40
0037  7402              KHLT,   HLT
0040  6201              KCDF,   6201
0041  6202              KCIF,   6202
0042  0703              KCF1,   CIF1-1
0043  1316              XFD,    EXFD
0044  0001              K1,     1
0045  0007              K7,     7
0046  0010              K10,    10
0047  7777              K7777,  7777
0050  7000              K7000,  7000
0051  7707              K7707,  7707
0052  7767              K7767,  7767
0053  7757              K7757,  7757
0054  7747              K7747,  7747
0055  7737              K7737,  7737
0056  7727              K7727,  7727
0057  7717              K7717,  7717
```

```
0060  7776          K7776,  7776
0061  7775          K7775,  7775
0062  7774          K7774,  7774
0063  7773          K7773,  7773
0064  7772          K7772,  7772
0065  7771          K7771,  7771
0066  7770          K7770,  7770
0067  0071          POINT,  .+2
```

```
0070  0071          K7S,    .+1
0071  7766          K7766,  7766
0072  7755                  7755
0073  7744          K7744,  7744
0074  7733                  7733
0075  7722                  7722
0076  7711                  7711
0077  7700                  7700
0100  1171          XSTDF,  STDF
0101  1172          XSTDF1, STDF+1
0102  1302          KXFLD,  EXFLD
0103  5402          KJMP,   JMP I 2
0104  1200          KNTR,   ENTER
0105  0020          K20,    20
0106  5507          JMP2,   JMP I KFLD0
0107  1427          KFLD0,  RTRN
0110  1422          KRTN,   E45A+2
0111  1400          XFIB,   SFIB
```

```
                        /TEST CDF AND RDF
                        /
          0200          *200
                        /
0200      7200          BEGIN,  CLA
0201      3027                  DCA LOOP                /LOOP COUNTER
                        /
0202      6201          DF0,    CDF 00          /DF 0
0203      6214                  RDF
0204      7450                  SNA             /SHOULD NOT SKIP
0205      5211                  JMP DF7
0206      7402          E1,     HLT             /ERROR, CDF OR RDF FAILED
0207      7200                  CLA
0210      5202                  JMP DF0         /REPEAT
                        /
0211      1051          DF7,    TAD K7707               /7707
0212      6271                  CDF 70          /DF 7
0213      6214                  RDF
0214      7040                  CMA             /AC = 0
0215      7450                  SNA             /SHOULD NOT SKIP
0216      5222                  JMP OK1
0217      7402          E2,     HLT             /CDF OR RDF FAILED
0220      7200                  CLA
0221      5211                  JMP DF7
                        /
0222      2027          OK1,    ISZ LOOP                /CHECK DONE
0223      5202                  JMP DF0
                        /
0224      7200                  CLA
0225      3027                  DCA LOOP                /LOOP COUNVER
                        /
0226      1052          DF1,    TAD K7767               /7767
0227      6211                  CDF 10          /DF 10
0230      6214                  RDF
0231      7040                  CMA             /AC=0
0232      7450                  SNA
0233      5237                  JMP DF2
0234      7402          E3,     HLT             /CDF1 OR RDF FAILED
0235      7200                  CLA
0236      5226                  JMP DF1
                        /
0237      1053          DF2,    TAD K7757               /7757
0240      6221                  CDF 20          /DF2
0241      6214                  RDF
0242      7040                  CMA             /AC=0
0243      7450                  SNA
0244      5250                  JMP OK2
```

```
0245  7402            E4,     HLT             /CDF 2 OR RDF FAILED
0246  7200                    CLA
0247  5237                    JMP DF2
                      /
0250  2027            OK2,    ISZ LOOP                /DONE IF SKIP
0251  5226                    JMP DF1
0252  7200                    CLA
0253  3027                    DCA LOOP
                      /
0254  1054            DF3,    TAD K7747               /7747
0255  6231                    CDF 30          /DF 3
0256  6214                    RDF
0257  7040                    CMA             /AC=0
0260  7450                    SNA
0261  5265                    JMP DF4
0262  7402            E5,     HLT             /CDF 3 OR RDF FAILED
0263  7200                    CLA
0264  5254                    JMP DF3
                      /
0265  1055            DF4,    TAD K7737               /7737
0266  6241                    CDF 40          /DF 4
0267  6214                    RDF
0270  7040                    CMA             /AC=0
0271  7450                    SNA
0272  5276                    JMP OK3
0273  7402            E6,     HLT             /CDF 4 OR RDF FAILED
0274  7200                    CLA
0275  5265                    JMP DF4
                      /
0276  2027            OK3,    ISZ LOOP                /DONE IF SKIP
0277  5254                    JMP DF3
                      /
0300  7200                    CLA
0301  3027                    DCA LOOP
                      /
0302  1056            DF5,    TAD K7727               /7727
0303  6251                    CDF 50          /DF5
0304  6214                    RDF
0305  7040                    CMA             /AC=0
0306  7450                    SNA
0307  5313                    JMP DF6
0310  7402            E7,     HLT             /CDF 5 OR RDF FAILED,
0311  7200                    CLA
0312  5302                    JMP DF5
                      /
0313  1057            DF6,    TAD K7717               /7717
0314  6261                    CDF 60          /DF 6
0315  6214                    RDF
0316  7040                    CMA             /AC=0
0317  7450                    SNA
0320  5324                    JMP OK4
```

```
0321  7402          E8,     HLT             /CDF 6 OR RDF FAILED
0322  7200                  CLA
0323  5313                  JMP DF6
                      /
0324  2027          OK4,    ISZ LOOP                /DONE WHEN SKIP
0325  5302                  JMP DF5
                      /
                      /NOW TEST INTERRUPT BUFFER (IB) BITS 9-11 WITH
                      /RIB, PI IS ENABLED, TELEPRINTER FLAG IS
                      /USED FOR INTERRUPT,
                      /
0326  6201                  CDF 00          /DF0
0327  1020                  TAD JMPI0               /JMP I0=JMP I 0
0330  3001                  DCA 1           /C(1)=JMP I 0
0331  3027                  DCA LOOP
0332  6041                  TSF             /TEST TTY FLAG
0333  4422                  JMS I XTFLG     /SET FLAG
                      /
0334  6001          IB0,    ION             /ENABLE PI
0335  7200                  CLA
0336  6234                  RIB             /READ SF
0337  7450                  SNA
0340  5343                  JMP IB1
0341  7402          E9,     HLT             /RIB FAILED
0342  5334                  JMP IB0
                      /
0343  6211          IB1,    CDF 10          /DF 1
0344  6001                  ION
0345  7200                  CLA
0346  6214                  RDF             /DF SHOULD BE 0 AFTER A PI
0347  7450                  SNA
0350  5353                  JMP .+3
0351  7402          E10,    HLT
0352  5343                  JMP IB1         /DF NOT CLEARED, OR NO PI
                      /
0353  1060                  TAD K7776
0354  6234                  RIB             /READ SF
0355  7040                  CMA             /AC=0
0356  7450                  SNA
0357  5362                  JMP OK5
0360  7402          E11,    HLT             /RIB OR SF FAILED
0361  5343                  JMP IB1
0362  2027          OK5,    ISZ LOOP                /DONE WHEN SKIP
0363  5334                  JMP IB0
0364  5765                  JMP I .+1
0365  0400                  IB2-2
```

```
      0400              *400
0400  7200              CLA
0401  3027              DCA LOOP

                        /
0402  6221              IB2,    CDF 20          /DF 2
0403  6001                      ION
0404  7200                      CLA
0405  6214                      RDF             /SHOULD BE 0 AFTER PI
0406  7450                      SNA
0407  5212              .       JMP .+3
0410  7402              E12,    HLT             /DF NOT CLEARED, OR NO PI
0411  5202                      JMP IB2
                        /
0412  1061                      TAD K7775
0413  6234                      RIB             /AC=7777
0414  7040                      CMA             /=0
0415  7450                      SNA
0416  5221                      JMP IB3
0417  7402              F13,    HLT             /RIB OR SF FAILED
0420  5202                      JMP IB2
                        /
0421  6231              IB3,    CDF 30          /DF3
0422  6001                      ION
0423  7200                      CLA
0424  6214                      RDF             /DF SHOULD BE CLEARED
0425  7450                      SNA
0426  5231                      JMP .+3
0427  7402              F14,    HLT             /DF NOT CLEARED
0430  5221                      JMP IB3
                        /
0431  1062                      TAD K7774
0432  6234                      RIB             /AC=7777
0433  7040                      CMA             /AC=0
0434  7450                      SNA
0435  5240                      JMP OK6
0436  7402              F15,    HLT             /RIB OR SF FAILED
0437  5221                      JMP IB3
                        /
0440  2027              OK6,    ISZ LOOP                /DONE IF SKIP
0441  5202                      JMP IB2
                        /
0442  7200                      CLA
0443  3027                      DCA LOOP
                        /
0444  6241              IB4,    CDF 40          /DF 3
0445  6001                      ION
0446  7200                      CLA
0447  6214                      RDF             /DF MWSV BE 00 AFVER A PI
0450  7450                      SNA             /ERROR IF SKIP
0451  5254                      JMP .+3
```

```
0452  7402          E16,  HLT             /DF NOT 0 AFTER PI
0453  5244                JMP IB4
                    /
0454  1063                TAD K7773               /AC=7773
0455  6234                RIB               /AC=7777
0456  7040                CMA               /AC=0
0457  7450                SNA
0460  5263                JMP IB5
0461  7402          E17,  HLT               /RIB OR SF FAILED
0462  5244                JMP IB4
                    /
0463  6251          IB5,  CDF 50            /DF5
0464  6001                ION
0465  7200                CLA
0466  6214                RDF               /DF SHOULD=000
0467  7450                SNA
0470  5273                JMP .+3
0471  7402          E18,  HLT               /DF NOT 0 AFTER PI
0472  5263                JMP IB5
                    /
0473  1064                TAD K7772               /AC= 7772
0474  6234                RIB               /    = 7777
0475  7040                CMA               /    = 0
0476  7450                SNA
0477  5302                JMP OK7
0500  7402          E19,  HLT               /RIB OR SF FAILED
0501  5263                JMP IB5
                    /
0502  2027          OK7,  ISZ LOOP                /DONE IF 0 AND SKIP
0503  5244                JMP IB4
                    /
0504  7200                CLA
0505  3027                DCA LOOP
                    /
0506  6261          IB6,  CDF 60            /DF6
0507  6001                ION
0510  7200                CLA
0511  6214                RDF               /DF MUST=0 AFTER PI
0512  7450                SNA
0513  5316                JMP .+3
0514  7402          E20,  HLT               /DF NOT 0 AFTER PI
0515  5306                JMP IB6
```

```
                        /
0516  1065                      TAD K7771               /,7771
0517  6234                      RIB                 /AC=7777
0520  7040                      CMA
0521  7450                      SNA
0522  5325                      JMP IB7
0523  7402              E21,    HLT                 /RIB OR SF FAILED
0524  5306                      JMP IB6
                        /
0525  6271              IB7,    CDF 70              /DF 7
0526  6001                      ION
0527  7200                      CLA
0530  6214                      RDF                 /DF MUST = 0 AFTER PI
0531  7450                      SNA
0532  5335                      JMP .+3
0533  7402              E22,    HLT                 /DF NOT 0
0534  5325                      JMP IB7
                        /
0535  1066                      TAD K7770
0536  6234                      RIB                 /AC=7777
0537  7040                      CMA
0540  7450                      SNA
0541  5344                      JMP OK8
0542  7402              E23,    HLT                 /RIB OR SF FAILED
0543  5325                      JMP IB7
                        /

0544  2027              OK8,    ISZ LOOP                    /DONE IF 0
0545  5306                      JMP IB6
0546  5747                      JMP I .+1           /NEW PAGE
0547  0600                      600
```

```
0600.                   *600
                        / NOW TEST DCA I AND TAD I TO ALL STACKS, NUMBER OF
                        /EXTENDED STACKS SHOULD BE IN SR9 TO 11, EACH STACK WILL
                        /CONTAIN ITS DF# IN LOCATION 7000.
                        /
0600  3027                      DCA LOOP
0601  4423              DCAI,   JMS I XSTKS       /READ SR 9-11
0602  7001                      IAC
0603  3030                      DCA NDF           /DF NUMBER = 1 TO START
0604  1040                      TAD KCDF                  /6201
0605  1046                      TAD K10
0606  3207                      DCA .+1           /DF 001 TO START WITH
0607  6201              DFLD,   CDF 00            /WILL BE INCREMENTED
0610  1030                      TAD NDF           /DF#
0611  3450                      DCA I K7000       /PUT IN 7000 OF STACK
0612  2031                      ISZ STKS                  /ALL STACKS WHEN 0
0613  7410                      SKP
0614  5222                      JMP TADI                  /TEST TAD I
0615  1046                      TAD K10
0616  1207                      TAD DFLD                  /INCR, CDF IOT
0617  3207                      DCA DFLD
0620  2030                      ISZ NDF
0621  5207                      JMP DFLD                  /-
                        /
0622  4423              TADI,   JMS I XSTKS       /SR9=11 AGAIN
0623  7001                      IAC
0624  3030                      DCA NDF           /DF#=1 AGAIN
0625  1040                      TAD KCDF                  /6201
0626  1046                      TAD K10
0627  3230                      DCA .+1
0630  6201              TFLD,   CDF 00
0631  1450                      TAD I K7000       /AC=DF CONTENTS NOW
0632  3032                      DCA DAT           /SAVE TEMP
0633  1032                      TAD DAT
0634  7041                      CIA               /2'S COMP
0635  1030                      TAD NDF           /BETTER BE EQUAL
0636  7640                      SZA CLA
0637  5252                      JMP E24-1                 /ERROR PATH
0640  2031                      ISZ STKS                  /ALL WHEN 0
0641  5245                      JMP .+4
0642  2027                      ISZ LOOP                  /DONE WHEN 0
0643  5201                      JMP DCAI
0644  5256                      JMP IBSF                  /NEXT TEST
0645  1046                      TAD K10
0646  1230                      TAD VFLD                  /CDF IOV + 10
0647  3230                      DCA TFLD
0650  2030                      ISZ NDF
0651  5230                      JMP TFLD
                        /
0652  1032                      TAD DAT           /DATA AS READ
0653  7402              E24,    HLT               /AC=DATA READ, DF INDICATORS
                                                  /EQUAL FIELD WHERE GOT DATA,
                                                  /BOTH SHOULD BE EQUAL
0654  7200                      CLA
```

```
0655  5230          JMP TFLD
```

```
                        /
                        / TEST CIF WITH PROGRAM INTERRUPT ENABLED, THE
                        /I.F. SHOULD ALWAYS = 00 SINCE A JMP OR JMS IS EX-
                        /ECUTED AFTER THE CIF IOT. THE SF REGISTER IS
                        /TESTED WITH THE RIB IOT AFTER THE INTERRUPT,
                        / THE I.F. IS SET A HLT WILL OCCUR AT LOC. 1
                        / THE EXTENDED FIELD.
                        / HLT WILL OCCUR AFTER THE ION IOT
                        / NO INTERRUPT OCCURS, PRESS CONT. TO REPEAT.

                        / LOCS. 1, 2 TO = ISZ 0, AND
                        / JMP I ., RESPECTIVELY.
                        /
0656  6201               INTR,   CDF 00          /SET DF TO 000.
0657  1021                      TAD ISZ0          /ISZ 0
0660  3001                      DCA 1
0661  1022                      TAD JMRI0         /JMR I 0
0662  3002                      DCA 2
                        /
                        / PUT A HLT IN LOC. 1 OF ALL EXTENDED FIELDS.
                        /
0663  4423                      JMS I XSTKS
0664  1040                      TAD KCDF
0665  1046                      TAD K10
0666  3267                      DCA .+1
0667  6211                      CDF 10            /FIELD 1 TO START WITH
0670  1047                      TAD KHLT          /KHLT = 7402
0671  3444                      DCA I K1
0672  2041                      ISZ STKS          /ALL FIELDS WHEN SKIP
0673  7410                      SKP
0674  5277                      JMP .+3
0675  1267                      TAD HLTS
0676  5263                      JMP HLTS-1
                        /
                        / CIF TESTS
0677  6201                      CDF 00
0700  6141                      CSF
0701  4422                      JMS I XTF         /SET TTY FLAG
0702  3027                      DCA LOOP
0703  4423                      JMS I XSTKS       /READ SR 9-11

0704  6212                TST1, CIF 10            /FIELD 1
0705  6001                      ION
0706  7000                      NOP
0707  5310                      JMP .+1
0710  7402                ERR,  HLT               /ERROR, NO PI OR INHIBIT PI
0711  6234                      RIB               /RETURN HERE FROM LOC.3
0712  1052                      TAD K7767
0713  7040                      CMA
0714  7650                      SNA CLA           /OK IF NO SKIP
0715  5322                      JMP OKF1
0716  6234                      RIB
0717  7402                ERR,  HLT               /I.F. OR S.F. FAILED, C(AC)=C(IB)
```

```
0720  7200          CLA
0721  5304          JMP CIF1              /REPEAT
```

```
                        /
0720  2031               OKF1,   ISZ STKS                /ALL FIELDS IF 0
0721  5327                      JMP CIF2
0722  2027                      ISZ LOOP                  /ALL DONE IF 0
0723  5303                      JMP CIF1-1
0724  5424                      JMP I XRMF        /TEST RMF
                        /
0725  6222               CIF2,   CIF 22            /FIELD 2
0726  6001                      ION
0727  7000                      NOP
0730  5335                      JMP .+1
0731  7402               F2A,    HLT               /NO PI OR INHIBIT PI
0732  6234                      RIB               /RETURN FROM LOC,3
0733  1053                      TAD K7757
0734  7040                      CMA
0735  7650                      SNA CLA           /ERROR IF SKIP
0736  5345                      JMP OKF2
0737  6234                      RIB
0740  7402               F2B,    HLT               /IR OR SF FAILED, C(AC)=C(IB)
0741  7200                      CLA
0742  5327                      JMP CIF2
                        /
0743  2031               OKF2,   ISZ STKS                /ALL FIELDS IF 0
0744  5352                      JMP CIF3
0745  2027                      ISZ LOOP                  /ALL DONE IF 0
0746  5303                      JMP CIF1-1
0747  5424                      JMP I XRMF        /TEST RMF
                        /
0750  6232               CIF3,   CIF 30            /FIELD 3
0751  6001                      ION
0752  7000                      NOP
0753  5356                      JMP .+1
0754  7402               F3A,    HLT               /NO PI OR INHIBIT PI
0755  6234                      RIB               /RETURN FROM LOC,3
0756  1054                      TAD K7747
0757  7040                      CMA
0760  7650                      SNA CLA           /ERROR IF SKIP
0761  5370                      JMP OKF3
0762  6234                      RIB
0763  7402               F3B,    HLT               /SF OR IR FAILED, C(AC)=C(IB)
0764  7200                      CLA
0765  5352                      JMP CIF3
                        /
0766  2031               OKF3,   ISZ STKS                /ALL FIELDS IF 0
0767  5775                      JMP I .+4
0770  2027                      ISZ LOOP                  /ALL DONE IF 0
0771  5303                      JMP CIF1-1
0772  5424                      JMP I XRMF        /TEST RMF
0773  1000                      CIF4
                        /
```

```
                                /POP-8,8I EXT,MEM, CONTROLL TEST-TAPE 2
      1000                      *1000
                                /
1000  6242    CIF4,   CIF 40          /FIELD 4
1001  6001            ION
1002  7000            NOP
1003  5204            JMP .+1
1004  7402    E31,    HLT             /NO PI OR INHIBIT PI
1005  6234            RIB             /JMP TO HERE FROM LOC, 3
1006  1055            TAD K7737
1007  7040            CMA
1010  7650            SNA CLA         /AC MUSV BE 0
1011  5216            JMP OKF4
1012  6234            RIB
1013  7402    E32,    HLT             /IB OR SF FAILED, C(AC)=C(IB)
1014  7200            CLA
1015  5200            JMP CIF4
                        /
1016  2031    OKF4,   ISZ STKS                /ALL FIELDS IF 0
1017  5223            JMP CIF5
1020  2027            ISZ LOOP                /ALL DONE IF 0
1021  5442            JMP I KCF1
1022  5312            JMP TRMF                /TEST RMF
                        /
1023  6252    CIF5,   CIF 50          /FIELD 5
1024  6001            ION
1025  7000            NOP
1026  5227            JMP .+1
1027  7402    E33,    HLT             /NO PI OR INHIBIT PI
1030  6234            RIB             /JMP HERE FROM LOC, 3
1031  1056            TAD K7727
1032  7040            CMA
1033  7650            SNA CLA         /ERROR IF SKIP
1034  5241            JMP OKF5
1035  6234            RIB
1036  7402    E34,    HLT             /IB OR SF FAILED, C(AC)=C(IB)
1037  7200            CLA
1040  5223            JMP CIF5
                        /
1041  2031    OKF5,   ISZ STKS                /DONE WHEN SKIP
1042  5246            JMP CIF6
1043  2027            ISZ LOOP                /512 VIMES IF SKIP
1044  5442            JMP I KCF1
1045  5312            JMP TRMF                /TEST RMF
                        /
1046  6262    CIF6,   CIF 60          /FIELD 6
1047  6001            ION
1050  7000            NOP
1051  5252            JMP .+1
1052  7402    E35,    HLT             /NO PI OR INHIBIT PI
1053  6234            RIB             /JMP HERE FROM LOC, 3
1054  1057            TAD K7717
1055  7040            CMA
1056  7650            SNA CLA         /TO SKIP IS TO ERROR
```

```
1057  5264          JMP OKF6
1060  6234          RIB
```

```
1061  7402          E36,    HLT             /IB OR SF FAILED, C(AC)=C(IB)
1062  7200                  CLA
1063  5246                  JMP CIF6
                    /
1064  2031          OKF6,   ISZ STKS                /SEE IF ALL FIELDS
1065  5271                  JMP CIF7
1066  2027                  ISZ LOOP                /ALL DONE WHEN SKIP
1067  5442                  JMP I KCF1
1070  5312                  JMP TRMF                /TEST RMF
                    /
1071  6272          CIF7,   CIF 70          /FIELD 7
1072  6001                  ION
1073  7000                  NOP
1074  5275                  JMP .+1
1075  7402          E37,    HLT             /NO PI OR INHIBIT PI
1076  6234                  RIB             /RETURN HERE FROM LOC,3
1077  1051                  TAD K7707
1100  7040                  CMA
1101  7650                  SNA CLA         /ERROR IF SKIP
1102  5307                  JMP OKF7
1103  6234                  RIB
1104  7402          E38,    HLT             /IB OR SF FAILED, C(AC)=C(IB)
1105  7200                  CLA
1106  5271                  JMP CIF7
                    /
1107  2027          OKF7,   ISZ LOOP                /DONE IF SKIP
1110  5442                  JMP I KCF1
1111  5312                  JMP TRMF                /TEST RMF
```

```
                        /
                        /TEST INTERRUPT INHIBIT
                        /FROM EACH FIELD, REFER TO HEADING TITLED "EXTENDED
                        /FIELD TEST ROUTINE", THIS ROUTINE IS PLACED IN
                        /EACH TESTED FIELD AT THE ADDRESSES SPECIFIED. THE
                        /INDICATED ERROR HALTS WILL BE IN THE EXTENDED
                        /FIELD.  PRESS CONT, TO RECOVER, ONLY 1 FIELD WILL
                        /CONTAIN THE ROUTINE AT ANY ONE TIME, OTHER FIELDS
                        /WILL CONTAIN ALL0'S.  THE ROUTINE IS REPLACED WITH
                        /HALTS AFTER COMPLETION, THE PORTIONS OF THE FIELD
                        /WHICH DO NOT CONTAIN THE ROUTINE ARE SET TO 0000
                        /BEFOREHAND.
                        /
                        /
                        /SETUP FIELDS TO TEST, POINTERS, ETC.,
                        /
1112  4423              TRMF,   JMS I XSTKS     /READ SR9-11
1113  1040                      TAD KCDF                /6201
1114  3322                      DCA .+6
1115  1322                      TAD .+5
1116  1046                      TAD K10
1117  3322                      DCA .+3
1120  7040                      CMA
1121  3010                      DCA 10
1122  6201                      CDF 00
1123  3410                      DCA I 10                /PLACE 0'S IN EACH FIELD FROM
1124  1010                      TAD 10          /LOC, 0 TO 7777.
1125  7040                      CMA
1126  7640                      SZA CLA
1127  5323                      JMP .-4
1130  2031                      ISZ STKS
1131  5315                      JMP TRMF+3
```

```
                        /
                        /NOW PUT A HLT IN EACH FIELD IN THE SAME
                        /LOCATION AS E40, BELOW.
                        /
1132  4423                      JMS I XSTKS     /READ SR 9-11
1133  1040                      TAD KCDF
1134  1046                      TAD K10
1135  3336                      DCA .+1
1136  6201              CHDF,   CDF 00
1137  1036                      TAD KE40                /KE40 = ADDRESS OF E40.
1140  3027                      DCA LOOP                /SAVE TEMPORARILY
1141  1037                      TAD KHLT                /KHLT = 7402 (HLT)
1142  3427                      DCA I LOOP
1143  2031                      ISZ STKS                /DONE ALL STACKS WHEN SKIP
1144  7410                      SKP
1145  5350                      JMP .+3
1146  1336                      TAD CHDF
1147  5334                      JMP CHDF-2
                        /
1150  6201                      CDF 00
1151  6041              STDMF,  TSF                     /CHECK TTY FLAG
1152  4422                      JMS I XTFLG             /GO SET IT
1153  1051                      TAD K7707
1154  3027                      DCA LOOP
1155  1067                      TAD POINT
1156  3070                      DCA K7S                 /POINTER FOR K7700 TO K7766
1157  4423                      JMS I XSTKS             /READ SR 9-11
1160  1040                      TAD KCDF                        /6201
1161  1046                      TAD K10                 /10
1162  3371                      DCA STDF
1163  1041                      TAD KCIF                        /6202
1164  1046                      TAD K10                 /10
1165  3372                      DCA STDF+1
1166  1372                      TAD STDF+1
1167  3443                      DCA I XFD
1170  4425                      JMS I XRANS             /PUT TEST ROUTINE INTO FIELD X
                        /
1171  6211              STDF,   CDF 10                  /FIELD 1 TO START WITH
1172  6212                      CIF 10
1173  5374                      JMP .+1                 /SHOULD ENTER EXTENDED FIELD
                                                        /AFTER THIS JMP, HLT IF NOT
1174  7000                      NOP
1175  7402              E40,    HLT                     /ERROR, PI FAILED
                                                        /C(AC) = C(I.B.)
1176  5371                      JMP STDF                        /REPEAT SAME TEST.
                        /
```

```
                        /ENTER HERE AFTER PI FROM EXTENDED BANK
      1200              *1200
                        /
1200  6214              ENTER,  RDF             /DF SHOULD BE 000
1201  7450                      SNA             /ERROR IF SKIP
1202  5206                      JMP .+4         /CHECK C(SF)
1203  7402              E41,    HLT             /AC=C(DF)
1204  7200                      CLA
1205  5500                      JMP I XTDF      /REPEAT TEST
1206  6212                      CIF 10          /SET I,B, TO FIELD 1
1207  6244                      RMF             /I,B, NOW EQUAL TO SF
1210  6234                      RIB             /READ IB
1211  6202                      CIF 00
1212  6201                      CDF 00
1213  1470                      TAD I K7S
1214  7040                      CMA
1215  7650                      SNA CLA         /ERROR IF SKIP
1216  5226                      JMP CKPC
1217  6244                      RMF
1220  6234                      RIB
1221  7402              E42,    HLT             /ERROR RMF AND PI WORKED, BUT
                                                /I,B, NOT CORRECT AFTER RMF.
1222  7200                      CLA             /AC=C(IB)
1223  6201                      CDF 00
1224  6202                      CIF 00
1225  5500                      JMP I XTDF      /BACKUP A PAGE AND REPEAT
                        /
1226  1036              CKPC,   TAD KE40                /KE40=ADDRESS OF E40
1227  7001                      IAC             /MAKE E40+1
1230  7041                      CIA
1231  1000                      TAD 0           /COMPARE TO C(0)
1232  7650                      SNA CLA         /SHOULD NOT SKIP
1233  5240                      JMP .+5         /ALL OK SETUP FOR NEXT FIELD
1234  1000                      TAD 0
1235  7402              E43,    HLT             /ERROR, ALL WORKED, BUT
                                                /C(PC) WAS NOT=TO E40+1
                                                /AFTER PI IN EXTENDED
                                                /FIELD, C(AC)=C(0),F0,
                                                /CHECK FOR PI NOT INHIBITED,
                                                /OR AUTO-INDEX REG,
                                                /12 FAILING IN THE EXTENDED FIELD.
1236  7200                      CLA
1237  5500                      JMP I XTDF              /BACKUP AND REPEAT
                        /
                        /SETUP FOR NEXT FIELD
                        /
1240  2031                      ISZ STKS                /DONE ALL IF SKIP
1241  5246                      JMP .+5
1242  2027                      ISZ LOOP                /DONE LOOPING IF SKIP
1243  5645                      JMP I .+2               /REPEAT ALL AGAIN
1244  5511                      JMP I XFIB      /EXIT TO NEXT TEST
1245  1155                      STRMF+4         /BACK TO LAST PAGE
```

```
                        /
                        /SET LAST TESTED FIELD TO ALL 0'S AND PUT A
                        /HLT IN RESPECTIVE ADDRESS OF E40
                        /
1246  7240                      CLA CMA
1247  3010                      DCA 10
1250  1500                      TAD I XTDF        /CDF X0 AT STDF
1251  3252                      DCA .+1
1252  6211                      CDF 10            /F1 TO START WITH
1253  3410                      DCA I 10
1254  1010                      TAD 10
1255  7040                      CMA
1256  7640                      SZA CLA           /CLEARD IF SKIP
1257  5253                      JMP .-4
1260  6201                      CDF 00
1261  1500                      TAD I XTDF        /CDF X0 AT STDF
1262  3263                      DCA .+1
1263  6211                      CDF 10
1264  1037                      TAD KHLT                  /=7402 (HLT)
1265  3436                      DCA I KE40        /KE40=ADDRESS OF E40
1266  6201                      CDF 00            /RESTORE DF
                        /
                        /INCREMENT CDF AND CIF IOT'S AT STDF, STDF+1
                        /TO NEXT FIELD.
                        /
1267  1500                      TAD I XTDF        /CDF X0 AT STDF
1270  1046                      TAD K10
1271  3500                      DCA I XTDF
1272  1501                      TAD I XTDF1       /CIF X0 AT STDF
1273  1046                      TAD K10
1274  3501                      DCA I XTDF1
1275  1501                      TAD I XTDF1
1276  3316                      DCA EXFD
1277  2070                      ISZ K7S
1300  4321                      JMS TRANS                 /PUT ROUTINE IN NEW FIELD
1301  5500                      JMP I XTDF        /TEST NEW FIELD
```

```
                        /EXTENDED FIELD TEST ROUTINE
                        /
                        /THE FOLLOWING INSTRUCTIONS ARE PLACED IN
                        /EACH EXTENDED FIELD TESTED, THE NUMBERS IN THE
                        /COMMENTS FIELD CORRESPOND TO THE
                        /MEMORY LOCATIONS IN THE TESTED FIELLD, LOCATIONS
                        /0 THRU 11 ARE USED FOR AN ERROR ROUTINE
                        /IN CASE FIELD 0 IS NOT ENTERED AFTER AN
                        /INTERRUPT, THE EXTENDED FIELD SHOULD BE
                        /ENTERED AT LOCATION E40-1 WHICH CORRESPONDS
                        /TO E40-1 IN FIELD 0.
                        /
                        /EXTENDED FIELD INSTRUCTIONS:
                        /
1302  0000              EXFLD,  0         /0
1303  1000                      TAD 0     /1
1304  7450                      SNA       /IF LOC. 0 NOT =0 PI DIDN'T
                                            /ENTER FIELD 0
1305  5312                      JMP .+5   /3
1306  7402              E44,    HLT       /4, INTERRUPTED TO THIS FIELD
                                            /INSTEAD OF FIELD 0,C(AC)=C(0)
                                            /WHICH SHOULD BE E40+1
                                            /IF NOT, CHECK LOC, 7777,IT
                                            /MUST = 5412 (JMP I 12).
1307  7200                      CLA       /5
1310  3000                      DCA 0     /6
1311  5420                      JMP I 20          /7, C(20) =E40
1312  7402              E45,    HLT       /10, THE JMP I 12 AT LOC.
                                            /7777 WAS NOT EXECUTED,
                                            /OR INTERRUPT FAILED, IF
                                            /NO INTERRUPT, LOCATION 12
                                            /NOW CONTAINS 0 INSTEAD
                                            /OF ADDRESS E40.
1313  5307                      JMP .-4   /11, REPEAT IN THIS FIELD
1314  1175                      E40       /12, AUTO-INDEXS TO E40+1
                                            /IN F 0 IF THE JMP I 12
                                            /WORKS.
                        /LOCS. 13 TO 17 ARE ALL 0'S
                        /
1315  1175                      E40       /20, EQUALS E40 IN F0,
                        /
                        /LOCS. 21 TO E40-2 ARE ALL 0'S
                        /
1316  6212              EXFD,   CIF 10    /FIELD 1 TO START WITH
1317  6001                      ION       /LOC. E40, SEE SYMBOL TABLE
                                            /FOR E40.
                        /LOCS. E40+1 TO 7776 ARE ALL 0'S
                        /
1320  5412                      JMP I 12          /7777, PI SHOULD OCCUR,
                                                  /AFTER THIS INSTRUCTION,
                                                  /TO FIELD 0,
```

```
                        /
                        /ROUTINE TO TRANSFER TEST ROUTINE TO PROPER FIELD
                        /
1321  0000              TRANS,  0
1322  1103                      TAD KJMP                  /KJMP=JMP I 2
1323  3001                      DCA 1             /IN FIELD 0
1324  1104                      TAD KNTR                  /KNTR = LOC, ENTER
1325  3002                      DCA 2             /OF FIELD 0
1326  1102                      TAD KXFLD                 /KXFLD = LOC, EXFLD
1327  3010                      DCA 10
1330  3011                      DCA 11
1331  1071                      TAD K7766                 /1-10 DECIMAL
1332  3000                      DCA 0             /SAVE
1333  1500                      TAD I XTDF        /CDF X0 IN STDF
1334  3337                      DCA .+3
1335  6201                      CDF 00
1336  1410                      TAD I 10
1337  6211              TRFLD,  CDF 10            /F1 TO START WITH
1340  3411                      DCA I 11                  /PUT IN EXTENDED FIELD
1341  2000                      ISZ 0             /DONE LOCS 1 TO 12 IF SKIP
1342  5335                      JMP .-5
1343  1337                      TAD TRFLD
1344  3347                      DCA .+3
1345  6201                      CDF 00
1346  1410                      TAD I 10
1347  6211                      CDF 10
1350  3505                      DCA I K20                 /PUT E40 IN LOC, 20
1351  6201                      CDF 00
1352  1337                      TAD TRFLD
1353  3355                      DCA .+2
1354  1410                      TAD I 10
1355  6211                      CDF 10
1356  3435                      DCA I KE40M       /PUT CIF X0 IN E40-1
1357  6201                      CDF 00
1360  1337                      TAD TRFLD
1361  3363                      DCA .+2
1362  1410                      TAD I 10
1363  6211                      CDF 10
1364  3436                      DCA I KE40        /ION TO LOC, E40
1365  6201                      CDF 00
1366  1337                      TAD TRFLD
1367  3371                      DCA .+2
1370  1410                      TAD I 10
1371  6211                      CDF 10
1372  3447                      DCA I K7777       /PUT JMP I 12 IN 7777
1373  6201                      CDF 00
1374  5721                      JMP I TRANS       /EXIT
```

```
                    *1400
                    /
                    /TEST SF WITH AN RMF IOT, AN INTERRUPT IN FIELD 0 IS CREATED, AFTER
                    /WHICH, THE DF AND IB REGISTERS ARE SET TO FIELD 1.
                    /THE SF SHOULD CONTAIN FIELD 0, THE TEST
                    /THEN MAKES SURE THE IB IS CLEARED, THEN SET BY ISSUING AN RMF,
                    /FOLLOWED BY A JMP I K7000, IF THE IB IS CLEARED, THE JMP GOES TO 7000 IN FIELD 0.
                    /IF THE IB AND SF ARE INCLUSIVE OR'D, THE JMP GOES TO 7000 IN FIELD 1, AND
                    /A HALT OCCURS THERE. RESTART FROM 1400 AFTER AN ERROR. THE TEST IS LOOPED
                    /512 TIMES.
                    /
1400  6041  SFIB,   TSF                 /SEE IF FLAG IS SET.
1401  4422          JMS I XTFLG         /SET IT
1402  1456          TAD K7000           /7000
1403  3427          DCA LOOP
1404  6211          CDF 10              /DF=FIELD 1
1405  1427          TAD KHLT                    /HLT
1406  3456          DCA I K7000         /7000, FIELD 1=HLT
1407  6201          CDF 00              /DF=0
1410  1426          TAD JMP2                    /JMP2=JMP I KFLD0
1411  3457          DCA I K7000         /7000, FIELD 0=JMP I KFLD0
                                        /KFLD0=LOC, RTRN
1412  1433          TAD KJMP                    /KJMP=JMP I 2
1413  3401          DCA 1
1414  1417          TAD KRTN            /KRTN=LOC, E45A+2
1415  3402          DCA 2
                    /
                    /BEGIN TEST
                    /
1416  6001          ION                 /ENABLE PI
1417  7000          NOP
1420  7402  E45A,   HLT                 /ERROR NO PI
1421  5400          JMP SFIB                    /REPEAT TEST
                    /
                    /RETURN HERE AFTER PI
                    /
1422  7200          CLA
1423  6211          CDF 10              /DF=FIELD1
1424  6212          CIF 10              /IB=FIELD1
1425  6244          RMF                 /IB SHOULD=FIELD0
1426  5457          JMP I K7000         /IF SHOULD=FIELD0
                    /
1427  2027  RTRN,   ISZ LOOP                    /WORKED OK
1430  5215          JMP E45A-2          /LOOP
1431  5232          JMP TABLD                   /DONE, GO TO NEXT TEST
```

```
                        /
                        /
                        /TEST ALL AUTO-INDEX REGISTERS IN EACH EXTENDED FIELD.
                        /IDENTICAL TEST ROUTINES ARE PERFORMED FROM EACH FIELD.
                        /AND ERROR HALTS OCCUR IN THE FIELD CURRENTLY RUNNING
                        /THE ROUTINE. PRESS CONT, TO RESUME TESTING. EACH
                        /FIELD CONTAINS ALL 0'S EXCEPT FOR THE AREA OCCUPIED
                        /BY THE TEST ROUTINE. FIELD 0 IS RE-ENTERED
                        /AFTER EACH TEST, AND THE NEXT SEQUENTIAL FIELD
                        /IS THEN ENTERED. REFER TO THE HEADING "AUTO-
                        /INDEX TEST" FOR THE SEQUENCE OF OPERATIONS.
                        /
1432  6201              TAUTO,  CDF 00
1433  1751                      TAD K7707
1434  3027                      DCA LOOP                /LOOP COUNTER
1435  4423                      JMS I XSTKS     /READ SR 9-11
1436  1040                      TAD KCDF                /6201
1437  3246                      DCA DFN
1440  1246              NEXDF,  TAD DFN
1441  1045                      TAD K10         /INCREMENT DF
1442  3246                      DCA DFN
                        /
                        /CLEAR ONE FIELD TO 0
                        /
1443  7744                      CMA
1444  3010                      DCA 10
1445  3000                      DCA 0           /USE LOC. 0 FOR A COUNTER
1446  6211              DEF,    CDF 10          /FIELD 1 TO START WITH
1447  3410                      DCA I 10
1450  2000                      ISZ 0
1451  5247                      JMP .-2
1452  6201                      CDF 00
                        /
                        /NOW PUT TEST ROUTINE IN THE EXTENDED FIELD
                        /
1453  1316                      TAD DOAUTO      /1ST LOC. OF ROUTINE MINUS 1
1454  3010                      DCA 10          /SOURCE
1455  1073                      TAD K7744               /=28 DECIMAL
1456  3000                      DCA 0           /USE LOC. 0 AS COUNTER
1457  1316                      TAD DOAUTO
1460  3011                      DCA 11          /DESTINATION
1461  1246                      TAD DFN         /CDF X0
1462  3265                      DCA .+3
1463  6201              MOVE,   CDF 00
1464  1410                      TAD I 10
1465  6211                      CDF 10          /FIELD 1 TO START
1466  3411                      DCA I 11
1467  2000                      ISZ 0           /MOVE WHEN SKIP
1470  5263                      JMP MOVE
```

```
                        /
                        /NOW SET AUTO-I REGS 10 TO 17 TO 7777.
                        /
1471  1066                      TAD K7770               /-8 DECIMAL
1472  3000                      DCA 0
1473  1045                      TAD K7                  /7
1474  3010                      DCA 10
1475  7040                      CMA                     /7777
1476  3410                      DCA I 10
1477  2000                      ISZ 0                   /10 TO 17 = 7777 WHEN SKIP
1500  5275                      JMP .-3
1501  7040                      CMA
1502  3447                      DCA I K7777             /PUT 7777 IN LOC. 7777 OF EXTENDED FIELD
1503  6214                      RDF                     /READ D.F.
1504  1041                      TAD KCIF                        /6202
1505  3306                      DCA .+1
1506  6212                      CIF 10                  /FIELD 1 TO START
1507  4715                      JMS I FILDX             /ENTER EXTENDED FIELD
                                                        /515 OCTAL LOCS. BEFORE THE
                                                        /TAD I 10 INSTRUCTION.
                                                        /THIS IS A TEST OF THE
                                                        /DEFER BIT, 500 US DELAY
                        /
                        /ENTER FIELD 0 FROM EXTENDED FIELD HERE.
                        /
1510  2031              GOTOM,  ISZ STKS                /DONE ALL WHEN SKIP
1511  5240                      JMP NEWDF                       /SETUP FOR NEXT
1512  2027                      ISZ LOOP                        /ALL DONE IF SKIP
1513  5235                      JMP NEWDF_3             /REPEAT ALL
1514  5353                      JMP CSR8                        /CHECK SR 8
                        /
1515  1001              FILDX,  DOAUTO-515
```

```
                    /
                    /       AUTO-INDEX TEST
                    /
                    /THE ROUTINE WILL BE PLACED IN THE SAME RESPECTIVE
                    /LOCATIONS IN EACH EXTENDED FIELD. ANY ERROR
                    //HALTS WILL OCCUR IN THE EXTENDED FIELD. PRESS
                    /CONTINUE TO PROCEED WITH TESTING. THE INDEX
                    /REGISTERS 10 TO 17 INITIALLY CONTAIN 7777, AND
                    /ARE AUTO-INDEXED TO 0000 BY A TAD I INSTRUCTION.
                    /A HALT OCCURS IF THE REG. IS NOT INCREMENTED TO 0.
                    /THE TAD I WOULD HAVE THEN REFERENCED LOC. 7777,
                    /WHICH CONTAINS 7777.
                    /
1516  1516          DO/AUTO, .                /THIS LOC. IS NOT MOVED TO
                                                /THE EXTENDED FIELD.
1517  7200                    CLA
1520  1410                    TAD I 10
1521  7440                    SZA
1522  7402          E46,      HLT               /ERROR, INDEX REG. 10 FAILED
1523  1411                    TAD I 11
1524  7440                    SZA
1525  7402          E47,      HLT               /INDEX REG, 11 FAILED
1526  1412                    TAD I 12
1527  7440                    SZA
1530  7402          E48,      HLT               /12 FAILED
1531  1413                    TAD I 13
1532  7440                    SZA
1533  7402          E49,      HLT               /13 FAILED
1534  1414                    TAD I 14
1535  7440                    SZA
1536  7402          E50,      HLT               /14 FAILED
1537  1415                    TAD I 15
1540  7440                    SZA
1541  7402          E51,      HLT               /15 FAILED
1542  1416                    TAD I 16
1543  7440                    SZA
1544  7402          E52,      HLT               /16 FAILED
1545  1417                    TAD I 17
1546  7440                    SZA
1547  7402          E53,      HLT               /17 FAILED
1550  6201                    CDF 00            /SET DF TO FIELD 0
1551  6202                    CIF 00            /SET I.B. TO FIELD 0
1552  5310                    JMP GOTO0                 /EXIT TO FIELD 0
                    /END OF TEST ROUTINE
                    /
                    /
```

```
                        /CHECK SR 8, IF AN 8I IS BEING USED SR 8 MUST BE
                        /SET A 1, OTHERWISE, 0.
                        /
1553  7604              CS%8,   LAS
1554  0246                      AND K1Ø
1555  7640                      SZA CLA
1556  5766                      JMP I XMEM              /NEXT TEST
1557  0007                      AND 7
1560  1357              BELL,   TAD .-1
1561  6046                      ILS                     /RING BELL
1562  6041                      TSF
1563  5362                      JMP .-1
1564  5765                      JMP I XBGN              /START OVER AT 2ØØ
                        /
1565  0200              XBGN,   BEGIN
1566  1600              XMEM,   NOMEM
```

```
                    /
1600                *1600
                    /
                    /REFERENCE ALL 4K FIELDS NOT PRESENT, IF 32K
                    /IS PRESENT, THE TEST IS BY-PASSED, AND PROGRAM IS
                    /RESTARTED AT 200, EACH FIELD NOT PRESENT IS
                    /REFERENCED BY THE PROGRAM WITH JMP, DCA AND TAD.
                    //THE PROGRAM MUST CONTINUE IN SEQUENCE/ THE TTY
                    /BELL WILL SIGNAL A SUCCESSFUL TEST, AND THE PRO-
                    /GRAM IS THEN RESTARTED AT 200.
                    /
1600  7200  NOMEM,   CLA
1601  1066          TAD K7770
1602  3027          DCA LOOP                  /TEST LOOP COUNTER
1603  7604          LAS                 /READ SR9-11
1604  0045          AND K7
1605  7041          CIA
1606  1045          TAD K7              /SUBTRACT MAX, POSSIBLE
1607  7450          SNA
1610  5652          JMP I XBELL               /32K PRESENT, CAN'T TEST
1611  3033          DCA NOSTAK          /SAVE NO, MISSING
1612  3651          DCA I XBELL         /CLEAR THE TLS IOT AT
                                        /BELL+1 TO PROHIBIT
                                        /FALSE INDICATION, TLS
                                        /IS RESTORED LATER WRONG
                                        /ENTRY FROM NON-EXISTENT
                                        /MEMORY MAY CAUSE A
                                        /HANG-UP AT BELL+2 AND +3.
1613  7604          LAS                 /# OF FIELDS PRESENT
1614  0045          AND K7
1615  7001          IAC                 /+1 TO GET 1ST MISSING
1616  7100          CLL
1617  7006          RTL                 /POSITION TO AC 6-8,
1620  7004          RAL
1621  3034          DCA NOFLD                 /1ST MISSING
1622  1033          TAD NOSTAK          /# STACKS NOT HERE
1623  7041          CIA
1624  3033          DCA NOSTAK          /USED AS COUNTER
```

```
                        /
                        /
1625  1040                      TAD KCDF                /601
1626  1034                      TAD NOFLD               /MISSING STACK
1627  3262                      DCA CDFØS
1630  1040                      TAD KCDF
1631  1034                      TAD NOFLD
1632  3307                      DCA CDF1S
                        /
                        /NOW SEE IF AN ODD OR EVEN NUMBER IS MISSING
                        /
1633  1033                      TAD NOSTAK
1634  7041                      CIA
1635  7010                      RAR
1636  7620                      SNL CLA           /L=1, FIRST READ Ø,S, THEN ALWAYS
                                                  /ALL 1'S
1637  5257                      JMP POS+3                 /L=Ø, ALWAYS READ ALL 1'S
1640  4261                      JMS ALLØ                  /READ ALL Ø FROM 1ST
1641  2033              CNSTK,  ISZ NOSTAK        /DONE ALL MISSING IF SKIP
1642  5254                      JMP POS           /READ ALL 1'S FROM HERE ON
1643  2027                      ISZ LOOP                  /DONE LOOPING IF SKIP
1644  5650                      JMP I XNOM        /REPEAT
1645  1253                      TAD TTB
1646  3651                      DCA I XELL        /RESTORE TLS
1647  5652                      JMP I XBELL       /RING BELL
                        /
1650  1633              XNOM,   NOMEM+3
1651  1561              XELL,   BELL+1
1652  1560              XBELL,  BELL
1653  6046              TTB,    TLS
                        /
1654  1307              POS,    TAD CDF1S
1655  1046                      TAD K1Ø           /DF PLUS 1
1656  3307                      DCA CDF1S
1657  4306                      JMS ALL1                  /READ ALL 1'S
1660  5241                      JMP CNSTK                 /CHECK DONE
```

```
                        /
                        /ROUTINE TO READ ALL 0'S.
                        /
1661  0000              ALL0,   0
1662  6201              CDF0S,  CDF 00          /SET DF TO 1ST MISSING
1663  7240                      CLA CMA
1664  3010                      DCA 10          /10 AND 11 USED FOR ADDRESS
1665  7040                      CMA
1666  3011                      DCA 11
1667  3002                      DCA 2           /USE AS COUNTER
1670  7040                      CMA
1671  3410                      DCA I 10                /WRITE 1'S INTO NON-EXIS-
                                                /TENT FIELD.
1672  2002                      ISZ 2
1673  5270                      JMP .-3
1674  1411                      TAD I 11                /READ NON-EXIST. FIELD
1675  7650                      SNA CLA         /SHOULD = 0000
1676  5301                      JMP .+3
1677  1011                      TAD 11
1700  7402              E54,    HLT                     /ERROR, AN EXISTING FIELD
                                                /WAS REFERENCED. C(AC)=
                                                /ADDRESS REFERENCED

1701  2002                      ISZ 2
1702  5274                      JMP E54-4               /READ NEXV
                        /
1703  6201              NOE0,   CDF 00
1704  6202                      CIF 00
1705  5661                      JMP I ALL0      /EXIT
                        /
```

```
                        /ROUTINE TO READ ALL 1'S
                        /
1706  0000              ALL1,   0
1707  6201              CDF1S,  CDF 00          /SET DF TO MISSING FIELD
1710  7240                      CLA CMA
1711  3010                      DCA 10          /10 AND 11 USED FOR ADDRESSING
1712  7040                      CMA

1713  3011                      DCA 11
1714  3002                      DCA 2           /USED AS COUNTER
1715  3410                      DCA I 10                /WRITE 0'S
1716  2002                      ISZ 2
1717  5315                      JMP .-2
1720  1411                      TAD I 11                /READ 1'S FROM NO MEMORY
1721  7040                      CMA
1722  7450                      SNA
1723  5327                      JMP .+4
1724  7040                      CMA
1725  7402              E57,    HLT                     /7777 NOT READ, C(AC)= DATA
                                                        /READ, C(11)= ADDRESS,
1726  7200                      CLA
1727  2002                      ISZ 2
1730  5320                      JMP E57-5
1731  6201                      CDF 00
1732  6202                      CIF 00
1733  5706                      JMP I ALL1      /EXIT
                        /
```

```
                        /READ SR9-11
                        /
1734  0000              NSTKS,  0
1735  7604                      LAS
1736  0045                      AND K7
1737  7041                      CIA
1740  3031                      DCA STKS
1741  5734                      JMP I NSTKS
                        /
                        /SET TTY FLAG
                        /
1742  0000              TFLG,   0
1743  7200                      CLA
1744  0015                      AND 15
1745  1344                      TAD .-1
1746  6046                      TLS
1747  6041                      TSF
1750  5347                      JMP .-1
1751  7200                      CLA
1752  5742                      JMP I TFLG      /EXIT
                        /
                                $
```

THERE ARE NO ERRORS

SYMBOL TABLE

ALL0	1661
ALL1	1706
BEGIN	0200
BELL	1560
CDF	6201
CDFMS	1662
CDF1S	1707
CHDF	1136
CIF	6202
CIF1	0704
CIF2	0727
CIF3	0752
CIF4	1000
CIF5	1023
CIF6	1046
CIF7	1071
CKSC	1226
CNSTK	1641
CSRB	1553
DAT	0032
DCAI	0601
DFLD	0607
DF0	1446
DF0	0202
DF1	0226
DF2	0237
DF3	0254
DF4	0265
DF5	0302
DF6	0313
DF7	0211
D.AUTO	1516
DONE0	1703
ENTER	1200
EXFD	1316
EXFLD	1302
E1	0206
E10	0351
E11	0360
E12	0410
E13	0417
E14	0427
E15	0436
E16	0452
E17	0461
E18	0471
E19	0500
E2	0217
E20	0514
E21	0523
E22	0533
E23	0542
E24	0653

SYMBOL TABLE

E25	0710
E26	0717
E27	0733
E28	0742
E29	0756
E3	0234
E30	0765
E31	1004
E32	1013
E33	1027
E34	1036
E35	1052
E36	1061
E37	1075
E38	1104
E4	0245
E40	1175
E41	1203
E42	1221
E43	1235
E44	1306
E45	1312
E45A	1420
E46	1522
E47	1525
E48	1530
E49	1533
E5	0262
E50	1536
E51	1541
E52	1544
E53	1547
E54	1700
E57	1725
E6	0273
E7	0310
E8	0321
E9	0341
FILDX	1515
GOTO2	1512
HNTS	2667
IBSF	0656
IB2	2334
IB1	2343
IB2	2422
IB3	0421
IB4	2444
IB5	0463
IB6	0506
IB7	2525
ISZ0	0021
JMPI2	2222
JMP2	2126

SYMBOL TABLE

KCDF	0040
KCF1	0042
KCIF	0041
KE42	2236
KE4ØM	0035
KFLDØ	0107
KHLT	0037
KJMP	0103
KNTR	0104
KRTN	0110
KXFLD	0102
K1	0044
K1Ø	0046
K2Ø	0105
K7	0045
K7S	0070
K7ØØØ	0050
K77Ø7	0051
K7717	0057
K7727	0056
K7737	0055
K7744	0073
K7747	0054
K7757	0053
K7766	0071
K7767	0052
K777Ø	0066
K7771	0065
K7772	0064
K7773	0063
K7774	0062
K7775	0061
K7776	0060
K7777	0047
LOOP	0027
MOVE	1463
NDF	0030
NEWDF	1440
NOFLD	0034
NOMEM	1600
NOSTAK	0033
NSTKS	1734
OKF1	0722
OKF2	0745
OKF3	0770
OKF4	1016
OKF5	1041
OKF6	1064
OKF7	1107
OK1	0222
OK2	0250
OK3	0276
OK4	0324

SYMBOL TABLE

OK5	1362
OK6	1440
OK7	1502
OK8	1544
POINT	1067
POS	1654
RDF	6214
RIB	6234
RIF	6224
RMF	6244
RTRN	1427
SFIB	1400
STDF	1171
STKS	0031
STRMF	1151
TADI	0622
TAUTO	1432
TFLD	1630
TFLG	1742
TRANS	1321
TRFLD	1337
TRMI	1112
TTR	1653
XAUTO	0026
XBELL	1652
XBGN	1565
XELL	1651
XFD	0043
XFIB	0111
XMEM	1566
XNOM	1650
XRANS	0025
XRMF	0024
XSTKS	0023
XTDF	0100
XTDF1	0101
XTFLG	0022

SYMBOL TABLE

JMPL	0020
TSX4	0021
XTEL6	0022
XSTKR	0023
XRMI	0024
XRANS	0025
XAHLD	0026
LOOP	0027
NOE	0030
STKS	0031
DAT	0032
NOSTAK	0033
NOFLD	0034
KE40M	0035
KE41	0036
KHLT	0037
KCOF	0040
KCTF	0041
KCF1	0042
XFD	0043
K1	0044
K7	0045
K10	0046
K7777	0047
K7750	0050
K7757	0051
K7767	0052
K7757	0053
K7747	0054
K7737	0055
K7727	0056
K7717	0057
K7776	0060
K7775	0061
K7774	0062
K7773	0063
K7772	0064
K7771	0065
K7770	0066
POINT	0067
K7S	0070
K7766	0071
K7744	0073
XTDF	0100
XTDF1	0101
KXFLD	0102
KJMP	0103
KNTR	0104
K20	0105
JMP2	0106
KFLDS	0107
KRTN	0110
XFIG	0111

SYMBOL TABLE

BEGIN	0200
DF0	0202
E1	0206
DF7	0211
E2	0217
OK1	0222
DF1	0226
E3	0234
DF2	0237
E4	0245
OK2	0250
DF3	0254
E5	0262
DF4	0265
E6	0273
OK3	0276
DF5	0302
E7	0310
DF6	0313
E8	0321
OK4	0324
IB0	0334
E9	0341
IB1	0343
E10	0351
E11	0360
OK5	0362
IB2	0402
E12	0410
E13	0417
IB3	0421
E14	0427
E15	0436
OK6	0440
IB4	0444
E16	0452
E17	0461
IB5	0463
E18	0471
E19	0500
OK7	0502
IB6	0506
E20	0514
E21	0523
IB7	0525
E22	0533
E23	0542
OK8	0544
DCAI	0601
DFLD	0607
TADI	0622
TFLD	0630
E24	0653

SYMBOL TABLE

IBSF	0656
HLTS	0667
CIF1	0704
E25	0710
E26	0717
OKF1	0722
CIF2	0727
E27	0733
E28	0742
OKF2	0745
CIF3	0752
E29	0756
E30	0765
OKF3	0770
CIF4	1000
E31	1004
E32	1013
OKF4	1016
CIF5	1023
E33	1027
E34	1036
OKF5	1041
CIF6	1046
E35	1052
E36	1061
OKF6	1064
CIF7	1071
E37	1075
E38	1104
OKF7	1107
TRMF	1112
CHDF	1136
STRMF	1151
STDF	1171
E40	1175
ENTER	1200
E41	1203
E42	1221
CKPC	1226
E43	1235
EXFLD	1302
E44	1306
E45	1312
EXFD	1316
TRANS	1321
TRFLD	1337
SFIB	1400
E45A	1420
RTRN	1427
TAUTO	1432
NEWDF	1440
DFN	1446
MOVE	1463

SYMBOL TABLE

GOTOP	1510
FILDX	1515
DOAUTO	1516
E46	1522
E47	1525
E48	1530
E49	1533
E50	1536
E51	1541
E52	1544
E53	1547
CSP8	1553
BELL	1560
XBGN	1565
XMEM	1566
NOMEM	1600
CNSTK	1641
XNOM	1650
XBELL	1651
XBELL	1652
TTR	1653
POS	1654
ALL0	1661
CDF0S	1662
E54	1700
DONE0	1703
ALL1	1706
CDF1S	1707
E57	1725
NSTKS	1734
TFLG	1742
CDF	6201
CIF	6202
RDF	6214
RIF	6224
RIB	6234
RMF	6244