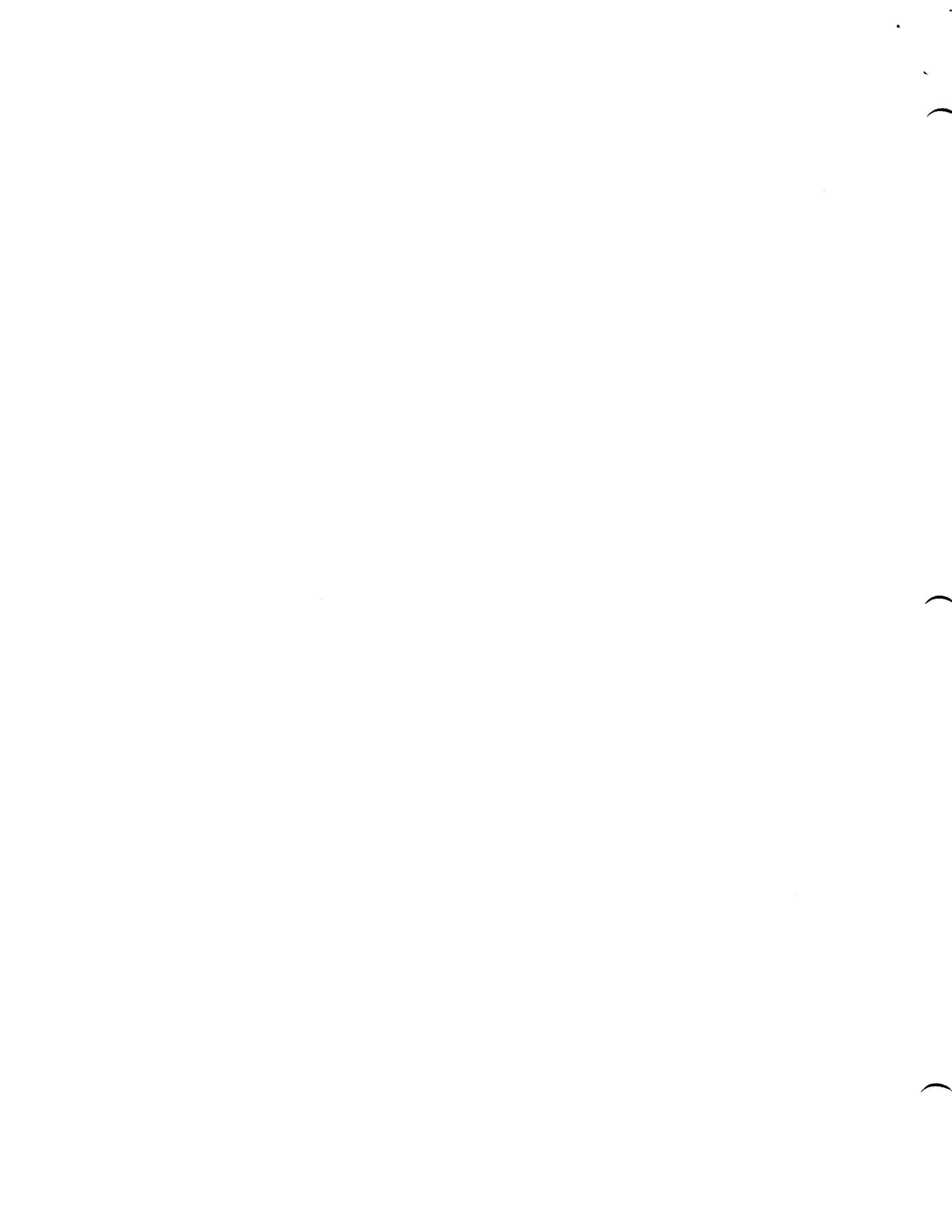


IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D000-D
PRODUCT NAME: RANDOM DCA TEST
DATE CREATED: JUNE 11, 1971
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: BRUCE HANSEN

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1. ABSTRACT

THIS PROGRAM TESTS THE DCA INSTRUCTION OF THE PDP-8/E. THE DCA INSTRUCTION ADDRESS, OPERAND ADDRESS, AND OPERANDS ARE TAKEN FROM A RANDOM NUMBER GENERATOR.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8/E EQUIPPED WITH TELETYPE.

2.2 STORAGE

THE DIAGNOSTIC PROGRAM IS STORED IN LOCATIONS 0000 THROUGH 0407. THE PROGRAM USES 0410 THROUGH 7600 FOR A TEST AREA. THE BINARY LOADER MUST BE STORED IN THE LAST MEMORY PAGE.

2.3 PRELIMINARY PROGRAMS

MAINDEC-8E-D0A(N), AND MAINDEC-8E-D0B(N)

3. LOADING PROCEDURE

3.1 METHOD

THE STANDARD BINARY LOADER IS USED.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SR0 (0) HALT AFTER ERROR PRINTOUT.
SR1 (1) BYPASS ERROR PRINTOUT
SR2 HOLD "FROM" CONSTANT (1). SELECT RANDOM "FROM" (0).
SR3 HOLD "OPERAND ADDRESS" CONSTANT (1). SELECT RANDOM "OPERAND ADDRESS" (0).
SR4 HOLD "OPERAND" CONSTANT (1). SELECT RANDOM "OPERAND" (0).

4.2 STARTING ADDRESS

0200

4.3 OPERATOR ACTION

1. SET SR TO 0200.
2. PRESS LOAD ADDRESS
3. SET SR TO 0000
4. PRESS CLEAR THEN CONTINUE

5. OPERATING PROCEDURE

SAME AS SECTION 4.

6. ERRORS

6.1 ERROR PRINTOUTS

F XXXX A YYYY O NNNN

L RRRR C MMMM

E

FROM, F XXXX WHERE XXXX = ADDRESS OF THE DCA
INSTRUCTION

ADDRESS, A YYYY WHERE YYYY = ADDRESS WHERE DCA WILL
DEPOSIT OPERAND

OPERAND O NNNN WHERE NNNN = THE OPERAND TO BE DEPOSITED.

LOCATION, L RRRR WHERE RRRR = A NONZERO LOCATION SOME-
WHERE IN THE TEST FIELD.

CONTENTS, C MMMM WHERE MMMM = CONTENTS OF LOCATION RRRR.

END, E THIS LETTER IS TYPED TO INFORM THAT THE
ENTIRE TEST AREA HAS BEEN SEARCHED FOR
NONZERO OPERANDS.

A. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F 4572 A 0205 0 2525
L 0205 C 2527
E
```

LINE 1 IS SIMPLY A STATEMENT OF THE PROBLEM. IT SAYS THAT A DCA INSTRUCTION LOCATED AT 4572 TRIED TO DEPOSIT THE OPERAND 2525 INTO LOCATION 0205.

LINE 2 SAYS THAT INSTEAD OF FINDING A 2525 IN LOCATION 0205, THE PROGRAM FOUND A 2527. BIT 10 WAS "PICKED UP." THE E SIGNIFIES THAT A SEARCH OF THE TEST AREA SHOWED ONLY THE ABOVE PRINTED LOCATIONS DIFFERING FROM WHAT THEY SHOULD BE.

B. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F 4572 A 0205 0 2525
L 0215 C 2525
E
```

LINE 1 IS A STATEMENT OF THE PROBLEM AS IN THE PREVIOUS EXAMPLE. LINE 2 SAYS THAT LOCATION 0215 CONTAINS 2525, AND THE E ON LINE 3 SAYS THAT NO OTHER LOCATIONS WERE DISTURBED. IT IS APPARENT THEN THAT THE DCA INSTRUCTION DEPOSITED ITS OPERAND NOT INTO LOCATION 0205, BUT INTO LOCATION 0215. BIT 8 WAS "PICKED UP".

6.3 ERROR RECOVERY

TO ENTER A SCOPE MODE LOOP, SET SR0 TO A 0. WHEN A HALT OCCURS FOLLOWING AN ERROR, SET SWITCHES 1, 2, 3, AND 4 AND PUSH CONTINUE. A SCOPE MODE LOOP IS ENTERED USING THE CONDITIONS DESCRIBED BY THE LAST ERROR PRINTOUT.

IF IT IS DESIRED TO ENTER A SCOPE MODE LOOP USING A SPECIFIC SET OF CONDITIONS, STOP THE PROGRAM AND MAKE THE FOLLOWING ENTRIES:

- A. ENTER DESIRED FROM ADDRESS INTO MEMORY LOCATION 0167.
- B. ENTER DESIRED OPERAND ADDRESS INTO MEMORY LOCATION 0166.
- C. ENTER DESIRED OPERAND INTO MEMORY LOCATION 0170.

RESTART THE PROGRAM USING A CONTROL SWITCH SETTING OF 3600.

7. RESTRICTIONS (NONE)

8. MISCELLANEOUS

8.1 EXECUTION TIME

3904 RANDOM TESTS/PASS
7 PASSES/BELL
27,328 RANDOM TESTS/PASS

9. PROGRAM DESCRIPTION

MEMORY LOCATIONS 0410 THROUGH 7600 ARE DESIGNATED AS TEST LOCATIONS, AND ZEROES ARE DEPOSITED INTO EACH AT THE BEGINNING OF THE PROGRAM. THE PROGRAM NOW SELECTS A LOCATION FOR THE DCA INSTRUCTION. THIS SELECTED LOCATION MAY BE SPECIFIED OR RANDOM, DEPENDING UPON THE SWITCH REGISTER SETTING. THE OPERAND AND OPERAND ADDRESS ARE SELECTED IN A SIMILAR MANNER. THE PROGRAM NOW JUMPS TO THE TEST DCA, PERFORMS THE INSTRUCTION, THEN JUMPS BACK TO A CHECKING ROUTINE. THE CHECKING ROUTINE VERIFIES THAT THE OPERAND WAS DEPOSITED CORRECTLY. IF AN ERROR IS DETECTED, THE ERROR ROUTINE SEARCHES THE TEST AREA AND PRINTS THE CONTENTS OF ANY NONZERO LOCATION EXCEPT FOR THE TEST DCA INSTRUCTION. UPON COMPLETION OF THIS SCAN THROUGH THE TEST AREA, AN E IS PRINTED AND A NEW TEST IS BEGUN.

THE TELETYPE BELL RINGS AFTER 7 PASSES OF 3904 TEST/PASS.

/RANDOM DCA TEST
 /SR0(0)=HALT ON ERROR
 /SR1(1)=NO PRINTOUTS
 /SR2(1)=CONSTANT FROM
 /SR3(1)=CONSTANT OPERAND ADDRESS
 /SR4(1)=CONSTANT OPERAND
 *0

0000
 0000
 0001 5001
 0002 0002
 0003 0003
 0004 0000
 0005 0000
 0006 7771
 0007 0400
 0010 0000
 0011 0000
 0012 0300
 0013 0207
 0014 0003

0 JMP 1
 2
 3
 0
 0
 CNT2, 7771
 PSUB, SUB
 WORK, 0
 CNT, 0
 M7500, -7500
 BEL, 207
 THREE, 3

/CLEAR MEMORY
 *20
 START, TAD LIMLO
 DCA WORK
 DCA I WORK
 TAD WORK
 CIA
 TAD LIMHI
 SEA CLA
 JMP START+2

0020
 0021 1175
 0022 3010
 0023 3410
 0024 1010
 0025 7041
 0026 1174
 0027 7640
 0028 5022

/CHECK FOR CONSTANT FROM
 CK1,
 LAS
 RTL
 SPA
 JMP CK2

0030 7604
 0031 7006
 0032 7510
 0033 5052

/GET FROM ADDRESS
 JMS GENRAN
 DCA FROM

0034 4194
 0035 3167
 0036 1167
 0037 7510
 0040 5046
 0041 7041
 0042 1175
 0043 7710
 0044 5052
 0045 5034
 0046 7041
 0047 1174
 0050 7710
 0051 5034

TAD FROM
 SPA
 JMP .+6
 CIA
 TAD LIMLO
 SPA CLA
 JMP CK2
 JMP CK1+4
 CIA
 TAD LIMHI
 SPA CLA
 JMP CK1+4

/CHECK FOR CONSTANT OPERAND ADDRESS

0052 7604
0053 7006
0054 7004
0055 7510
0056 5075

CK2, LAS
RTL
RAL
SPA
JMP CK3

/GET OPERAND ADDRESS

0057 4154
0060 3166

JMS GENRAN
DCA OPAD

0061 1166
0062 7510
0063 5071
0064 7041
0065 1175
0066 7710
0067 5075
0070 5057
0071 7041
0072 1174
0073 7710
0074 5057

TAD OPAD
SPA
JMP .+6
CIA
TAD LIMLO
SPA CLA
JMP CK3
JMP CK2+5
CIA
TAD LIMHI
SPA CLA
JMP CK2+5

/CHECK FOR CONSTANT OPERAND

0075 7604
0076 7006
0077 7006
0100 7710
0101 5104

CK3, LAS
RTL
RTL
SPA CLA
JMP CK4

/GET OPERAND

0102 4154
0103 3170

JMS GENRAN
DCA OPER

/CHECK FOR FROM+1=OPERAND ADDRESS

0104 1167
0105 7041
0106 1166
0107 7450
0110 5030
0111 7041
0112 7040
0113 7650
0114 5030

CK4, TAD FROM
CIA
TAD OPAD
SNA
JMP CK1
CIA
CMA
SNA CLA
JMP CK1

/PLACE THE INSTRUCTIONS

0115 1171
0116 3567
0117 1167
0120 7001
0121 3173
0122 1172

TAD DCA1
DCA I FROM
TAD FROM
IAC
DCA FROMP1
TAD JMP1

0123 3573
 0124 1170
 0125 7000
 0126 5567
 0127 7402

DCA I FROMP1
 TAD OPER
 NOP
 JMP I FROM
 HLT

/GO OUT TO TEST
 /JMP FAILURE

0130 1566
 0131 7041
 0132 1170
 0133 7640
 0134 4577
 0135 3566
 0136 3567
 0137 3573

/RETURN FROM TEST
 BACK, TAD I OPAD
 CIA
 TAD OPER
 SEA CLA
 JMS I AERR
 DCA I OPAD
 DCA I FROM
 DCA I FROMP1

/RING BELL AFTER 7 PASSES OF 3904 TEST PER PASS

0140 1011
 0141 7001
 0142 3011
 0143 1011
 0144 1012
 0145 7640
 0146 5030
 0147 3011
 0150 2006
 0151 5030
 0152 4407
 0153 5030

TAD CNT
 IAC
 DCA CNT
 TAD CNT
 TAD M7500
 SEA CLA
 JMP CK1
 DCA CNT
 ISZ CNT2
 JMP CK1
 JMS I PSUB
 JMP CK1

/RANDOM NUMBER GENERATOR

0154 0000
 0155 7200
 0156 1165
 0157 7104
 0160 7430
 0161 1014
 0162 3165
 0163 1165
 0164 5534
 0165 2525

GENRAN, 0
 CLA
 TAD RANUM
 RAL CLL
 SZL
 TAD THREE
 DCA RANUM
 TAD RANUM
 JMP I GENRAN
 RANUM, 2525

/CONSTANTS AND VARIABLES

0166 3000
 0167 3001
 0170 2525
 0171 3566
 0172 5130
 0173 3002
 0174 7600
 0175 0410
 0176 0000
 0177 0201

OPAD, 3000
 FROM, 3001
 OPER, 2525
 DCA1, DCA I OPAD
 JMP1, JMP BACK
 FROMP1, 3002
 LIMHI, 7600
 LIMLO, 410
 WORK1, 0
 AERR, ERR

0200
 0201 5020
 0202 0000
 0203 7604
 0204 7004
 0205 7710
 0206 5601
 0207 4265
 0210 3010
 0211 1410
 0212 7640
 0213 4233
 0214 1010
 0215 7041
 0216 1174
 0217 7640
 0220 9211
 0221 1374
 0222 4351
 0223 1375
 0224 4351
 0225 1376
 0226 4351
 0227 7604
 0230 7700
 0231 7402
 0232 5601

*200 /DCA ERROR, CHECK ALL MEMORY
 JMP START
 ERR, 0
 LAS
 RAL CLA
 SPA CLA
 JMP I ERR
 JMS PHD
 TAD LIMLO
 DCA WORK
 TAD I WORK
 SZA CLA
 JMS ER1
 TAD WORK
 CIA
 TAD LIMHI
 SZA CLA
 JMP -7
 TAD E
 JMS PRINT
 TAD CR
 JMS PRINT
 TAD LF
 JMS PRINT
 LAS
 SMA CLA
 HLT
 JMP I ERR /HALT ON ERROR

0233 0000
 0234 1010
 0235 7041
 0236 1167
 0237 7650
 0240 5633
 0241 1010
 0242 7041
 0243 1173
 0244 7650
 0245 5633
 0246 1372
 0247 4351
 0250 1010
 0251 4310
 0252 1010
 0253 3176
 0254 1373
 0255 4351
 0256 1576
 0257 4310

/MEMORY LOCATION WRONG (MAYBE)
 ER1, 0
 TAD WORK
 CIA
 TAD FROM
 SNA CLA
 JMP I ER1
 TAD WORK
 CIA
 TAD FROMP1
 SNA CLA
 JMP I ER1
 TAD L
 JMS PRINT
 TAD WORK
 JMS TYPAC
 TAD WORK
 DCA WORK1
 TAD C
 JMS PRINT
 TAD I WORK1
 JMS TYPAC
 /FORGET IT. THIS IS LOC FROM
 /FORGET IT. THIS IS LOC FROM+1

0260 1375
 0261 4351
 0262 1376
 0263 4351
 0264 5633

TAD CR
 JMS PRINT
 TAD LF
 JMS PRINT
 JMP I ER1

/PRINT FIRST LINE OF ERROR

0265 0000
 0266 7200
 0267 1367
 0270 4351
 0271 1167
 0272 4310
 0273 1371
 0274 4351
 0275 1166
 0276 4310
 0277 1377
 0300 4351
 0301 1170
 0302 4310
 0303 1375
 0304 4351
 0305 1376
 0306 4351
 0307 5665

PHD,
 0
 CLA
 TAD F
 JMS PRINT
 TAD FROM
 JMS TYPAC
 TAD A
 JMS PRINT
 TAD OPAD
 JMS TYPAC
 TAD O
 JMS PRINT
 TAD OPER
 JMS TYPAC
 TAD CR
 JMS PRINT
 TAD LF
 JMS PRINT
 JMP I PHD

/TYPE AC CONTENTS IN OCTAL

0310 5310
 0311 3366
 0312 1366
 0313 7012
 0314 7010
 0315 3365
 0316 1365
 0317 7012
 0320 7010
 0321 3364
 0322 1364
 0323 7012
 0324 7010
 0325 3363
 0326 1370
 0327 4351
 0330 1357
 0331 5360

TYPAC,
 JMP
 DCA SAVE+3
 TAD SAVE+3
 RTR
 RAR
 DCA SAVE+2
 TAD SAVE+2
 RTR
 RAR
 DCA SAVE+1
 TAD SAVE+1
 RTR
 RAR
 DCA SAVE
 TAD SPACE
 JMS PRINT
 TAD FOUR
 DCA CTR

0332 1363
 0333 0361
 0334 1362

LUP,
 TAD SAVE
 AND MSK7
 TAD TH6

0335 4351 JMS PRINT
 0336 1364 TAD SAVE+1
 0337 3363 DCA SAVE
 0340 1365 TAD SAVE+2
 0341 3364 DCA SAVE+1
 0342 1366 TAD SAVE+3
 0343 3365 DCA SAVE+2
 0344 2360 ISE CTR
 0345 5332 JMP LUP
 0346 1370 TAD SPACE
 0347 4351 JMS PRINT
 0350 5710 JMP I TYPAC
 PRINT, 0
 0351 0000 TLS
 0352 6046 TSF
 0353 6041 JMP .-1
 0354 5353 CLA
 0355 7200 JMP I PRINT
 0356 5751

/CONSTANTS

0357 7774 FOUR, -4
 0360 0000 CTR, 0
 0361 0007 HSK7, 7
 0362 0260 TW6, 0260
 0363 0000 SAVE, 0
 0364 0000 0
 0365 0000 0
 0366 0000 0
 0367 0306 F, 306
 0370 0240 SPACE, 240
 0371 0301 A, 301
 0372 0314 L, 314
 0373 0303 C, 303
 0374 0305 E, 305
 0375 0215 CR, 215
 0376 0212 LF, 212
 0377 0317 O, 317
 0400 *400
 0401 SUB, 0
 0402 TAD PASS
 0403 DCA CNT2
 0404 TAD BEL
 0405 TLS
 0406 CLA
 0407 JMP I SUB
 PASS, 7771
 \$