DECUS
PROGRAM LIBRARY

DECUS NO.	8-538
TITLE	INTEGER IOH FOR FORTRAN LIBRARY
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SOURCE LANGUAGE	SABR

Abstract

INTIOH is for use with FORTRAN programs having only integer arithmetic, and is a substitute for the format interpreting routine of the PS/8 FORTRAN library. Eight pages of core are saved. A new format is defined for input of file names used in device independent input/output and chaining.

Operating Principles

The organization of the PS/8 FORTRAN library as a set of independently loaded subroutines conserves core space by permitting the loading of just those routines actually needed by the user's program. Thus, in theory, a FORTRAN program which uses only integer arithmetic will not require loading of the 5 page floating point arithmetic routine. However, in practice, the floating point routine will be loaded anyway if the FORTRAN program contains formatted input/output statements. The reason is that the standard IOH routine, which is used for format interpretation, calls on the floating point routine, even though it will not be used in the execution of an all integer FORTRAN program.

INTIOH is a substitute for the standard IOH routine of the PS/8 FORTRAN library. The I,A,H, and X formats are implemented, but the E and F formats are excluded and the floating point routine is not requested. Integer FORTRAN programs thus gain 3 core pages from the reduced length of INTIOH and 5 core pages from the absence of the floating point routine.

New L Format

Another feature of INTIOH is the addition of the L format for alphanumeric input. The existing A format is inadequate for the special case of file names to be used in opening device independent input/output files or chaining to another program. The file name arguments of the IOPEN, OOPEN, and CHAIN routines must have exactly 6 characters. If the file name typed by the user has fewer than 6 characters, the remaining positions must be filled with zeros. The new L format for input is similar to the A format, except zeros rather than blanks are used to fill the remaining positions when the input string is shorter than the field specification. The L format for output is identical with the A format.

The following programming sequence illustrates the use of the L format to open a user specified file from the system device.

```
          READ (1,10) XNAME
10        FORMAT ('INPUT FILE=', L6)
          CALL IOPEN ('SYS',XNAME)
          etc.
```

Loading INTIOH

The relocatable binary tape of INTIOH is transfered to the device DSK: using PIP.

```
.R PIP
*INTIOH.RL  PTR:/B
```

INTIOH is loaded into core when needed by explicitly naming it as input to the linking loader. The following example shows how a previously compiled integer FORTRAN program, called TEST.RL, can be loaded and executed.

```
.R LOADER
*TEST,INTIOH/G
```

The explicit loading of INTIOH satisfies the request for the IOH subroutine, and thereby prevents the standard library IOH from being loaded.

```
AA        1252
AB        1474
ANDI      04000P
AR        1276
ARCOMN    1322
ARGUMT    0176ABS
ARMORE    1010
ARNORT    1316
AS        1261
ASNORT    1270
AS1       1341
AS3       1344
AX        1254
A2        0200
BA        0703
BB        1241
BG        0673
BH        0704
BL        0705
CH        0251
CHCH      1104
CHLOOP    1063
CHTYPE    1052
CLEAR     0000EXT
CM        0433
CR        0550
CRX       0547
CS        0242
CX        1343
DCAI      34000P
DEVNO1    0300
DG        0451
DGT       1527
DH        1330
DIGIT     1431
DIV       0000EXT
DT        1105
DV        0241
EJ        0660
ERRNO     0214
ERROR     0000EXT
ERR1      0222
ERR2      0215
ERR3      0217
ET        0267
E1        0676
E2        0665
FENTER    0515
FILL      1327
FPNT      0326
FPNT01    0335
GADR      1331
GCHR      0711
```

```
GENIO    0000EXT
GFRM     0327
GLST     1000
HH       0634
HR       0344
IB       1507
ID       1517
II       1446
IN       1400
IO       0262
IOGTAR   1020
IOH      1013EXT
IOHAR    1033
IOHBAK   1030
IOHCNT   1051
IOHINC   1050
IOH1     1023
IREM     0000EXT
ISZI     24000P
IX       1444
I1       0352
JD       0712
JMPI     54000P
JMPOTX   1077
JMPOUT   1076
JMSI     44000P
JMSKP    40000P
LL       1253
LP       0453
LS       1152
L2       0532
MR       1225
NPAR     0546
NU       1233
N1       0435
N2       0175ABS
N3       0543
OK       1305
PARN     0243
PENTER   0325
PR       1200
PRINT    0640
PRO      1433
PR2      1203
PUSH     0477
QQ       1354
QQA      1352
QT       0441
QT1      0442
READ     0253EXT
RETC     0607
RETN     0400
RETRY    0255
RETT     1110
RPAR     0500
```

```
RRS      1412
RRSIGN   1407
RTUR     0401
SA       0600
SACH     0023ABS
SACL     0025ABS
SACM     0024ABS
SL       0436
SN       0735
SVCHR    0422
SW       0263
S1       0544
S2       0545
TADI     14000P
TR       0534
TW       0252
VQ       1405
WH       0652
WHI      1475
WRITE    0264EXT
XX       0622
XX1      0631
XZ       1465

                /COPYRIGHT 1968, DIGIATAL EQUIPMENT CORP., MAYNARD, MASS.
                /
                /
                /       VERSION IOH.V08 (FEBRUARY 15, 1969)
                /
                /       INPUT OUTPUT CONVERSION SUBROUTINE
                /       FOR 8K ALICS-FORTRAN SYSTEM
                /

                /*************************************************************
                /
                / MODIFIED TO SAVE CORE SPACE IN PROGRAMS USING ONLY
                / INTEGER VARIABLES. DELETES E AND F FORMATS FROM IOH
                / AND AVOIDS CALLING FLOATING POINT SUBROUTINES. SAVES
                / 3 PAGES OF IOH AND THE 5 PAGES OF THE FLOATING POINT
                / SUBROUTINES. ADDS L FORMAT FOR LEFT JUSTIFIED ZERO FILLED CHAR
                / AS NEEDED WHEN SPECIFYING FILE NAMES.
                /
                / MODIFIED BY:  A.A. CALEK AND R.C. BARRETT
                /               COMPUTER SCIENCE DEPARTMENT
                /               NORTHWESTERN UNIVERSITY
                /               EVANSTON, ILL 60201
                /
                /               JUNE 22, 1971
                /
                /*************************************************************
0023                    ABSYM SACH 23           /SAVE FPAC FOR MANIPULATION OF F
0024                    ABSYM SACM 24
0025                    ABSYM SACL 25
0175                    ABSYM N2 175            /LAST ACCUMULATED NUMBER
0176                    ABSYM ARGUMT 176
```

```
                        DUMMY   ARGUMT
                        DUMMY   FPNT
                        ENTRY   READ
                        ENTRY   WRITE
                        ENTRY   IOH
                /
                /       THE FOLLOWING IS NECESSARY BECAUSE CERTAIN SUBROUTINES S
                /
     1400               OPDEF TADI 1400
     3400               OPDEF DCAI 3400
     0400               OPDEF ANDI 0400
     5400               OPDEF JMPI 5400
     4400               OPDEF JMSI 4400
     2400               OPDEF ISZI 2400
     4000               SKPDF JMSKP 4000
                        LAP

                /
0200 0000       A2,     BLOCK   14
0201 0000
0202 0000
0203 0000
0204 0000
0205 0000
0206 0000
0207 0000
0210 0000
0211 0000
0212 0000
0213 0000
                /
                /       IOH ERROR ROUTINES
                /
0214 0000       ERRNO,  BLOCK   1
0215 6201 05    ERR2,   ISZ     WHI     /SEE IF THIS WAS I FORMAT OR THE EXPONEN
0216 2777
0217 2214       ERR3,   ISZ     ERRNO   /IN E FORMAT
0220 2214               ISZ     ERRNO
0221 7410               SKP
0222 2241       ERR1,   ISZ     DV      /ERR1 IS ALWAYS FATAL
0223 7200               CLA
0224 1241               TAD     DV
0225 7650               SNA CLA         /WAS THIS AN INPUT ERROR FROM THE TELETY
0226 7330               CLA CLL CML RAR         /YES - NON-FATAL
0227 1376               TAD     (615
0230 3262               DCA     IO
0231 1214               TAD     ERRNO           /IOH ERROR NUMBER
0232 1375               TAD     (2461           /MAKE INTO BCD
0233 3263               DCA     SW              /TO ERROR COMMENT
0234 4033               CALL    1,ERROR
0235 0104 06
0236 6201 05            ARG     IO
0237 0262 01

0240 5255               JMP     RETRY           /DO ENTIRE READ STATEMENT OVER
```

```
0241  0000        DV,      0                          /SAVE DEVICE CODE
0242  0200 01     CS,      A2                         /INITIAL PUSH POINTER
0243  0000        PARN,    0
0244  7000                 NOP                 /CDF N
0245  1665                 TADI     WRITE#
0246  2265                 INC      WRITE#
0247  6201 05              JMP I    PARN
0250  5643
0251  0000        CH,      0
0252  0012        TW,      12
0253  0000        READ,    BLOCK    2                 /ENTRY POINT FOR READ
0254  0000
0255  1253        RETRY,   TAD      READ              /SNEAK IN
0256  3264                 DCA      WRITE
0257  1254                 TAD      READ#
0260  3265                 DCA      WRITE#            /SAVE SECOND RETURN WORD
0261  5267                 JMP      ET
                           CPAGE 4
0262  0000        IO,      0
0263  0000        SW,      0                          /LEFT OR RIGHT HALF OF FORMAT
0264  0000        WRITE,   BLOCK    2                 /ENTRY POINT
0265  0000
0266  7201                 CLA IAC                    /INITIALIZE SWITCH
0267  3262        ET,      DCA      IO
0270  3251                 DCA      CH                /CLEAR CHARACTER
0271  3214                 DCA      ERRNO             /ZERO ERROR NUMBER IN CASE ERROR
0272  1264                 TAD      WRITE
0273  3244                 DCA      PARN#
0274  4243                 JMS      PARN
0275  3300                 DCA      DEVNO1
0276  4243                 JMS      PARN
0277  3007                 DCA      7
0300  7000        DEVNO1,  NOP                 /CDF N
0301  7240                 CLA CMA
0302  1407                 TADI     7                 /PICK UP DEVICE NUMBER
0303  7112                 CLL RTR                    /ROTATE IT INTO BITS 0-3
0304  7012                 RTR
0305  7010                 RAR
0306  3241                 DCA      DV
0307  1242                 TAD      CS                /INITIALIZE PUSH STACK
0310  6201 05              DCA      PUSH              /-
0311  3774
0312  4243                 JMS      PARN
0313  3335                 DCA      FPNT01
0314  4243                 JMS      PARN
0315  3326                 DCA      FPNT
0316  7201                 CLA IAC             /SET UP "SW" TO START FORMAT
0317  3263                 DCA      SW         /FROM SECOND CHARACTER (FIRST IS LPAREN.
0320  3773                 DCA      BA         /ZAP END-OF-LINE SWITCH
0321  1325                 TAD      PENTER     /FAKE RE-ENTRY TO SET UP FIRST LPAREN
0322  3772                 DCA      GLST       /ON PUSHDOWN STACK
0323  4040                 RETRN    WRITE
0324  0002 06
0325  0515 01     PENTER,  FENTER
```

```
0326  0000        FPNT,    0
0327  0000        GFRM,    0
0330  1263                 TAD      SW
0331  2263                 INC      SW
0332  7110                 CLL RAR
0333  1326                 TAD      FPNT                /FORM ADDRESS IN AC AND LEFT/RI
0334  3007                 DCA      7                   /SWITCH IN LINK
0335  7000        FPNT01,  NOP                          /CDF N
0336  1407                 TADI     7
0337  7430                 SZL                          /LEFT OR RIGHT?
0340  5344                 JMP      HR
0341  7012                 RTR
0342  7012                 RTR
0343  7012                 RTR
0344  0371        HR,      AND      <77
0345  6201 05              JMP I    GFRM
0346  5727
                           CPAGE    5
0347  0000                 0                   /I1000
0350  0000                 0                   /I100
0351  0000                 0                   /I10
0352  0000        I1,      0                   /I1
0353  4000                 4000
0371  0077
0372  1000 01
0373  0703 01
0374  0477 01
0375  2461
0376  0615
0377  1475 01
                           PAGE                /EXPERIMENTAL
0400  3023        RETN,    DCA      SACH                /SET SACH TO 0
0401  4777        RTUR,    JMS      GFRM                /GET NEXT CHAR IN FORMAT
                           CPAGE 24
0402  4776                 JMS      CHTYPE              /CLASSIFY FORMAT CHARACTER
0403  0451 01              DG                           /DIGIT EXIT
0404  7721                 -57;     SL
0405  0436 01
0406  7724                 -54;     CM
0407  0433 01
0410  7727                 -51;     RPAR
0411  0500 01
0412  7730                 -50;     LP
0413  0453 01
0414  7731                 -47;     QT
0415  0441 01
0416  7740                 -40;     RTUR
0417  0401 01
0420  0000                 0;       SVCHR
0421  0422 01
0422  6201 05     SVCHR,   DCA      CH
0423  3775
0424  4774                 JMS      NU                  /GET THE ACCUMULATED NUMBER
0425  7040                 CMA                          /KRONK IT
0426  3235                 DCA      N1                  /AND SAVE        COUNT FOR ALL C
```

```
0427  1775                TAD      CH
0430  0373                AND      (7757
0431  1372                TAD      (7770            /THIS TESTS IF CH IS AN ,X, OR ,
0432  7650                SNA CLA
0433  4771        CM,     JMS      PR               /IT WAS , PROCESS IT
0434  5200                JMP      RETN             /NOT X OR H, KILL NUMBER AND TRY
0435  0000        N1,     0

0436  4771        SL,     JMS      PR               /GO PROCESS THE PREVIOUS ITEM (]
0437  4770                JMS      EJ
0440  5200                JMP      RETN
0441  4771        QT,     JMS      PR               /PROCESS PREVIOUS ITEM, IF ANY
0442  4777        QT1,    JMS      GFRM
0443  1367                TAD      (-47
0444  7450                SNA                       /ANOTHER QUOTE?
0445  5200                JMP      RETN
0446  1366                TAD      (47
0447  4765                JMS      PRINT            /PRINT CHAR
0450  5242                JMP      QT1
0451  4764        DG,     JMS      DGT              /ACCUMULATE DIGIT INTO SACH
0452  5201                JMP      RTUR             /TRY ANOTHER CHARACTER
0453  2277        LP,     ISZ      PUSH             /LEFT PAREN
0454  7240                CLA CMA                   /COUNT NESTING DEPTH, NEGATIVE
0455  1346                TAD      NPAR
0456  3346                DCA      NPAR
0457  6201 05             TAD      SW               /PICK UP THE FORMAT POINTER
0460  1763
0461  3677                DCA I    PUSH             /CRAM IT INTO THE LIST
0462  2277                ISZ      PUSH             /KICK AGAIN
0463  4774                JMS      NU               /THERE MAY BE AN ACCUMULATED NUM
0464  7041                CIA                       /SAVE NUMBER
0465  3677                DCA I    PUSH             /*
0466  7326                CLA CLL CML RTL            /HERE WE SEE IF THIS IS A POSSIB
0467  1346                TAD      NPAR             /RESTART POINT
0470  7710                SPA CLA                   /IF FIRST SAVE SW IN S1
0471  5200                JMP      RETN             /NOPE- FORGET IT
0472  1763                TAD      SW               /YES--FIRST CRAM FORMAT---
0473  3344                DCA      S1               /---INTO SAVE1
0474  1677                TAD I    PUSH             /AND THAT STUFF IN THE LIST---
0475  3345                DCA      S2               /---GOES INTO SAVE 2
0476  5200                JMP      RETN             /READY FOR ANYTHING, HERE WE GO
0477  0000        PUSH,   0                   /PARENTHESIS PUSHDOWN LIST POINTER

0500  4771        RPAR,   JMS      PR               /PROCESS PREVIOUS ITEM, IF ANY
0501  2677                ISZ I    PUSH
0502  5334                JMP      TR
0503  7344                CLA CLL CMA RAL            /-2
0504  1277                TAD      PUSH             /DELETE THIS ITEM FORM THE LIST
0505  3277                DCA      PUSH             /PUSH = PUSH-2
0506  2346                ISZ      NPAR             /NPAR = NPAR +1 ]-1[ SINCE MINUS
0507  5200                JMP      RETN
0510  4762                JMS      WH               /THIS PAREN WAS THE BALANCING PA
0511  1344                TAD      S1               /GET THE FORMAT POINTER OF THE--
0512  3763                DCA      SW               /RESTART POINT AND CRAM IT
0513  1345                TAD      S2               /GET SWITCH AND THE COUNT
```

```
0514  7041                CIA
0515  3023       FENTER,  DCA      SACH
0516  7240                CLA CMA
0517  6201 05             TAD      SW                 /TEST TO SEE IF SW IS ORIGINAL F
0520  1763
0521  7650                SNA CLA
0522  5332                JMP      L2                 /YES - FAKE A RESTART
0523  2277                ISZ      PUSH               /NO - PUSH ORIGINAL POINTER
0524  7201                CLA IAC                     /SINCE WE ARE RETURNING TO DEPTH
0525  3677                DCA I    PUSH
0526  2277                ISZ      PUSH
0527  7240                CLA CMA                     /SET COUNT = 1, SWITCH = 1
0530  3677                DCA I    PUSH
0531  7040                CMA
0532  3346       L2,      DCA      NPAR               /PARNRN = -1
0533  5253                JMP      LP

0534  7240       TR,      CLA CMA                     /GET OUT THE FORMAT POINTER--
0535  1277                TAD      PUSH               /*
0536  3343                DCA      N3
0537  6201 05             TAD I    N3
0540  1743
0541  3763                DCA      SW                 /HAA-- IT IS NOW RESTORED
0542  5200                JMP      RETN               /AWAY WE GO
0543  0000       N3,      0                           /W FOR E AND F CONVER
0544  0000       S1,      0
0545  0000       S2,      0                           /SAVE THE COUNT AND SWITCH
0546  0000       NPAR,    0
0547  0000       CRX,     0
0550  0000       CR,      0
0562  0652 01
0563  0263 01
0564  1527 01
0565  0640 01
0566  0047
0567  7731
0570  0660 01
0571  1200 01
0572  7770
0573  7757
0574  1233 01
0575  0251 01
0576  1052 01
0577  0327 01
                          PAGE
0600  0000       SA,      0
0601  1335                TAD      SN
0602  7500                SMA                 /THIS IS -(NUM OF BLANKS)
0603  5777                JMP      AS3        /POSITIVE, NUMBER TOO BIG FOR FIELD
0604  6201 05             DCA      CRX
0605  3776
0606  7610                SKP CLA
0607  4240       RETC,    JMS      PRINT      /HERE WE PUT OUT THAT MANY BLANKS
0610  1375                TAD      (40
0611  2776                ISZ      CRX
```

```
0612  5207                JMP      RETC     /YES
0613  7200                CLA
0614  1335                TAD      SN
0615  7650                SNA CLA           /IS SIGN MINUS?
0616  5600                JMP I    SA       /EVIDENTLY NOT
0617  1374                TAD      (55
0620  4240                JMS      PRINT    /PUT OUT A MINUS SIGN
0621  5600                JMP I    SA
0622  4773        XX,     JMS      MR                /TEST FOR MORE
0623  1772                TAD      IO                /TEST FOR INPUT-OUTPUT
0624  7650                SNA CLA
0625  5231                JMP      XX1               /INPUT, PSEUDO-JUMP
0626  1375                TAD      (40               /OUTPUT A BLANK
0627  4240                JMS      PRINT
0630  5222                JMP      XX                /CYCLE
0631  4311        XX1,    JMS      GCHR              /IGNORE SPACES ON INPUT
0632  7200                CLA
0633  5222                JMP      XX

0634  4773        HH,     JMS      MR       /THE H FIELD PROCESSOR
0635  4771                JMS      GFRM     /SAME AS XXX, BUT PRINT NEXT
0636  4240                JMS      PRINT    /----- FORMAT CHARACTER
0637  5234                JMP      HH       /OUTPUT ONLY

0640  0000        PRINT,  0
0641  1370                TAD      (-40
0642  7510                SPA
0643  1367                TAD      (100              /CONVERT 6-BIT TO 8-BIT
0644  1366                TAD      (240
0645  6201 05             TAD      DV                /ADD ON DEVICE NUMBER IN BITS 0-
0646  1765
0647  4033                CALL     0,GENIO
0650  0005 06
0651  5640                JMP I    PRINT

0652  0000        WH,     0
0653  4260                JMS      EJ       /END THE RECORD
0654  1177                TAD      ARGUMT#
0655  7650                SNA CLA           /TEST PARAMETER FOR 0
0656  4764                JMS      GLST     /RETURN TO MAIN PROGRAM ON 0 PAR
0657  5652                JMP I    WH       /MORE AGRUMENTS RETURN

0660  0000        EJ,     0                           /ROUTINE TO END RECORD
0661  6201 05             TAD      IO
0662  1772
0663  7640                SZA CLA                     /INPUT OR OUTPUT?
0664  5276                JMP      E1                 /OUTPUT
0665  7200        E2,     CLA
0666  1303                TAD      BA
0667  7640                SZA CLA
0670  5273                JMP      BG                 /CARRIAGE RETURN SEEN - GOODBYE
0671  4311                JMS      GCHR               /GET A CHARACTER
0672  5265                JMP      E2                 /KEEP LOOKING FOR CR
0673  3303        BG,     DCA      BA
0674  6201 05             JMP I    EJ
```

```
0675  5660
0676  1363      E1,     TAD     (7715           /7715 TRANSLATES TO 213
0677  4240              JMS     PRINT
0700  1362              TAD     (7712
0701  4240              JMS     PRINT           /PRINT CR-LF
0702  5660              JMP I   EJ

0703  0000      BA,     0                 /THIS IS THE END OF LINE SWITCH
0704  2303      BH,     ISZ     BA        /ENTRY TO LOOK FOR AN END OF LINE
0705  1375      BL,     TAD     (40
0706  0361              AND     (77             /KEEP THIS - BL IS REFERENCED B
0707  6201 05           JMP I   GCHR
0710  5711

0711  0000      GCHR,   0                 /GET AN INPUT STRING CHARACTER
0712  7200      JD,     CLA
0713  1303              TAD     BA        /GET EOR SWITCH
0714  7640              SZA CLA
0715  5305              JMP     BL        /IS EOR, RETURN BLANK
0716  7332              CLA CLL CML RTR         /****** IF # OF DEVICES IS CHANG
0717  6201 05           TAD     DV              /THIS SHOULD BE CHANGED TOO ***
0720  1765
0721  4033              CALL    0,GENIO         /CALL GENIO WITH OFFSET DEVICE N
0722  0005 06
0723  0360              AND     (177            /STRIP PARITY
0724  1357              TAD     (7763
0725  7450              SNA                     /CARRIAGE RETURN?
0726  5304              JMP     BH
0727  1356              TAD     (7655
0730  7100              CLL
0731  1367              TAD     (100            /IS CHAR IN RANGE 237<CHAR<340?
0732  7420              SNL
0733  5312              JMP     JD              /NO - IGNORE
0734  5305              JMP     BL              /CONVERT TO SIXBIT AND RETURN
0735  0000      SN,     0
0756  7655
0757  7763
0760  0177
0761  0077
0762  7712
0763  7715
0764  1000 01
0765  0241 01
0766  0240
0767  0100
0770  7740
0771  0327 01
0772  0262 01
0773  1225 01
0774  0055
0775  0040
0776  0547 01
0777  1344 01
                      PAGE              /EXPERIMENTAL
1000  0000      GLST,   0                 /GET NEXT ARGUMENT ROUTINE
```

```
1001  4033                CALL     0,CLEAR /CLEAR FLOATING AC
1002  0006 06
1003  2251                ISZ      IOHCNT  /ARE WE IN AN ARRAY I/O LOOP?
1004  5210                JMP      ARMORE  /YES - GET NEXT ELEMENT
1005  2214                INC      IOH#
1006  4040                RETRN    IOH     /RETURN TO USERS PROGRAM FOR MORE DATA
1007  0003 06
1010  1177        ARMORE, TAD      ARGUMT#
1011  1250                TAD      IOHINC  /BUMP ARGUMENT POINTER BY ELEMENT LENGTH
1012  5230                JMP      IOHBAK  /RESUME I/O CONVERSIONS WITH UPDATED ARG

                          CPAGE 33
1013  0000        IOH,    BLOCK 2
1014  0000
1015  7640                SZA CLA          /IS THIS A SCALAR OR AN ARRAY CALL?
1016  5233                JMP      IOHAR   /AN ARRAY CALL
1017  7240                CLA CMA
1020  3251        IOGTAR, DCA      IOHCNT  /SET UP ARGUMENT COUNT FOR THIS CALL
1021  1213                TAD      IOH
1022  3223                DCA      IOH1
1023  7000        IOH1,   NOP              /SET DATA FIELD TO ARGUMENT LIST
1024  1614                TADI     IOH#
1025  3176                DCA      ARGUMT
1026  2214                INC      IOH#
1027  1614                TADI     IOH#
1030  3177        IOHBAK, DCA      ARGUMT#
1031  6201 05             JMP I    GLST    /RETURN TO I/O CONVERSION
1032  5600
1033  2214        IOHAR,  INC      IOH#
1034  7330                CLA CLL  CML RAR
1035  4067                AND I    IOH     /GET TYPE OF ARRAY
1036  1013 01
1037  0407
1040  7106                CLL RTL
1041  7024                CML RAL          /FORM A 1 OR A 3, DEPENDING ON ARRAY TYPE
1042  3250                DCA      IOHINC
1043  7350                CLA CLL  CMA RAR
1044  0407                ANDI     7       /GET THE ELEMENT COUNT
1045  7041                CIA
1046  2214                INC      IOH#
1047  5220                JMP      IOGTAR  /SAVE IT AND GET ARRAY POINTER
1050  0000        IOHINC, 0
1051  0000        IOHCNT, 0

1052  0000        CHTYPE, 0                /SUBROUTINE TO CLASSIFY CHARACTERS
1053  3304                DCA      CHCH
1054  1304                TAD      CHCH
1055  1377                TAD      (7706
1056  7100                CLL
1057  1376                TAD      (12
1060  7430                SZL              /IS THE CHARACTER NUMERIC?
1061  5276                JMP      JMPOUT  /YES - TAKE FIRST EXIT
1062  2252                INC      CHTYPE
1063  7200        CHLOOP, CLA
1064  6201 05             TAD I    CHTYPE
```

```
1065  1652
1066  2252                INC      CHTYPE
1067  7450                SNA                /CHARACTER LIST EXHAUSTED?
1070  5277                JMP      JMPOTX    /YES - TAKE LAST EXIT WITH CHAR IN AC
1071  1304                TAD      CHCH
1072  7650                SNA CLA            /MATCH?
1073  5276                JMP      JMPOUT    /YES - TAKE EXIT WITH AC=0
1074  2252                INC      CHTYPE
1075  5263                JMP      CHLOOP    /NO MATCH - GO ON TO NEXT CHAR
1076  3304        JMPOUT, DCA      CHCH
1077  6201 05     JMPOTX, TAD I    CHTYPE
1100  1652
1101  3252                DCA      CHTYPE
1102  1304                TAD      CHCH
1103  5652                JMP I    CHTYPE
1104  0000        CHCH,   0

1105  0000        DT,     0
1106  7041                CIA
1107  3304                DCA      CHCH      /STORE COUNT
1110  4352        RETT,   JMS      LS        /LEFT SHIFT 1
1111  6211                TAD      ACL       /SAVE THE FPAC
1112  1775
1113  3025                DCA      SACL
1114  1774                TAD      ACM
1115  3024                DCA      SACM
1116  1773                TAD      ACH
1117  0372                AND      <17
1120  3023                DCA      SACH
1121  1023                TAD      SACH
1122  3773                DCA      ACH       /TRIM AC TO 28 BITS
1123  4352                JMS      LS        /LEFT SHIFT 2
1124  4352                JMS      LS
1125  6211                TAD      ACL       /ADD THE DSAVE TO THE ACC
1126  1775
1127  1025                TAD      SACL
1130  3775                DCA      ACL
1131  7004                RAL                /*
1132  1774                TAD      ACM
1133  1024                TAD      SACM
1134  3774                DCA      ACM
1135  7004                RAL                /*
1136  1773                TAD      ACH
1137  1023                TAD      SACH
1140  3773                DCA      ACH
1141  1773                TAD      ACH
1142  7110                CLL RAR            /ROTATE 3 RIGHT
1143  7012                RTR
1144  0372                AND      <17
1145  1371                TAD      <60       /MAKE DIGIT
1146  4770                JMS      PRINT     /DUMP IT AND SEE IF ANY MORE
1147  2304                ISZ      CHCH      /LOOP ON COUNT
1150  5310                JMP      RETT      /*
1151  5705                JMP I    DT
```

```
1152  0000        LS,     0                   /LEFT SHIFT THE FPAC 1
1153  6211                TAD       ACL
1154  1775
1155  7104                CLL RAL
1156  3775                DCA       ACL
1157  1774                TAD       ACM
1160  7004                RAL
1161  3774                DCA       ACM
1162  1773                TAD       ACH
1163  7004                RAL
1164  3773                DCA       ACH
1165  6201 05             JMP I     LS        /DONE
1166  5752
1170  0640 01
1171  0060
1172  0017
1173  0020
1174  0021
1175  0022
1176  0012
1177  7706
                          PAGE                /EXPERIMENTAL
1200  0000        PR,     0
1201  1023                TAD       SACH      /GET THE LAST NUMBER ACCUMULATED
1202  3175                DCA       N2        /SAVE IT
1203  6201 05     PR2,    TAD       CH
1204  1777
1205  7450                SNA
1206  5600                JMP I     PR        /NOTHING TO DO
                          CPAGE 22
1207  4776                JMS       CHTYPE    /CLASSIFY CH
1210  0222 01             ERR1                /DIGIT IS ILLEGAL
1211  7750                -30;XX
1212  0622 01
1213  7767                -11;II
1214  1446 01
1215  7770                -10;HH
1216  0634 01
1217  7777                -1;AA
1220  1252 01
1221  7764                -14;LL
1222  1253 01
1223  0000                0;ERR1
1224  0222 01

1225  0000        MR,     0                   /MORE?
1226  6201 05             ISZ       N1        /SEE IF IT GOES TO ZERO
1227  2775
1230  5625                JMP I     MR
1231  3777                DCA       CH        /NO MORE FIELDS, FIRST WIPE CHAR
1232  5600                JMP I     PR        /GO BACK TO FORMAT SCANNER
1233  0000        NU,     0                   /ROUTINE TO FETCH THE ACCUM NUMB
1234  1023                TAD       SACH
1235  7450                SNA                 /IF IT IS ZERO, SET IT TO 1
1236  7201                CLA IAC             /IT IS AND WE DO
```

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1237  6201 05          JMP I   NU       /GO HOME
1240  5633
1241  0000      BB,    0
1242  4225             JMS     MR       /MORE?
1243  1177             TAD     ARGUMT#
1244  7650             SNA CLA          /IF ARG=0,
1245  4774             JMS     WH       /END RECORD AND RETURN TO USERS PROGRAM
1246  1773             TAD     IO       /TEST IN OUT SWITCH
1247  7640             SZA CLA          /OUTPUT
1250  2241             INC     BB       /INPUT
1251  5641             JMP I   BB
1252  1372      AA,    TAD     <40      /SPACE FILL FOR A FORMAT
1253  3327      LL,    DCA     FILL     /ZERO FILL FOR L FORMAT
1254  1175      AX,    TAD     N2
1255  7041             CIA
1256  3343             DCA     CX
1257  4241             JMSKP   BB
1260  5276             JMP     AR
1261  4331      AS,    JMS     GADR     /GET CHARACTER ADDRESS
1262  1407             TADI    7
1263  7430             SZL
1264  5270             JMP     ASNORT
1265  7012             RTR
1266  7012             RTR
1267  7012             RTR
1270  0371      ASNORT, AND    <77      /MASK 6 BITS
1271  4770             JMS     PRINT
1272  2343             ISZ     CX
1273  5261             JMP     AS       /LOOP FOR CHARACTER COUNT
1274  4767             JMS     GLST     /GET NEXT ARGUMENT(IF ANY)
1275  5254             JMP     AX

1276  4766      AR,    JMS     GCHR
1277  3330             DCA     DH       /GET AND SAVE INPUT CHAR
1300  1765             TAD     BA       /CHECK EOR FLAG
1301  7650             SNA CLA
1302  5305             JMP OK           /NOT EOR YET.
1303  1327             TAD     FILL     /EOR, USE CORRECT FILL.
1304  3330             DCA     DH
1305  4331      OK,    JMS     GADR     /GET CHARACTER POINTER
1306  7430             SZL              /WHICH HALF?
1307  5316             JMP     ARNORT   /RIGHT HALF
1310  1330             TAD     DH
1311  7006             RTL
1312  7006             RTL
1313  7006             RTL
1314  1327             TAD     FILL     /ZERO OR SPACE FILL
1315  5322             JMP     ARCOMN
1316  1327      ARNORT, TAD    FILL     /CANCEL ZERO OR SPACE FILL
1317  7041             CIA
1320  1407             TADI    7
1321  1330             TAD     DH
1322  3407      ARCOMN, DCAI   7
1323  2343             ISZ     CX
1324  5276             JMP     AR
```

```
1325  4767                JMS     GLST    /GET NEXT ARGUMENT (IF ANY)
1326  5254                JMP     AX
1327  0000        FILL,   0       /ZERO OR SPACE FILL

1330  0000        DH,     0
1331  0000        GADR,   0               /SUBR TO COMPUTE CHARACTER ADDR FOR "A"
1332  1176                TAD     ARGUMT
1333  3341                DCA     AS1
1334  1175                TAD     N2
1335  1343                TAD     CX
1336  7110                CLL RAR
1337  1177                TAD     ARGUMT# /AC=WORD POINTER, LINK=LEFT/RIGHT FLAG
1340  3007                DCA     7
1341  7000        AS1,    NOP             /SET UP DATA FIELD OF ARGUMENT
1342  5731                JMPI    GADR
1343  0000        CX,     0

1344  7200        AS3,    CLA             /PRINT ASTERISKS FOR WHOLE FIELD SIZE
1345  6201 05             TAD     N3      /GET FIELD SIZE, E OR F
1346  1764
1347  7040                CMA
1350  3343                DCA     CX      /-COUNT
1351  5354                JMP     QQ
1352  1363        QQA,    TAD     (52     /PRINT CX ASTERISKS
1353  4770                JMS     PRINT
1354  2343        QQ,     ISZ     CX      /INDEX COUNT
1355  5352                JMP     QQA
1356  4767                JMS     GLST    /TEST FOR MORE
1357  5203                JMP     PR2     /RETURN TO FORMAT PROCESSOR, SAME TYPE
1363  0052
1364  0543 01
1365  0703 01
1366  0711 01
1367  1000 01
1370  0640 01
1371  0077
1372  0040
1373  0262 01
1374  0652 01
1375  0435 01
1376  1052 01
1377  0251 01
                          PAGE            /EXPERIMENTAL
1400  1175        IN,     TAD     N2      /INTEGER INPUT, GET WIDTH OF FIELD
1401  7040                CMA             /1,S COMP TO COUNTER, CR
1402  6201 05             DCA     CR
1403  3777
1404  7040                CMA
1405  3275        VQ,     DCA     WHI     /-1 TO NUMBER ACCUMULATED
1406  7040                CMA             /-1 TO SIGN
1407  6201 05     RRSIGN, DCA     SN
1410  3776
1411  3023                DCA     SACH
1412  6201 05     RRS,    ISZ     CR      /HAS WHOLE NUMBER BEEN ACCUMULATED
1413  2777
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1414  7410                SKP
1415  5233                JMP      PRO
1416  4775                JMS      GCHR
                          CPAGE 14
1417  4774                JMS      CHTYPE   /CLASSIFY CHARACTER
1420  1431 01             DIGIT             /ITS A DIGIT
1421  7740                -40;     RRS
1422  1412 01
1423  7725                -53;     RRS
1424  1412 01
1425  7723                -55;     RRSIGN
1426  1407 01
1427  0000                0;       ERR2
1430  0215 01
1431  4327       DIGIT,   JMS      DGT      /ACCUMULATE DIGIT INTO SACH
1432  5212                JMP      RRS      /GET NEXT DIGIT
1433  1023       PRO,     TAD      SACH     /WE HAVE AN INTEGER ...
1434  2275                ISZ      WHI      /WHAT KIND?
1435  7402                HLT               /*********************
1436  6201 05             ISZ      SN       / 'I' FORMAT
1437  2776
1440  7041                CIA
1441  4067                DCA I    ARGUMT
1442  0176
1443  3407

1444  7200       IX,      CLA
1445  4773                JMS      GLST     /INTEGER CONVERSION
1446  4772       II,      JMSKP    BB       /TEST MORE AND NON ZERO CURRENT LIST ITE
1447  5200                JMP      IN       /INPUT
1450  1274                TAD      AB
1451  3025                DCA      SACL     /OUTPUT
1452  1371                TAD      (-4
1453  3275                DCA      WHI      /-4
1454  3776                DCA      SN       /0
1455  4067                TAD I    ARGUMT
1456  0176
1457  1407
1460  7500                SMA               /SET SN 0 FOR PLUS, 1 FOR MINUS
1461  5265                JMP      XZ       /PLACE MAGNITUDE IN 20
1462  7041                CIA
1463  6201 05             ISZ      SN
1464  2776
1465  4033       XZ,      CALL     1,DIV
1466  0107 06
1467  6201 05             ARG      TW
1470  0252 01
1471  3023                DCA      SACH
                          CPAGE 4
1472  4033                CALL     0,IREM   /IREM NEEDS AN ARGUMENT TO IGNORE
1473  0010 06
1474  0352 01    AB,      I1
1475  0000       WHI,     0
```

```
1476  6201 05          DCA I   SACL    /SAVE REMAINDER
1477  3425
1500  7040             CMA
1501  1025             TAD     SACL    /SACL=SACL-1
1502  3025             DCA     SACL
1503  2275             ISZ     WHI     /INDEX COUNT
1504  1023             TAD     SACH    /AND CHECK NUM FOR 0
1505  7440             SZA
1506  5265             JMP     XZ      /CYCLE
1507  1175       IB,   TAD     N2
1510  6201 05          DCA     N3      /IN CASE OF OVERFLOW
1511  3770
1512  1175             TAD     N2
1513  7040             CMA
1514  1275             TAD     WHI
1515  1367             TAD     (4      /COMPUTE NUMBER OF LEADING BLANKS
1516  4766             JMS     SA      /PRINT LEADING BLANKS AND SIGN
1517  2025       ID,   INC     SACL    /POINT TO DIGIT TO PRINT NEXT
1520  6201 05          TAD I   SACL    /GET IT
1521  1425
1522  7510             SPA             /TERMINATOR?
1523  5244             JMP     IX      /YUP
1524  1365             TAD     (60
1525  4764             JMS     PRINT   /NOPE - PRINT THE DIGIT
1526  5317             JMP     ID      /GET NEXT

1527  0000       DGT,  0
1530  3024             DCA     SACM
1531  1023             TAD     SACH
1532  7106             CLL RTL
1533  1023             TAD     SACH
1534  7004             RAL
1535  1024             TAD     SACM
1536  3023             DCA     SACH
1537  6201 05          JMP I   DGT
1540  5727

1564  0640 01
1565  0060
1566  0600 01
1567  0004
1570  0543 01
1571  7774
1572  1241 01
1573  1000 01
1574  1052 01
1575  0711 01
1576  0735 01
1577  0550 01
                       END
```