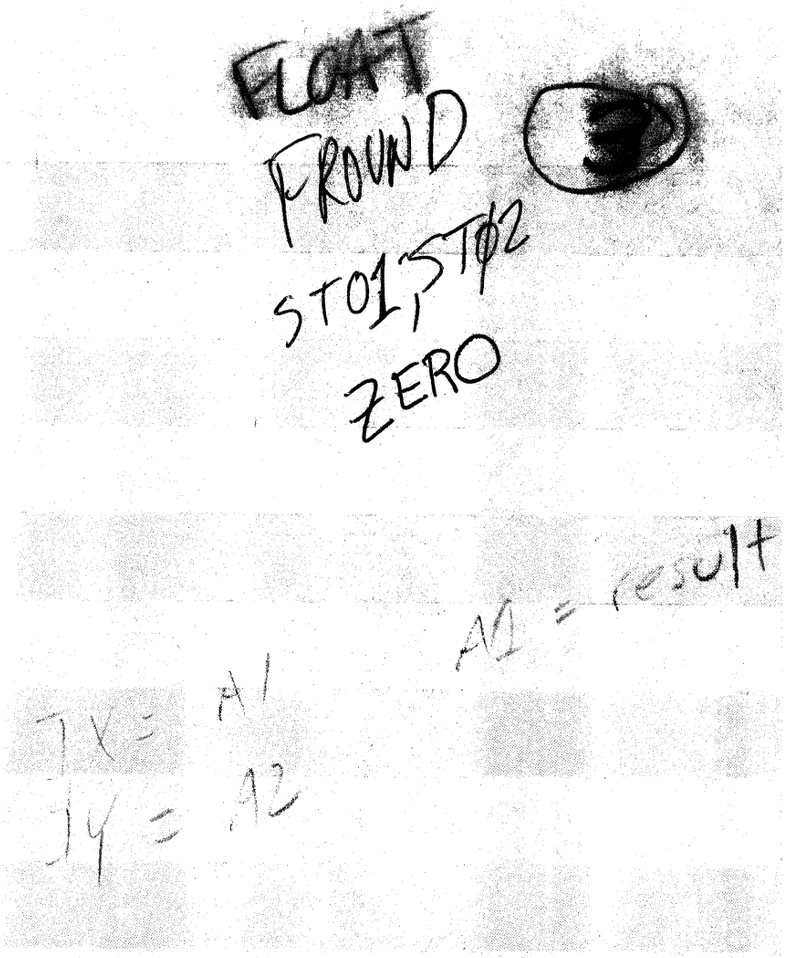
FLOAT
FROUND
3
ST01,ST02
ZERO
A2 = result
JX = A1
JY = A2

```
LOC   OBJ CODE M STMT SOURCE STATEMENT                              ASM 5.0

                 525  *H FLOAT
                 526  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 527  ;
                 528  ; FLOAT CONVERTS 16 BIT 2'S COMPLEMENT INTEGER
                 529  ;          TO FLOATING POINT FORMAT
                 530  ;    (FLOAT1 ASSUMES INPUT IS IN HL)
                 531  ;
                 532  ;    INPUT:  IX  PTS TO 16 BIT 2'S COMP INTEGER
                 533  ;    OUTPUT: IX  PTS TO FLOATING PT NUMBER
                 534  ;    ERRORS: NONE
                 535  ;    ALGORITHM:  CONVERT TO SIGN MAGNITUDE AND NORMALIZE
                 536  ;    REGISTERS:  HL IS 16 BIT ACCUM
                 537  ;                A  IS SIGN
                 538  ;                C  IS EXPONENT
                 539  ;
                 540  ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 541  ;
                 542  ; TEST INPUT
                 543  ;
0255  DD6E00     544  FLOAT   LD   L,(IX)       ; LOAD 16 BIT INTEGER
0258  DD6601     545          LD   H,(IX+1)
025B  7C         546  FLOAT1  LD   A,H          ; TEST FOR ZERO
025C  B5         547          OR   L
025D  CA8504   R 548          JP   Z,ZERO       ; INPUT WAS ZERO
                 549  ;
                 550  ; CONVERT TO SIGN MAGNITUDE, SIGN IN A
                 551  ;
```

```
0260   7C            552            LD    A,H         ; GET SIGN BIT
0261   E680          553            AND   80H
0263   2806          554            JR    Z,FL10      ; POSITIVE
0265   EB            555            EX    DE,HL
0266   210000        556            LD    HL,0
0269   ED52          557            SBC   HL,DE       ; NEGATE
                     558  ;
                     559  ; NORMALIZE
                     560  ;
026B   0E90          561  FL10      LD    C,16+80H    ; INITIAL EXPONENT
026D   FA7702    R   562            JP    M,FL30      ; ALREADY NORMALIZED
0270   A7            563            AND   A           ; CLEAR CY
0271   0D            564  FL20      DEC   C           ; DEC EXP
0272   ED6A          565            ADC   HL,HL       ; SHIFT LEFT
0274   F27102    R   566            JP    P,FL20      ; NOT NORMALIZED YET
                     567  ;
                     568  ; STORE RESULT
                     569  ;
0277   CBBC          570  FL30      RES   7,H         ; CLEAR IMPLIED 1
0279   B4            571            OR    H           ; ADD SIGN
027A   DD7700        572            LD    (IX),A
027D   DD7501        573            LD    (IX+1),L
0280   DD360200      574            LD    (IX+2),0
0284   DD7103        575            LD    (IX+3),C
0287   C9            576            RET
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                    ASM 5.0

                    577  *H BRK
                    578  ;
                    579  ; BRK SEPARATES INTEGER AND FRACTION PARTS
                    580  ;
                    581  ;   INPUT:  IX  PTS TO X
                    582  ;   OUTPUT: IX  PTS TO FRACTION 0 <= X < 1
                    583  ;           HL  IS LOW ORDER 16 BITS OF 2'S COMP FIX32(X)
                    584  ;           CY  IS SET IF INPUT > 2↑24
                    585  ;   ALGORITHM: USES 32 BIT FIX AND FLOAT, AND FL PT SUB
                    586  ;       ALWAYS RETURNS VALID FRACTION PART
                    587  ;
0288  CD8503    R   588  BRK     CALL ST01       ; SAVE COPY OF X
028B  CD4803    R   589          CALL FIX32      ; GET 32 BIT INTEGER
028E  381D          590          JR   C,BRK20    ; X > 2↑24
0290  D9            591          EXX             ; ALT BANK
0291  CB78          592          BIT  7,B
0293  D9            593          EXX             ; MAIN BANK
0294  E5            594          PUSH HL         ; SAVE HL AND FLAGS
0295  F5            595          PUSH AF
0296  CDFB02    R   596          CALL FL032      ; CONVERT TO FLOATING
0299  FD21CF04  R   597          LD   IY,TEMP1
029D  CD0000    R   598          CALL RSUB       ; CALC X - INT(X)
02A0  F1            599          POP  AF         ; RESTORE REGS
02A1  E1            600          POP  HL
02A2  2807          601          JR   Z,BRK10    ; POSITIVE SIGN
02A4  EB            602          EX   DE,HL
                    <
02A5  210000        603          LD   HL,0
```

```
02A8   A7            604           AND  A
02A9   ED52          605           SBC  HL,DE      ; NEGATE HL
02AB   A7            606  BRK10    AND  A         ; CLEAR CY
02AC   C9            607           RET
02AD   CD8504    R   608  BRK20    CALL ZERO      ; FORCE ZERO FRACTION
02B0   37            609           SCF            ; SET CY
02B1   C9            610           RET
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                          ASM 5.0

                    611  *H CP
                    612  ;
                    613  ; COMPARE ROUTINE
                    614  ;   RETURNS CY SET IF X < Y
                    615  ;   RETURNS Z  SET IF X = Y
                    616  ;
02B2   DD7E00       617  CP      LD   A,(IX)      ; GET MS BYTE OF X
02B5   E680         618          AND  80H
02B7   2021         619          JR   NZ,CP10     ; X IS NEGATIVE
02B9   FDCB007E     620          BIT  7,(IY)
02BD   C0           621          RET  NZ          ; Y IS NEGATIVE
02BE   DD7E03       622          LD   A,(IX+3)    ; TEST EXP'S
02C1   FDBE03       623          CP   (IY+3)
02C4   C0           624          RET  NZ
02C5   DD7E00       625          LD   A,(IX)      ; TEST MS BYTE
02C8   FDBE00       626          CP   (IY)
02CB   C0           627          RET  NZ
02CC   DD7E01       628          LD   A,(IX+1)
02CF   FDBE01       629          CP   (IY+1)
02D2   C0           630          RET  NZ
02D3   DD7E02       631          LD   A,(IX+2)
02D6   FDBE02       632          CP   (IY+2)
02D9   C9           633          RET
02DA   FDAE00       634  CP10    XOR  (IY)        ; TEST SIGN AND SET NZ
02DD   17           635          RLA              ; PUT SIGN IN CY
02DE   D8           636          RET  C           ; SIGNS DIFFERENT
02DF   FD7E03       637          LD   A,(IY+3)
```

```
02E2   DDBE03      638          CP   (IX+3)
02E5   C0          639          RET  NZ
02E6   FD7E00      640          LD   A,(IY)
02E9   DDBE00      641          CP   (IX)
02EC   C0          642          RET  NZ
02ED   FD7E01      643          LD   A,(IY+1)
02F0   DDBE01      644          CP   (IX+1)
02F3   C0          645          RET  NZ
02F4   FD7E02      646          LD   A,(IY+2)
02F7   DDBE02      647          CP   (IX+2)
02FA   C9          648          RET
```

```
                        649  *H FL032
                        650  ;
                        651  ; FL032   CONVERTS 32 BIT INTEGER TO FLOATING POINT
                        652  ;   BY NORMALIZING AND ROUNDING TO 24 BITS
                        653  ;   ENTRY TO FL0321 WITH DE ZERO AVOIDS ROUNDING
                        654  ;   INPUT:   H'L'HL IS 32 BIT INTEGER
                        655  ;            DE IS ROUNDING VALUE FOR FL0321
                        656  ;            B' BIT 7 IS SIGN
                        657  ;   OUTPUT:  IX POINTS TO FL PT NUMBER
                        658  ;
                        659  ;
                        660  ; TEST FOR ZERO
                        661  ;
02FB   118000           662  FL032   LD   DE,80H      ; ROUNDING BIT
02FE   7D               663  FL0321  LD   A,L         ; OR ALL 4 BYTES
02FF   B4               664          OR   H
0300   D9               665          EXX              ; ALT BANK
0301   B5               666          OR   L
0302   B4               667          OR   H
0303   CA8504    R      668          JP   Z,ZERO      ; INPUT IS ZERO
                        669  ;
                        670  ; NORMALIZE ACCUM, COUNT EXP IN C'
                        671  ;
0306   0EA0             672  FNORM   LD   C,0A0H      ; INIT EXP TO +32
0308   CB7C             673          BIT  7,H
030A   2009             674          JR   NZ,FROUND   ; ALREADY NORMALIZED
030C   0D               675  FNORL   DEC  C           ; DEC EXP
```

```
030D   D9          676          EXX             ; MAIN BANK
030E   29          677          ADD  HL,HL      ; SHIFT ACC LEFT
030F   D9          678          EXX             ; ALT BANK
0310   ED6A        679          ADC  HL,HL
0312   F20C03   R  680          JP   P,FNORL    ; NOT NORMALIZED YET
                   681  ;
                   682  ; ROUND  FRACTION TO 24 BITS
                   683  ;   NOTE: ROUNDING OVERFLOW IMPLIES FRACTION
                   684  ;         IS A POWER OF 2, SO HIGHEST BIT NEED
                   685  ;         NOT BE PUT IN BEFORE STORING
                   686  ;
0315   D9          687  FROUND  EXX             ; MAIN BANK
0316   19          688          ADD  HL,DE      ; ADD ROUNDING BIT
0317   D9          689          EXX             ; ALT BANK
0318   110000      690          LD   DE,0
031B   ED5A        691          ADC  HL,DE
031D   3004        692          JR   NC,FSTO    ; NO OVERFLOW
031F   0C          693          INC  C          ; INC EXP
0320   CAAF04   R  694          JP   Z,OVERB    ; OVERFLOW
                   695  ;
                   696  ; STORE RESULTS  (ENTER IN ALT BANK)
                   697  ;
0323   DD7103      698  FSTO     LD   (IX+3),C   ; BINARY EXPONENT
0326   7C          699          LD   A,H        ; PUT IN SIGN BIT
0327   E67F        700          AND  7FH
0329   B0          701          OR   B
032A   DD7700      702          LD   (IX),A     ; MSBYTE
032D   DD7501      703          LD   (IX+1),L   ; 2ND BYTE
0330   D9          704          EXX             ; MAIN BANK
0331   DD7402      705          LD   (IX+2),H   ; 2RD BYTE
```

```
0334    C9          706         RET
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                    ASM 5.0

                    707  ;
                    708  ; LOAD FRACTION PART (CALLED IN ALT BANK)
                    709  ;
0335   2600        710  FLD     LD    H,0          ; H'L'HL IS ACCUM
0337   DD6E00      711          LD    L,(IX)
033A   7D          712          LD    A,L          ; GET SIGN BIT
033B   E680        713          AND   80H
033D   47          714          LD    B,A          ; PUT IN B'
033E   CBFD        715          SET   7,L          ; RESTORE IMPLIED 1
0340   D9          716          EXX                ; MAIN BANK
0341   DD6601      717          LD    H,(IX+1)
0344   DD6E02      718          LD    L,(IX+2)
0347   C9          719          RET
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                          ASM 5.0

                    720  *H FIX32
                    721  ;
                    722  ; FIX32  CONVERTS FL PT NUMBER TO 32 BIT INTEGER
                    723  ;   INPUT:   IX POINTS TO FL PT NUMBER
                    724  ;   OUTPUT:  H'L'HL - 32 BIT INTEGER
                    725  ;            B'     - BIT 7 IS SIGN BIT
                    726  ;            A      - ZERO IF INPUT WAS INTEGER
                    727  ;            CY     - SET IF INPUT >= 2↑32
                    728  ;
0348   AF           729  FIX32   XOR  A          ; TEST FOR ZERO
0349   DDBE03       730          CP   (IX+3)
034C   C25603    R  731          JP   NZ,FXA     ; NOT ZERO
034F   67           732          LD   H,A        ; CLEAR H'L'
0350   6F           733          LD   L,A
0351   47           734          LD   B,A        ; CLEAR SIGN
0352   D9           735          EXX             ; MAIN BANK
0353   67           736          LD   H,A        ; CLEAR HL
0354   6F           737          LD   L,A
0355   C9           738          RET             ; A IS ZERO, CY OFF
                    739  ;
                    740  ; CALCULATE SHIFT COUNT
                    741  ;
0356   CD3503    R  742  FXA      CALL FLD        ; LOAD FRACTION TO L'HL
0359   3E98         743          LD   A,98H      ; CALC SHIFT COUNT
035B   DD9603       744          SUB  (IX+3)
035E   D8           745          RET  C          ; INPUT WAS TOO BIG
035F   C8           746          RET  Z          ; SHIFT COUNT IS ZERO
```

```
0360  0618        747          LD   B,24       ; MAX COUNT IS 24
0362  B8          748          CP   B
0363  3001        749          JR   NC,FX1     ; COUNT >= 24
0365  47          750          LD   B,A        ; PUT COUNT IN B
0366  AF          751  FX1     XOR  A          ; CLEAR A
                  752  ;
                  753  ; SHIFT LOOP
                  754  ;
0367  D9          755  FXL     EXX             ; ALT BANK
0368  CB3C        756          SRL  H          ; SHIFT ACCUM RIGHT
036A  CB1D        757          RR   L
036C  D9          758          EXX             ; MAIN BANK
036D  CB1C        759          RR   H
036F  CB1D        760          RR   L
0371  CE00        761          ADC  A,0        ; COUNT 1'S SHFTD OUT
0373  10F2        762          DJNZ FXL        ; COUNT NOT DONE
                  763  ;
                  764  ; USE CEILING FUNCTION FOR NEGATIVE NUMBERS
                  765  ;
0375  C8          766          RET  Z          ; NO 1'S SHIFTED OUT
0376  D9          767          EXX             ; ALT BANK
0377  CB78        768          BIT  7,B
0379  D9          769          EXX             ; MAIN BANK
037A  C8          770          RET  Z          ; POSITIVE SIGN
037B  110100      771          LD   DE,1       ; INCREMENT ACCUM
037E  19          772          ADD  HL,DE
037F  D0          773          RET  NC         ; NO CY FROM  INCR
0380  D9          774          EXX             ; ALT BANK
0381  23          775          INC  HL         ; ADD CY
0382  D9          776          EXX             ; MAIN BANK
```

```
0383   A7          777          AND  A          ; TURN OFF CY
```

LOC OBJ CODE M STMT SOURCE STATEMENT ASM 5.0

```
0384   C9              778          RET
```

```
                        779  *H UTILITIES
                        780  ;
                        781  ; UTILITIES
                        782  ;
0385  11CF04    R    783  ST01    LD    DE,TEMP1    ; DEST IS TEMP1
0388  C39403    R    784          JP    ST0
038B  11D304    R    785  ST02    LD    DE,TEMP2    ; DEST IS TEMP2
038E  C39403    R    786          JP    ST0
0391  11D704    R    787  ST03    LD    DE,TEMP3    ; DEST IS TEMP3
0394  DDE5           788  ST0     PUSH  IX          ; SOURCE IS ACCUM
0396  E1             789          POP   HL
0397  010400         790  MOV     LD    BC,4        ; COUNT IS 4
039A  EDB0           791          LDIR
039C  C9             792          RET
039D  DDE5           793  LD      PUSH  IX          ; DEST IS ACCUM
039F  D1             794          POP   DE
03A0  C39703    R    795          JP    MOV
```

LOC OBJ CODE M STMT SOURCE STATEMENT ASM 5.0

```
                        796  *H BOOLEAN
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                    ASM 5.0

                    797  *H BOOLEAN
                    798  ;
                    799  ; LOGICAL OPERATORS
                    800  ;
03A3   DD7E00       801  IOR     LD    A,(IX)
03A6   DDB601       802          OR    (IX+1)
03A9   FDB600       803          OR    (IY)
03AC   FDB601       804          OR    (IY+1)
03AF   C33004    R  805          JP    INE1
03B2   DD7E00       806  IAND    LD    A,(IX)
03B5   DDB601       807          OR    (IX+1)
03B8   CA7C04    R  808          JP    Z,IZERO     ; X IS ZERO
03BB   FD7E00       809          LD    A,(IY)
03BE   FDB601       810          OR    (IY+1)
03C1   C33004    R  811          JP    INE1
03C4   DD7E00       812  INOT    LD    A,(IX)
03C7   DDB601       813          OR    (IX+1)
03CA   1850         814          JR    IEQ1
03CC   DD7E03       815  OR      LD    A,(IX+3)
03CF   FDB603       816          OR    (IY+3)
03D2   C35E04    R  817          JP    NE1
03D5   DD7E03       818  AND     LD    A,(IX+3)
03D8   A7           819          AND   A
03D9   CA8504    R  820          JP    Z,ZERO      ; X IS ZERO
03DC   FD7E03       821          LD    A,(IY+3)
03DF   A7           822          AND   A
03E0   187C         823          JR    NE1
```

```
03E2   DD7E03        824  NOT     LD    A,(IX+3)
03E5   A7            825          AND   A
03E6   186F          826          JR    EQ1
                     827  ;
                     828  ; RELATIONAL OPERATORS
                     829  ;
03E8   CD0000    X   830  SGT     CALL  SCP
03EB   181C          831          JR    IGT1
03ED   CD0000    X   832  SLE     CALL  SCP
03F0   1820          833          JR    ILE1
03F2   CD0000    X   834  SLT     CALL  SCP
03F5   1824          835          JR    ILT1
03F7   CD0000    X   836  SGE     CALL  SCP
03FA   1826          837          JR    IGE1
03FC   CD0000    X   838  SEQ     CALL  SCP
03FF   1828          839          JR    IEQ1
0401   CD0000    X   840  SNE     CALL  SCP
0404   182A          841          JR    INE1
0406   CD0000    X   842  IGT     CALL  ICP
0409   2871          843  IGT1    JR    Z,IZERO
040B   386F          844          JR    C,IZERO
040D   1853          845          JR    IONE
040F   CD0000    X   846  ILE     CALL  ICP
0412   284E          847  ILE1    JR    Z,IONE
0414   384C          848          JR    C,IONE
0416   1864          849          JR    IZERO
0418   CD0000    X   850  ILT     CALL  ICP
041B   3845          851  ILT1    JR    C,IONE
041D   185D          852          JR    IZERO
041F   CD0000    X   853  IGE     CALL  ICP
```

0422 3858 854 IGE1 JR C.IZERO

LOC OBJ CODE M STMT SOURCE STATEMENT ASM 5.0

```
0424  183C        855          JR   IONE
0426  CD0000  X   856  IEQ     CALL ICP
0429  2837        857  IEQ1    JR   Z,IONE
042B  184F        858          JR   IZERO
042D  CD0000  X   859  INE     CALL ICP
0430  284A        860  INE1    JR   Z,IZERO
0432  182E        861          JR   IONE
0434  CDB202  R   862  GT      CALL CP
0437  284C        863  GT1     JR   Z,ZERO
0439  384A        864          JR   C,ZERO
043B  182E        865          JR   ONE
043D  CDB202  R   866  LE      CALL CP
0440  2829        867  LE1     JR   Z,ONE
0442  3827        868          JR   C,ONE
0444  183F        869          JR   ZERO
0446  CDB202  R   870  LT      CALL CP
0449  3820        871  LT1     JR   C,ONE
044B  1838        872          JR   ZERO
044D  CDB202  R   873  GE      CALL CP
0450  3833        874  GE1     JR   C,ZERO
0452  1817        875          JR   ONE
0454  CDB202  R   876  EQ      CALL CP
0457  2812        877  EQ1     JR   Z,ONE
0459  182A        878          JR   ZERO
045B  CDB202  R   879  NE      CALL CP
045E  2825        880  NE1     JR   Z,ZERO
0460  1809        881          JR   ONE
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                    ASM 5.0

                    882  *H CONSTANT FUNCTIONS
                    883  ;
                    884  ; PRODUCE UNITY RESULT
                    885  ;
0462   DD360001     886  IONE    LD    (IX),1
0466   DD360100     887          LD    (IX+1),0
046A   C9           888          RET
046B   DD360000     889  ONE     LD   (IX),0
046F   DD360100     890          LD   (IX+1),0
0473   DD360200     891          LD   (IX+2),0
0477   DD360381     892          LD   (IX+3),81H
047B   C9           893          RET
                    894  ;
                    895  ; PRODUCE ZERO RESULT
                    896  ;
047C   DD360000     897  IZERO   LD    (IX),0
0480   DD360100     898          LD    (IX+1),0
0484   C9           899          RET
0485   DD360000     900  ZERO    LD    (IX),0
0489   DD360100     901          LD    (IX+1),0
048D   DD360200     902          LD    (IX+2),0
0491   DD360300     903          LD    (IX+3),0
0495   C9           904          RET
                    905  ;
                    906  ; PRODUCE INFINITE RESULT
                    907  ;
0496   DDCB0016     908  INF     RL    (IX)        ; GET OLD SIGN
```

```
049A   DD3600FE      909            LD    (IX),0FEH
049E   DDCB001E      910            RR    (IX)          ; REPLACE SIGN
04A2   DD3601FF      911            LD    (IX+1),0FFH
04A6   DD3602FF      912            LD    (IX+2),0FFH
04AA   DD3603FF      913            LD    (IX+3),0FFH
04AE   C9            914            RET
                     915  ;
                     916  ; FLAG OVERFLOW ERROR, STORE INFINITY
                     917  ;
04AF   D9            918  OVERB     EXX                 ; ALT BANK
04B0   DD7000        919            LD    (IX),B        ; SET SIGN BIT
04B3   210000    X   920  OVER      LD    HL,ERROR
04B6   CBF6          921            SET   6,(HL)        ; FLAG OVERFLOW
04B8   C39604    R   922            JP    INF
                     923  ;
                     924  ; FLAG UNDERFLOW ERROR, STORE ZERO
                     925  ;
04BB   210000    X   926  UNDER     LD    HL,ERROR
04BE   CBEE          927            SET   5,(HL)        ; FLAG UNDERFLOW
04C0   C38504    R   928            JP    ZERO
```

```
 LOC   OBJ CODE M STMT SOURCE STATEMENT                                  ASM 5.0

                    929  *H CONSTANTS AND WORK AREAS
04C3   0000         930  C1      DEFW 0          ; 1.0
04C5   0081         931          DEFW 8100H
04C7   0000         932  C_5     DEFW 0          ; 0.5
04C9   0080         933          DEFW 8000H
04CB   0000         934  SEED    DEFW 0
04CD   0000         935          DEFW 0
04CF                936  TEMP1   DEFS 4
04D3                937  TEMP2   DEFS 4
04D7                938  TEMP3   DEFS 4
                    939  ;
                    940  ; REFERENCES
                    941  ;
                    942          EXTERNAL        ERROR,ICP,SCP
                    943          GLOBAL          ADD,SUB,RSUB,MULT,DIVI,REC
                    944          GLOBAL          FIX,FIXA,FLOAT,BRK,FIX32,FL032,FL0321
                    945          GLOBAL          CP,ST01,ST02,ST03,TEMP1,TEMP2
                    946          GLOBAL          TEMP3,SEED,LD,FLD,FLOAT1
                    947          GLOBAL          OVER,UNDER,ZERO,ONE,INF
                    948          GLOBAL          GT,LT,GE,LE,EQ,NE,AND,OR,NOT
                    949          GLOBAL          IGT,ILT,IGE,ILE,IEQ,INE,IAND,IOR,INOT
                    950          GLOBAL          SGT,SLT,SGE,SLE,SEQ,SNE
                    951          GLOBAL          C1,C_5
```