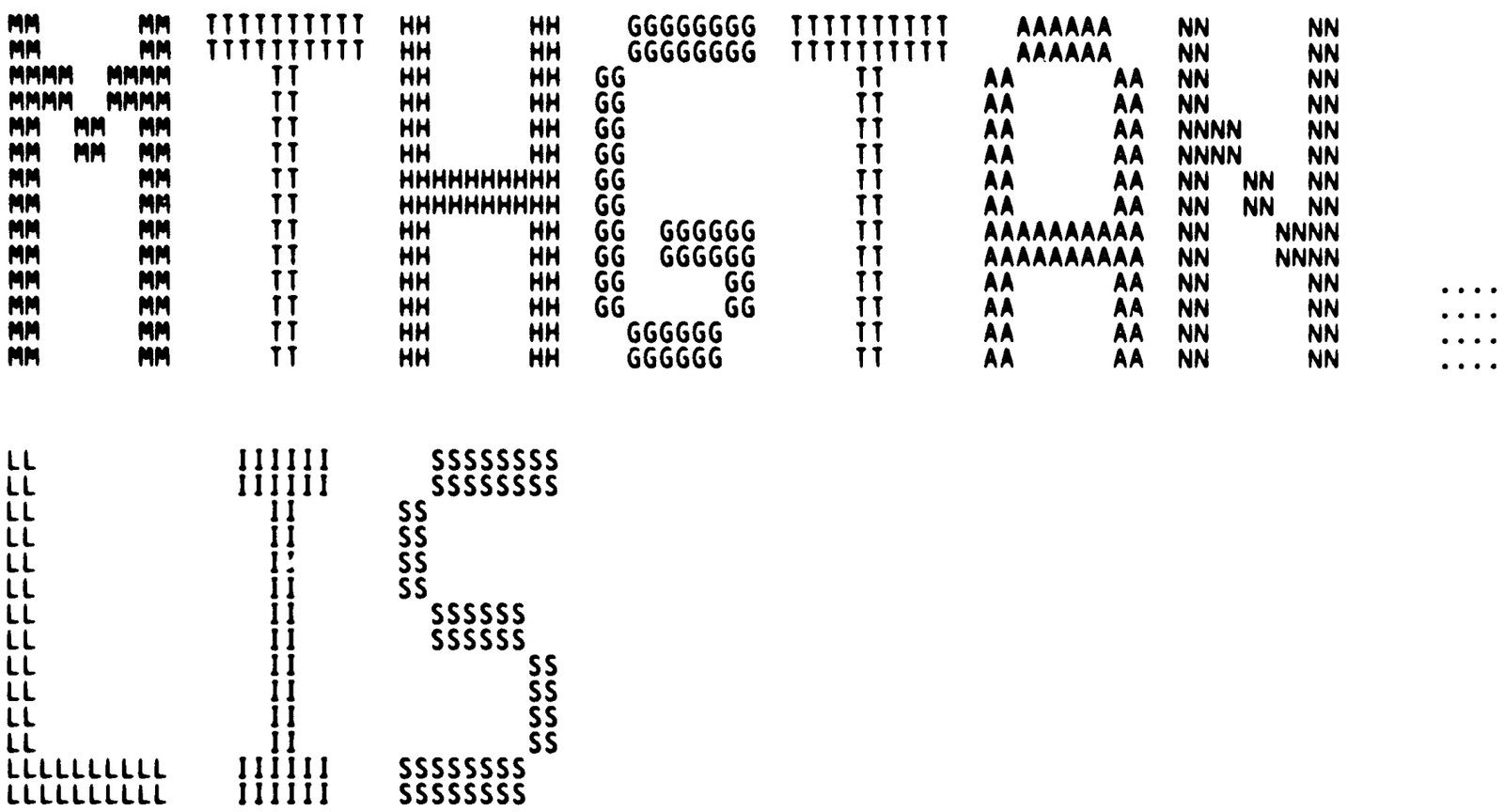
```
MMM          MMM  TTTTTTTTTTTTTTT   HHH          HHH  RRRRRRRRRRR     TTTTTTTTTTTTTTT   LLL
MMM          MMM  TTTTTTTTTTTTTTT   HHH          HHH  RRRRRRRRRRRR    TTTTTTTTTTTTTTT   LLL
MMM          MMM  TTTTTTTTTTTTTTT   HHH          HHH  RRRRRRRRRRRR    TTTTTTTTTTTTTTT   LLL
MMMMMM    MMMMMM        TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMMMMM    MMMMMM        TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMMMMM    MMMMMM        TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMM   MMM   MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMM   MMM   MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMM   MMM   MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLL
MMM         MMM         TTT         HHHHHHHHHHHHHHHH  RRRRRRRRRRR           TTT         LLL
MMM         MMM         TTT         HHHHHHHHHHHHHHHH  RRRRRRRRRRRR          TTT         LLL
MMM         MMM         TTT         HHHHHHHHHHHHHHHH  RRRRRRRRRRRR          TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR   RRR             TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR   RRR             TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR   RRR             TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR      RRR          TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR      RRR          TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR      RRR          TTT         LLL
MMM         MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLLLLLLLLLLLLLLL
MMM         MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLLLLLLLLLLLLLLL
MMM         MMM         TTT         HHH          HHH  RRR         RRR       TTT         LLLLLLLLLLLLLLLL
```

**FILE**ID**MTHGTAN



```
0000     1          .TITLE  MTH$GTAN        ; G Floating Point Tangent routine
0000     2                                  ; (GTAN,GTAND)
0000     3          .IDENT /1-011/          ; File: MTHGTAN.MAR  EDIT: SBL1011
0000     4 ;
0000     5 ;*****************************************************************************
0000     6 ;*                                                                           *
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0000    23 ;*  SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL.                  *
0000    24 ;*                                                                           *
0000    25 ;*                                                                           *
0000    26 ;*****************************************************************************
0000    27 ;
0000    28 ;
0000    29 ; FACILITY: MATH LIBRARY
0000    30 ;++
0000    31 ; ABSTRACT:
0000    32 ;
0000    33 ; MTH$GTAN is a function  which  returns the G floating point tangent
0000    34 ; of its G floating point radian argument. The call is standard
0000    35 ; call-by-reference.  It JSB to MTH$GTAN_R7.
0000    36 ;
0000    37 ; MTH$GTAND is a function  which  returns the G floating point tangent
0000    38 ; of its G floating point degree argument. The call is standard
0000    39 ; call-by-reference.  It JSB to MTH$GTAND_R7.
0000    40 ;
0000    41 ;--
0000    42 ;
0000    43 ; VERSION: 1
0000    44 ;
0000    45 ; HISTORY:
0000    46 ; AUTHOR:
0000    47 ;       Steven B. Lionel, 12-Jan-79: Version 1
0000    48 ;
0000    49 ; MODIFIED BY:
0000    50 ;
0000    51 ;
0000    52 ;
```

```
                        .SBTTL  HISTORY ; Detailed Current Edit History

; Edit History for Version 1 of MTH$GTAN
;
; 1-001 - Adapted from MTH$DTAN version 1-002.  SBL 15-Jan-79
; 1-002 - Handle exceptions correctly and use general addressing for
;         externals.  JBS 16-AUG-1979
; 1-003 - Add JSB entry point.  JBS 16-AUG-1979
; 1-004 - Correct a typo in edit 003.  JBS 17-AUG-1979
; 1-005 - Do range check in JSB routine with CMPZV rather than with a pair of
;         CMPG's.  JAW 16-Oct-1979
; 1-006 - Change MOVD to MOVG in JSB routine.  JAW 17-Oct-1979
; 1-007 - Have CALL use JSB routine.  Fix error handling.
;         SBL 31-Oct-1979
; 1-008 - Added degree entry points. RNH 8-MAR-1981
; 1-009 - Modify MTH$GTAN_R7 and MTH$GTAND_R7 to JSB to MTH$GSINCOS_R7 and
;         MTH$GSINCOSD_R7 instead of MTH$GSIN_R7, MTH$GCOS_R7, and
;         MTH$GSIND_R7, MTH$GCOSD_R7.  RNH 27-AUG-81.
; 1-010 - Change shared external references to G^ RNH 25-Sep-81
; 1-012 - Use general mode addressing.  SBL 30-Nov-1981
;
```

```
                     0000     77          .SBTTL  DECLARATIONS    ; Declarative Part of Module
                     0000     78
                     0000     79 ;
                     0000     80 ; INCLUDE FILES:
                     0000     81 ;
                     0000     82 ; EXTERNAL SYMBOLS:
                     0000     83          .DSABL  GBL             ; prevent undefineds from becoming
                     0000     84                                  ; global
                     0000     85          .EXTRN  MTH$GSINCOS_R7  ; G Floating sine cosine routine (radian)
                     0000     86          .EXTRN  MTH$GSINCOSD_R7 ; G Floating sine cosine routine (degree)
                     0000     87          .EXTRN  MTH$$SIGNAL     ; Math error signal routine
                     0000     88          .EXTRN  MTH$K_FLOOVEMAT ; Overflow error code
                     0000     89          .EXTRN  MTH$K_FLOUNDMAT ; Underflow error code
                     0000     90          .EXTRN  MTH$$JACKET_TST
                     0000     91 ;
                     0000     92 ; EQUATED SYMBOLS:      none
                     0000     93 ;
                     0000     94 ; MACROS:
                     0000     95          $SFDEF                  ; Define SF (Stack Frame)  symbols
                     0000     96 ;
                     0000     97 ;
                     0000     98 ; PSECT DECLARATIONS:
                     0000     99
                00000000    100          .PSECT  _MTH$CODE       PIC,SHR,LONG,EXE,NOWRT
                     0000    101                                          ; program section for math routines
                     0000    102 ;
                     0000    103 ; OWN STORAGE:  none
                     0000    104 ;
                     0000    105 ; CONSTANTS:
                     0000    106
                00000004     0000    107          X = 4                                   ;Position of argument from AP.
                     0000    108
                     0000    109 G_SMALLEST_DEG:
C1F81A63 A5DC006C    0000    110          .LONG   ^XA5DC006C, ^XC1F81A63  ; 180/pi*2**1024
                     0008    111
```

```
                        0008   113          .SBTTL  MTH$GTAN  - Standard G Floating GTAN
                        0008   114
                        0008   115
                        0008   116 ;++
                        0008   117 ; FUNCTIONAL DESCRIPTION:
                        0008   118 ;
                        0008   119 ; GTAN  - G floating point function
                        0008   120 ;
                        0008   121 ;       For algorithm, see MTH$GTAN_R7.
                        0008   122 ;
                        0008   123 ; CALLING SEQUENCE:
                        0008   124 ;
                        0008   125 ;       gtan.wg.v = MTH$GTAN(X.rg.r)
                        0008   126 ;
                        0008   127 ; INPUT PARAMETERS:
                        0008   128 ;
                        0008   129 ;       X.rg.r                  ;Adrress of value of angle in radians.
                        0008   130 ;
                        0008   131 ; IMPLICIT INPUTS:      none
                        0008   132 ;
                        0008   133 ; OUTPUT PARAMETERS:
                        0008   134 ;
                        0008   135 ;       VALUE:  G floating  angent of the argument
                        0008   136 ;
                        0008   137 ; IMPLICIT OUTPUTS:     none
                        0008   138 ;
                        0008   139 ; COMPLETION CODES:     none
                        0008   140 ;
                        0008   141 ; SIDE EFFECTS:
                        0008   142 ;
                        0008   143 ;       See MTH$GTAN_R7
                        0008   144 ;
                        0008   145 ;---
                        0008   146
                        0008   147
                40FC    0008   148          .ENTRY  MTH$GTAN, ^M<IV, R2, R3, R4, R5, R6, R7>
                        000A   149                                          ; standard call-by-reference entry
                        000A   150                                          ; disable DV (and FU), enable IV
                        000A   151          MTH$FLAG_JACKET
                        000A
6D  00000000'GF   9E    000A                MOVAB   G^MTH$$JACKET_HND, (FP)
                        0011                                                ; set handler address to jacket
                        0011                                                ; handler
                        0011
     50  04 BC 50FD     0011   152          MOVG    @X(AP), R0              ; R0/R1 = argument
         01    10       0016   153          BSBB    MTH$GTAN_R7             ; Get the tangent
               04       0018   154          RET                             ; With result in R0-R1
```

```
                        0019   156          .SBTTL  MTH$GTAN_R7 - JSB entry point
                        0019   157 ;
                        0019   158 ;++
                        0019   159 ; FUNCTIONAL DESCRIPTION:
                        0019   160 ;
                        0019   161 ; GTAN - JSB entry point
                        0019   162 ;
                        0019   163 ; Algorithmic steps:
                        0019   164 ;  1. Compute GSIN and GCOS.
                        0019   165 ;  2. If GCOS is zero, we have an error.
                        0019   166 ;  3. Return GSIN / GCOS.
                        0019   167 ;
                        0019   168 ; CALLING SEQUENCE:
                        0019   169 ;
                        0019   170 ;       MOVG    argument, R0
                        0019   171 ;       JSB     MTH$GTAN_R7
                        0019   172 ;
                        0019   173 ; INPUT PARAMETERS:
                        0019   174 ;
                        0019   175 ;       R0 / R1 contains x
                        0019   176 ;
                        0019   177 ; IMPLICIT INPUTS:
                        0019   178 ;
                        0019   179 ;       NONE
                        0019   180 ;
                        0019   181 ; OUTPUT PARAMETERS:
                        0019   182 ;
                        0019   183 ;       The result is the tangent of x, in G_floating.
                        0019   184 ;
                        0019   185 ; IMPLICIT OUTPUTS:
                        0019   186 ;
                        0019   187 ;       NONE
                        0019   188 ;
                        0019   189 ; SIDE EFFECTS:
                        0019   190 ;
                        0019   191 ;       NONE
                        0019   192 ;--
                        0019   193 MTH$GTAN_R7::                            ; entry point
00000000'GF    16       0019   194          JSB     G^MTH$GSINCOS_R7                ; Compute GSIN(X), and GCOS(X).
        52 53FD         001F   195          TSTG    R2                      ; Is GCOS(X) zero ?
        69    13        0022   196          BEQL    COSZER                  ; If zero, error
    50  52 46FD         0024   197          DIVG2   R2, R0                  ; Compute GSIN / GCOS
              05        0028   198          RSB                             ; Return.
                        0029   199
```

```
                                0029   201          .SBTTL  MTH$GTAND  - Standard G Floating GTAND
                                0029   202
                                0029   203
                                0029   204 ;++
                                0029   205 ; FUNCTIONAL DESCRIPTION:
                                0029   206 ;
                                0029   207 ; GTAND  - G floating point function
                                0029   208 ;
                                0029   209 ;       For algorithm, see MTH$GTAND_R7.
                                0029   210 ;
                                0029   211 ; CALLING SEQUENCE:
                                0029   212 ;
                                0029   213 ;       GTAND.wg.v = MTH$GTAND(x.rg.r)
                                0029   214 ;
                                0029   215 ; INPUT PARAMETERS:
                                0029   216 ;
                                0029   217 ;       X.rg.r                          ;Address of value of angle in degrees.
                                0029   218 ;
                                0029   219 ; IMPLICIT INPUTS:      none
                                0029   220 ;
                                0029   221 ; OUTPUT PARAMETERS:
                                0029   222 ;
                                0029   223 ;       VALUE:  G floating tangent of the argument
                                0029   224 ;
                                0029   225 ; IMPLICIT OUTPUTS:     none
                                0029   226 ;
                                0029   227 ; COMPLETION CODES:     none
                                0029   228 ;
                                0029   229 ; SIDE EFFECTS:
                                0029   230 ;
                                0029   231 ;       See MTH$GTAND_R7
                                0029   232 ;
                                0029   233 ;---
                                0029   234
                                0029   235
                        40FC    0029   236          .ENTRY  MTH$GTAND, ^M<IV, R2, R3, R4, R5, R6, R7>
                                002B   237                                          ; standard call-by-reference entry
                                002B   238                                          ; disable DV (and FU), enable IV
                                002B   239          MTH$FLAG_JACKET
                                002B
6D      00000000'GF       9E    002B                MOVAB   G^MTH$$JACKET_HND, (FP)
                                0032                                                ; set handler address to jacket
                                0032                                                ; handler
                                0032
     50     04 BC   50FD       0032   240          MOVG    @X(AP), R0              ; R0/R1 = argument
                01      10     0037   241          BSBB    MTH$GTAND_R7            ; Get the tangent
                        04     0039   242          RET                             ; With result in R0-R1
```

```
                        .SBTTL  MTH$GTAND_R7 - JSB entry point
                ;
                ;++
                ; FUNCTIONAL DESCRIPTION:
                ;
                ; GTAND - JSB entry point
                ;
                ; Algorithmic steps:
                ;  1. Make sure that the absolute value of the argument is greater than
                ;     180/pi*2**-1024, otherwise GSIND will underflow.
                ;  2. Compute GSIND and GCOSD.
                ;  3. If GCOSD is zero, we have an error.
                ;  4. Return GSIND / GCOSD.
                ;
                ; CALLING SEQUENCE:
                ;
                ;       MOVG    argument, R0
                ;       JSB     MTH$GTAND_R7
                ;
                ; INPUT PARAMETERS:
                ;
                ;       R0 / R1 contains x
                ;
                ; IMPLICIT INPUTS:
                ;
                ;       NONE
                ;
                ; OUTPUT PARAMETERS:
                ;
                ;       The result is the tangent of x, in G_floating.
                ;
                ; IMPLICIT OUTPUTS:
                ;
                ;       NONE
                ;
                ; SIDE EFFECTS:
                ;
                ;       NONE
                ;
                ;--
                MTH$GTAND_R7::
 52   50 50FD    MOVG    R0, R2                  ; Save argument
52  8000 8F AA   BICW    #^X8000, R2             ; R2/R3 = |argument|
52  0070 8F B1   CMPW    #^X70, R2               ; Compare |arg| with 2**-1017
        0F 15    BLEQ    20$                     ; No possible underflow, compute GCOSD
  52  B2 AF 51FD CMPG    G_SMALLEST_DEG, R2      ; Possible underflow, use better test
        08 15    BLEQ    20$                     ; No possible underflow, compute GCOSD
        52 53FD  TSTG    R2                      ; Check for arg = 0
        13 12    BNEQ    UNFL                    ; Branch to underflow logic if not zero
        50 7C    CLRG    R0                      ; Load R0/R1 with 0
           05    RSB                             ; Return with value equal zero
                20$:
00000000'GF 16   JSB     G^MTH$GSINCOSD_R7               ; Compute GSIND(X) and GCOSD(X).
        52 53FD  TSTG    R2                      ; Is GCOSD(X) zero ?
        29 13    BEQL    COSZER                  ; If yes, error
   50   52 46FD  DIVG2   R2, R0                  ; Compute GSIND / GCOSD
           05    RSB                             ; Return.
```

0069  301

```
                          0069   303 ;
                          0069   304 ;       COMMON ERROR CODE
                          0069   305 ;
                          0069   306
                          0069   307 ;
                          0069   308 ; Underflow; if user has FU set, signal error.  Always return 0.0
                          0069   309 ;
                          0069   310 UNFL:
                    52    DC   0069   311         MOVPSL  R2                              ; R2 = user's or jacket routine's PSL
00000000'GF         00    FB   006B   312         CALLS   #0, G^MTH$$JACKET_TST           ; R0 = TRUE if JSB from jacket routine
                 04 50    E9   0072   313         BLBC    R0, 10$                         ; branch if user did JSB
              52 04 AD    3C   0075   314         MOVZWL  SF$W_SAVE_PSW(FP), R2           ; get user PSL saved by CALL
                    50    D4   0079   315 10$:    CLRL    R0                              ; R0 = result. LIB$SIGNAL will save in
                          007B   316                                                     ; CHF$L_MCH_R0/R1 so any handler can fixup
              0D 52 06    E1   007B   317         BBC     #6, R2, 20$                     ; has user enabled floating underflow?
                    6E    DD   007F   318         PUSHL   (SP)                            ; yes, return PC from special routine
              7E 00'8F    9A   0081   319         MOVZBL  #MTH$K_FLOUNDMAT, -(SP)         ; trap code for hardware floating underflow
                          0085   320                                                     ; convert to MTH$_FLOUNDMAT (32-bit VAX-11
                          0085   321                                                     ; exception code)
00000000'GF         02    FB   0085   322         CALLS   #2, G^MTH$$SIGNAL               ; signal (condition, PC)
                    05    RSB  008C   323 20$:    RSB                                     ; return
                          008D   324
                          008D   325 ;+
                          008D   326 ; COS was zero, so TAN is infinite, signal an error.
                          008D   327 ;-
                          008D   328 COSZER:
                    6E    DD   008D   329         PUSHL   (SP)                            ; Push "caller" PC
              7E 00'8F    9A   008F   330         MOVZBL  #MTH$K_FLOOVEMAT, -(SP)         ; Condition value
           50 01    0F    79   0093   331         ASHQ    #15, #1, R0                     ; R0/R1 = reserved operand
00000000'GF         02    FB   0097   332         CALLS   #2, G^MTH$$SIGNAL               ; Signal an error
                    05    RSB  009E   333         RSB                                     ; Return to caller
                          009F   334
                          009F   335         .END
```

```
COSZER              0000008D R      02
G_SMALLEST_DEG      00000000 R      02
MTH$$JACKET_HND     ********   X    02
MTH$$JACKET_TST     ********   X    00
MTH$$SIGNAL         ********   X    00
MTH$GSINCOSD_R7     ********   X    00
MTH$GSINCOS_R7      ********   X    00
MTH$GTAN            00000008 RG     02
MTH$GTAND           00000029 RG     02
MTH$GTAND_R7        0000003A RG     02
MTH$GTAN_R7         00000019 RG     02
MTH$K_FLOOVEMAT     ********   X    00
MTH$K_FLOUNDMAT     ********   X    00
SF$W_SAVE_PSW   = 00000004
UNFL                00000069 R      02
X               = 00000004
```

## Psect synopsis

| PSECT name | Allocation | PSECT No. | Attributes |
|---|---|---|---|
| . ABS . | 00000000 ( 0.) | 00 ( 0.) | NOPIC USR CON ABS LCL NOSHR NOEXE NORD NOWRT NOVEC BYTE |
| $ABS$ | 00000000 ( 0.) | 01 ( 1.) | NOPIC USR CON ABS LCL NOSHR EXE RD WRT NOVEC BYTE |
| _MTH$CODE | 0000009F ( 159.) | 02 ( 2.) | PIC USR CON REL LCL SHR EXE RD NOWRT NOVEC LONG |

## Performance indicators

| Phase | Page faults | CPU Time | Elapsed Time |
|---|---|---|---|
| Initialization | 33 | 00:00:00.09 | 00:00:01.23 |
| Command processing | 120 | 00:00:00.71 | 00:00:04.90 |
| Pass 1 | 120 | 00:00:01.43 | 00:00:06.36 |
| Symbol table sort | 0 | 00:00:00.02 | 00:00:00.03 |
| Pass 2 | 72 | 00:00:00.76 | 00:00:02.79 |
| Symbol table output | 3 | 00:00:00.02 | 00:00:00.04 |
| Psect synopsis output | 2 | 00:00:00.02 | 00:00:00.05 |
| Cross-reference output | 0 | 00:00:00.00 | 00:00:00.00 |
| Assembler run totals | 352 | 00:00:03.06 | 00:00:15.40 |

The working set limit was 1050 pages.
6467 bytes (13 pages) of virtual memory were used to buffer the intermediate code.
There were 10 pages of symbol table space allocated to hold 44 non-local and 3 local symbols.
395 source lines were read in Pass 1, producing 16 object records in Pass 2.
9 pages of virtual memory were used to define 8 macros.

## Macro library statistics

| Macro library name | Macros defined |
|---|---|
| _$255$DUA28:[SYSLIB]STARLET.MLB;2 | 4 |

88 GETS were required to define 4 macros.

There were no errors, warnings or information messages.

```
MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS$:MTHGTAN/OBJ=OBJ$:MTHGTAN MSRC$:MTHJACKET/UPDATE=(ENH$:MTHJACKET)+MSRC$:
```