```
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSSSSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMMMMM   MMMMMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRR         RRR  MMM   MMM   MMM  SSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRRRRRRRRRRR     MMM         MMM     SSSSSSSSS
RRR   RRR        MMM         MMM              SSS
RRR   RRR        MMM         MMM              SSS
RRR   RRR        MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR      RRR     MMM         MMM              SSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
RRR         RRR  MMM         MMM  SSSSSSSSSSSS
```

FILEID**RM3CMPRSS

```
RRRRRRRR    MM      MM    333333      CCCCCCCC  MM      MM  PPPPPPPP    RRRRRRRR      SSSSSSSS    SSSSSSSS
RRRRRRRR    MM      MM    333333      CCCCCCCC  MM      MM  PPPPPPPP    RRRRRRRR      SSSSSSSS    SSSSSSSS
RR      RR  MMMM  MMMM  33      33  CC          MMMM  MMMM  PP      PP  RR      RR  SS          SS
RR      RR  MMMM  MMMM  33      33  CC          MMMM  MMMM  PP      PP  RR      RR  SS          SS
RR      RR  MM  MM  MM          33  CC          MM  MM  MM  PP      PP  RR      RR  SS          SS
RR      RR  MM  MM  MM          33  CC          MM  MM  MM  PP      PP  RR      RR  SS          SS
RRRRRRRR    MM      MM        33    CC          MM      MM  PPPPPPPP    RRRRRRRR      SSSSSS      SSSSSS
RRRRRRRR    MM      MM        33    CC          MM      MM  PPPPPPPP    RRRRRRRR      SSSSSS      SSSSSS
RR  RR      MM      MM          33  CC          MM      MM  PP          RR  RR              SS          SS
RR  RR      MM      MM          33  CC          MM      MM  PP          RR  RR              SS          SS
RR    RR    MM      MM  33      33  CC          MM      MM  PP          RR    RR            SS          SS      ....
RR    RR    MM      MM  33      33  CC          MM      MM  PP          RR    RR            SS          SS      ....
RR      RR  MM      MM    333333      CCCCCCCC  MM      MM  PP          RR      RR  SSSSSSSS    SSSSSSSS        ....
RR      RR  MM      MM    333333      CCCCCCCC  MM      MM  PP          RR      RR  SSSSSSSS    SSSSSSSS        ....

LL            IIIIII      SSSSSSSS
LL            IIIIII      SSSSSSSS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II        SSSSSS
LL              II        SSSSSS
LL              II              SS
LL              II              SS
LL              II              SS
LL              II              SS
LLLLLLLLLL    IIIIII    SSSSSSSS
LLLLLLLLLL    IIIIII    SSSSSSSS
```

Table of contents

```
0000          $BEGIN  RM3CMPRSS,000,RM$RMS3,<>,<PIC,NOWRT,QUAD>
0000
0000    ;*****************************************************************************
0000    ;*                                                                           *
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0000    ;*                                                                           *
0000    ;*                                                                           *
0000    ;*****************************************************************************
0000    ;
0000
0000    ;++
0000    ;
0000    ; Facility:     RMS32 Index Sequential File Organization
0000    ;
0000    ; Abstract:
0000    ;
0000    ;       This modules contains the routines to handle compressed buckets
0000    ;       and compressed records.
0000    ;
0000    ; Environment:          VAX/VMS Operating System
0000    ;
0000    ; Author:       Todd M. Katz             Creation Date:  13-Aug-1982
0000    ;
0000    ; Modified By:
0000    ;
0000    ;       V03-008 TMK0006         Todd M. Katz            03-Feb-1983
0000    ;               Add support for Recovery Unit Journalling and RU ROLLBACK
0000    ;               Recovery of ISAM files. This involves a change to RM$SRCH_CMPR.
0000    ;               Check both for IRC$V_DELETED and IRC$V_RU_DELETED before setting
0000    ;               the IRB$V_DUPS_SEEN flag. Previously, just IRC$V_DELETED was
0000    ;               being checked.
0000    ;
0000    ;       V03-007 TMK0005         Todd M. Katz            16-Sep-1982
0000    ;               The field IRB$B_SRCHFLAGS has been changed to a word in size.
0000    ;               Fix all the references to it.
0000    ;
0000    ;               If a record is encountered with a key that is an exact duplicate
0000    ;               of the search key, then set the bit IRB$V_DUP_KEY regardless
0000    ;               of whether the record is or isn't marked deleted if RMS is
0000    ;               currently positioning for insertion.
0000    ;
```

```
0000  ;           Performance enhancement. RMS does not have to call
0000  ;           RM$GETNEXT_REC to position to the next record in the bucket.
0000  ;           If this is an index record, then the address of the next record
0000  ;           is REC_ADDR + current key size + 2 for compression overhead.
0000  ;           If this is anyother type of record, (primary data or SIDR) then
0000  ;           RMS knows that the record size field makes up the last two bytes
0000  ;           of the record overhead, and can use the quantity there + the
0000  ;           record overhead to position to the next record.
0000  ;
0000  ;           At the present time, RMS positions past deleted records even
0000  ;           when the search would otherwise be terminated because of the
0000  ;           key value of the current record, the search key value, and the
0000  ;           goal of the search. This is incorrect, and inconsistant with the
0000  ;           manner in which the rest of the searching is performed. It
0000  ;           creates problems during next record positioning which always
0000  ;           tries to first position to the current record before positioning
0000  ;           to the next record, and thus, could end up positioning past a
0000  ;           stream's internal current record because its marked deleted, and
0000  ;           therefore wrongly assume that the record had been completely
0000  ;           deleted from the file. The solution to this problem is to return
0000  ;           the record that the search terminates at regardless of whether
0000  ;           the record is or isn't marked deleted, and to let the upper
0000  ;           level routines decide what to do if the record is in fact marked
0000  ;           deleted.
0000  ;
0000  ;           At the present time, RM$SRCH_CMPR always starts its search with
0000  ;           the first record in the current bucket. This is unacceptable
0000  ;           because of the above made change - ie, searches may now
0000  ;           terminate with deleted records, and thus, may have to resume
0000  ;           positioning somewhere within the bucket in order to find a
0000  ;           non-deleted record. Fortunately, this change is easv to make
0000  ;           provided several assumptions hold:
0000  ;
0000  ;           1. The goal of the search does not change between invocations
0000  ;              of RM$SRCH_CMPR.
0000  ;
0000  ;           2. The search key does not change between invocations of
0000  ;              RM$SRCH_CMPR.
0000  ;
0000  ;           2. The bucket being searched is kept locked between invocations
0000  ;              of this routine.
0000  ;
0000  ;           3. The keys are always in ascending order in the bucket, and the
0000  ;              compression of these keys are always correct.
0000  ;
0000  ;           If these assumptions hold true, then it will always possible to
0000  ;           resume the search in the middle of a bucket, and return whether
0000  ;           the next record has a key value equal to (if the goal of the
0000  ;           search is EQ) or GT (if the goal of the search is GT or EQ) the
0000  ;           search key.
0000  ;
0000  ;   V03-006 KBT0159         Keith B. Thompson       21-Aug-1982
0000  ;           Reorganize psects
0000  ;
0000  ;   V03-005 TMK0004         Todd M. Katz            13-Aug-1982
0000  ;           Completely re-wrote the routine responsible for searching
0000  ;           compressed buckets, and the routine responsible for determining
```

```
                0000  ;                the amount of front compression of records.
                0000  ;
                0000  ;                Added support for prologue 3 SIDRs to both the compressed key
                0000  ;                bucket searching routine and the front compression determining
                0000  ;                routine.
                0000  ;
                0000  ;--
```

```
0000          .SBTTL  DEFINITIONS
0000
0000
0000    ;
0000    ; Internal Structure Symbol Definitions
0000    ;
0000
0000          $BKTDEF
0000          $IRBDEF
0000          $IFBDEF
0000          $IRCDEF
0000          $IDXDEF
```

```
0000            .SBTTL  RM$SRCH_CMPR - Search a Compressed Index, SIDR, or Data Bucket
0000    ;++
0000    ;
0000    ; FUNCTIONAL DESCRIPTION:
0000    ;
0000    ;       This routine performs an equal search or a greater-than search on a
0000    ;       primary data, SIDR, or index bucket with compressed key records using
0000    ;       the search key found in keybuffer 2. The search may start with the first
0000    ;       record in the bucket, or with a record somewhere in the middle of the
0000    ;       bucket. When the search is completed, REC_ADDR is positioned to the
0000    ;       record to be returned, and R0 contains the status of the search.
0000    ;
0000    ;       This routine makes some basic assumptions which can not be violated
0000    ;       without expecting totally unpredicatble search results.
0000    ;
0000    ;       1. It is assumed that the keys of the records in the bucket are strictly
0000    ;          in ascending order, and that they are always as fully compressed
0000    ;          as they can be for the position they occupy.
0000    ;
0000    ;       2. The two key compression bytes always follow whatever record overhead
0000    ;          is present in the record (if any), regardless of the bucket type. The
0000    ;          first key compression byte is always the number of bytes of key
0000    ;          present, and the second key compression byte is always the amount of
0000    ;          front compression of the key.
0000    ;
0000    ;       3. Record overhead is a fixed quantity for each record type.
0000    ;          Furthermore, if a record has record overhead associated with it, the
0000    ;          record's size minus the record overhead is always stored in the last
0000    ;          two bytes of record overhead.
0000    ;
0000    ;       4. Whenever RMS is positioning for insertion it performs a greater-than
0000    ;          search.
0000    ;
0000    ;       5. The decision to terminate a search is based on the goal of the search
0000    ;          and the outcome of the comparison between the key of the record being
0000    ;          returned and the search key. It is never based on anything else about
0000    ;          the record, for example, whether the record is marked deleted or not.
0000    ;
0000    ;       6. If this routine is called to resume a search within a bucket then:
0000    ;
0000    ;          a. The bucket has been locked between routine invocations.
0000    ;          b. IRAB[IRB$L_LST_NCMP] still points to the last record with a zero
0000    ;             front-compressed key.
0000    ;          c. The goal of all consecutive routine invocations is identical
0000    ;             (either EQ or GT).
0000    ;          d. The search key has not changed between routine invocations.
0000    ;
0000    ; CALLING SEQUENCE:
0000    ;
0000    ;       BSBW    RM$SRCH_CMPR
0000    ;
0000    ; INPUT PARAMETERS:
0000    ;
0000    ;       R1      - if 0, greater-than or equal search
0000    ;                 if 1, greater-than search
0000    ;
0000    ; IMPLICIT INPUT:
```

```
0000  ;
0000  ;       R5      - BKT_ADDR                  - address of bucket
0000  ;                    BKT$W_FREESPACE        - offset to first free byte in bucket
0000  ;                    BKT$B_INDEXNO          - key of reference of bucket
0000  ;                    BKT$B_LEVEL            - level of bucket
0000  ;
0000  ;       R6      - REC_ADDR                  - address of where to begin search
0000  ;
0000  ;       R7      - IDX_DFN                   - address of index descriptor
0000  ;
0000  ;       R9      - IRAB                      - address of IRAB
0000  ;                     IRB$L_KEYBUF          - address of contigious keybuffers
0000  ;                     IRB$B_KEYSZ           - size of the search key
0000  ;                     IRB$V_LAST_GT         - if set, GT search result ocurred
0000  ;                     IRB$V_POSINSERT       - if set, positioning for insertion
0000  ;                     IRB$W_SRCHFLAGS       - search flags
0000  ;
0000  ;       R10     - IFAB                      - address of IFAB
0000  ;                     IFB$W_KBUFSZ          - size of each keybuffer
0000  ;
0000  ; OUTPUT PARAMETERS:
0000  ;       NONE
0000  ;
0000  ; IMPLICIT OUTPUT:
0000  ;
0000  ;       IRB$V_DUP_KEY   - if set, there is at least one data record in the file
0000  ;                         (deleted or otherwise) with a key identical to that of
0000  ;                         the search key
0000  ;       IRB$V_DUPS_SEEN - if set, there is at least one primary data record with
0000  ;                         a key identical to that of the search key.
0000  ;       IRB$V_LAST_GT   - if set, the result of this search was that the search
0000  ;                         key was less than the record positioned to.
0000  ;       IRB$L_LST_NCMP  - address of last key with no front compression
0000  ;       IRB$L_LST_REC   - address of last primary data record in duplicate chain
0000  ;       IRB$L_REC_COUNT - number of the record found
0000  ;       REC_ADDR        - address of record found
0000  ;
0000  ; ROUTINE VALUE:
0000  ;
0000  ;       R0:  -1, search key < record found
0000  ;             0, search key = record found
0000  ;             1, search key > all records in the bucket
0000  ;
0000  ; SIDE EFFECTS:
0000  ;
0000  ;       If positioning for insertion within a primary data bucket, and a record
0000  ;       with a key value duplicate of the key of the record to be inserted is
0000  ;       encountered, IRB$V_DUP_KEY is set, IRB$V_DUPS_SEEN is set (provided
0000  ;       the record is not marked deleted), and the address of the record is
0000  ;       placed in IRB$L_LST_REC. In fact at the conclusion of the search, this
0000  ;       same field will contain the address of the last such duplicate
0000  ;       encountered while REC_ADDR points to the record that follows it which
0000  ;       is where the new record will be inserted. Of course, if the bucket is a
0000  ;       SIDR bucket, then there can only be one instance of a record with a
0000  ;       g'ven key value in a bucket.
0000  ;
0000  ;       Whenever the search key is greater that the key of all the records in
```

```
                    0000   250 ;        the bucket, then REC_ADDR is left positioned at the end of the bucket
                    0000   251 ;        when this status is returned. This is independent of bucket type.
                    0000   252 ;
                    0000   253 ;---
                    0000   254
                    0000   255 RM$SRCH_CMPR::
 091E 8F     BB     0000   256          PUSHR   #^M<R1,R2,R3,R4,R8,R11> ; save the working registers
```

```
RM]
Sym

$$
$$F
$$F
$$F
$$F
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BK1
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Cr
As

Th
```

```
                   0004  258
                   0004  259 ;
                   0004  260 ; Register Usage:
                   0004  261 ;
                   0004  262 ; R0  - Result of the comparison between the search key and the "last" record.
                   0004  263 ;
                   0004  264 ; R1  - Set to the type of bucket for determining the amount of record overhead.
                   0004  265 ;     - Number of bytes of search key and record key to be compared.
                   0004  266 ;     - Scratch register.
                   0004  267 ;
                   0004  268 ; R2  - Offset in the search key to the byte where the comparison between the
                   0004  269 ;       search key and the key of the "current" record is to begin.
                   0004  270 ;
                   0004  271 ; R3  - Working register for CMPC3 and CMPC5.
                   0004  272 ;       Working register during next record positioning.
                   0004  273 ;
                   0004  274 ; R4  - Number of bytes of record overhead, not including key compression bytes.
                   0004  275 ;
                   0004  276 ; R5  - Address of the beginning of the bucket in memory.
                   0004  277 ;
                   0004  278 ; R6  - Address in memory of the current record in the bucket.
                   0004  279 ;
                   0004  280 ; R7  - Address of the index descriptor.
                   0004  281 ;
                   0004  282 ; R8  - Address in memory of the first free byte in the bucket. Effectively the
                   0004  283 ;       address of the end of the bucket.
                   0004  284 ;
                   0004  285 ; R9  - Address of the IRAB.
                   0004  286 ;
                   0004  287 ; R10 - Address of .ne IFAB.
                   0004  288 ;
                   0004  289 ; R11 - Address of keybuffer 2. Effectively the address of the search key.
                   0004  290 ;
                   0004  291
  58   04 A5   3C  0004  292         MOVZWL  BKT$W_FREESPACE(R5),R8  ; compute the address of the first free
     58   55   C0  0008  293         ADDL2   R5,R8                   ; byte in the bucket, and put it in R8
                   000B  294
     58   56   D1  000B  295         CMPL    R6,R8                   ; if the bucket is empty, return a GT
          03   1F  000E  296         BLSSU   1$                      ; status (primary data or SIDR buckets)
        0136   31  0010  297         BRW     140$                    ; otherwise continue
                   0013  298
  51   0C A5   9A  0013  299 1$:     MOVZBL  BKT$B_LEVEL(R5),R1      ; if this is an index bucket, then as
          04   13  0017  300         BEQLU   5$                      ; index records do not contain any
          54   D4  0019  301         CLRL    R4                      ; overhead intialize R4 to 0, and skip
          2B   11  001B  302         BRB     15$                     ; call to determine record overhead
                   001D  303
       01 A5   95  001D  304 5$:     TSTB    BKT$B_INDEXNO(R5)       ; if this is a primary data bucket,
          03   13  0020  305         BEQLU   10$                     ; setup R1 with a 0, else it is a SIDR
     51   01   CE  0022  306         MNEGL   #1,R1                   ; bucket and a -1 is placed in R1
                   0025  307
       FFD8'   30  0025  308 10$:    BSBW    RM$REC_OVHD             ; determine the amount of overhead in
     54   50   D0  0028  309         MOVL    R0,R4                   ; each record and store it in R4
                   002B  310
51   55   0E   C1  002B  311         ADDL3   #BKT$C_OVERHDSZ,R5,R1   ; get address of first record in bucket
                   002F  312
     56   51   D1  002F  313         CMPL    R1,R6                   ; if RMS is to start search with first
          14   13  0032  314         BEQLU   15$                     ; record, then go start search
```

```
                       0034
                       0034    ;
                       0034    ; RMS is resuming a search. and not starting with the first record in the
                       0034    ; bucket. The rules for resuming a search are as follows:
                       0034    ;
                       0034    ; 1. If the goal of the search is GT, then as the previous record must have
                       0034    ;    been GT the search key, so must the current record. Therefore the search
                       0034    ;    can immediately terminate with this status.
                       0034    ;
                       0034    ; 2. If the goal of the search is EQ, then if the number of bytes the current
                       0034    ;    record's key is front compression is equal to or exceeds the size of the
                       0034    ;    search key, then the current record and the search key must also be EQ.
                       0034    ;    Therefore, such a status can be immed'ately returned.
                       0034    ;
                       0034    ; 3. If the goal of the search is EQ, but the number of bytes the current
                       0034    ;    record's key is front compressed is less than the size of the search key,
                       0034    ;    then the current record's key must be greater than the search key, and
                       0034    ;    such a status maybe immediately returned.
                       0034    ;
                       0034
            0A    E1   0034            BBC     #IRB$V_LAST_GT,-          ; if the result of the last routine
      03 42 A9         0036                    IRB$W_SRCHFLAGS(R9),12$ ; invocation was LT, then so is the
          009B    31   0039    11$:    BRW     90$                       ; result of this contigious invocation
                       003C
00A6 C9   01 A644  91  003C    12$:    CMPB    1(R6)[R4],-               ; determine whether the key of the
                       0043                    IRB$B_KEYSZ(R9)           ; current record is equal to or
            F4    1F   0043            BLSSU   11$                       ; greater than the search key and
          00CF    31   0045    13$:    BRW     110$                      ; return the appropriate status
                       0048
                       0048    ;
                       0048    ; RMS is to start the search with the first record in the bucket.
                       0048    ;
                       0048
                       0048    15$:    CSB     #IRB$V_LAST_GT,-          ; if the search is starting with the
                       0048                    IRB$W_SRCHFLAGS(R9)      ; first record in the bucket then there
                       004D                                              ; is no previous context
   0098 C9    56  D0   004D            MOVL    R6,IRB$L_LST_NCMP(R9)     ; the first non-compressed record
                       0052
   5B   00B4 CA   3C   0052            MOVZWL  IFB$W_KBUFSZ(R10),R11     ; compute the address of keybuffer 2
     5B   60 A9   C0   0057            ADDL2   IRB$L_KEYBUF(R9),R11      ; and place it in R11
                       005B
        0094 C9   D4   005B            CLRL    IRB$L_REC_COUNT(R9)       ; RMS is positioned to the first record
```

```
                         005F
                         005F   ;
                         005F   ; The only time it is ever necessary to compare the key of the current record
                         005F   ; with the search key is when the number of bytes the key of the current record
                         005F   ; is compressed is the same as the offset to the character in the search key
                         005F   ; which terminated key comparison the last time it was done. The comparison is
                         005F   ; now done to see whether this previous comparison terminating character (and
                         005F   ; implicitely the rest that follow it in the search key) is still greater then
                         005F   ; its opposite in the key of the new current record.
                         005F   ;
                         005F   ; The comparison starts in the search key with the character that had previously
                         005F   ; terminated such a comparison, and the number of bytes of key to be compared
                         005F   ; is the minimum of the number of bytes thus remaining in the search key and the
                         005F   ; number of bytes in the key of the current record.
                         005F   ;
                         005F   ; Note that this strategy guarentees that a comparison is always done between
                         005F   ; the search key and the key of the first record in the bucket.
                         005F   ;
                         005F
              52     D4  005F             CLRL    R2                          ; initialize the search key offset to 0
                         0061
     51   00A6 C9    9A  0061   20$:      MOVZBL  IRB$B_KEYSZ(R9),R1          ; compute the number of bytes in the
          51    52   82  0066             SUBB2   R2,R1                       ; search key remaining to be compared
                         0069
        6644    51   91  0069             CMPB    R1,(R6)[R4]                 ; use the minimum of the search key
                04   1B  006D             BLEQU   30$                         ; bytes remaining and the current record
        51    6644   9A  006F             MOVZBL  (R6)[R4],R1                 ; key size as the key comparison size
                         0073
6B42  02 A644   51   29  0073   30$:      CMPC3   R1,2(R6)[R4],(R11)[R2]      ; if the search key is equal to or less
                65   13  007A             BEQLU   100$                        ; than the current record key process
                59   1A  007C             BGTRU   90$                         ; accordingly, otherwise position to the
          50    01   9A  007E             MOVZBL  #1,R0                       ; next record in the bucket
                         0081
                         0081   ;
                         0081   ; Position to the record which follows the current record in the bucket. Before
                         0081   ; performing this positioning, save the address of the old current record if it
                         0081   ; was zero front compressed.
                         0081   ;
                         0081
     52   53    5B   C3  0081   40$:      SUBL3   R11,R3,R2                   ; compute terminating search key offset
                         0085
        01 A644     95   0085   50$:      TSTB    1(R6)[R4]                   ; if the key of the current record is
                05   12  0089             BNEQU   55$                         ; 0 front compressed, save its address
     0098 C9    56   D0  008B             MOVL    R6,IRB$L_LST_NCMP(R9)       ; before positioning to the next record
                         0090
          0C A5      95  0090   55$:      TSTB    BKT$B_LEVEL(R5)             ; if this is an index bucket then next
                0A   13  0093             BEQL    60$                         ; record position equals the current
          53    66   9A  0095             MOVZBL  (R6),R3                     ; record position + current record key
     56   02 A643    9E  0098             MOVAB   2(R6)[R3],R6                ; size + two bytes for the key
                0A   11  009D             BRB     62$                         ; compression overhead
                         009F
          56    54   C0  009F   60$:      ADDL2   R4,R6                       ; otherwise, next record position equals
      53   FE A6     3C  00A2             MOVZWL  -2(R6),R3                   ; current record position + record
          56    53   C0  00A6             ADDL2   R3,R6                       ; overhead + record size
                         00A9
        0094 C9      D6  00A9   62$:      INCL    IRB$L_REC_COUNT(R9)         ; increment the record counter
```

```
                              00AD      ;
                              00AD      ; There are a number of circumstances under which the result of the comparison
                              00AD      ; between the key of the new current record and the search key is known or can
                              00AD      ; be quickly determined without actually performing the comparison.
                              00AD      ;
                              00AD      ; 1. If RMS has positioned to the end of the bucket, or to a RRV record within
                              00AD      ;    a primary data bucket then the search is terminated with a GT status.
                              00AD      ;
                              00AD      ; 2. If the search key was found to be equal to the key of the last record, but
                              00AD      ;    the front compression of the key of the current record is less than the
                              00AD      ;    size of the search key, then the search key will be less than the key of
                              00AD      ;    new current record and it is processed as such.
                              00AD      ;
                              00AD      ; 3. If the search key was found to be equal to the key of the last record, and
                              00AD      ;    the front compression of the key of the new current record is either equal
                              00AD      ;    to or greater-than the size of the search key, then the search key will
                              00AD      ;    also be equal to the key of the new current record and is processed as
                              00AD      ;    such. The front compression of the key of the new current record maybe
                              00AD      ;    greater-than the size of the search key because RMS maybe performing a
                              00AD      ;    generic search with a search key smaller in size than the full size of a
                              00AD      ;    key for this key of reference.
                              00AD      ;
                              00AD      ; 4. If the search key was found to be greater-than the key of the last record,
                              00AD      ;    and the front compression of the key of the new current record is
                              00AD      ;    greater-than the position in the search key where the last comparison
                              00AD      ;    terminated, then the search key will also be greater-than the key of the
                              00AD      ;    new current record and RMS proceeds to position to the next record.
                              00AD      ;
                              00AD      ; 5. If the search key was found to be greater-than the key of the last record,
                              00AD      ;    but the front compression of the key of the new current record is less-than
                              00AD      ;    the position in the search key where the last comparison terminated, then
                              00AD      ;    the search key will be less-than the key of the new current record and is
                              00AD      ;    processed as such.
                              00AD      ;
                              00AD      ; In the remaining circumstances a direct comparison between the key of the new
                              00AD      ; current record and the search key is required, and is performed.
                              00AD      ;
                              00AD
         58    56       D1    00AD              CMPL    R6,R8                   ; if RMS is at the end of the bucket
               0C       1E    00B0              BGEQU   65$                     ; or has positioned ti a RRV record
            01 A5       89    00B2              BISB3   BKT$B_INDEXNO(R5),-     ; in a primary data bucket then
      51    0C A5             00B5                      BKT$B_LEVEL(R5),R1      ; go return a status of GT (search key
               07       12    00B8              BNEQU   70$                     ; greater than all the records in the
      03 66    03       E1    00BA              BBC     #IRC$V_RRV,(R6),70$     ; bucket)
             0088       31    00BE      65$:    BRW     140$
                              00C1
               50       D5    00C1      70$:    TSTL    R0                      ; if the last comparison's result was GT
               09       14    00C3              BGTR    80$                     ; then go decide between cases 4 or 5 or
                              00C5                                              ; whether a key comparison must be made
                              00C5
   52    01 A644        91    00C5              CMPB    1(R6)[R4],R2            ; if CASE 2 holds true process as
               0B       1F    00CA              BLSSU   90$                     ; less-than, but if CASE 3 holds true
               53       11    00CC              BRB     115$                    ; process as equal
                              00CE
   52    01 A644        91    00CE      80$:    CMPB    1(R6)[R4],R2            ; ;f CASE 4 holds true go position to
               B0       1A    00D3              BGTRU   50$                     ; the next record, but if CASE 5 holds
               8A       13    00D5              BEQLU   20$                     ; true process as less-than otherwise
```

```
                           00D7    473
                           00D7    474 ;
                           00D7    475 ; RMS has positioned to a record whose key is greater than that of the search
                           00D7    476 ; key. Return this status.
                           00D7    477 ;
                           00D7    478
             50    01   CE 00D7    479 90$:     MNEGL   #1,R0                      ; setup the status in R0 to be LT and
                           00DA    480          SSB     #IRB$V_LAST_GT,-           ; save that the result of this search
                           00DA    481                  IRB$W_SRCHFLAGS(R9)        ; was GT in case the search must resume
                   6D   11 00DF    482          BRB     150$                       ; go return this status
                           00E1    483
                           00E1    484 ;
                           00E1    485 ; On an actual search key - current record key comparison, the parts of the
                           00E1    486 ; key that were compared were found to be equivalent. This does not necessairly
                           00E1    487 ; mean that the two keys are in fact identical. If the size of the search key
                           00E1    488 ; (including those characters front compressed but not rear-end truncated) is
                           00E1    489 ; less than or equal to the size of the key of the current record, then in fact
                           00E1    490 ; the two keys are identical, and are processed as such. However, if because of
                           00E1    491 ; rear-end truncation the search key is greater in size then the key of the
                           00E1    492 ; current record, then the comparison between the two keys must be continued.
                           00E1    493 ; This is done by extending the key of the current record by the last character
                           00E1    494 ; present, and comparing the remaining bytes in the search key with it alone. If
                           00E1    495 ; the two keys are still identical they are processed as such; otherwise, they
                           00E1    496 ; are processed depending on whether the search key is greater-than or
                           00E1    497 ; less-than the key of the current record.
                           00E1    498 ;
                           00E1    499
  51   01 A644   6644   81 00E1    500 100$:    ADDB3   (R6)[R4],1(R6)[R4],R1      ; if the size of the search key is
         51   00A6 C9   91 00E8    501          CMPB    IRB$B_KEYSZ(R9),R1         ; less-than or equal to the size of the
                   28   1B 00ED    502          BLEQU   110$                       ; current record's key, process as equal
                           00EF    503
         52    53  5B   C3 00EF    504          SUBL3   R11,R3,R2                  ; determine where in the search key the
                   53   D4 00F3    505          CLRL    R3                         ; comparison stopped and how many search
     53   00A6 C9  52   83 00F5    506          SUBB3   R2,IRB$B_KEYSZ(R9),R3      ; key bytes remain to be compared
                           00FB    507
             51   6644  9A 00FB    508          MOVZBL  (R6)[R4],R1                ; compute the offset to the last
         51    01 A441  9E 00FF    509          MOVAB   1(R4)[R1],R1               ; character in the current record's key
                           0104    510
 53   6641   6641  01   2D 0104    511          CMPC5   #1,(R6)[R1],(R6)[R1],-     ; compare the remaining search key bytes
                 6B42      010B    512                  R3,(R11)[R2]               ; with the current record key's last
                   C8   1A 010D    513          BGTRU   90$                        ; character, and continue processing
                   06   13 010F    514          BEQLU   110$                       ; depending upon whether they are
             50    01   9A 0111    515          MOVZBL  #1,R0                      ; identical, the search key is less-than
                 FF6A   31 0114    516          BRW     40$                        ; the current record's key or vice versa
```

```
                         0117
                         0117     ;
                         0117     ; The search key has been found to be identical with the key of the current
                         0117     ; record.
                         0117     ;
                         0117     ; If the goal of the search is to find an equal match then RMS is done and
                         0117     ; should return such a status provided the record is not a primary data record
                         0117     ; marked deleted. In such an instance, RMS continues the search with the next
                         0117     ; primary data record in the bucket.
                         0117     ;
                         0117     ; If the goal of the search is to find a greater-than match, then RMS will also
                         0117     ; continue the searc' with the next record in the bucket. However, before
                         0117     ; continuing the search, if RMS is positioning for insertion within a data
                         0117     ; bucket, then as the key of the new record will be identical to the key of the
                         0117     ; current record, RMS saves the address of the current record as the last record
                         0117     ; seen in the data bucket with this key value. RMS will also indicate that a
                         0117     ; a record with a key duplicate to that of the new record has been seen by
                         0117     ; setting a bit in the IRAB, provided the current record is not marked deleted,
                         0117     ; and it will indicate that some record with this key value has been seen by
                         0117     ; setting another bit in the IRAB, regardless of the setting of the current
                         0117     ; record.
                         0117     ;
                         0117
            50   D4      0117     110$:   CLRL    R0                          ; setup the status in R0 to be equal
                         0119
            6E   D5      0119             TSTL    (SP)                        ; if the goal of the search is an equal
            31   13      011B             BEQLU   150$                        ; match then go an EQ status, otherwise
  52   53   5B   C3      011D             SUBL3   R11,R3,R2                   ; compute terminating search key offset
                         0121
       0C A5   95        0121     115$:   TSTB    BKT$B_LEVEL(R5)             ; if rms is not currently positioning
            20   12      0124             BNEQU   130$                        ; for insertion within a data bucket,
            00   E1      0126             BBC     #IRB$V_POSINSERT,-          ; then continue the search for a record
    1B 42 A9             0128                     IRB$W_SRCHFLAGS(R9),130$;   with a key greater-than the search key
                         012B
                         012B             SSB     #IRB$V_DUP_KEY,-            ; otherwise, save the address of the
                         012B                     IRB$W_SRCHFLAGS(R9)         ; current record, set a bit indicating
   4C A9    56   D0      0130             MOVL    R6,IRB$L_LST_REC(R9)        ; that a duplicate key was encountered
       01 A5   95        0134             TSTB    BKT$B_INDEXNO(R5)           ; during the search, and indicate that
            08   12      0137             BNEQ    120$                        ; duplicates have been seen during the
   09 66    02   E0      0139             BBS     #IRC$V_DELETED,(R6),130$;   search if the current record is a
      66    05   E0      013D             BBS     #IRC$V_RU_DELETE,(R6),- ;   SIDR, or if the current record is a
            05           0140                     130$                        ; primary data record that is not
      80 8F   88         0141     120$:   BISB2   #IRB$M_DUPS_SEEN,-          ; marked either deleted or deleted
      44 A9              0144                     IRB$B_SPL_BITS(R9)          ; within a Recovery Unit
       FF3C   31         0146     130$:   BRW     50$
```

```
                   0149
                   0149      ;
                   0149      ; RMS has found that the search key is greater-than the key of every record
                   0149      ; in the bucket. In this case RMS will immediately terminate the search with
                   0149      ; a greater-than status.
                   0149      ;
                   0149
   50   01    9A   0149      140$:   MOVZBL  #1,R0                   ; go terminate the search with a status
        15    11   014C              BRB     160$                    ; of greater-than
                   014E
                   014E      ;
                   014E      ; Return the status of the search to the caller of this routine. If the bucket
                   014E      ; that was searched was a data level bucket, and RMS was not positioning for
                   014E      ; insertion, then save the address of the current record as the last zero
                   014E      ; front compressed record encountered provided it is zero front compressed
                   014E      ; and there is a record to be returned (ie - the status of the search is not
                   014E      ; greater-than).
                   014E      ;
                   014E
   0C A5      95   014E      150$:   TSTB    BKT$B_LEVEL(R5)         ; immediately return the appropriate
      10      12   0151              BNEQU   160$                    ; status if this is not a data bucket
                   0153
      00      E0   0153              BBS     #IRB$V_POSINSERT,-      ; if RMS is positioning for insertion
 0B 42 A9          0155                      IRB$W_SRCHFLAGS(R9),160$; then immediately return status
                   0158
 01 A644      95   0158              TSTB    1(R6)[R4]               ; if the current record is zero front
      05      12   015C              BNEQU   160$                    ; compressed then save its address as
0098 C9 56    D0   015E              MOVL    R6,IRB$L_LST_NCMP(R9)   ; the last seen zero-compressed record
                   0163
 091E 8F      BA   0163      160$:   POPR    #^M<R1,R2,R3,R4,R8,R11> ; restore the registers used and
              05   0167              RSB                             ; return
```

```
0168
0168              .SBTTL  RM$FRNT_CMPR - Compute a Record's Front Compression Count
0168        ;+++
0168        ;
0168        ; FUNCTIONAL DESCRIPTION:
0168        ;
0168        ;       This routine's responsibility is to take a proposed point of insertion
0168        ;       of a new record, and determine the amount of front compression the key
0168        ;       of the new record will have if it is inserted there. The record maybe
0168        ;       a primary data, an index, or a SIDR record. There are two assumptions
0168        ;       which this routine makes:
0168        ;
0168        ;       1. The keys of the records in the bucket are in ascending order and are
0168        ;          correctly compressed (ie - they are as compressed as they can be for
0168        ;          their place in the bucket).
0168        ;
0168        ;       2. Each record in the bucket is preceeded by the same number of bytes of
0168        ;          overhead, a constant for the type of file and type of bucket, and
0168        ;          key compression overhead always consists of two bytes - the first the
0168        ;          size of the key that is present, and the second the number of bytes
0168        ;          of front compression.
0168        ;
0168        ; INPUT PARAMETERS:
0168        ;
0168        ;       R6      - address where new record is to be inserted
0168        ;       R8      - address of key of new record
0168        ;                 (including key compression overhead)
0168        ;
0168        ; IMPLICIT INPUT:
0168        ;
0168        ;       R5      - BKT_ADDR                  - address of primary/index/SIDR bucket
0168        ;                     BKT$B_INDEXNO         - index number of bucket
0168        ;                     BKT$B_LEVEL           - level of bucket
0168        ;
0168        ;       R7      - IDX_DFN                   - address of index descriptor
0168        ;                     IDX$B_KEYSZ           - size of key
0168        ;
0168        ;       R9      - IRAB                      - address of IRAB
0168        ;                     IRB$L_LST_NCMP        - address of last key not compressed
0168        ;                     IRB$L_REC_COUNT       - number of preceeding records
0168        ;
0168        ;       R10     - IFAB                      - address of IFAB
0168        ;
0168        ; OUTPUT PARAMETERS:
0168        ;       NONE
0168        ;
0168        ; IMPLICIT OUTPUT:
0168        ;       NONE
0168        ;
0168        ; ROUTINE VALUE:
0168        ;
0168        ;       R0      - number of characters which can be front compressed
0168        ;
0168        ; SIDE EFFECTS:
0168        ;       NONE
0168        ;
0168        ;---
```

```
                     0168
                     0168   RM$FRNT_CMPR::
       081E 8F   BB  0168           PUSHR   #^M<R1,R2,R3,R4,R11>    ; save the working registers
       0094 C9   DD  016C           PUSHL   IRB$L_REC_COUNT(R9)     ; save the record count
            7E   D4  0170           CLRL    -(SP)                   ; 0 is current front compression guess
                     0172
                     0172   ;
                     0172   ; If the size of the key is zero bytes, or if the new record is to be inserted
                     0172   ; at the beginning of the bucket, then go return indicating that the key of the
                     0172   ; new record will not have to be front compressed.
                     0172   ;
                     0172
            68   95  0172           TSTB    (R8)                    ; if the new record's key size is zero
            5D   13  0174           BEQLU   50$                     ; then return 0 bytes front compresion
                     0176
   51  55   0E   C1  0176           ADDL3   #BKT$C_OVERHDSZ,R5,R1   ; if the new record is to be inserted as
       51   56   D1  017A           CMPL    R6,R1                   ; the first record in the bucket then
            54   1B  017D           BLEQU   50$                     ; go return 0 bytes front compression
```

```
                            017F
                            017F      ;
                            017F      ; Before a determination can be made of the front compression that will be
                            017F      ; required for the key of the new record there are some necessary preparations.
                            017F      ;
                            017F      ;
                            017F      ; Register Usage:
                            017F      ;
                            017F      ; R0  - Size of the key of the current record in the bucket.
                            017F      ;
                            017F      ; R1  - Set to the type of bucket for determining the amount of record overhead.
                            017F      ;         Offset to the last character of the current record's key.
                            017F      ;
                            017F      ; R2  - Offset to the character in the key of the new record where the
                            017F      ;         comparison is to resume.
                            017F      ;
                            017F      ; R3  - Number of bytes of the new record's key remaining to be compared with
                            017F      ;         the key of the current record.
                            017F      ;
                            017F      ; R4  - Number of bytes of record overhead, not including key compression bytes.
                            017F      ;
                            017F      ; R5  - Address of the beginning of the bucket in memory.
                            017F      ;
                            017F      ; R6  - Address in memory of the current record in the bucket.
                            017F      ;
                            017F      ; R7  - Addre   of the index descriptor.
                            017F      ;
                            017F      ; R8  - Address of the key of the new record to be inserted.
                            017F      ;
                            017F      ; R9  - Address of the IRAB.
                            017F      ;
                            017F      ; R10 - Address of the IFAB.
                            017F      ;
                            017F      ; R11 - Address in memory of the bucket address where the new record is to be
                            017F      ;         inserted.
                            017F      ;
                            017F
         5B   56      D0    017F              MOVL    R6,R11                  ; save the point of insertion in R11 and
    56  0098 C9       D0    0182              MOVL    IRB$L_LST_NCMP(R9),R6   ; initialize REC_ADDR to the address of
                            0187                                              ; the last zero-compressed record
                            0187
   51    0C A5        9A    0187              MOVZBL  BKT$B_LEVEL(R5),R1      ; if this is an index bucket, then as
              04      13    018B              BEQLU   10$                     ; index records do not contain any
              54      D4    018D              CLRL    R4                      ; overhead initialize R4 to 0, and skip
              0E      11    018F              BRB     30$                     ; call to determine record overhead
                            0191
         01 A5        95    0191      10$:    TSTB    BKT$B_INDEXNO(R5)       ; if this is a primary data bucket,
              03      13    0194              BEQL    20$                     ; setup R1 with a 0, else it is a SIDR
         51   01      CE    0196              MNEGL   #1,R1                   ; bucket and a -1 is placed in R1
                            0199
          FE64'       30    0199      20$:    BSBW    RM$REC_OVHD             ; determine the amount of overhead in
         54   50      D0    019C              MOVL    R0,R4                   ; each record and store it in R4
```

```
                                  019F
                                  019F  ;
                                  019F  ; The records in the bucket are assumed to be in ascending order and correctly
                                  019F  ; compressed. Therefore, if RMS's current best guess for the front compression
                                  019F  ; of the key of the new record is less then the front compression count of the
                                  019F  ; key of the current record, then there will be no need to compare the two keys.
                                  019F  ; because the current record's key can not contribute any more to the
                                  019F  ; compression of the key of the new record then was contributed by the key of
                                  019F  ; last record the new record's key was compared with. Only if the current front
                                  019F  ; compression estimate and the front compression count of the current record are
                                  019F  ; the same will it be necessary to compare the two keys, because only then can
                                  019F  ; the key of the current record influence the compression of the key of the new
                                  019F  ; record.
                                  019F  ;
                                  019F
              01 A644    6E   91  019F  30$:    CMPB    (SP),1(R6)[R4]          ; if compression counts arn't identical
                         25   12  01A4          BNEQ    40$                     ; then go position to the next record
                                  01A6
                                  01A6  ;
                                  01A6  ; Compare the key of the new record with the key of the current record. Because
                                  01A6  ; the current record's key is fully compressed, rear-end truncated as well as
                                  01A6  ; front compressed, it will be necessary to extend it by its last character as
                                  01A6  ; necessary. Furthermore, the comparison starts in the key of the new record,
                                  01A6  ; not with its first character, but with the first character past those RMS has
                                  01A6  ; already determined will be front compressed.
                                  01A6  ;
                                  01A6
                   50   6644  9A  01A6          MOVZBL  (R6)[R4],R0             ; setup R0 and R1 with the size of and
              51   01   A044  9E  01AA          MOVAB   1(R0)[R4],R1            ; offset to the last character in the
                                  01AF                                          ; current record's key respectively
                                  01AF
                      52   6E D0  01AF          MOVL    (SP),R2                 ; setup R2 and R3 with the offset to
                  53   20 A7   9A 01B2          MOVZBL  IDX$B_KEYSZ(R7),R3      ; the first character to be compared
                      53   52  C2 01B6          SUBL2   R2,R3                   ; and the number of bytes to compare in
                                  01B9                                          ; the new record's key respectively
                                  01B9
                                  01B9
 53    6641   02 A644    50   2D  01B9          CMPC5   R0,2(R6)[R4],(R6)[R1],- ; compare the key of the new record
                    02 A842       01C1                  R3,2(R8)[R2]            ; with the key of the current record
                                  01C4
              6E   53    58   C3  01C4          SUBL3   R8,R3,(SP)              ; compute a new best guess for the front
                   6E    02   C2  01C8          SUBL2   #2,(SP)                 ; compression of the new record's key
                                  01CB                                          ; correcting for compression overhead
```

```
                 01CB
                 01CB     ;
                 01CB     ; Increment the current record pointer to the next record in the bucket. If the
                 01CB     ; address of the new current record is the same as the address of the point
                 01CB     ; of insertion of the new record, then go return the number of bytes the key of
                 01CB     ; the new record will have to be front compressed. Otherwise, go determine
                 01CB     ; whether the front compression of the key of the current record is the same
                 01CB     ; as RMS's current guess of the front compression of the key of the new record,
                 01CB     ; and the two keys will have to be compared, or whether the latter is
                 01CB     ; greater-than the former and they will not have to be compared.
                 01CB     ;
                 01CB
   FE32'   30    01CB     40$:    BSBW    RM$GETNEXT_REC          ; position to next record in the bucket
                 01CE
5B    56   D1    01CE             CMPL    R6,R11                  ; if RMS has positioned to the point of
      CC   1F    01D1             BLSSU   30$                     ; insertion then return, else continue
                 01D3
                 01D3     ;
                 01D3     ; Return the number of bytes the the key of the new record will have to be front
                 01D3     ; compressed if the new record is to go at the indicated place of insertion.
                 01D3     ;
                 01D3
     50 8ED0     01D3     50$:    POPL    R0                      ; load front compression count into R0
0094 C9 8ED0     01D6             POPL    IRB$L_REC_COUNT(R9)     ; restore the record count
081E 8F   BA     01DB             POPR    #^M<RT,R2,R3,R4,R11>    ; restore the working registers and
          05     01DF             RSB                             ; return
                 01E0             .END
```

```
$$.PSECT_EP                     = 00000000
$$RMSTEST                       = 0000001A
$$RMS_PBUGCHK                   = 00000010
$$RMS_TBUGCHK                   = 00000008
$$RMS_UMODE                     = 00000004
BKT$B_INDEXNO                   = 00000001
BKT$B_LEVEL                     = 0000000C
BKT$C_OVERHDSZ                  = 0000000E
BKT$W_FREESPACE                 = 00000004
IDX$B_KEYSZ                     = 00000020
IFB$W_KBUFSZ                    = 000000B4
IRB$B_KEYSZ                     = 000000A6
IRB$B_SPL_BITS                  = 00000044
IRB$L_KEYBUF                    = 00000060
IRB$L_LST_NCMP                  = 00000098
IRB$L_LST_REC                   = 0000004C
IRB$L_REC_COUNT                 = 00000094
IRB$M_DUPS_SEEN                 = 00000080
IRB$V_DUP_KEY                   = 00000008
IRB$V_LAST_GT                   = 0000000A
IRB$V_POSINSERT                 = 00000000
IRB$W_SRCHFLAGS                 = 00000042
IRC$V_DELETED                   = 00000002
IRC$V_RRV                       = 00000003
IRC$V_RU_DELETE                 = 00000005
RM$FRNT_CMPR                      00000168 RG    01
RM$GETNEXT_REC                    ********    X  01
RM$REC_OVHD                       ********    X  01
RM$SRCH_CMPR                      00000000 RG    01

                                         +----------------+
                                         ! Psect synopsis !
                                         +----------------+

PSECT name                      Allocation           PSECT No.  Attributes
----------                      ----------           ---------  ----------
.  ABS  .                       00000000  (     0.)  00 (  0.)  NOPIC   USR   CON   ABS   LCL NOSHR NOEXE NORD   NOWRT NOVEC BYTE
RM$RMS3                         000001E0  (   480.)  01 (  1.)    PIC   USR   CON   REL   GBL NOSHR   EXE   RD   NOWRT NOVEC QUAD
$ABS$                           00000000  (     0.)  02 (  2.)  NOPIC   USR   CON   ABS   LCL NOSHR   EXE   RD     WRT NOVEC BYTE

                                       +------------------------+
                                       ! Performance indicators !
                                       +------------------------+

Phase                        Page faults    CPU Time       Elapsed Time
-----                        -----------    --------       ------------
Initialization                        31    00:00:00.07    00:00:01.14
Command processing                   111    00:00:00.78    00:00:04.80
Pass 1                               240    00:00:05.98    00:00:19.78
Symbol table sort                      0    00:00:00.75    00:00:01.49
Pass 2                               164    00:00:02.06    00:00:06.21
Symbol table output                    5    00:00:00.05    00:00:00.13
Psect synopsis output                  1    00:00:00.02    00:00:00.34
Cross-reference output                 0    00:00:00.00    00:00:00.00
Assembler run totals                 554    00:00:09.71    00:00:33.89

The working set limit was 1350 pages.
```

```
34246 bytes (67 pages) of virtual memory were used to buffer the intermediate code.
There were 30 pages of symbol table space allocated to hold 509 non-local and 34 local symbols.
795 source lines were read in Pass 1, producing 14 object records in Pass 2.
16 pages of virtual memory were used to define 15 macros.

                                             +--------------------------+
                                             ! Macro library statistics !
                                             +--------------------------+

Macro library name                           Macros defined
------------------                           --------------
_$255$DUA28:[RMS.OBJ]RMS.MLB;1                      8
_$255$DUA28:[SYS.OBJ]LIB.MLB;1                      0
_$255$DUA28:[SYSLIB]STARLET.MLB;2                   3
TOTALS (all libraries)                             11

597 GETS were required to define 11 macros.

There were no errors, warnings or information messages.

MACRO/LIS=LIS$:RM3CMPRSS/OBJ=OBJ$:RM3CMPRSS MSRC$:RM3CMPRSS/UPDATE=(ENH$:RM3CMPRSS)+EXECML$/LIB+LIB$:RMS/LIB
```

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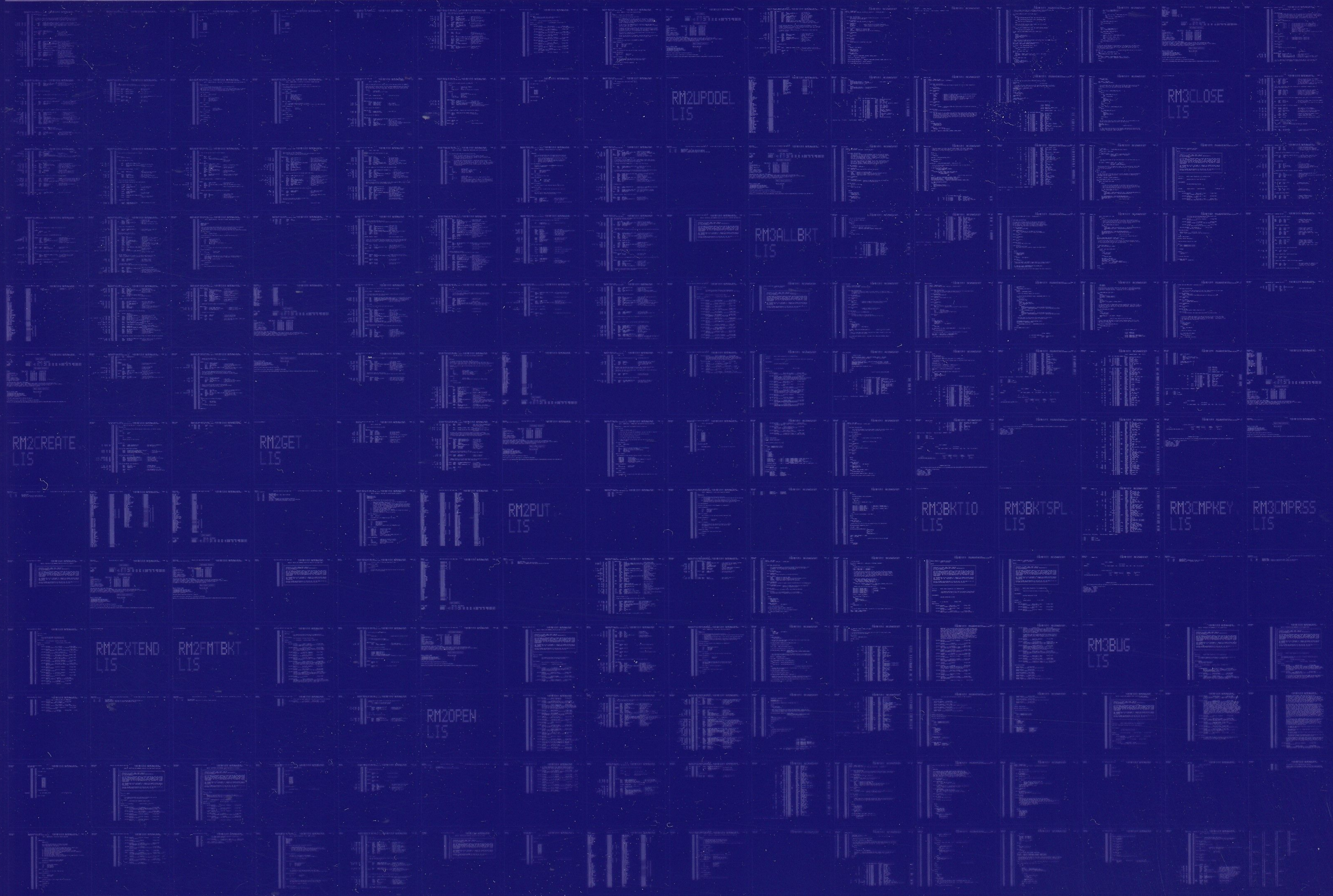

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