```
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
```

```
**FILE**ID**RM3JOURNL                                    G 9




RRRRRRRR    MM      MM    333333            JJ    000000    UU      UU  RRRRRRRR    NN      NN  LL
RRRRRRRR    MM      MM    333333            JJ    000000    UU      UU  RRRRRRRR    NN      NN  LL
RR      RR  MMMM  MMMM  33      33          JJ  00      00  UU      UU  RR      RR  NN      NN  LL
RR      RR  MMMM  MMMM  33      33          JJ  00      00  UU      UU  RR      RR  NN      NN  LL
RR      RR  MM  MM  MM          33          JJ  00      00  UU      UU  RR      RR  NNNN    NN  LL
RR      RR  MM  MM  MM          33          JJ  00      00  UU      UU  RR      RR  NNNN    NN  LL
RRRRRRRR    MM      MM        33            JJ  00      00  UU      UU  RRRRRRRR    NN  NN  NN  LL
RRRRRRRR    MM      MM        33            JJ  00      00  UU      UU  RRRRRRRR    NN  NN  NN  LL
RR  RR      MM      MM          33  JJ      JJ  00      00  UU      UU  RR  RR      NN    NNNN  LL
RR  RR      MM      MM          33  JJ      JJ  00      00  UU      UU  RR  RR      NN    NNNN  LL
RR    RR    MM      MM  33      33  JJ      JJ  00      00  UU      UU  RR    RR    NN      NN  LL              ....
RR    RR    MM      MM  33      33  JJ      JJ  00      00  UU      UU  RR    RR    NN      NN  LL              ....
RR      RR  MM      MM    333333      JJJJJJ      000000    UUUUUUUUUU  RR      RR  NN      NN  LLLLLLLLLL      ....
RR      RR  MM      MM    333333      JJJJJJ      000000    UUUUUUUUUU  RR      RR  'NN     NN  LLLLLLLLLL      ....

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
```

```
0 MODULE RM3JOURNL (LANGUAGE (BLISS32) ,
0                   IDENT = 'V04-000'
0                  ) =
1 BEGIN
1 !
1 !****************************************************************************
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1 !*                                                                          *
1 !****************************************************************************
1
1 !++
1 !
1 ! FACILITY:     RMS32 INDEX SEQUENTIAL FILE ORGANIZATION
1 !
1 ! ABSTRACT:     This module contains routine specific for Recovery Unit
1 !               Journaling and RU rollback recovery of RMS32 ISAM files.
1 !
1 !
1 ! ENVIRONMENT:
1 !
1 !               VAX/VMS OPERATING SYSTEM
1 !
1 !--
1
1 !
1 ! AUTHOR:       Todd M. Katz            CREATION DATE:          08-Jan-82
1 !
1 ! MODIFIED BY:
1 !
1 !       V03-011 JAS0002         David Solomon           25-Mar-1984
1 !               Fix broken branches.
1 !
1 !       V03-010 DAS0001         David Solomon           01-Jul-1983
1 !               Fill in correct value for RJR$B_ENTRY_TYPE.
1 !
1 !       V03-009 TSK0001         Tamar Krichevsky         7-Jun-1983
1 !               Move module to RM$RMS_JOURNAL psect.  Replace JNLDEF.R32
1 !               with RMSINTDEF.L32.  Change addressing mode of RM$RU_RECLAIM
1 !               to long relative.
```

```
:    58          0058  1 !
:    59          0059  1 !        V03-008 KPL0001         Peter Lieberwirth       26-May-1983
:    60          0060  1 !                New format of RJR.
:    61          0061  1 !
:    62          0062  1 !        V03-007 TMK0003         Todd M. Katz            03-Apr-1983
:    63          0063  1 !                Whenever refering to the actual bucket contents being journalled
:    64          0064  1 !                in RM$AI_AND_BI_3, refer to the bucket in the journalling buffer
:    65          0065  1 !                and not to the bucket controlled by the arguement BDB. Note that
:    66          0066  1 !                in the case of AI Journalling, these two buckets will be the
:    67          0067  1 !                same, but this will not be so in the case of BI Journalling.
:    68          0068  1 !
:    69          0069  1 !        V03-006 TMK0003         Todd M. Katz            27-Mar-1983
:    70          0070  1 !
:    71          0071  1 !                1. Change the linkage of RM$RU_JOURNAL3 to RL$RABREG_67.
:    72          0072  1 !                2. Change the linkage of RM$WRTJNL to RL$RABREG_4.
:    73          0073  1 !                3. Change the routine RM$RU_JOURNAL3 to reflect the linkage
:    74          0074  1 !                   changes.
:    75          0075  1 !                4. Add the routine RM$AI_AND_BI_3 to direct the construction
:    76          0076  1 !                   and journalling of entries to AI and BI Journals for ISAM
:    77          0077  1 !                   files.
:    78          0078  1 !                5. Modify RM$RU_RECOVER so that the RFA field within the RAB
:    79          0079  1 !                   is not zeroed when the operation being recovered is a $FIND.
:    80          0080  1 !
:    81          0081  1 !        V03-005 MCN0002         Maria del C. Nasr       24-Mar-1983
:    82          0082  1 !                More linkages reorganization.
:    83          0083  1 !
:    84          0084  1 !        V03-004 TMK0002         Todd M. Katz            17-Mar-1983
:    85          0085  1 !                Change RJR$_DELET to RJR$_DELETE and RJR$_UPDAT to RJR$_UPDATE.
:    86          0086  1 !                Also, fix up the External Register Linkages in RM$RU_JOURNL3.
:    87          0087  1 !
:    88          0088  1 !        V03-003 TMK0002         Todd M. Katz            16-Mar-1983
:    89          0089  1 !
:    90          0090  1 !                1. Change all RMSR$_ symbols to be RJR$_ symbols.
:    91          0091  1 !                2. Change RJR$B_OP RJR$B_ORG to RJR$B_OPER and RJR$B_ENTRY_TYPE
:    92          0092  1 !                   respectively.
:    93          0093  1 !                3. Change the linkage to RM$RU_JOURNAL3 so that the BDB is an
:    94          0094  1 !                   external register.
:    95          0095  1 !                4. The interface to RM$WRTJNL has changed. Reflect this change
:    96          0096  1 !                   within RM$RU_JOURNAL3.
:    97          0097  1 !
:    98          0098  1 !        V03-002 TMK0001         Todd M. Katz            11-Mar-1983
:    99          0099  1 !                If the primary data bucket has not been exclusively locked,
:   100          0100  1 !                then RM$RU_RECLAIM returns 0 indicating that the record/RRV
:   101          0101  1 !                could not be reclaimed.
:   102          0102  1 !
:   103          0103  1 !        V03-001 MCN0001         Maria del C. Nasr       24-Feb-1983
:   104          0104  1 !                Reorganize linkages
:   105          0105  1 !
:   106          0106  1 !*****
:   107          0107  1
:   108          0108  1 LIBRARY 'RMSLIB:RMSINTDEF';
:   109          0109  1
:   110          0110  1 LIBRARY 'SYS$LIBRARY:LIB';
:   111          0111  1
:   112          0112  1 REQUIRE 'RMSSRC:RMSIDXDEF';
:   113          0177  1
:   114          0178  1 ! Define default PSECTs for code.
```

RM
VO

```
;  115        0179  1 !
;  116        0180  1 PSECT
;  117        0181  1     CODE = RM$RMS_JOURNAL(PSECT_ATTR),
;  118        0182  1     PLIT = RM$RMS_JOURNAL(PSECT_ATTR);
;  119        0183  1
;  120        0184  1 ! Linkages.
;  121        0185  1 !
;  122        0186  1 LINKAGE
;  123        0187  1     L_JSB,
;  124        0188  1     L_PRESERVE1,
;  125        0189  1     L_QUERY_AND_LOCK,
;  126        0190  1     L_RABREG,
;  127        0191  1     L_RABREG_4,
;  128        0192  1     L_RABREG_4567,
;  129        0193  1     L_RABREG_457,
;  130        0194  1     L_RABREG_567,
;  131        0195  1     L_RABREG_67,
;  132        0196  1     L_RABREG_7,
;  133        0197  1     L_REC_OVHD;
;  134        0198  1
;  135        0199  1
;  136        0200  1 ! External Routines.
;  137        0201  1 !
;  138        0202  1 EXTERNAL ROUTINE
;  139        0203  1     RM$DELETE3B         : RL$RABREG ADDRESSING_MODE (LONG_RELATIVE),
;  140        0204  1     RM$DELETE_UDR       : RL$RABREG_4567 ADDRESSING_MODE (LONG_RELATIVE),
;  141        0205  1     RM$KEY_DESC         : RL$RABREG_7 ADDRESSING_MODE (LONG_RELATIVE),
;  142        0206  1     RM$LOCK             : RL$QUERY_AND_LOCK ADDRESSING_MODE (LONG_RELATIVE),
;  143        0207  1     RM$MOVE             : RL$PRESERVE1 ADDRESSING_MODE (LONG_RELATIVE),
;  144        0208  1     RM$NOREAD_LONG      : RL$JSB ADDRESSING_MODE (LONG_RELATIVE),
;  145        0209  1     RM$QUERY_PROC       : RL$QUERY_AND_LOCK ADDRESSING_MODE (LONG_RELATIVE),
;  146        0210  1     RM$RECORD_ID        : RL$RABREG_67 ADDRESSING_MODE (LONG_RELATIVE),
;  147        0211  1     RM$RECORD_KEY       : RL$PRESERVE1 ADDRESSING_MODE (LONG_RELATIVE),
;  148        0212  1     RM$RECORD_VBN       : RL$PRESERVE1 ADDRESSING_MODE (LONG_RELATIVE),
;  149        0213  1     RM$REC_OVHD         : RL$REC_OVHD ADDRESSING_MODE (LONG_RELATIVE),
;  150        0214  1     RM$UPDATE3B         : RL$RABREG_67 ADDRESSING_MODE (LONG_RELATIVE),
;  151        0215  1     RM$WRTJNL           : RL$RABREG_4 ADDRESSING_MODE (LONG_RELATIVE);
;  152        0216  1
;  153        0217  1 ! Forward Routines.
;  154        0218  1 !
;  155        0219  1 FORWARD ROUTINE
;  156        0220  1     RM$RU_REFORMAT      : RL$RABREG_567 NOVALUE;
```

```
1 %SBTTL 'RM$AI_AND_BI_3'
1 GLOBAL ROUTINE RM$AI_AND_BI_3 (JOURNAL) : RL$RABREG_4 =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       The purpose of this routine is to construct all AI and BI Journal
1 !       entries for ISAM files, and to oversee their writing.
1 !
1 ! CALLING SEQUENCE:
1 !
1 !       RM$AI_AND_BI_3()
1 !
1 ! INPUT PARAMETERS:
1 !
1 !       JOURNAL                 - type of journalling being done (AI or BI)
1 !
1 ! IMPLICIT INPUT:
1 !
1 !       BDB                     - address of BDB for bucket to be Journalled
1 !           BDB$L_ADDR          - address of buffer
1 !           BDB$L_AI_BDB        - address of AI Journalling BDB
1 !           BDB$L_BI_BDB        - address of BI Journalling BDB
1 !           BDB$W_NUMB          - number of bytes of buffer in use
1 !           BDB$L_VBN           - VBN of bucket
1 !
1 ! OUTPUT PARAMETER:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUT:
1 !       NONE
1 !
1 ! ROUTINE VALUE:
1 !
1 !       Whatever value is returned from the call to RM$WRTJNL.
1 !
1 ! SIDE EFFECTS:
1 !       NONE
1 !
1 !--
1
2    BEGIN
2
2    EXTERNAL REGISTER
2       COMMON_RAB_STR,
2       R_BDB_STR;
2
2    GLOBAL REGISTER
2       RJR_ADDR = 5    : REF BBLOCK;
2
2    LOCAL
2       JNL_BDB         : REF BBLOCK,
2       RJR_BUCKET      : REF BBLOCK;
2
2    ! Retrieve the address of the appropriate journalling BDB, and then the
2    ! appropriate journalling buffer from the journalling BDB.
```

```
;  215      0278  2        !
;  216      0279  2        IF .JOURNAL EQLU CJF$_AI
;  217      0280  2        THEN
;  218      0281  2            JNL_BDB = .BDB[BDB$L_AI_BDB]
;  219      0282  2        ELSE
;  220      0283  2            JNL_BDB = .BDB[BDB$L_BI_BDB];
;  221      0284  2
;  222      0285  2        RJR_ADDR    = .JNL_BDB[BDB$L_ADDR];
;  223      0286  2        RJR_BUCKET  = .RJR_ADDR + RJR$C_BKTLEN;
;  224      0287  2
;  225      0288  2        ! Construct the AI/BI Journal Entry for the current Journalled operation.
;  226      0289  2        ! If the bucket is a single block in size, or is an index bucket, then the
;  227      0290  2        ! entire bucket is journalled; otherwise, just the contents of the bucket
;  228      0291  2        ! up to the freespace pointer is journalled.
;  229      0292  2        !
;  230      0293  2        RJR_ADDR[RJR$B_ORG]          = RJR$C_IDX;
;  231      0294  2        RJR_ADDR[RJR$B_ENTRY_TYPE]   = RJR$C_BUCKET;
;  232      0295  2        RJR_ADDR[RJR$B_OPER]         = RJR$_BUCKET;
;  233      0296  2        RJR_ADDR[RJR$L_BKT_VBN]      = .BDB[BDB$L_VBN];
;  234      0297  2        RJR_ADDR[RJR$W_BKT_SIZE]     = .BDB[BDB$W_NUMB];
;  235      0298  2
;  236      0299  2        IF  .BDB[BDB$W_NUMB] EQLU 512
;  237      0300  2             OR
;  238      0301  2            .RJR_BUCKET[BKT$B_LEVEL] GTRU 0
;  239      0302  2        THEN
;  240      0303  2            RJR_ADDR[RJR$W_JBKT_SIZE] = .BDB[BDB$W_NUMB]
;  241      0304  2        ELSE
;  242      0305  2            RJR_ADDR[RJR$W_JBKT_SIZE] = .RJR_BUCKET[BKT$W_FREESPACE];
;  243      0306  2
;  244      0307  2        JNL_BDB[BDB$W_NUMB] = RJR$C_BKTLEN + .RJR_ADDR[RJR$W_JBKT_SIZE];
;  245      0308  2
;  246      0309  2        ! Write out the AI/BI Journal Entry, and return the success or status of
;  247      0310  2        ! the journal operation.
;  248      0311  2        !
;  249      0312  2        RETURN RM$WRTJNL (.JOURNAL, .JNL_BDB);
;  250      0313  2
;  251      0314  1        END;


                                                        .TITLE  RM3JOURNL
                                                        .IDENT  \V04-000\

                                                        .EXTRN  RM$DELETE3B, RM$DELETE_UDR
                                                        .EXTRN  RM$KEY_DESC, RM$LOCK
                                                        .EXTRN  RM$MOVE, RM$NOREAD_LONG
                                                        .EXTRN  RM$QUERY_PROC, RM$RECORD_ID
                                                        .EXTRN  RM$RECORD_KEY, RM$RECORD_VBN
                                                        .EXTRN  RM$REC_OVHD, RM$UPDATE3B
                                                        .EXTRN  RM$WRTJNL

                                                        .PSECT  RM$RMS_JOURNAL,NOWRT,  GBL,  PIC,2

                                       55  DD 00000 RM$AI_AND_BI_3::
                                                        PUSHL   R5                                          ; 0222
                    03        08       AE  D1 00002     CMPL    JOURNAL, #3                                 ; 0279
                                       06  12 00006     BNEQ    1$                                          ;
                    50        34       A4  D0 00008     MOVL    52(BDB), JNL_BDB                            ; 0281
```

```
                                     04  11 0000C        BRB     2$                                             ;
                   50          30    A4  D0 0000E 1$:    MOVL    48(BDB), JNL_BDB                               ; 0283
                   55          18    A0  D0 00012 2$:    MOVL    24(JNL_BDB), RJR_ADDR                          ; 0285
                   51          44    A5  9E 00016        MOVAB   68(R5), RJR_BUCKET                             ; 0286
              03   A5        0204    8F  B0 0001A        MOVW    #516, 3(RJR_ADDR)                              ; 0294
              05   A5                01  90 00020        MOVB    #1, 5(RJR_ADDR)                                ; 0295
              3C   A5          1C    A4  D0 00024        MOVL    28(BDB), 60(RJR_ADDR)                          ; 0296
              40   A5          14    A4  B0 00029        MOVW    20(BDB), 64(RJR_ADDR)                          ; 0297
            0200   8F          14    A4  B1 0002E        CMPW    20(BDB), #512                                  ; 0299
                                     05  13 00034        BEQL    3$                                             ;
                               0C    A1  95 00036        TSTB    12(RJR_BUCKET)                                 ; 0301
                                     07  13 00039        BEQL    4$                                             ;
              42   A5          14    A4  B0 0003B 3$:    MOVW    20(BDB), 66(RJR_ADDR)                          ; 0303
                                     05  11 00040        BRB     5$                                             ;
              42   A5          04    A1  B0 00042 4$:    MOVW    4(RJR_BUCKET), 66(RJR_ADDR)                    ; 0305
   14    A0   42   A5        0044    8F  A1 00047 5$:    ADDW3   #68, 66(RJR_ADDR), 20(JNL_BDB)                 ; 0307
                                     50  DD 0004F        PUSHL   JNL_BDB                                        ; 0312
                               0C    AE  DD 00051        PUSHL   JOURNAL                                        ;
                        00000000G    EF  16 00054        JSB     RMSWRTJNL                                      ;
                   5E                08  C0 0005A        ADDL2   #8, SP                                         ;
                                     20  BA 0005D        POPR    #^M<R5>                                        ; 0314
                                     05  05 0005F        RSB                                                    ;

; Routine Size:  96 bytes,    Routine Base:  RMSRMS_JOURNAL + 0000
```

```
%SBTTL 'RM$RU_JOURNAL3'
GLOBAL ROUTINE RM$RU_JOURNAL3 (OPERATION, VBN, ID, SIZE) : RL$RABREG_67 =

!++
!
! FUNCTIONAL DESCRIPTION:
!
!       The purpose of this routine is to construct all RU Journal entries
!       for ISAM files, and to oversee their writing.
!
! CALLING SEQUENCE:
!
!       RM$RU_JOURNAL3()
!
! INPUT PARAMETERS:
!
!       OPERATION                   - operation being RU Journalled
!       VBN                         - VBN of RU Journalled record's RFA
!       ID                          - ID of RU Journalled record's RFA
!       SIZE                        - size of record image to be journalled
!
! IMPLICIT INPUT:
!
!       IRAB                        - address of IRAB
!           IRB$L_CURBDB            - address of BDB for primary data bucket
!           IRB$L_JNLBDB            - address of BDB for journal entry buffer
!
!       REC_ADDR                    - address of record image to be journalled
!
! OUTPUT PARAMETER:
!       NONE
!
! IMPLICIT OUTPUT:
!       NONE
!
! ROUTINE VALUE:
!
!       whatever value is returned from the call to RM$WRTJNL.
!
! SIDE EFFECTS:
!       NONE
!
!--

    BEGIN

    EXTERNAL REGISTER
        COMMON_RAB_STR,
        R_REC_ADDR;

    GLOBAL REGISTER
        RJR_ADDR = 5    : REF BBLOCK;

    LOCAL
        JNL_BDB         : REF BBLOCK;

    ! Retrieve the address of the RU Journal Entry buffer.
```

```
;  310      0372  2      !
;  311      0373  2      JNL_BDB = .IRAB[IRB$L_JNLBDB];
;  312      0374  2      RJR_ADDR = .JNL_BDB[BDB$L_ADDR];
;  313      0375  2
;  314      0376  2      ! Construct the RU Journal Entry for the current RU Journalled operation.
;  315      0377  2      !
;  316      0378  2      RJR_ADDR[RJR$B_ENTRY_TYPE]  = RJR$C_RECORD;
;  317      0379  2      RJR_ADDR[RJR$B_ORG]         = RJR$C_IDX;
;  318      0380  2      RJR_ADDR[RJR$B_OPER]        = .OPERATION;
;  319      0381  2      RJR_ADDR[RJR$L_RFA0]        = .VBN;
;  320      0382  2      RJR_ADDR[RJR$W_RFA4]        = .ID;
;  321      0383  2      RJR_ADDR[RJR$W_RSIZE]       = .SIZE;
;  322      0384  2
;  323      0385  3      BEGIN
;  324      0386  3
;  325      0387  3      GLOBAL REGISTER
;  326      0388  3          R_BDB,
;  327      0389  3          R_IDX_DFN;
;  328      0390  3
;  329      0391  3      JNL_BDB[BDB$W_NUMB] = RM$MOVE (.SIZE, .REC_ADDR, RJR_ADDR[RJR$T_RIMAGE])
;  330      0392  3                                  - .RJR_ADDR;
;  331      0393  2      END;
;  332      0394  2
;  333      0395  2      ! Write out the RU Journal Entry, and return the success or status of the
;  334      0396  2      ! journal operation.
;  335      0397  2      !
;  336      0398  3      BEGIN
;  337      0399  3
;  338      0400  3      GLOBAL REGISTER
;  339      0401  3          R_BDB;
;  340      0402  3
;  341      0403  3      BDB = .IRAB[IRB$L_CURBDB];
;  342      0404  3
;  343      0405  3      RETURN RM$WRTJNL (CJF$_RU, .JNL_BDB);
;  344      0406  2      END;
;  345      0407  2
;  346      0408  1      END;



                                    00B0   8F  BB 00000 RM$RU_JOURNAL3::
                                                               PUSHR    #^M<R4,R5,R7>                      ; 0316
                            51        30   A9  D0 00004        MOVL     48(IRAB), JNL_BDB                  ; 0373
                            55        18   A1  D0 00008        MOVL     24(JNL_BDB), RJR_ADDR              ; 0374
                     03     A5      0202   8F  B0 0000C        MOVW     #514, 3(RJR_ADDR)                  ; 0378
                     05     A5        10   AE  90 00012        MOVB     OPERATION, 5(RJR_ADDR)             ; 0380
                     40     A5        14   AE  D0 00017        MOVL     VBN, 64(RJR_ADDR)                  ; 0381
                     44     A5        18   AE  B0 0001C        MOVW     ID, 68(RJR_ADDR)                   ; 0382
                     46     A5        1C   AE  B0 00021        MOVW     SIZE, 70(RJR_ADDR)                 ; 0383
                                      48   A5  9F 00026        PUSHAB   72(RJR_ADDR)                       ; 0391
                                           56  DD 00029        PUSHL    REC_ADDR                           ;
                                      24   AE  DD 0002B        PUSHL    SIZE                               ;
                               00000000G   EF  16 0002E        JSB      RM$MOVE                            ;
                            5E             08  C0 00034        ADDL2    #8, SP                             ;
          14    A1          50             55  A3 00037        SUBW3    RJR_ADDR, R0, 20(JNL_BDB)          ; 0392
```

```
                                   54       20  A9  D0 0003C          MOVL     32(IRAB), BDB                      ; 0403
                                   6E           51  D0 00040          MOVL     JNL_BDB, (SP)                      ; 0405
                                                01  DD 00043          PUSHL    #1                                 ;
                                     00000000G  EF  16 00045          JSB      RM$WRTJNL                          ;
                                   5E           08  C0 0004B          ADDL2    #8, SP                             ;
                                          0080  8F  BA 0004E          POPR     #^M<R4,R5,R7>                      ; 0408
                                                    05 00052          RSB                                         ;

; Routine Size:  83 bytes,    Routine Base:  RM$RMS_JOURNAL + 0060
```

```
1 %SBTTL 'RM$RU_RECLAIM'
1 GLOBAL ROUTINE RM$RU_RECLAIM : RL$RABREG_67 =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       The purpose of this routine is to try and reclaim space from the current
1 !       record which has been previously modified within a Recovery Unit. Such
1 !       reclamation can only take place if the Recovery Unit in which the
1 !       current record was modified has successfully terminated, the file
1 !       has been opened for write access, and the primary data bucket containing
1 !       the record has been exclusively locked.
1 !
1 !       If the current record was updated within a Recovery Unit that has since
1 !       terminated, then at this time the record maybe re-formatted. This
1 !       involves placing the record into the normal format from the special
1 !       format it is put in to reserve space during a Recovery Unit, and
1 !       reclamating any unused space.
1 !
1 !       If the current record was deleted within a Recovery Unit that has since
1 !       terminated, then at this time the record is deleted for good according
1 !       to the normal rules of primary data record or RRV deletion.
1 !
1 !       Note that if the record had both been deleted and updated within a
1 !       Recovery Unit, then the deletion takes precedence over the updating.
1 !
1 !       This routine returns success whenever it has modified the current
1 !       primary data record regardless of whether or not any space was actually
1 !       reclaimed through doing do.
1 !
1 ! CALLING SEQUENCE:
1 !
1 !       RM$RU_RECLAIM()
1 !
1 ! INPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT INPUT:
1 !
1 !       IFAB                    - address of IFAB
1 !           IFB$V_RUP           - if set, Recovery Unit is in progress
1 !           IFB$V_WRTACC        - if set, file is opened for write access
1 !
1 !       IRAB                    - address of IRAB
1 !           IRB$L_CURBDB        - address of BDB for primary data bucket
1 !
1 !       REC_ADDR                - address of current primary data record
1 !
1 ! OUTPUT PARAMETER:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUT:
1 !       NONE
1 !
1 ! ROUTINE VALUE:
1 !
```

```
:  405     0466  1 !        0       - reclamation of the record was not possible.
:  406     0467  1 !        1       - reclamation of the record was possible.
:  407     0468  1 !        RLK     - reclamation of the record was not possible because it could
:  408     0469  1 !                  not be locked
:  409     0470  1 !
:  410     0471  1 ! SIDE EFFECTS:
:  411     0472  1 !
:  412     0473  1 !        If the current record had been updated within a Recovery Unit,
:  413     0474  1 !            then it might have been re-formatted.
:  414     0475  1 !        If the current record had been deleted within a Recovery Unit,
:  415     0476  1 !            then it might have been deleted for good and its space partially
:  416     0477  1 !            or totally reclaimed.
:  417     0478  1 !        If any reclamation took place, the BDB for the primary data bucket is
:  418     0479  1 !            marked dirty.
:  419     0480  1 !
:  420     0481  1 !--
:  421     0482  1
:  422     0483  2     BEGIN
:  423     0484  2
:  424     0485  2     BUILTIN
:  425     0486  2         AP;
:  426     0487  2
:  427     0488  2     EXTERNAL REGISTER
:  428     0489  2         COMMON_RAB_STR,
:  429     0490  2         R_IDX_DFN_STR,
:  430     0491  2         R_REC_ADDR_STR;
:  431     0492  2
:  432     0493  2     GLOBAL REGISTER
:  433     0494  2         R_BDB;
:  434     0495  2
:  435     0496  2     LABEL
:  436     0497  2         RECLAIM;
:  437     0498  2
:  438     0499  2     LOCAL
:  439     0500  2         STATUS;
:  440     0501  2
:  441     0502  2     ! Determine the lock status of the record which has been modified
:  442     0503  2     ! with a Recovery Unit but do not wait for the lock to be released if
:  443     0504  2     ! another stream has the record locked.
:  444     0505  2     !
:  445     0506  2     AP  = 3;
:  446     0507  2     IRAB[IRB$V_NO_Q_WAIT] = 1;
:  447     0508  2     STATUS = RM$QUERY_PROC (RM$RECORD_VBN(), RM$RECORD_ID());
:  448     0509  2
:  449     0510  2     ! If and only if the Recovery Unit in which the current primary data record
:  450     0511  2     ! was modified has completed and the file was opened for write access can
:  451     0512  2     ! this record be subject to special processing. If the query lock indicates
:  452     0513  2     ! that the current record is not locked by any stream, or if the current
:  453     0514  2     ! stream already has the record locked but it is not in a Recovery Unit,
:  454     0515  2     ! then RMS may conclude that the Recovery Unit in which the current record
:  455     0516  2     ! was modified has concluded, and subject the record to special processing.
:  456     0517  2     !
:  457     0518  2     IF  .IFAB[IFB$V_WRTACC]
:  458     0519  2         AND
:  459     0520  4         (.STATUS<0,16> EQLU RMSSUC()
:  460     0521  3              OR
:  461     0522  4             (NOT .IFAB[IFB$V_RUP]
:   462         0523  4                         AND
:   463         0524  3                        .STATUS<0,16> EQLU RMSSUC(OK_ALK)))
:   464         0525  2     THEN
:   465         0526  2 RECLAIM:
:   466         0527  3         BEGIN
:   467         0528  3
:   468         0529  3         GLOBAL REGISTER
:   469         0530  3             COMMON_IO_STR;
:   470         0531  3
:   471         0532  3         ! If the primary data bucket containing the record has not been
:   472         0533  3         ! exclusively locked, then no space reclamation can take place.
:   473         ^534  3         !
:   474         0535  3         BDB = .IRAB[IRB$L_CURBDB];
:   475         0536  3
:   476         0537  3         IF NOT .BBLOCK[.BDB[BDB$L_BLB_PTR], BLB$V_LOCK]
:   477         0538  3         THEN
:   478         0539  4             BEGIN
:   479         0540  4             STATUS = 0;
:   480         0541  4             LEAVE RECLAIM;
:   481         0542  3             END;
:   482         0543  3
:   483         0544  3         ! Retrieve the a.dress of the primary data bucket.
:   484         0545  3         !
:   485         0546  3         BKT_ADDR = .BDB[BDB$L_ADDR];
:   486         0547  3
:   487         0548  3         ! A 1 will be returned as the value of this routine indicating that
:   488         0549  3         ! reclamation was possible. This will be regardless of whether any
:   489         0550  3         ! space will actually be reclaimed. Also, mark the primary data bucket's
:   490         0551  3         ! BDB as dirty.
:   491         0552  3         !
:   492         0553  3         STATUS = 1;
:   493         0554  3         BDB[BDB$V_DRT] = 1;
:   494         0555  3
:   495         0556  3         ! If the current record had been deleted within a Recovery Unit then
:   496         0557  3         ! it maybe truely deleted at this time, and the space it occupies
:   497         0558  3         ! reclaimed according to the normal rules for the deletion of primary
:   498         0559  3         ! data or RRV records.
:   499         0560  3         !
:   500         0561  3         IF .REC_ADDR[IRC$V_RU_DELETE]
:   501         0562  3         THEN
:   502         0563  4             BEGIN
:   503         0564  4
:   504         0565  4             ! Clear the RU_DELETE and the RU_UPDATE bit within the current
:   505         0566  4             ! record's control byte.
:   506         0567  4             !
:   507         0568  4             REC_ADDR[IRC$V_RU_DELETE] = 0;
:   508         0569  4             REC_ADDR[IRC$V_RU_UPDATE] = 0;
:   509         0570  4
:   510         0571  4             ! Delete the current record (RRV or primary data record).
:   511         0572  4             !
:   512         0573  4             IF NOT .REC_ADDR[IRC$V_RRV]
:   513         0574  4             THEN
:   514         0575  4                 RMSDELETE_UDR()
:   515         0576  4             ELSE
:   516         0577  5                 BEGIN
:   517         0578  5
:   518         0579  5                 LOCAL
```

```
;   519         0580  5                     LENGTH;
;   520         0581  5
;   521         0582  6                 LENGTH = (.BKT_ADDR + .BKT_ADDR[BKT$W_FREESPACE])
;   522         0583  5                                     - (.REC_ADDR + IRC$C_FIXOVHSZ3);
;   523         0584  5
;   524         0585  5                 IF .LENGTH GTR 0
;   525         0586  5                 THEN
;   526         0587  5                     RM$MOVE (.LENGTH, .REC_ADDR + IRC$C_FIXOVHSZ3, .REC_ADDR);
;   527         0588  5
;   528         0589  5                 BKT_ADDR[BKT$W_FREESPACE] = .BKT_ADDR[BKT$W_FREESPACE]
;   529         0590  5                                             - IRC$C_FIXOVHSZ3;
;   530         0591  4                 END;
;   531         0592  4             END
;   532         0593  4
;   533         0594  4         ! If the current record had been updated within a Recovery Unit
;   534         0595  4         ! then it maybe reformated at this time.
;   535         0596  4         !
;   536         0597  3         ELSE
;   537         0598  3             RM$RU_REFORMAT();
;   538         0599  3         END
;   539         0600  3
;   540         0601  3     ! If RMS is unable to lock the current primary data record, or if the
;   541         0602  3     ! stream itself has it locked and the current process is within a Recovery
;   542         0603  3     ! Unit then RMS concludes that the Recovery Unit in which the record was
;   543         0604  3     ! modified has not successfully concluded. In these cases, and also when
;   544         0605  3     ! the file was not opned for write access the routine will return a status
;   545         0606  3     ! indicating that no reclamation was possible. RLK will be returned if RMS
;   546         0607  3     ! could not lock the record; otherwise, a status of 0 is returned.
;   547         0608  3     !
;   548         0609  2     ELSE
;   549         0610  3         IF .STATUS<0,16> NEQU RMSERR(RLK)
;   550         0611  2         THEN
;   551         0612  2             STATUS = 0;
;   552         0613  2
;   553         0614  2     ! Return whether or not any reclamation of the current primary data record
;   554         0615  2     ! was possible.
;   555         0616  2     !
;   556         0617  2     RETURN .STATUS;
;   557         0618  1     END;



                                  3C  BB 00000 RM$RU_RECLAIM::
                                                         PUSHR   #^M<R2,R3,R4,R5>                    ; 0410
                  5C              03  D0 00002           MOVL    #3, AP                              ; 0506
            07    A9              01  88 00005           BISB2   #1, 7(IRAB)                         ; 0507
                     00000000G    EF  16 00009           JSB     RM$RECORD_ID                        ; 0508
                  52              50  D0 0000F           MOVL    R0, R2                              ;
                     00000000G    EF  16 00012           JSB     RM$RECORD_VBN                       ;
                  51              50  D0 00018           MOVL    R0, R1                              ;
                     00000000G    EF  16 0001B           JSB     RM$QUERY_PROC                       ;
                  52              50  D0 00021           MOVL    R0, STATUS                          ;
                  67        06    AA  E9 00024           BLBC    6(IFAB), 5$                         ; 0518
                  01              52  B1 00028           CMPW    STATUS, #1                          ; 0520
                                  0D  13 0002B           BEQL    1$                                  ;
```

```
5C    00A2  CA                 02 E0 0002D      BBS      #2, 162(IFAB), 5$               ; 0522
      8039  8F                 52 B1 00033      CMPW     STATUS, #32825                  ; 0524
                               55 12 00038      BNEQ     5$                              ;
            54              20 A9 D0 0003A 1$:  MOVL     32(IRAB), BDB                   ; 0535
            50              10 A4 D0 0003E      MOVL     16(BDB), R0                     ; 0537
            50              0A A0 E9 00042      BLBC     10(R0), 6$                      ;
            55              18 A4 D0 00046      MOVL     24(BDB), BKT_ADDR               ; 0546
            52                 01 D0 0004A      MOVL     #1, STATUS                      ; 0553
        0A  A4                 02 88 0004D      BISB2    #2, 10(BDB)                     ; 0554
35          66                 05 E1 00051      BBC      #5, (REC_ADDR), 4$              ; 0561
            66              60 8F 8A 00055      BICB2    #96, (REC_ADDR)                 ; 0569
08          66                 03 E0 00059      BBS      #3, (REC_ADDR), 2$              ; 0573
                     00000000G EF 16 0005D      JSB      RM$DELETE_UDR                   ; 0575
                               33 11 00063      BRB      7$                              ;
            50              04 A5 3C 00065 2$:  MOVZWL   4(BKT_ADDR), R0                 ; 0582
            50                 55 C0 00069      ADDL2    BKT_ADDR, R0                    ;
            50                 56 C2 0006C      SUBL2    REC_ADDR, R0                    ; 0583
            50                 09 C2 0006F      SUBL2    #9, LENGTH                      ;
                               10 15 00072      BLEQ     3$                              ; 0585
                               56 DD 00074      PUSHL    REC_ADDR                        ; 0587
                            09 A6 9F 00076      PUSHAB   9(R6)                           ;
                               50 DD 00079      PUSHL    LENGTH                          ;
                     00000000G EF 16 0007B      JSB      RM$MOVE                         ;
            5E                 0C C0 00081      ADDL2    #12, SP                         ;
        04  A5                 09 A2 00084 3$:  SUBW2    #9, 4(BKT_ADDR)                 ; 0590
                               0E 11 00088      BRB      7$                              ; 0561
                            0000V 30 0008A 4$:  BSBW     RM$RU_REFORMAT                  ; 0598
                               09 11 0008D      BRB      7$                              ; 0518
      82AA  8F                 52 B1 0008F 5$:  CMPW     STATUS, #33450                  ; 0610
                               02 13 00094      BEQL     7$                              ;
                               52 D4 00096 6$:  CLRL     STATUS                          ; 0612
            50                 52 D0 00098 7$:  MOVL     STATUS, R0                      ; 0617
                               3C BA 0009B      POPR     #^M<R2,R3,R4,R5>                ; 0618
                                  05 0009D      RSB                                      ;

; Routine Size:  158 bytes,    Routine Base:  RM$RMS_JOURNAL + 00B3
```

```
1 %SBTTL 'RM$RU_RECOVER'
1 GLOBAL ROUTINE RM$RU_RECOVER (OPERATION) : RL$RABREG =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       The purpose of this routine is to oversee the RU ROLLBACK Recovery
1 !       operations. Whenever one of these operations are initiated on an ISAM
1 !       file, it is intercepted by the appropriate routine in the module
1 !       RM3FACE, and control is transfered here. This routine then performs a
1 !       number of checks, sets up the internal environment common to all RU
1 !       ROLLBACK operations, and then dispatches to the code which actually
1 !       directs each of the individual RU ROLLBACK Recovery operations.
1 !
1 ! CALLING SEQUENCE:
1 !
1 !       RM$RU_RECOVER()
1 !
1 ! INPUT PARAMETERS:
1 !
1 !       OPERATION               - the operation to be RU ROLLBACK Recovered
1 !
1 ! IMPLICIT INPUT:
1 !
1 !       IDX_DFN                 - address of the primary key index descriptor
1 !           IDX$B_DATBKTSZ      - size of a primary data bucket in blocks
1 !           IDX$B_DATBKTYP      - primary data bucket type
1 !           IDX$V_DUPKEYS       - if set, duplicate primary keys are allowed
1 !           IDX$V_KEY_COMPR     - if set, primary key compression is enabled
1 !           IDX$B_KEYSZ         - size of primary key
1 !           IDX$W_MINRECSZ      - minimum size of record to contain primary key
1 !           IDX$V_REC_COMPR     - if set, record compression is enabled
1 !
1 !       IFAB                    - address of IFAB
1 !           IFB$W_KBUFSZ        - size of an internal keybuffer
1 !           IFB$L_LRL           - longest record length
1 !           IFB$W_MRS           - maximum record size
1 !           IFB$B_RFMORG        - record format
1 !
1 !       IRAB                    - address of IRAB
1 !           IRB$L_KEYBUF        - address of the contigious keybuffers
1 !           IRB$B_MODE          - access mode of the user operaion
1 !
1 !       RAB                     - address of the RAB
1 !           RAB$L_RBF           - address of the user record buffer
1 !           RAB$L_RFA0          - RFA VBN of the record to be RU Recovered
1 !           RAB$W_RFA4          - RFA ID of the record to be RU Recovered
1 !           RAB$W_RSZ           - size of the user record
1 !
1 ! OUTPUT PARAMETER:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUT:
1 !
1 !       IRAB                    - address of the IRAB
1 !           IRB$B_CUR_KREF      - 0
```

```
1 !             IRB$L_RBF           - address of the user record buffer
1 !             IRB$B_RP_KREF       - 0
1 !             IRB$W_RSZ           - size of the user record
1 !             IRB$W_POS_ID        - RFA ID of the record to be RU Recovered
1 !             IRB$L_POS_VBN       - RFA VBN of the record to be RU Recovered
1 !             IRB$W_UDR_ID        - RFA ID of the record to be RU Recovered
1 !             IRB$L_UDR_VBN       - RFA VBN of the record to be RU Recovered
1 !
1 !         RAB                     - address of user RAB
1 !             RAB$L_RFA0          - 0 (Unless the operation is a $FIND Recovery)
1 !             RAB$W_RFA4          - 0 (Unless the operation is a $FIND Recovery)
1 !
1 ! ROUTINE VALUE:
1 !
1 !         CUR - there is no current record to be RU ROLLBACK Recovered.
1 !         RBF - unable to read user's record buffer.
1 !         RSZ - user record size is bad
1 !         SUC - successful RU ROLLBACK Recovery operatio.
1 !
1 !         Various Routine values from the following routines:
1 !
1 !         RM$DELETE3B
1 !         RM$LOCK
1 !         RM$UPDATE3B
1 !
1 ! SIDE EFFECTS:
1 !
1 !         On success, the RU operation will have been successfully recovered.
1 !         On failures, the RU operation might have been successfully recovered
1 !              depending on where the failure occurred and what the failure was.
1 !
1 !         AP is trashed.
1 !         The primary key of the record will be placed into keybuffers 1 and 2.
1 !         Several parts of the NRP context will be initialized with information
1 !             about the record that is to be recovered.
1 !         The RAB's RFA field will be zeroed (Unless the operation is a
1 !             $FIND Recovery).
1 !
1 !
1 !--
1
2       BEGIN
2
2       BUILTIN
2           AP;
2
2       EXTEPNAL REGISTER
2           COMMON_RAB_STR;
2
2       LABEL
2           IN.TIALIZE;
2
2       ! Perform the initilizations and checks common to all RU ROLLBACK Recovery
2       ! operations.
2       !
2 INITIALIZE:
3       BEGIN
```

```
3
3    GLOBAL REGISTER
3        R_IDX_DFN_STR;
3
3    ! Make sure there is a record to be recovered.
3    !
3    IF  .RAB[RAB$L_RFA0] EQLU 0
3         OR
3        .RAB[RAB$W_RFA4] EQLU 0
3    THEN
3        RETURN RMSERR(CUR);
3
3    ! If this is a $FIND RU ROLLBACK Recovery operation than all the required
3    ! initializations and checks have been performed.
3    !
3    IF .OPERATION EQLU RJR$_FIND
3    THEN
3        LEAVE INITIALIZE;
3
3    ! Save the size of the record and the address of the record buffer.
3    !
3    IRAB[IRB$L_RBF] = .RAB[RAB$L_RBF];
3    IRAB[IRB$W_RSZ] = .RAB[RAB$W_RSZ];
3
3    ! Make sure the size of the record isn't greater than the maximum record
3    ! size allowed.
3    !
3    IF .IFAB[IFB$B_RFMORG] EQL FAB$C_FIX
3    THEN
4        BEGIN
4
4        IF .IRAB[IRB$W_RSZ] NEQU .IFAB[IFB$W_LRL]
4        THEN
4            RETURN RMSERR(RSZ);
4        END
3    ELSE
3        IF .IFAB[IFB$W_MRS] NEQ 0
3            AND
3           .IRAB[IRB$W_RSZ] GTRU .IFAB[IFB$W_MRS]
3        THEN
3            RETURN RMSERR(RSZ);
3
3    ! Make sure the record will fit in a primary data bucket. This is done
3    ! by taking the size of the bucket less bucket overhead, subtracting the
3    ! maximum overhead which maybe associated with a record in this file
3    ! including possible key and record compression overhead, and comparing this
3    ! value with the size of the record.
3    !
4    BEGIN
4
4    LOCAL
4        BUCKET_SIZE     : WORD;
4
4    ! Retrieve the index descriptor for the primary key of reference.
4    !
4    RETURN_ON_ERROR (RM$KEY_DESC(0));
4
```

```
4    BUCKET_SIZE = (.IDX_DFN[IDX$B_DATBKTSZ] * 512) - BKT$C_OVERHDSZ
4                                                   - BKT$C_DATBKTOVH
4                                                   - IRC$C_FIXOVHSZ3;
4
4    IF .IDX_DFN[IDX$V_DUPKEYS]
4    THEN
4        BUCKET_SIZE = .BUCKET_SIZE - BKT$C_DUPBKTOVH;
4
4    IF  .IFAB[IFB$B_RFMORG] NEQU FAB$C_FIX
4         OR
5        (.IFAB[IFB$B_RFMORG] EQLU FAB$C_FIX
5                 AND
5                .IDX_DFN[IDX$B_DATBKTYP] NEQU IDX$C_NCMPNCMP)
4    THEN
4        BUCKET_SIZE = .BUCKET_SIZE - IRC$C_DATSZFLD;
4
4    IF .IDX_DFN[IDX$V_KEY_COMPR]
4    THEN
4        BUCKET_SIZE = .BUCKET_SIZE - IRC$C_KEYCMPOVH;
4
4    IF .IDX_DFN[IDX$V_REC_COMPR]
4    THEN
4        BUCKET_SIZE = .BUCKET_SIZE - IRC$C_DATCMPOVH;
4
4    IF .IRAB[IRB$W_RSZ] GTRU .BUCKET_SIZE
4    THEN
4        RETURN RMSERR(RSZ);
3    END;
3
3    ! Verify that the record is large enough to contain the whole primary key.
3    !
3    IF .IRAB[IRB$W_RSZ] LSSU .IDX_DFN[IDX$W_MINRECSZ]
3    THEN
3        RETURN RMSERR(RSZ);
3
3    ! Probe the record buffer.
3    !
3    IF RM$NOREAD_LONG (.IRAB[IRB$W_RSZ], .IRAB[IRB$L_RBF], .IRAB[IRB$B_MODE])
3    THEN
3        RETURN RMSERR(RBF);
3
3    ! Extract the primary key of the record into keybuffers 1 and 2.
3    !
4    BEGIN
4
4    GLOBAL REGISTER
4        R_BDB,
4        R_REC_ADDR;
4
4    AP = 3;
4    REC_ADDR = .IRAB[IRB$L_RBF];
4    RM$RECORD_KEY (KEYBUF_ADDR(1));
4
4    RM$MOVE (.IDX_DFN[IDX$B_KEYSZ], KEYBUF_ADDR(1), KEYBUF_ADDR(2));
3    END;
3
3    ! Initialize the fields in the NRP such that the record being recovered
```

```
	! becomes the current primary data record.
	!
	IRAB[IRB$B_CUR_KREF] = 0;
	IRAB[IRB$B_RP_KREF]  = 0;

	IRAB[IRB$L_UDR_VBN]  = .RAB[RAB$L_RFA0];
	IRAB[IRB$W_UDR_ID]   = .RAB[RAB$W_RFA4];
	IRAB[IRB$L_POS_VBN]  = .IRAB[IRB$C_UDR_VBN];
	IRAB[IRB$W_POS_ID]   = .IRAB[IRB$W_UDR_ID];
	END;

	! Dispatch to the RU ROLLBACK Recovery Code Which is Specific for each
	! type of operation to be recovered.
	!
	BEGIN

	LOCAL
	    STATUS;

	SELECTONEU .OPERATION OF
	    SET

	    ! The RU ROLLBACK operation requested is a $FIND. This just consists of
	    ! locking the record with the indicated RFA.
	    !
	    [RJR$_FIND]:    STATUS = RM$LOCK (.RAB[RAB$L_RFA0], .RAB[RAB$W_RFA4]);

	    ! The RU ROLLBACK operation requested is a $DELETE. This Recovery
	    ! operation consists of un-deleting each part of the current record that
	    ! had been deleted within the Recovery Unit being rolled back.
	    !
	    [RJR$_DELETE]:  BEGIN
	                    IRAB[IRB$V_RU_UNDEL] = 1;
	                    STATUS = RM$DELETE3B();
	                    IRAB[IRB$V_RU_UNDEL] = 0;
	                    END;

	    ! The RU ROLLBACK operation requested is a $PUT. This Recovery operation
	    ! consists of deleting each and every part of the current record that
	    ! was inserted as a new record within the Recovery Unit being rolled
	    ! back.
	    !
	    [RJR$_PUT]:     STATUS = RM$DELETE3B();

	    ! The RU ROLLBACK operation requested is a $UPDATE. This Recovery
	    ! operation consists of replacing a newer version of a record with an
	    ! older version of the same record which had been replaced within the
	    ! Recovery Unit being rolled back.
	    !
	    [RJR$_UPDATE]:  BEGIN

	                    GLOBAL REGISTER
	                        R_IDX_DFN,
	                        R_REC_ADDR;

	                    IRAB[IRB$V_UPDATE] = 1;
	                    STATUS = RM$UPDATE3B();
```

```
;  844          0904  4                   IRAB[IRB$V_UPDATE] = 1;
;  845          0905  3                   END;
;  846          0906  3          TES;
;  847          0907  3
;  848          0908  3      ! Zero in the user's RAB the RFA of the record which has been RU ROLLBACK
;  849          0909  3      ! Recovered unless the operation being recovered is a $FIND.
;  850          0910  3      !
;  851          0911  3      IF .OPERATION NEQU RJR$_FIND
;  852          0912  3      THEN
;  853          0913  4          BEGIN
;  854          0914  4          RAB[RAB$W_RFA4] = 0;
;  855          0915  4          RAB[RAB$L_RFA0] = 0;
;  856          0916  3          END;
;  857          0917  3
;  858          0918  3      ! Return the status of the RU ROLLBACK Recovery operation.
;  859          0919  3      !
;  860          0920  3      RETURN .STATUS;
;  861          0921  2      END;
;  862          0922  1      END;




                              00FC    8F   BB 00000 RM$RU_RECOVER::
                                                             PUSHR    #^M<R2,R3,R4,R5,R6,R7>                        ; 0620
                                10    A8   D5 00004          TSTL     16(RAB)                                       ; 0739
                                      05   13 00007          BEQL     1$                                            ;
                                14    A8   B5 00009          TSTW     20(RAB)                                       ; 0741
                                      08   12 0000C          BNEQ     3$                                            ;
                        50    8484    8F   3C 0000E 1$:      MOVZWL   #33972, R0                                    ; 0743
                                   0143    31 00013 2$:      BRW      21$                                           ;
                        55      1C    AE   D0 00016 3$:      MOVL     OPERATION, R5                                 ; 0748
                        0B            55   D1 0001A          CMPL     R5, #11                                       ;
                                      03   12 0001D          BNEQ     4$                                            ;
                                   00E0    31 0001F          BRW      16$                                           ;
                   58   A9      28    A8   D0 00022 4$:      MOVL     40(RAB), 88(IRAB)                             ; 0754
                   56   A9      22    A8   B0 00027          MOVW     34(RAB), 86(IRAB)                             ; 0755
                        01      50    AA   91 0002C          CMPB     80(IFAB), #1                                  ; 0760
                                      09   12 00030          BNEQ     5$                                            ;
                   52   AA      56    A9   B1 00032          CMPW     86(IRAB), 82(IFAB)                            ; 0764
                                      0E   13 00037          BEQL     6$                                            ;
                                      59   11 00039          BRB      12$                                           ; 0766
                                60    AA   B5 0003B 5$:      TSTW     96(IFAB)                                      ; 0769
                                      07   13 0003E          BEQL     6$                                            ;
                   60   AA      56    A9   B1 00040          CMPW     86(IRAB), 96(IFAB)                            ; 0771
                                      4D   1A 00045          BGTRU    12$                                           ;
                                      7E   D4 00047 6$:      CLRL     -(SP)                                         ; 0788
                           00000000G  EF   16 00049          JSB      RM$KEY_DESC                                   ;
                        5E            04   C0 0004F          ADDL2    #4, SP                                        ;
                        BE            50   E9 00052          BLBC     STATUS, 2$                                    ;
                        51      17    A7   9A 00055          MOVZBL   23(IDX_DFN), R1                               ; 0790
              51        51            09   78 00059          ASHL     #9, R1, R1                                    ;
              50        51            19   A3 0005D          SUBW3    #25, R1, BUCKET_SIZE                          ; 0792
                        03      1C    A7   E9 00061          BLBC     28(IDX_DFN), 7$                               ; 0794
                        50            04   A2 00065          SUBW2    #4, BUCKET_SIZE                               ; 0796
                        01      50    AA   91 00068 7$:      CMPB     80(IFAB), #1                                  ; 0798
```

```
                             06  12 0006C        BNEQ    8$                                    ;
             06         29   A7  91 0006E        CMPB    41(IDX_DFN), #6                       ; 0802
                             03  13 00072        BEQL    9$                                    ;
             50              02  A2 00074 8$:    SUBW2   #2, BUCKET_SIZE                       ; 0804
  03     1C  A7                  06  E1 00077 9$:    BBC     #6, 28(IDX_DFN), 10$                  ; 0806
             50              02  A2 0007C        SUBW2   #2, BUCKET_SIZE                       ; 0808
                        1C   A7  95 0007F 10$:   TSTB    28(IDX_DFN)                           ; 0810
                             03  18 00082        BGEQ    11$                                   ;
             50              03  A2 00084        SUBW2   #3, BUCKET_SIZE                       ; 0812
             50         56   A9  B1 00087 11$:   CMPW    86(IRAB), BUCKET_SIZE                 ; 0814
                             07  1A 0008B        BGTRU   12$                                   ;
         22  A7         56   A9  B1 0008D        CMPW    86(IRAB), 34(IDX_DFN)                 ; 0821
                             07  1E 00092        BGEQU   13$                                   ;
             50       86A4   8F  3C 00094 12$:   MOVZWL  #34468, R0                            ; 0823
                             1C  11 00099        BRB     14$                                   ;
             7E         0A   A9  9A 0009B 13$:   MOVZBL  10(IRAB), -(SP)                       ; 0827
                        58   A9  DD 0009F        PUSHL   88(IRAB)                              ;
             7E         56   A9  3C 000A2        MOVZWL  86(IRAB), -(SP)                       ;
                 00000000G   EF  16 000A6        JSB     RM$NOREAD_LONG                        ;
             5E              0C  C0 000AC        ADDL2   #12, SP                               ;
             08              50  E9 000AF        BLBC    R0, 15$                               ;
             50       8654   8F  3C 000B2        MOVZWL  #34388, R0                            ; 0829
                           009F  31 000B7 14$:   BRW     21$                                   ;
             5C              03  D0 000BA 15$:   MOVL    #3, AP                                ; 0839
             56         58   A9  D0 000BD        MOVL    88(IRAB), REC_ADDR                    ; 0840
                        60   A9  DD 000C1        PUSHL   96(IRAB)                              ; 0841
                 00000000G   EF  16 000C4        JSB     RM$RECORD_KEY                         ;
             50       00B4   CA  3C 000CA        MOVZWL  180(IFAB), R0                         ; 0843
             6E         60 B940  9E 000CF        MOVAB   @96(IRAB)[R0], (SP)                   ;
                        60   A9  DD 000D4        PUSHL   96(IRAB)                              ;
             7E         20   A7  9A 000D7        MOVZBL  32(IDX_DFN), -(SP)                    ;
                 00000000G   EF  16 000DB        JSB     RM$MOVE                               ;
             5E              0C  C0 000E1        ADDL2   #12, SP                               ;
                      00C2   C9  B4 000E4        CLRW    194(IRAB)                             ; 0850
       00B0  C9         10   A8  D0 000E8        MOVL    16(RAB), 176(IRAB)                    ; 0852
       00BC  C9         14   A8  B0 000EE        MOVW    20(RAB), 188(IRAB)                    ; 0853
       00AC  C9       00B0   C9  D0 000F4        MOVL    176(IRAB), 172(IRAB)                  ; 0854
       00BA  C9       00BC   C9  B0 000FB        MOVW    188(IRAB), 186(IRAB)                  ; 0855
             0B              55  D1 00102 16$:   CMPL    R5, #11                               ; 0872
                             10  12 00105        BNEQ    17$                                   ;
             52         14   A8  3C 00107        MOVZWL  20(RAB), R2                           ;
             51         10   A8  D0 0010B        MOVL    16(RAB), R1                           ;
                 00000000G   EF  16 0010F        JSB     RM$LOCK                               ;
                             37  11 00115        BRB     20$                                   ;
             05              55  D1 00117 17$:   CMPL    R5, #5                                ; 0878
                             12  12 0011A        BNEQ    18$                                   ;
         07  A9         40   8F  88 0011C        BISB2   #64, 7(IRAB)                          ; 0879
                 00000000G   EF  16 00121        JSB     RM$DELETE3B                           ; 0880
         07  A9         40   8F  8A 00127        BICB2   #64, 7(IRAB)                          ; 0881
                             20  11 0012C        BRB     20$                                   ; 0866
             13              55  D1 0012E 18$:   CMPL    R5, #19                               ; 0889
                             08  12 00131        BNEQ    19$                                   ;
                 00000000G   EF  16 00133        JSB     RM$DELETE3B                           ;
                             13  11 00139        BRB     20$                                   ;
             1C              55  D1 0013B 19$:   CMPL    R5, #28                               ; 0896
                             0E  12 0013E        BNEQ    20$                                   ;
         06  A9              08  88 00140        BISB2   #8, 6(IRAB)                           ; 0902
```

```
                                    00000000G  EF   16 00144           JSB     RM$UPDATE3B                                  ; 0903
                              06    A9         08   88 0014A           BISB2   #8, 6(IRAB)                                  ; 0904
                                    0B         55   D1 0014E 20$:      CMPL    R5, #11                                      ; 0911
                                               06   13 00151           BEQL    21$                                          ;
                                          14   A8   B4 00153           CLRW    20(RAB)                                      ; 0914
                                          10   A8   D4 00156           CLRL    16(RAB)                                      ; 0915
                                        00FC   8F   BA 00159 21$:      POPR    #^M<R2,R3,R4,R5,R6,R7>                       ; 0922
                                                    05 0015D           RSB                                                  ;

; Routine Size:  350 bytes,    Routine Base:  RM$RMS_JOURNAL + 0151
```

```
; R

;
```

```
1 %SBTTL 'RMSRU_REFORMAT'
1 GLOBAL ROUTINE RMSRU_REFORMAT : RL$RABREG_567 NOVALUE =
1
1 !++
1 !
1 ! FUNCTIONAL DESCRIPTION:
1 !
1 !       This routine's responsibility is to reformat primary data records which
1 !       have decreased in size during an $UPDATE within a recovery unit and
1 !       consequently were placed in a special format to reserve the space that
1 !       would otherwise have been freed. Such records have the control bi
1 !       IRC$V_RU_UPDATE set.
1 !
1 !       These records are in a special format in that two record sizes are
1 !       associated with them. The number of bytes the primary data record
1 !       reserves in the bucket (not including the record overhead) is stored
1 !       in the record size field in the record overhead. The true size of the
1 !       record is stored in the last two bytes of the primary data record.
1 !
1 !       This routine reformats the primary data record by:
1 !
1 !       1. Clearing the IRC$V_RU_UPDATE control bit.
1 !       2. Moving the true record size into the record size field of the record
1 !          overhead.
1 !       3. Eliminating the space reserved by the record by shifting over the
1 !          primary data records that follow it in the primary data bucket, sc
1 !          that this reserved space is freed.
1 !       4. Adjusting the bucket's freespace offset pointer to reflect the bytes
1 !          which have been freed through the reformating of the record.
1 !
1 ! CALLING SEQUENCE:
1 !
1 !       RMSRU_REFORMAT()
1 !
1 ! INPUT PARAMETERS:
1 !       NONE
1 !
1 ! IMPLICIT INPUT:
1 !
1 !       BKT_ADDR                - address of the primary data bucket
1 !           BKT$W_FREESPACE     - bucket's freespace offset pointer
1 !
1 !       REC_ADDR                - address of the record to be reformated
1 !
1 ! OUTPUT PARAMETER:
1 !       NONE
1 !
1 ! IMPLICIT OUTPUT:
1 !
1 !       BKT_ADDR                - address of the primary data bucket
1 !           BKT$W_FREESPACE     - bucket's freespace offset pointer
1 !
1 ! ROUTINE VALUE:
1 !       NONE
1 !
1 ! SIDE EFFECTS:
1 !
```

```
!       The record is reformatted, and the bucket's freespace offset pointer
!       is updated to reflect the bytes which have been freed.
!
!--

    BEGIN

    EXTERNAL REGISTER
        R_BKT_ADDR_STR,
        COMMON_RAB_STR,
        R_IDX_DFN,
        R_REC_ADDR_STR;

    LOCAL
        FAKE_SIZE,
        LENGTH,
        SAVE_REC_ADDR,
        TRUE_SIZE;

    ! Clear the special record format bit in the record's control byte.
    !
    REC_ADDR[IRC$V_RU_UPDATE] = 0;

    ! Place the true size of the record in the record size field of the record
    ! overhead. This size maybe found in the last two bytes of the record proper
    ! as it currently exists in the primary data bucket.
    !
    BEGIN

    LOCAL
        REC_SIZE;

    SAVE_REC_ADDR       = .REC_ADDR;
    REC_ADDR            = .REC_ADDR + RM$REC_OVHD(0; REC_SIZE);
    FAKE_SIZE           = .REC_SIZE;
    END;

    TRUE_SIZE = .(.REC_ADDR + .FAKE_SIZE - IRC$C_DATSZFLD)<0,16>;

    (.REC_ADDR - IRC$C_DATSZFLD)<0,16> = .TRUE_SIZE;

    ! If there are any records following the current record, shift them down
    ! in the primary data bucket so that the space, formerly reserved by this
    ! special record, is now utilized, and the corresponding amount of space
    ! is made available.
    !
    LENGTH = .BKT_ADDR[BKT$W_FREESPACE] - (.REC_ADDR + .FAKE_SIZE - .BKT_ADDR);

    IF .LENGTH GTRU 0
    THEN
        BEGIN

        GLOBAL REGISTER
            R_BDB;

        RM$MOVE (.LENGTH, (.REC_ADDR + .FAKE_SIZE), (.REC_ADDR + .TRUE_SIZE));
        END;
```

```
;  978        1037  2
;  979        1038  2      ! Adjust the bucket's freespace offset pointer to reflect the amount of
;  980        1039  2      ! space which has become available through reformatting of the current
;  981        1040  2      ! record.
;  982        1041  2      !
;  983        1042  2      BKT_ADDR[BKT$W_FREESPACE] = .BKT_ADDR[BKT$W_FREESPACE]
;  984        1043  2                                 - (.FAKE_SIZE - .TRUE_SIZE);
;  985        1044  2      REC_ADDR = .SAVE_REC_ADDR;
;  986        1045  1      END;



                                      1C  BB 00000 RM$RU_REFORMAT::
                                                            PUSHR   #^M<R2,R3,R4>                  ; 0924
                        5E            04  C2 00002          SUBL2   #4, SP                         ;
                        66      40    8F  8A 00005          BICB2   #64, (REC_ADDR)                ; 1001
                        53            56  D0 00009          MOVL    REC_ADDR, SAVE_REC_ADDR        ; 1012
                                      51  D4 0000C          CLRL    R1                             ; 1013
                           00000000G  EF  16 0000E          JSB     RM$REC_OVHD                    ;
                        56            50  C0 00014          ADDL2   R0, REC_ADDR                   ;
                        52            51  D0 00017          MOVL    REC_SIZE, FAKE_SIZE            ; 1014
            54          56            52  C1 0001A          ADDL3   FAKE_SIZE, REC_ADDR, R4        ; 1017
                        51      FE    A4  3C 0001E          MOVZWL  -2(R4), TRUE_SIZE              ;
                   FE   A6            51  B0 00022          MOVW    TRUE_SIZE, -2(REC_ADDR)        ; 1019
            50          55            54  C3 00026          SUBL3   R4, BKT_ADDR, R0               ; 1026
                        6E      04    A5  3C 0002A          MOVZWL  4(BKT_ADDR), (SP)              ;
                        50            6E  C0 0002E          ADDL2   (SP), LENGTH                   ;
                                      0E  13 00031          BEQL    1$                             ; 1028
                                    6146  9F 00033          PUSHAB  (TRUE_SIZE)[REC_ADDR]          ; 1035
                                      11  BB 00036          PUSHR   #^M<R0,R4>                     ;
                           00000000G  EF  16 00038          JSB     RM$MOVE                        ;
                        5E            0C  C0 0003E          ADDL2   #12, SP                        ;
                        51            52  C2 00041 1$:      SUBL2   FAKE_SIZE, R1                  ; 1043
                   04   A5            51  A0 00044          ADDW2   R1, 4(BKT_ADDR)                ;
                        56            53  D0 00048          MOVL    SAVE_REC_ADDR, REC_ADDR        ; 1044
                        5E            04  C0 0004B          ADDL2   #4, SP                         ; 1045
                                      1C  BA 0004E          POPR    #^M<R2,R3,R4>                  ;
                                          05 00050          RSB                                    ;

; Routine Size:  81 bytes,    Routine Base:  RM$RMS_JOURNAL + 02AF


;  987        1046  1
;  988        1047  1 END
;  989        1048  0 ELUDOM




;                                PSECT SUMMARY
;
;       Name                        Bytes                          Attributes
;
```

```
;  RM$RMS_JOURNAL                        768  NOVEC,NOWRT,  RD ,  EXE,NOSHR,  GBL,  REL,  CON,  PIC,ALIGN(2)



;                               Library Statistics
;
;                                               -------- Symbols --------       Pages       Processing
;       File                                    Total    Loaded   Percent       Mapped      Time
;
;  _$255$DUA28:[RMS.OBJ]RMSINTDEF.L32;1          1484        74         4          83         00:00.2
;  _$255$DUA28:[SYSLIB]LIB.L32;1                18619        43         0        1000         00:04.6




;                                       COMMAND QUALIFIERS

;       BLISS/CHECK=(FIELD,INITIAL,OPTIMIZE)/LIS=LIS$:RM3JOURNL/OBJ=OBJ$:RM3JOURNL MSRC$:RM3JOURNL/UPDATE=(ENH$:RM3JOURNL)

; Size:          768 code + 0 data bytes
; Run Time:         00:25.3
; Elapsed Time:     00:48.7
; Lines/CPU Min:     2485
; Lexemes/CPU-Min:  14022
; Memory Used:  183 pages
; Compilation Complete
```

0325 AH-BT13A-SE
VAX/VMS V4.0

DIGITAL EQUIPMENT CORPORATION
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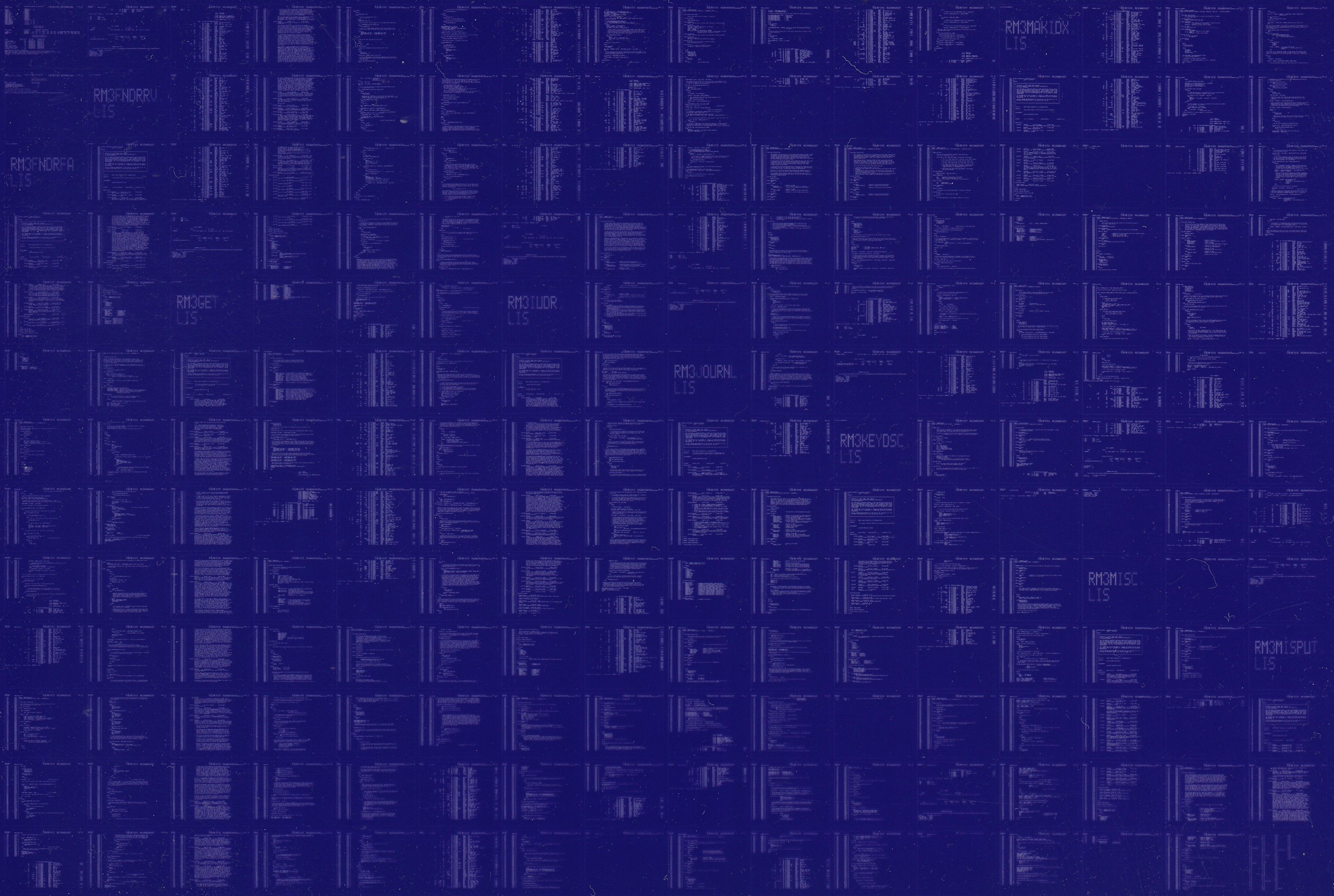

RM3MAKIDX
LIS

RM3FNDRRV
LIS

RM3FNDRFA
LIS

RM3GET
LIS

RM3IUDR
LIS

RM3JOURNL
LIS

RM3KEYDSC
LIS

RM3MISC
LIS

RM3MISPUT
LIS