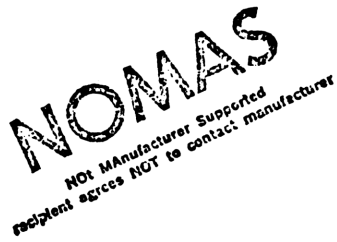
```
VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @0-1777
*
     4                    FILE   CN0B
     5                    ENTRY  ALPDEF
     6                    ENTRY  END2
     7                    ENTRY  END3
     8                    ENTRY  CLCTMG
     9                    ENTRY  QUTCAT
    10                    ENTRY  STMSGF
    11                    ENTRY  XAVIEW
    12                    ENTRY  XVIEW
    13                    ENTRY  ADRFCH
    14                    ENTRY  TONSTF
    15                    ENTRY  BCDBIN
    16                    ENTRY  BIGBRC
    17                    ENTRY  INTINT
    18                    ENTRY  COLDST
    19                    ENTRY  DROWSY
    20                    ENTRY  DRSY05
    21                    ENTRY  DRSY25
    22                    ENTRY  DRSY51
    23                    ENTRY  ERRNE
    24                    ENTRY  ERROF
    25                    ENTRY  GOTINT
    26                    ENTRY  GTAINC
    27                    ENTRY  GTAI40
    28                    ENTRY  INCGT2
    29                    ENTRY  MSGDLY
    30                    ENTRY  NFRC
    31                    ENTRY  NFRENT
    32                    ENTRY  NFRFST
    33                    ENTRY  NFRKB
    34                    ENTRY  NFRKB1
    35                    ENTRY  NFRNC
    36                    ENTRY  NFRNIO
    37                    ENTRY  NFRPR
    38                    ENTRY  NFRPU
    39                    ENTRY  NFRSIG
    40                    ENTRY  NFRX
    41                    ENTRY  NFRXY
    42                    ENTRY  ROW10
    43                    ENTRY  RUNNK
    44                    ENTRY  WKUP70
    45                    ENTRY  X<>ROW
    46                    ENTRY  XCUTB1
    47                    ENTRY  XCUTE
    48                    ENTRY  XCUTEB
    49                    ENTRY  XROW1
*
    51                    LEGAL
    52    0             1 GOLNC  LSWKUP
    52    1             2
    53    2             1 GOLONG.DSWKUP
    53    3             2
*****************************************************
```

```
*THE FOLLOWING ROUTINE TAKES A BINARY REGISTER
*NUMBER FROM STATUS AND RETURNS THAT REGISTER
*IN C, ITS ADDRESS IN N, AND X IN M. IT SENDS
*ILLEGAL ADDRESSES TO ERROR "NONEXISTENT."
*IT ALSO HANDLES INDIRECT ADDRESS. CYCLE TIMES
*AVERAGE ABOUT 30 FOR DIRECT AND 60 FOR INDIRECT
* USES: A,B,C,M,N,ACTIVE POINTER, S9,S8,S7, DADD, + 2 SUB LEVELS
* MAY EXIT TO ERRNE
* IN: ADDR IN S7:0 (MAY BE INDIRECT)
*     NO PERIPHERAL ENABLED
* OUT: C = C(EFFECTIVE ADDR)
*     N = EFFECTIVE ADDR
*     DADD = EFFECTIVE ADDR
*     M = X REGISTER CONTENTS
*     S7 = 0
*************************************************
    71     4 ADRFCH   116 C=0                        GETX
    72     5          1160 DADD=C
    73     6           370 C=REGN 3
    74     7           530 M=C                       X IS STORED IN M
    75    10          1630 C=ST                      GET ADDRESS FROM STATUS
    76    11           126 C=0     XS                CLEAR 9 FROM XS
    77    12          1204 S7=     0                 KILL INDIRECT FLAG
    78    13          1730 CST EX                    PUT ORIG STATUS BACK
    79    14           514 ?S6=1                     STACK RCL?
    80    15           133 GONC    OVRSTK (  30) NO
    81    16           214 ?S5=1
    82    17           113 GONC    OVRSTK (  30) NO
    83    20           114 ?S4=1
    84    21            73 GONC    OVRSTK (  30) NO
    85    22          1434 PT=     1                 SET TO CLEAR HIGH BITS
    86    23           102 C=0     PT                CLEAR HIGH BITS
    87    24          1160 DADD=C                    PUT OUT ADDRESS
    88    25           160 N=C                       SAVE ADDRESS IN N
    89    26            70 C=DATA                    GET REGISTER
    90    27           113 GOTO    FCHRTN (  40)  DONE
    91    30 OVRSTK    256 AC EX                     SAVE RELATIVE ADDRESS
    92    31          1570 C=REGN 13                 GET STATUS REG
    93    32            74 RCR     3                 MOVE REG0 TO POSITION
    94    33          1006 C=C+A   X                 COMPUTE ADR OF REG
    95    34           160 N=C                       SAV ADR FOR CALNG ROUT
    96    35             1 GOSUB   CHKADR            CHECK ADR, VAL RTNS IN B
    96    36             0
    97    37           316 C=B                       BRING RCL VALUE TO C
    98    40 FCHRTN   1214 ?S7=1                     INDIRECT
    99    41          1640 RTN NC                    DONE IF NOT INDIRECT
   100    42             1 GOSUB   BCDBIN            DO BCD BIN
   100    43             0
   101    44          1204 S7=     0                 CLEAR INDIRECT FLAG
   102    45          1633 GOTO    OVRSTK (  30) NEW ADR STRT OVER
   103                     FILLTO:@45
*************************************************
* THIS ROUTINE IS A SPECIAL "ROW" FOR X<>NN
*************************************************
   107    46 X<>ROW   1166 C=C-1   XS                RESTORE BYTE 1
   108    47          1166 C=C-1   XS
   109                     LEGAL
   110    50             1 GOSUB   INCGT2
   110    51             0
   111    52           256 AC EX
```

```
   112   53          1530 ST=C
   113   54          1374 RCR     13
   114   55           130 G=C
   115   56           363 GOTO    ADRGSB ( 114)
*
   117   57 XROW0       1 GOLONG  ROW0
   117   60             2
   118   61 XROW10      1 GOLONG  ROW10
   118   62             2
   119   63 XROW11      1 GOLONG  ROW11
   119   64             2
   120   65 XROW12      1 GOLONG  ROW12
   120   66             2
   121   67 XROW13      1 GOLONG  XGTO
   121   70             2
   122   71 XROW14      1 GOLONG  XXEQ
   122   72             2
************************************************************
*ONE BYTE STORE AND RECALL FUNCTIONS ENTER HERE TO
*BE TRANSMOGRAPHIED INTO TWO BYTE FUNCTIONS
************************************************************
   127       XROW2
   128       XROW3
   129   73          1142 C=C-1   PT             HIGH DIGIT -2
   130   74          1142 C=C-1   PT
   131   75          1706 C SR    X              CREATE BYTE TWO
   132   76          1712 C SR    WPT            CREATE BYTE 1
   133   77          1120 LC      9
   134  100            34 PT=     3
   135  101            43 GOTO    REGADR ( 105)
************************************************************
*TWO BYTE RCLS, STOS, DSP FORMAT ETC COMPRISE ROW 9
*ROW9 GETS BYTE TWO, FETCHES X (IN M), FETCHES
*REGISTER NN (IN B), AND LEAVE THE ADDRESS OF NN
*IN N FOR ALL DATA RELATED FUNTIONS (0-11). IT THEN
*DOES A SIXTEEN WAY BRANCH TO SORT OUT THE ROW.
************************************************************
   143  102 XROW9       1 GOSUB   INCGT2          GET BYTE TWO
   143  103             0
   144  104           256 AC EX                   BRING BACK TO C
   145  105 REGADR   1530 ST=C                    SAVE BYTE 2
   146  106          1374 RCR     13             MOVE TO G POSITION
   147  107           130 G=C                     SAVE IN G
   148  110           742 C=C+C   PT              SEP OUT 0-7
   149  111            33 GONC    ADRGSB ( 114) DO RCL ETC
   150  112           742 C=C+C   PT              SEP OUT DSP & TONE
   151  113           467 GOC     TONETC ( 161)
   152  114 ADRGSB      1 GOSUB   ADRFCH          GET X,RNN, AND ADR
   152  115             0
   153  116           356 BC EX                   SAVE VALUE IN RNN
   154  117 BIGBRC   1534 PT=     12             SET FOR G LOAD
   155  120           230 C=G                     GET BYTE ONE BACK
   156  121            34 PT=     3
   157  122             1 GOLONG  XOUTB1          DO 256 WAY BRANCH
   157  123             2
************************************************************
*THIS SECTION SORTS OUT INDIRECT TONE, FIX, ENG, AND
*SCI FROM DIRECT. IF INDIRECT GOES THROUGH ADDRESS
*FETCH OTHERWISE GOES IMMEDIATELY TO 256 WAY BRANCH.
************************************************************
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```
163  124 TONSTF 1214 ?S7=1                INDIRECT
164  125        1640 RTN NC               NO DO BRANCH
165  126        1204 S7=    0             CLEAR INDIRECT BIT
166  127           1 GOSUB  ADRFCH        GET REG
166  130           0
167  131           1 GOSUB  BCDBIN        CONVERT TO BINARY
167  132           0
168  133        1530 ST=C                 SAVE BINARY STATUS
169  134         414 ?S8=1                MORE THAN ONE DIGIT
170  135        1640 RTN NC               256 WAY BRANCH
171  136           1 GOLONG ERRDE         YES THEN DATA ERROR
171  137           2
172                  FILLTO @137
173  140 ROWTBL 1173 GOTO   XROW0  (  57) ROWTBL MUST BE AT @140
174  141         233 GOTO   XROW1  ( 164)  OTHER LOGIC MAKES USE OF
175  142        1313 GOTO   XROW2  (  73)  THE FACT THAT ROWTBL IS IN
176  143        1303 GOTO   XROW3  (  73)  THE FIRST 256 WORDS OF CHIP 0
177  144         423 GOTO   XROW4  ( 206)  AND ON AN EVEN BOUNDARY OF
178  145         343 GOTO   XROW5  ( 201)  16 WORDS.
179  146         333 GOTO   XROW6  ( 201)
180  147         513 GOTO   XCUTEB ( 220) ROW 7
181  150         503 GOTO   XCUTEB ( 220) ROW 8
182  151        1313 GOTO   XROW9  ( 102)
183  152        1073 GOTO   XROW10 (  61)
184  153        1103 GOTO   XROW11 (  63)
185  154        1113 GOTO   XROW12 (  65)
186  155        1123 GOTO   XROW13 (  67)
187  156        1133 GOTO   XROW14 (  71)
188  157           1 GOLONG TEXT          ROW 15
188  160           2
189  161 TONETC    1 GOSUB  TONSTF
189  162           0
190  163        1343 GOTO   BIGBRC ( 117)
*
192  164 XROW1   416 A=C                  SAVE FC IN A
193  165        1034 PT=    2
194  166        1520 LC     13           SPLIT OFF DIGIT ENTRY
195  167        1426 ? A<C  XS
196  170           1 GOLC   DERUN         DIGIT ENTRY
196  171           3
197                                       NOTE - WE GO TO DERUN WITH
198                                       THE FC IN A[3:2] AND THE
199                                       PTR AT 1.
200  172           1 GOSUB  GTAINC        GET ALPHA OPERAND
200  173           0
201  174         256 AC EX
202  175         416 A=C
203                                       MUST GO TO XCUTEB WITH
204                                       FC BACK IN C[3:2] AND PT=3
205  176         223 GOTO   XCUTEB ( 220)
206  177 ROW7   1704 CLR ST               FOR ISG DSE COMP MESG
207  200         203 GOTO   XCUTEB ( 220)
*
*
210      XROW5
211  201 XROW6   160 N=C
212  202         772 C=C+C  M
213  203         560 STK=C                PUTS ADDRESS OF NFRX ON STACK
214  204        1240 SETDEC
215  205          63 GOTO   MATH   ( 213)
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```
   216  206 XROW4    360 NC EX
   217  207          270 C=REGN 2
   218  210          416 A=C
   219  211            1 GOSUB  CHK#S
   219  212            0
   220  213 MATH     370 C=REGN 3
   221  214            1 GOSUB  CHK#S2
   221  215            0
   222  216         1704 CLR ST
   223  217          360 NC EX
* (FALL INTO XCUTEB HERE)
*
* XCUTEB - EXECUTE, PART B
* INPUT CONDITIONS: FC IN C[3:2], PT=3,  ASSUMES NONPROGRAMMABLE
*     XCUTB1 ASSUMES FC IN C[13:12]
*
   230  220 XCUTEB   174 RCR    4
   231  221 XCUTB1   460 LDI
   232  222           24 CON    @24           @12000\256 MAIN FCN TABLE
   233  223         1174 RCR    9
   234  224         1460 CXISA
   235  225          120 LC     1
   236  226          674 RCR    11
   237  227          740 GOTOC
*
*
*
* RSTKB - RESET AND DEBOUNCE KEYBOARD
* USES C,X
* WAITS 5 MILLISEC AFTER FIRST SEEING KEY RESET BEFORE
* ALLOWING A SECOND KEY TO BE SENSED.
*
* WAIT LOOP IS 4 WORDS LONG.
* 5 MILLISEC/ 4*155 MICROSEC = 8
*
* RST05 ENTRY POINT IS FOR DEBOUNCE ONLY
*
   251                   ENTRY  RSTKB
   252                   ENTRY  RST05
   253  230 RSTKB   1710 RST KB
   254  231         1714 CHK KB
   255  232         1767 GOC    RSTKB  ( 230)
   256  233 RST05    460 LDI
   257  234           10 CON    8
   258  235 RST10   1710 RST KB
   259  236         1714 CHK KB
   260  237         1146 C=C-1  X
   261  240         1753 GONC   RST10  ( 235)
   262  241         1740 RTN
   263                   FILLTO:@241
   264  242 ERROF      1 GOSUB  ERROR          OVERFLOW TREATED AS ERROR
   264  243            0
   265  244            0 XDEF   MSGOF
*
   267       NFRNC                            !! ASSUMES CHIP 0 ON
   268  245            1 GOSUB  OVFL10         FILL X AND Y FROM N AND C
   268  246            0
   269  247          360 NC EX                 GET Y, SAVE X.
   270  250          324 ? PT=  10
   271  251          117 GOC    XBAD   ( 262) GO IF X OVERFLOWED
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```
   272  252           1 GOSUB  OVFL10
   272  253           0
   273  254         324 ? PT=  10
   274  255          77 GOC    YBAD   ( 264) GO IF Y OVERFLOWED
   275  256 FILLY   250 REGN=C 2              FILL IN Y VALUE
   276  257         360 CN EX                 GET X OUT OF STORAGE
   277  260         356 BC EX                 PUT X IN B. GOTO FILL X AND LASTX
   278  261         713 GOTO   FILLXL ( 352)
   279  262 XBAD      1 GOSUB  OVFL10         STILL NEED TO CONVERT Y TO 9 IF NEC
   279  263           0
   280  264 YBAD    256 AC EX                 SAVE Y VALUE WHILE GET FLAGS
   281  265        1670 C=REGN 14
   282  266         574 RCR    6              GET ERROR AND OVERFLOW FLAGS FOR ST
   283  267        1530 ST=C
   284  270         256 AC EX                 PUT Y BACK INTO C
   285  271        1214 ?S7=1                 OVERFLOW FLAG SET?
   286  272        1647 GOC    FILLY  ( 256) IF SO FILL Y AND GO TO FILLXL
   287                  ENTRY  ERRIGN
   288  273 ERRIGN  514 ?S6=1                 ERROR FLAG SET?
   289  274        1463 GONC   ERROF  ( 242) IF NOT GOTO ERROR: OVERFLOW
   290  275         504 S6=    0              TURN OFF ERROR FLAG
   291  276        1630 C=ST
   292  277         474 RCR    8
   293  300        1650 REGN=C 14
   294  301         603 GOTO   NFRC   ( 361) NO PRINT, LEAVE PUSH ALONE
*
* NFRSIG IS USED BY SIGMA+, SIGMA-, CLX, AND CLST.
* NFRENT IS USED BY ENTER.
   298  302 NFRSIG 1665 CON    @1665          GOSUB PRT1
   299  303         674 CON    @674
   300  304 NFRENT  604 S11=   0              CLEAR PUSHFLAG
   301  305         543 GOTO   NFRC   ( 361)
*
   303  306 NFRKB1 1114 ?S9=1                 KEY ALREADY RESET?
   304  307 NFRKB     1 GSUBNC RSTKB
   304  310           0
   305  311         503 GOTO   NFRC   ( 361)
*
   307                  FILLTO @311
   308  312          23 GOTO   NFRX   ( 314) MUST BE @0312 FOR ROW 5
   309  313           0 NOP
   310       NFRX                             !! ASSUMES CHIP 0 ON
   311  314           1 GOSUB  OVFL10         MUST BE @0314 FOR ROW 6
   311  315           0
   312  316         356 BC EX                 SAVE X IN B
   313  317         324 ? PT=  10
   314  320         323 GONC   FILLXL ( 352)
   315  321        1670 C=REGN 14
   316  322         574 RCR    6
   317  323        1530 ST=C
   318  324        1214 ?S7=1                 OVERFLOW FLAG?
   319  325        1463 GONC   ERRIGN ( 273)
   320  326         243 GOTO   FILLXL ( 352)
*
* FILL THRU @331 - GETS SPACING RIGHT SO THAT NFRPU ENDS UP
* AT @360 AND THERE ARE NO INLINE NOPS
* PCTOC - PROGRAM COUNTER TO C
* THIS LITTLE SUBROUTINE SIMPLY COPIES THE ADDRESS OF THE ROM WORD
*- AFTER THE CALLING GOSUB INTO C AND RETURNS. IT IS INTENDED TO
*- FACILITATE THE WRITING OF ROUTINES IN PLUG IN ROMS FOR SUCH THINGS
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```
*- AS CALLING ANOTHER ROM CHIP OR FOR OTHER ROUTINES REQUIRING
*- KNOWLEDGE OF THE CURRENT ABSOLUTE ADDRESS OF THE ROM.
*
   331  327 PCTOC    660 C=STK
   332  330          560 STK=C
   333  331         1740 RTN
   334                   FILLTO:@331
   335       NFRXY                          !! ASSUMES CHIP 0 ON
   336  332            1 GOSUB  OVFL10
   336  333            0
   337  334          356 BC EX                SAVE X IN B
   338  335          324 ? PT=  10
   339  336           63 GONC   DROPST ( 344) IF NO OVERFLOW GO DROP STACK
   340  337         1670 C=REGN 14
   341  340          574 RCR    6
   342  341         1530 ST=C
   343  342         1214 ?S7=1               OVERFLOW FLAG?
   344  343         1303 GONC   ERRIGN ( 273) IF NOT SET GO CHECK ERROR FLAG
   345                   ENTRY  DROPST
   346  344 DROPST   170 C=REGN 1             GET Z
   347  345          250 REGN=C 2             PUT INTO Y
   348  346          116 C=0
   349  347         1160 DADD=C
   350  350           70 C=DATA               GET T
   351  351          150 REGN=C 1             PUT INTOZ
   352

   354                   ENTRY  FILLXL
   355  352 FILLXL   370 C=REGN 3             GET OLD X
   356  353          450 REGN=C 4             FILL LASTX
   357  354          356 BC EX                GET NEW X FROM B
   358  355          350 REGN=C 3             FILL X
   359  356 NFRPR   1665 CON    @1665         GOSUB PRT1
   360  357          674 CON    @674
   361                   FILLTO:@357          @360 IS PUT ON THE STK
   362                                        AT RUNNK - NFRPU MUST BE
   363                                        AT @360
   364  360 NFRPU    610 S11=   1             SET PUSH
   365  361 NFRC    1140 SETHEX
   366  362          240 SEL P
   367  363          116 C=0                  RE-ENABLE CHIP 0
   368  364         1160 DADD=C
   369  365         1670 C=REGN 14
   370  366         1530 ST=C
   371       NFRFST
   372  367          540 ?LLD                 TEST LOW BATTERY
   373  370          103 GONC   LOWBRT ( 400)
   374  371          514 ?S6=1                LOWBAT?
   375  372           67 GOC    LOWBRT ( 400) YES
   376  373          510 S6=    1             SET LOWBAT
   377  374            1 GOSUB  STOST0        STORE STATUS SET 0
   377  375            0
   378  376            1 GOSUB  ANNOUT        TURN ON BAT ANNUNCIATOR
   378  377            0
   379       LOWBRT                           LOW BATTERY LOGIC RETURN TO MAIN FL
*
   381  400         1354 ?F13=1              DOES A PERIPHERAL WANT
   382                                        SERVICE?
   383  401           37 GOC    IOSERV ( 404) YES
   384  402         1014 ?S2=1                IOFLAG?
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```
   385  403           33 GONC   NFRNIO ( 406) NO
   386  404 IOSERV     1 GOSUB  IORUN          YES
   386  405            0
*
   388       NFRNIO                            NORMAL FUNCTION RETURN, NO I/O
   389  406         1314 ?S13=1                 RUNNING?
   390  407          633 GONC   DRWSYL ( 472) NO
   391                                          !!! CHECK SSTFLAG HERE?
*
   393                   ENTRY  RUNING          NULLS RE-ENTER HERE
   394       RUNING                             RUNNING
   395  410         1714 CHK KB
   396  411          243 GONC   RUNNK  ( 435)
   397  412         1040 C=KEYS
   398  413           74 RCR    3
   399  414          126 C=0    XS
   400  415          406 A=C    X               KEYCODE TO A.X
   401  416          460 LDI
   402  417           30 CON    24              H18=OFF KEY
   403  420         1546 ? A#C  X
   404  421            1 GOLNC  OFF
   404  422            2
   405  423          460 LDI
   406  424          207 CON    135             H87=R/S KEY
   407  425         1546 ? A#C  X
   408  426           57 GOC    IGNKEY ( 433) NOT RUNSTOP
   409  427            1 GOSUB  RSTSEQ          STOP THE PROGRAM
   409  430            0
   410  431            1 GOLONG NFRKB
   410  432            2
*
   412  433 IGNKEY 1710 RST KB                 TRY TO RESET KEYBOARD
   413  434         1714 CHK KB
*
   415       RUNNK                             RUNNING, NO KEY HIT
   416  435          134 PT=    4               PUT NFRPU ON THE
   417  436          132 C=0    M                SUBROUTINE STACK
   418  437         1720 LC     15                HERE
   419  440          560 STK=C                  NFRPU ASSUMED = @360
*
* NXTBYT - NEXT BYTE
* - INCREMENTS PGMCTR IN PLACE
* - PLACES BYTE POINTED TO BY NEW VALUE OF PGMCTR IN C[13-12]
* - FOR RAM ONLY, S8=1 IF BYTE NUM = 0 OTHERWISE S8=0.
*   IF S8=0 THEN C[11-10] CONTAINS THE NEXT BYTE IN PROGRAM MEMORY.
* - FOR ROM, S8 IS LEFT UNDEFINED, AND ONLY THE FIRST BYTE IS
*   BROUGHT INTO C.
* - ASSUMES CHIP 0 SELECTED AND PT=3, LEAVES PT=3, USES C.
*
   430  441         1470 C=REGN 12              PGMCTR TO C[3-0]
   431  442          314 ?S10=1                 ROMFLAG?
   432  443          227 GOC    NEXROM ( 465) YES
   433  444          404 S8=    0
   434  445         1142 C=C-1  PT              DECREMENT BYTE NUMBER
   435  446          107 GOC    NXTBT1 ( 456) BYTE 6 DESIRED
   436  447         1450 REGN=C 12              REPLACE PGMCTR
   437  450         1160 DADD=C                 TURN ON THE RIGHT SLEEPER CHIP
   438  451          174 RCR    4               BYTE NUM TO C.S
   439  452          460 LDI
   440  453           24 CON    @24             TBLGBR\16=@500\16
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```
   441  454          374 RCR     10
   442  455          740 GOTOC
*
   444  456 NXTBT1   620 LC      6              DESIRED BYTE IS BYTE #6
   445  457         1146 C=C-1   X
   446  460         1450 REGN=C  12
   447  461           34 PT=     3
   448  462         1160 DADD=C
   449  463           70 C=DATA
   450  464          433 GOTO    NXBEND ( 527)
*
   452  465 NEXROM 1056 C=C+1                  INCREMENT PGMCTR
   453  466         1450 REGN=C  12             PUT PGMCTR BACK
   454  467          674 RCR     11
   455  470         1460 CXISA                  NEW BYTE TO C.X
   456  471          353 GOTO    NXROM1 ( 526)
*
   458  472 DRWSYL  463 GOTO    DROWSY ( 540)
*
*
* STOST0 - STORE STATUS SET 0 BACK TO REG 14
* ENTRY REQUIREMENTS: CHIP 0 ENABLED, STATUS SET 0 IN STATUS BITS
* DESTROYS C (LEAVES A COPY OF REG 14 IN C)
*
   465                      ENTRY  STOST0
   466  473 STOST0 1670 C=REGN 14
   467  474         1630 C=ST
   468  475         1650 REGN=C 14
   469  476         1740 RTN
   470                      FILLTO :@477
        477         0000 NOP
   471
   472       TBLGBR                             TABLE FOR GET BYTE ROTATE
   473                                          MUST BE ON 16 WORD BOUNDARY
   474  500          243 GOTO    GBYTR0 ( 524) NEW BYTE NUM = 0
   475  501          203 GOTO    GBYTR1 ( 521)
   476  502          143 GOTO    GBYTR2 ( 516)
   477  503          103 GOTO    GBYTR3 ( 513)
   478  504           43 GOTO    GBYTR4 ( 510)
   479  505 GBYTR5    70 C=DATA                 NOTE NO BYTE 6 THIS PATH
   480  506         1574 RCR     12
   481  507          203 GOTO    NXBEND ( 527)
   482  510 GBYTR4    70 C=DATA
   483  511          374 RCR     10
   484  512          153 GOTO    NXBEND ( 527)
   485  513 GBYTR3    70 C=DATA
   486  514          474 RCR     8
   487  515          123 GOTO    NXBEND ( 527)
   488  516 GBYTR2    70 C=DATA
   489  517          574 RCR     6
   490  520           73 GOTO    NXBEND ( 527)
   491  521 GBYTR1    70 C=DATA
   492  522          174 RCR     4
   493  523           43 GOTO    NXBEND ( 527)
   494  524 GBYTR0    70 C=DATA
   495  525          410 S8=     1
   496  526 NXROM1  1074 RCR     2
   497       NXBEND                           END OF NEXT BYTE
   498  527         1614 ?S0=1                 IS A PRINTER CONNECTED?
   499  530           33 GONC    NOPRT  ( 533) NO
```

```
   500  531         1655 CON    @1655          IN TRACE MODE, PRINT
   501                                          NEXT INSTRUCTION
   502  532          674 CON    @674           GOSUB PRT2
   503                     ENTRY  NOPRT          FOR THE PRINTER
   504       NOPRT
*
* XCUTE - EXECUTE
* - DECODES AND SENDS TO EXECUTION THE BYTE FOUND IN
*   C[13-12].  IF S8=0 THEN C[11-10] CONTAINS THE
*   NEXT BYTE.
* - ON INPUT: HEXMODE, PTR P = 3, STATUS SET 0 UP AND VALID
* - SELECTS RAM CHIP 0.
*
   513  533 XCUTE   460 LDI
   514  534           6 CON    @006           ROWTBL\16
   515                                          ROWTBL MUST BE IN 1ST 256 BYTES OF
   516  535        1160 DADD=C                  SELECT RAM 0
   517  536         374 RCR    10
   518  537         740 GOTOC
   519                     EJECT
```

```
* DROWSY - REFRESH DISPLAY AND TRY TO SLEEP
*
  522  540 DROWSY 1110 S9=     1              KEYBOARD ALREADY RESET
  523  541 DRSY05    1 GOSUB  ANNOUT          REFRESH ANNUNCIATORS
  523  542           0
  524  543         214 ?S5=1                   MSGFLG?
  525  544         177 GOC    DRSY25 ( 563) YES
  526  545          14 ?S3=1                   PRGMMODE?
  527  546          43 GONC   DRSY10 ( 552) NO
  528  547           1 GOSUB  DFRST8          DFILLF WITH SCROLL & NO PROMPT
  528  550           0
  529  551         123 GOTO   DRSY25 ( 563)
  530  552 DRSY10 1214 ?S7=1                   ALPHAMODE?
  531  553          53 GONC   DRSY20 ( 560) NO
  532  554         404 S8=    0              SCROLL & NO PROMPT
  533  555           1 GOSUB  ARGOUT
  533  556           0
  534  557          43 GOTO   DRSY25 ( 563)
  535  560 DRSY20  370 C=REGN 3              GET X
  536  561           1 GOSUB  DSPCRG          DISPLAY CONTENTS OF C REG
  536  562           0
  537       DRSY25
* SST (PRGMMODE ONLY) AND BST (PRGMMODE & NORMAL MODE) ENTER
* AT DRSY25 TO BYPASS BOTH MAIN LCD UPDATE AND ANNUNCIATOR
* UPDATE.  ENTRY CONDITIONS ARE THE SAME AS FOR DRSY51.
  541  563        1114 ?S9=1                   KEYBOARD RESET YET?
  542  564          77 GOC    DRSY30 ( 573) YES
  543  565         460 LDI                    DELAY 25 MILLISEC
  544  566         121 CON    81               FOR DEBOUNCE
  545  567 DRSY26 1146 C=C-1  X
  546  570        1773 GONC   DRSY26 ( 567)
  547  571           1 GOSUB  RSTKB
  547  572           0
*
  549  573 DRSY30  104 S4=    0              CLEAR SSTFLAG
  550  574           1 GOSUB  STOST0
  550  575           0
  551  576        1414 ?S1=1                   PAUSING?
  552  577         307 GOC    PAUSLP ( 627) YES
*
* LIGHT SLEEP WAKEUP LOGIC
*
  556                   ENTRY  LSWKUP
  557  600 LSWKUP    1 CON    @0001          GOSUB DIAGNOSTIC
  558  601         400 CON    @0400
  559  602           1 GOSUB  PACH11          LEAVES SS0 UP
  559  603           0
  560                                         PACH11 GOES TO MEMCHK
  561                   ENTRY  WKUP10          PARSE PKSEQ ENTERS HERE
  562  604 WKUP10 1714 CHK KB
  563  605         417 GOC    WKUP20 ( 646)
  564  606         460 LDI
  565  607          10 CON    8              I O SERVICE
  566  610           1 GOSUB  ROMCHK          NEEDS CHIP 0,SS0,HEX,P SELECTED
  566  611           0
  567  612        1014 ?S2=1                   IOFLAG?
  568  613        1717 GOC    WKUP10 ( 604) YES
  569                                         GOING TO LIGHT SLEEP NOW
  570  614        1670 C=REGN 14
```

```
   571  615          1074 RCR    2
   572  616          1530 ST=C                  PUT UP SS1
   573  617            14 ?S3=1                 STAYON?
   574                     ENTRY  DRSY50
   575       DRSY50                            OFF ENTERS HERE WITH
   576                                         DISPLAY TURNED OFF
   577  620             1 GSUBNC :ENLCD         NO
   577  621             0
   578  622           140 POWOFF
   578  623             0
*
*
   591       DRSY51                            THIS ENTRY USED TO BYPASS
   582                                         DEFAULT DISPLAY LOGIC
   583                                         ENTRY REQ: HEX, CHIP 0 ON.
   584                                         S9 SAYS WHETHER KB HAS
   585                                         BEEN RESET, SS 0 UP,
   586                                         P SEL.
   587  624             1 GOSUB  ANNOUT
   587  625             0
   588  626          1353 GOTO   DRSY25 ( 563)
*
* PAUSE LOOP
*
   592  627 PAUSLP      1 GOSUB  PGMAON          TURN ON PRGM ANNUNCIATOR
   592  630             0
   593  631           460 LDI                    INITIALIZE PAUSETIMER
   594  632           134 CON    92
   595  633           406 A=C    X               A.X=PAUSETIMER
* PAUSETIMER SET EMPIRICALLY TO MATCH HP67 ON A BENCHMARK PGM
* CONSISTING OF 100 PSE'S FOLLOWED BY FIX 9, STOP.
* THIS TIMING WAS SUBSEQUENTLY SCREWED UP BY EXTENDING ROMCHK'S
* SEARCH FROM ADDRESSES C-F DOWN TO 5-F.  HP-41C'S PSE IS NOW
* .1-.2 SEC LONGER THAN HP-67'S.  DRC 10/20/79
   601  634 PAUS10  1714 CHK KB                 IS A KEY DOWN?
   602  635           117 GOC    WKUP20 ( 646) YES
   603  636           460 LDI
   604  637            14 CON    12
   605  640             1 GOSUB  RMCK05
   605  641             0
   606  642           646 A=A-1  X               HAS PAUSE EXPIRED?
   607  643          1713 GONC   PAUS10 ( 634) NO, NOT YET
   608  644             1 GOLONG RUN             YEP
   608  645             2
*
*
   611  646 WKUP20  1040 C=KEYS
   612                     ENTRY  WKUP21          ADD FOR ADV IO ON 6/15/81
   613  647 WKUP21    34 PT=     3
   614  650           742 C=C+C  PT               OFF KEY? (OFF KC=18HEX)
   615  651             1 GOLNC  PARSE            NO
   615  652             2
   616  653 OFFXFR      1 GOLONG OFF              YES
   616  654             2
*
* DEEP SLEEP WAKEUP LOGIC
*
   620                     ENTRY  DSWKUP          WAKE UP FROM DEEP SLEEP
   621  655 DSWKUP      1 CON    @0001           GOSUB DIAGNOSTIC
   622  656           400 CON    @0400           CHIP 4
```

```
* ON WAKEUP FROM DEEP SLEEP, THE DISPLAY MAY BE EITHER OFF (IN THE
* CASE WHERE THE USER OR A PROGRAM TURNED THE CALCULATOR OFF
* EXPLICITLY) OR ON (IN THE CASE WHERE THE CALCULATOR WENT FROM
* LIGHT SLEEP TO DEEP SLEEP AUTOMATICALLY).
  627  657          1340 DISOFF                    GET THE DISPLAY TO A KNOWN
  628                                               STATE
  629  660             1 GOSUB  PACH11             PACH11 GOES TO MEMCHK
  629  661             0
  630  662          1714 CHK KB                    DID THE ON KEY WAKE US UP?
  631  663            77 GOC    WKUP25 ( 672) YES
  632  664           460 LDI                       NO
  633  665            12 CON    10
  634  666             1 GOSUB  ROMCHK
  634  667             0
  635  670          1014 ?S2=1                     IOFLAG?
  636  671          1273 GONC   DRSY50 ( 620) NOPE - GO BACK TO SLEEP
  637                    ENTRY  WKUP25
  638       WKUP25
  639                                               INITIALIZE STATUS BITS
  640  672          1670 C=REGN 14
  641  673             1 GOSUB  PACH12             DECOMPILES & RTNS WITH R14 IN C,
  641  674             0
  642                                                 SS0 UP(S0-S7=0), C.X= 0
  643  675           574 RCR    6
  644  676          1730 CST EX                    PUT UP SS 3
  645  677          1404 S1=    0                  CLEAR CATALOG FLAG
  646  700           210 S5=    1                  SET AUDIO ENABLE FLAG
  647  701           504 S6=    0                  CLEAR ERROR IGNORE FLAG
  648  702          1204 S7=    0                  CLEAR OUT-OF-RANGE FLAG
  649  703          1730 CST EX
  650  704          1074 RCR    2                  CLEAR FLAGS 12-23
  651  705           106 C=0    X
  652  706           574 RCR    6
  653  707          1650 REGN=C 14
  654  710          1304 S13=   0                  CLEAR RUNNING FLAG
  655                                               RELEASE ALL I/O BUFFERS
  656  711          1570 C=REGN 13
  657  712           356 BC EX                     CHAINHEAD TO B.X
  658  713           460 LDI
  659  714           277 CON    191
  660  715           416 A=C                       CURRENT REG ADDR TO A.X
  661  716 WKUP30    546 A=A+1  X
  662  717 WKUP40   1446 ? A<B  X                  STILL BELOW CHAINHEAD?
  663  720           173 GONC   WKUP50 ( 737) NO - DONE.
  664  721           246 C=A    X
  664  722           406
  665  723          1160 DADD=C
  666  724            70 C=DATA
  667  725          1356 ? C#0  W                  IS THIS REG OCCUPIED?
  668  726           113 GONC   WKUP50 ( 737) NO - DONE.
  669  727          1076 C=C+1  S                  IS IT A KEY REASSIGNMENT?
  670  730          1667 GOC    WKUP30 ( 716) YES
  671  731           136 C=0    S                  NO, MUST BE AN I/O BUFFER
  672  732          1360 DATA=C                    RELEASE IT
  673  733           374 RCR    10                 ROTATE SIZE TO C[1:0]
  674  734           126 C=0    XS
  675  735           506 A=A+C  X                  SKIP OVER BUFFER
  676                    LEGAL
  677  736          1613 GOTO   WKUP40 ( 717)
*
```

```
   679  737 WKUP50  460 LDI
   680  740           7 CON    7              DEEP SLEEP
   681  741        1160 DADD=C                 RE-ENABLE CHIP 0
   682  742           1 GOSUB  ROMCHK
   682  743           0
   683  744           1 GOSUB  PKIOAS          GOSUB I/O AREA PACK SUBR.
   683  745           0
   684                                         RETURNS WITH CHIP 0 DISABLED
   685  746         116 C=0                     RE-ENABLE CHIP 0
   686  747        1160 DADD=C
   687  750           1 GOSUB  RSTKB
   687  751           0
* CHECK FOR MASTER CLEAR HERE
* THE PROTOCOL FOR MASTER CLEAR IS TO PRESS AND HOLD THE
* BACKARROW KEY WHILE SIMULTANEOUSLY HITTING THE ON KEY.
   691  752        1714 CHK KB                 ANOTHER KEY DOWN?
   692  753         113 GONC   WKUP60 ( 764) NO
   693  754         460 LDI                    YES. SEE IF IT IS BKARROW
   694  755         303 CON2   12     3        KC FOR BKARROW
   695  756         406 A=C    X
   696  757        1040 C=KEYS
   697  760          74 RCR    3
   698  761        1434 PT=     1
   699  762        1552 ? A#C   WPT
   700  763         773 GONC   COLDST (1062) MASTER CLEAR
   701       WKUP60
   702  764        1440 DISTOG                 TURN THE DISPLAY BACK ON
   703  765 WKUP70 1670 C=REGN 14
   704  766         674 RCR    11
   705  767        1530 ST=C
   706  770        1614 ?S0=1                  FLAG 11?
   707  771           1 GOLNC  NFRC            NO
   707  772           2
   708                                         GOTO NFRC TO INITIALIZE
   709                                         LOWBAT BEFORE GOING TO
   710                                         DROWSY
   711  773        1604 S0=     0              YES. CLEAR FLAG 11
   712  774        1630 C=ST
   713  775          74 RCR    3
   714  776        1650 REGN=C 14
   715                ENTRY  WKUP80            FOR CARD RDR LOAD&GO
   716  777 WKUP80 1340 DISOFF                 TURN OFF DISPLAY DURING BEEP
   717 1000           1 GOSUB  TONE7X
   717 1001           0
   718 1002        1440 DISTOG                 TURN DISPLAY BACK ON
   719 1003           1 GOLONG RUN             START RUNNING THE USER'S PGM
   719 1004           2
*
* MEMCHK (MEMORY CHECK) - CHECK INTEGRITY OF ROM AND RAM
*
* MEMCHK PERFORMS THREE QUICK TESTS OF RAM AND ROM IN AN
* EFFORT TO DETERMINE WHETHER ANY PLUG-IN MODULES OR THE
* BATTERIES HAVE BEEN REMOVED.
*
* 1. TEST DIGITS 0:6 OF REG 13 TO SEE WHETHER THE WARM START
* CONSTANT (@551) IS THERE.  IF NOT, COLD START.
* 2. READ/WRITE/READ/RESTORE REG0-1 TO JUDGE WHETHER THE LABEL
* CHAIN IS INTACT.  IF NOT, COLD START.
* 3. IF THE USER PC IS ON ROM, VERIFY THAT THE FIRST WORD OF THE
* ROM CHIP IS NON-ZERO TO JUDGE WHETHER THE ROM MODULE IS STILL
```

```
* PLUGGED IN.  IF NOT, SET THE PC TO THE TOP OF PROGRAM MEMORY IN
* RAM. (SEE CHKRPC COMMENTS BELOW)
*
* ON EXIT, CHIP 0 IS ENABLED, SS0 IS UP, HEXMODE.
* USES A AND C.
* DOESN'T CALL ANY SUBROUTINES (MUST NOT, BECAUSE MEMCHK IS CALLED
* DURING PARTIAL KEY SEQUENCES).  EXITS VIA PUTPCX.
* IF PC IS IN RAM, NORMALLY RETURNS IN 31 WORD-TIMES.
* IF PC IS IN ROM, NORMALLY RETURNS IN 39 WORD-TIMES.
*
  743                   ENTRY  MEMCHK
  744 1005 MEMCHK 1710 RST KB                  THESE THREE STATES
  745 1006        1714 CHK KB                   NECESSARY BECAUSE OF
  746 1007        1140 SETHEX                    PROBLEMS WITH CPU WAKEUP
  747 1010         106 C=0    X
  748 1011        1760 PFAD=C                  TURN OFF PERIPHERAL CHIPS
  749 1012        1160 DADD=C                  TURN ON CHIP 0
  750 1013         460 LDI
  751 1014         551 CON    @551             WARM START CONSTANT
  752 1015         406 A=C    X
  753 1016        1570 C=REGN 13
  754 1017         574 RCR    6
  755 1020        1546 ? A#C  X                COLD START?
  756 1021         417 GOC    COLDST (1062) YES
  757                                          NOW HEXMODE IS ASSUMED
  758 1022         674 RCR    11               REG0 TO C.X
  759 1023        1146 C=C-1  X                C.X=REG0-1
  760 1024        1160 DADD=C
  761 1025          70 C=DATA                  GET C(REG0-1)
  762 1026         416 A=C                      & SAVE IN A
  763 1027        1272 C=-C-1 M
* WE INVERT THE BIT PATTERN IN DIGITS 12:3.  CHARACTERISTICALLY,
* WHEN A NON-EXISTENT DATA STORAGE REGISTER IS READ, THE DATA
* IS EITHER ALL ONES OR ALL ZEROES.  INVERTING PART OF THE REGISTER
* GUARANTEES THAT, IF THE REGISTER EXISTS, EITHER WHAT WE READ
* ORIGINALLY OR THE PARTIALLY INVERTED PATTERN WILL BE DIFFERENT
* FROM ALL ZEROES AND FROM ALL ONES.
  770 1030        1360 DATA=C                  WRITE IT BACK
  771 1031          70 C=DATA                  READ IT AGAIN
  772 1032        1272 C=-C-1 M                INVERT IT AGAIN
  773 1033        1556 ? A#C                   NON-EXISTENT REGISTER?
  774 1034         267 GOC    COLDST (1062) YES
  775 1035        1360 DATA=C                  RESTORE THE REGISTER
  776
  777 1036         106 C=0    X                RE-ENABLE CHIP 0
  778 1037        1160 DADD=C
  779 1040        1670 C=REGN 14               PUT UP SS0
  780 1041        1530 ST=C
  781
* CHKRPC (CHECK ROM PC) - CONFIRMS THAT, IF ROMFLAG IS SET, THE
* ROM CHIP POINTED TO BY THE USER PC IS ACTUALLY PLUGGED IN.
*
* ON ENTRY, CHIP 0 MUST BE ENABLED.
* IF ROMFLAG IS CLEAR, RETURNS IN 2 WORD-TIMES AND USES NOTHING.
* IF ROMFLAG IS SET, USES A[3:0] AND C AND PT AND USUALLY RETURNS
* IN 8 WORD-TIMES.
*
  790                   ENTRY  CHKRPC
  791 1042 CHKRPC  314 ?S10=1                ROMFLAG?
  792 1043        1640 RTN NC                  NO. ALL FINISHED.
```

```
   793 1044         1470 C=REGN 12             GET PC
   794 1045          106 C=0    X              C[3:0]=ADDR OF 1ST WORD
   795 1046          674 RCR    11              ON CHIP
   796 1047         1460 CXISA
   797 1050         1346 ? C#0  X
   798 1051         1540 RTN C
   799 1052          304 S10=   0              CHIP IS NOT THERE
   800 1053         1570 C=REGN 13
   801 1054           74 RCR    3              C.X=REG0
   802 1055           34 PT=    3
   803 1056          102 C=0    PT
   804 1057          412 A=C    WPT
   805 1060            1 GOLONG.PUTPCX
   805 1061            2
*
* COLD START INITIALIZATION
*
   809 1062 COLDST 1140 SETHEX
   810 1063         640 CLRABC
   811 1064         530 M=C
   812 1065         160 N=C
   813 1066         130 G=C
   814 1067        1530 ST=C
   815 1070        1130 F=SB
   816 1071         560 STK=C
   817 1072         560 STK=C
   818 1073         560 STK=C
   819 1074         560 STK=C
   820 1075         340 SEL Q
   821 1076        1334 PT=    13
   822 1077         240 SEL P
   823 1100        1304 S13=   0
   824 1101        1504 S12=   0
   825 1102         604 S11=   0
   826 1103         304 S10=   0
   827 1104        1104 S9=    0
   828 1105         404 S8=    0
   829 1106           1 GOSUB  MSGA
   829 1107           0
   830 1110           0 XDEF   MSGML           "MEMORY LOST" MESSAGE
* IS THE LCD ENABLE IN THE NEXT LINE REALLY NECESSARY?
   832 1111           1 GOSUB  ENLCD
   832 1112           0
   833 1113           1 GOSUB  RSTKB
   833 1114           0
   834 1115         460 LDI                    SET UP A.X FOR ILOOP
   835 1116        1777 CON    @1777
* I THINK THIS CONSTANT COULD JUST AS WELL BE @777, WHICH WOULD
* RESULT IN FASTER COLD STARTS, BUT FOR NOW I'M LEAVING WELL ENOUGH
* ALONE.  DRC 3/26/79
   839 1117         416 A=C
   840 1120         116 C=0
   841 1121        1360 WRTEN                  CLEAR ANNUNCIATORS
   842 1122        1340 DISOFF
   843 1123        1440 DISTOG
   844 1124        1760 PFAD=C
   845 1125 ILOOP   256 AC EX
   846 1126        1160 DADD=C
   847 1127         256 AC EX
   848 1130        1360 DATA=C
```

```
   849 1131          646 A=A-1  X
   850 1132         1733 GONC   ILOOP  (1125)
*
   852 1133          460 LDI                    INITIALIZE REG0 (0EF)
   853 1134          357 CON2   14     15
   854 1135          474 RCR    8
   855 1136          460 LDI                    INITIALIZE SIGMADDR (0FA)
   856 1137          372 CON2   15     10
   857 1140           74 RCR    3
   858 1141          460 LDI
   859 1142          356 CON2   14     14       INITIALIZE CHAINHEAD (0EE)
   860 1143         1550 REGN=C 13
   861 1144          132 C=0    M
   862 1145         1056 C=C+1
   863 1146         1450 REGN=C 12               PGMPTR (00EF)
   864 1147         1160 DADD=C                  PUT PERMANENT END AT CHAINHEAD
   865 1150          116 C=0                      LOCATION
   866 1151          234 PT=    5
   867 1152         1420 LC     12
   868 1153          460 LDI
   869 1154           40 CON    32
   870 1155         1650 REGN=C 14
   871 1156          116 C=0                    INITIALIZE STATUS BITS
   872 1157         1160 DADD=C
   873 1160         1234 PT=    7
   874 1161          220 LC     2                TURN ON AUDIO ENABLE
   875 1162         1420 LC     12              SET DIGIT GROUPING & DP FLAGS
   876 1163          134 PT=    4
   877 1164          420 LC     4               #DIGITS_4
   878 1165         1020 LC     8               SET FIXFLAG
   879 1166         1650 REGN=C 14              STORE STATUS SETS EXCEPT SS0
   880 1167          210 S5=    1               SET MSGFLG
* ROMCHK ASSUMES SS0 IS UP, CLEARS S2 (IOFLAG), AND STORES SS0
* BACK TO REG 14
   883 1170          460 LDI
   884 1171            6 CON    6               COLD START
   885 1172            1 GOSUB  ROMCHK
   885 1173            0
   886 1174          460 LDI
   887 1175          551 CON    @551            WARM START CONSTANT
   888 1176          406 A=C    X
   889 1177         1570 C=REGN 13
   890 1200          574 RCR    6
   891 1201          246 AC EX  X
   892 1202          474 RCR    8
   893 1203         1550 REGN=C 13
   894 1204            1 GOLONG WKUP70
   894 1205            2
   895                   EJECT
```

```
* INCGT2 - INCREMENT PGMCTR AND VALIDATE BYTE#2
* INPUT: C AS LEFT BY ROW DECODE (FC IN DIGITS 3:2, 2ND BYTE
*     MAY BE IN DIGITS 1:0).  PT=3. STATUS SET 0 UP.
* USES A AND C
* RETURNS WITH VALID BYTES IN A[3:0], PT=3, STATUS SET 0 UP.
* LEAVES S8 ALONE
*
  903 1206 INCGT2  416 A=C                    SAVE FIRST BYTE IN A[3:2]
  904 1207        1314 ?S13=1                  RUNNING?
  905 1210          37 GOC    INCG1  (1213)    YES
  906 1211         114 ?S4=1                   SSTFLAG?
  907 1212        1640 RTN NC                  KEYBOARD - DO NOTHING.
*
  909 1213 INCG1  1470 C=REGN 12               GET PGMCTR
  910 1214         314 ?S10=1                  ROMFLAG?
  911 1215         103 GONC   INCG2  (1225)    RAM
  912 1216        1056 C=C+1                   ROM
  913 1217        1450 REGN=C 12               PUT PGMPTR BACK
  914 1220         674 RCR    11
  915 1221        1460 CXISA
  916 1222         266 AC EX  XS               PUT THE TWO BYTES TOGETHER
  917 1223         406 A=C    X
  918 1224        1740 RTN
*
  920 1225 INCG2   414 ?S8=1                   IS BYTE 2 BAD?
  921 1226         153 GONC   INCG3  (1243)    BYTE 2 IS GOOD
  922 1227         620 LC     6                INCREMENT PGMCTR ACROSS A
  923 1230        1146 C=C-1  X                 REGISTER BOUNDARY
  924 1231        1450 REGN=C 12               PUT PGMCTR BACK
  925 1232        1160 DADD=C                  GET SECOND BYTE
  926 1233          70 C=DATA
  927 1234        1574 RCR    12
  928 1235        1434 PT=    1
  929 1236         412 A=C    WPT
  930 1237          34 PT=    3                RESTORE POINTER
  931 1240         116 C=0
  932 1241        1160 DADD=C                  RE-ENABLE STATUS CHIP
  933 1242        1740 RTN
*
  935 1243 INCG3  1142 C=C-1  PT               INCREMENT PGMCTR
  936 1244        1450 REGN=C 12               PUT PGMCTR BACK
  937 1245        1740 RTN
  938                  EJECT
```

```
*************************************************************
*ROW10 INCLUDES FLAGS, EXEC ROM, NON-PROGRAMMABLE
*FUNCTIONS AND EXECUTE INDIRECT. FLAGS ARE THE ONLY
*FUNCTIONS IN ROW10 WHICH CAN BE PREPROCESSED. IN THE
*ROW 10 ROUTINE ERROR CHECKING IS DONE AND A MASK
*IS BUILT WITH A ONE IN THE POSITION OF THE FLAG
*OF INTEREST.
*************************************************************
   947 1246 ROW10     1 GOSUB  INCGT2          GET BYTE 2
   947 1247           0
   948 1250         256 AC EX
   949 1251        1530 ST=C                   SAVE BYTE 2
   950 1252        1034 PT=    2
   951 1253         130 G=C
   952                 ENTRY  P10RTN
   953 1254 P10RTN  766 C=C+C  XS              SEP XEC ROM
   954 1255           1 GOLNC  XROM
   954 1256           2
   955 1257        1104 S9=    0               TEST ONLY FLAG SET
   956 1260         766 C=C+C  XS              SEP SET AND CLEARS
   957 1261         103 GONC   FLAGS  (1271)
   958 1262        1110 S9=    1               THESE 2 TEST ONLYS
   959 1263         766 C=C+C  XS
   960 1264          53 GONC   FLAGS  (1271)
   961 1265         766 C=C+C  XS              SPARE FC?
   962 1266        1540 RTN C                  YES
   963 1267           1 GOLONG BIGBRC          XEQ/GTO INDIRECT
   963 1270           2
   964 1271 FLAGS   126 C=0    XS              CLEAR FRO ERROR CHECKS
   965 1272        1214 ?S7=1                  INDIRECT FLAG?
   966 1273          63 GONC   CONFLG (1301) NO
   967 1274        1204 S7=    0               DO INDIRECT ACCESS
   968 1275           1 GOSUB  ADRFCH
   968 1276           0
   969 1277           1 GOLONG PACH10
   969 1300           2
   970 1301 CONFLG  256 AC EX                  MOVE BINARY FLAG NUMBER TO A
   971 1302         216 B=A                    SAVE N IN B
   972 1303         460 LDI                    LOAD DECIMAL 30
   973 1304          36 CON    @36
   974 1305         706 A=A-C  X               CHECK TO SEE IF SETCLR FLAG
   975 1306          77 GOC    ALLOK  (1315) YES THEN ALL OPS OK
   976 1307        1114 ?S9=1                  TEST ONLY FLAG?
   977 1310         303 GONC   ERRNE  (1340) NO THIS ONE SET OR CLEARS
   978 1311         460 LDI                    SUBTRACT BALANCE OF FLAGS
   979 1312          32 CON    @32
   980 1313         706 A=A-C  X               IF NC NN>55
   981 1314         243 GONC   ERRNE  (1340)
*
* THE ENTRY POINT "ALLOK" WAS ADDED BY STEVE CHOU ON 02-11-81
* FOR THE FUNCTION "STOFLAG" IN THE ADVANCED PROGRAMMING ROM
*
   986                 ENTRY  ALLOK
   987 1315 ALLOK   156 AB EX                 NO ERRORS AT THIS POINT
   988 1316         460 LDI                   COUNT DOWN BY 8S
   989 1317          10 CON    @10
   990 1320         356 BC EX
   991 1321         116 C=0                   SET C=1 AND ADDRESS CHIP 0
   992 1322        1160 DADD=C
```

```
   993 1323          1056 C=C+1
   994 1324 SHF8     1074 RCR    2              SHIFT ONE RIGHT 8 AT A TIME
   995 1325           606 A=A-B  X              COUNT N DOWN
   996 1326          1763 GONC   SHF8   (1324)
   997 1327            23 GOTO   PSTDBL (1331)
   998 1330 DBL       756 C=C+C                 SHIFT BACK BY CARRY AMOUNT
   999 1331 PSTDBL    546 A=A+1  X              COUNT BACK CARRY
  1000 1332          1763 GONC   DBL    (1330)
  1001 1333           356 CB EX                SAVE MASK
  1002 1334          1670 C=REGN 14            GET STATUS SET
  1003 1335           256 AC EX                SAVE IN A
  1004 1336             1 GOLONG BIGBRC        DO 256 WAY BRANCH
  1004 1337             2
  1005 1340 ERRNE       1 GOSUB  ERROR
  1005 1341             0
  1006 1342             0 XDEF   MSGNE         "NONEXISTENT"
*************************************************
*THIS ROUTINE TAKES A STANDARD FLOATING POINT
*NUMBER, STRIPS OFF AN ABSOLUTE INTEGER LESS THAN
*1000, AND COVERTS THAT INTEGER TO BINARY.
*IF THE FLOATING POINT INPUT IS A FRACTION ZERO
*IS RETURNED, IF LARGER THAN 999 A NONEXISTANT
*ERROR IS GENERATED. INPUT IS IN C, OUTPUT IS
*IN C-X, CHARACTER DATA ALSO GENERATES ERROR.
* USES: A,X, C, S8, AND 1 ADDITIONAL SUBROUTINE LEVEL
* IN: C=FLOATING POINT NUMBER
*     NO PERIPHERAL ENABLED
* OUT: C.X = BINARY NUMBER
*      CHIP 0 ENABLED
* MAY EXIT TO ERRAD OR ERRNE
*************************************************
  1022 1343 BCDBIN 1176 C=C-1  S              CHECK FOR CHARACTER
  1023 1344        1176 C=C-1  S
  1024 1345           1 GOLC   ERRAD
  1024 1346           3
  1025 1347         406 A=C    X              MOVE EXPONENT
  1026 1350         136 C=0    S
  1027 1351         404 S8=    0              CLEAR ZERO TO 9 FLAG
  1028 1352         106 C=0    X
  1029 1353        1160 DADD=C
  1030 1354        1526 ? A#0   XS             NEGATIVE EXPONENT?
  1031 1355        1540 RTN C                  YES WE ARE DONE
  1032 1356        1574 RCR    12              MOVE DIGIT 1 TO 0
  1033 1357         646 A=A-1  X              DEC EXP
  1034 1360         107 GOC    GOTINT (1370) DONE IF X=0
  1035 1361         410 S8=    1              SET FLAGS FOR 10 OR LARGER
  1036 1362        1374 RCR    13             ROT NXT DG IN
  1037 1363         646 A=A-1  X              EXP=1?
  1038 1364          47 GOC    GOTINT (1370) YES
  1039 1365        1374 RCR    13             SHIFT AGAIN
  1040 1366         646 A=A-1  X              X=2
  1041 1367        1513 GONC   ERRNE  (1340) VALUE TOO LARGE FOR ADR
*************************************************
*THE FOLLOWING ROUTINE TAKES A BCD INTEGER IN C-X
*(3 DIGITS) AND CONVERTS IT TO BINARY IN C-X
*
* IN: C.X= BCD NUMBER,    C[4:3]= 00
* ASSUME: HEXMODE
* OUT: C.X= BINARY NUMBER.    HEXMODE
* USES: A.X, C, +1 SUB LEVEL        (NO ST, NO PT, NO DADD)
```

```
*****************************************************
 1051 1370 GOTINT 1074 RCR    2              GET FIRST DIGIT
 1052 1371           1 GOSUB  INTINT
 1052 1372           0
 1053 1373 INTINT  746 C=C+C   X              MULTIPLY BY 10
 1054 1374         406 A=C     X
 1055 1375         746 C=C+C   X
 1056 1376         746 C=C+C   X
 1057 1377         506 A=A+C   X
 1058 1400         106 C=0     X
 1059 1401        1374 RCR     13             SHIFT IN NEXT DIGIT
 1060 1402        1006 C=C+A   X              COMBINE 10S
 1061 1403        1740 RTN
 1062                  EJECT
```

```
*
*  GTAINC - GET ALPHA LABEL AND INCREMENT PROGRAM
*           COUNTER
*- GET AN ALPHA LABEL FROM VARIOUS LOCATIONS DEPENDING
*- ON THE MODE OF OPERATION, AND FORMAT THE ALPHA
*- LABEL APPROPRIATELY
*- IN:  S9=1 IMPLIES AN ADDRESS IS RETURNED IN M
*-      A[3:2]= FUNCTION CODE
*-      CHIP 0 SELECTED
*- OUT: M[13:0]= ALPHA LABEL (RIGHT JUSTIFIED)
*-       OR ALPHA LABEL ADDRESS
*       PC SET AT LAST BYTE OF ALPHA LABEL
*- USES: A[13:0], B[13:0], C[13:0], M[13:0]
*- USES: 1 SUBROUTINE LEVEL
  1077
  1078
  1079
  1080 1404 GTAINC   34 PT=    3              -
  1081 1405         216 B=A                   COPY FC FROM A[3:2]
  1082 1406         316 C=B                    TO B[3:2] AND C[3:2]
  1083 1407        1314 ?S13=1                RUNNING?
  1084 1410         107 GOC     GTAI10 (1420) YES
  1085 1411         114 ?S4=1                 SSTFLAG?
  1086 1412          67 GOC     GTAI10 (1420) YES
  1087 1413        1170 C=REGN 9              M_ALPHA STRING (KYBRD)
  1088 1414        1114 ?S9=1                 ADDR IN M?
  1089 1415          27 GOC     *+2    (1417) YES
  1090 1416         530 M=C                   -
  1091 1417        1740 RTN                   -
  1092 1420 GTAI10  314 ?S10=1                ROM?
  1093 1421         603 GONC    GTAI40 (1501) NOPE
  1094 1422        1470 C=REGN 12             B[6:3]_PGMCTR      (ROM)
  1095 1423         674 RCR     11            -
  1096 1424        1072 C=C+1   M             -
  1097 1425         356 BC EX                 C[3:2]_F.C.
  1098 1426         742 C=C+C   PT             ALBL?
  1099 1427         337 GOC     GTAI22 (1462) YES
  1100 1430         316 C=B                   XEQ/GTO F.C.
  1101 1431        1460 CXISA                 STRING OPERAND ADDR?
  1102 1432 GTAI26  216 B=A                   SAVE F.C. & K.C.
  1103 1433         432 A=C     M             A[6:3]_PGMCTR
  1104 1434        1474 RCR     1             A[13]_#CHARS
  1105 1435        1176 C=C-1   S             -
  1106 1436         436 A=C     S             -
  1107 1437         116 C=0                   -
  1108 1440        1434 PT=     1             -
  1109 1441 GTAI30  256 AC EX                 GET A CHAR
  1110 1442        1072 C=C+1   M             -
  1111 1443        1460 CXISA                 -
  1112 1444         256 AC EX                 -
  1113 1445         252 AC EX   WPT           -
  1114 1446        1074 RCR     2             POSITION CHAR
  1115 1447         676 A=A-1   S             CHARS FINISHED?
  1116 1450        1713 GONC    GTAI30 (1441) NOPE
  1117 1451          23 GOTO    *+2    (1453) -
  1118 1452        1074 RCR     2             -
  1119 1453        1352 ? C#0   WPT           -
  1120 1454        1763 GONC    *-2    (1452) -
  1121 1455         530 M=C                   M_ALPHA STRING
```

```
1122 1456          256 AC EX                   A[3:0]_F.C. & K.C.
1123 1457          156 AB EX                   -
1124 1460           34 PT=     3               -
1125 1461          123 GOTO    GTAI20 (1473) B[3:0]_PGMCTR
1126 1462 GTAI22   316 C=B                     POSITION PGMCTR
1127 1463         1072 C=C+1   M                -
1128 1464         1460 CXISA                    -
1129 1465         1474 RCR     1                -
1130 1466          106 C=0     X                -
1131 1467          374 RCR     10               -
1132 1470          156 AB EX                    -
1133 1471         1032 C=A+C   M                -
1134 1472         1072 C=C+1   M                -
1135 1473 GTAI20    74 RCR     3                PLACE PGMCTR
1136 1474          352 BC EX   WPT              -
1137 1475         1470 C=REGN 12                -
1138 1476          312 C=B     WPT              -
1139 1477         1450 REGN=C 12                -
1140 1500         1740 RTN                      -
1141
1142 1501 GTAI40 1104 S9=     0                -
1143 1502          742 C=C+C   PT               ALBL?
1144 1503           63 GONC    GTAI50 (1511) NOFE
1145 1504            1 GSBLNG  GETPCA           INCREMENT
1145 1505            0
1146 1506            1 GSBLNG  INCADA           -
1146 1507            0
1147 1510           33 GOTO    GTAI55 (1513) -
1148 1511 GTAI50     1 GSBLNG  GETPCA           A[13]_#CHARS
1148 1512            0
1149 1513 GTAI55     1 GSBLNG  NXBYTA           -
1149 1514            0
1150 1515         1474 RCR     1                -
1151 1516          436 A=C     S                -
1152 1517          116 C=0                      -
1153 1520 GTAI60   676 A=A-1   S                CHARS FINISHED?
1154 1521          117 GOC     GTAI70 (1532) YES
1155 1522          530 M=C                      -
1156 1523            1 GSBLNG  NXBYTA           -
1156 1524            0
1157 1525         1730 CST EX                   SHIFT CHAR IN
1158 1526          630 C=M                      -
1159 1527         1730 CST EX                   -
1160 1530         1074 RCR     2                -
1161 1531         1673 GOTO    GTAI60 (1520) -
1162 1532 GTAI70     1 GOSUB   RTJLBL           RIGHT JUSTIFY
1162 1533            0
1163 1534          530 M=C                      SAVE ALPHA STRING IN M
1164 1535           34 PT=     3                -
1165 1536            1 GSBLNG  PUTPC            PLACE PGMCTR
1165 1537            0
1166 1540          156 AB EX                    A[3:0]_F.C. & K.C.
1167 1541         1670 C=REGN 14                RESTORE SS0
1168 1542         1530 ST=C
1169 1543         1740 RTN                      -
*
*************************************************
* VIEW ROUTINE
*************************************************
*
```

```
 1175 1544 XAVIEW 1545 CON    @1545
 1176 1545         674 CON    @674          GOSUB PRT11
 1177 1546        1214 ?S7=1                 ALPHAMODE?
 1178 1547          33 GONC   AVW10  (1552) NO
 1179 1550        1314 ?S13=1                RUNNING?
 1180 1551        1640 RTN NC                NO - KEYBOARD, ALPHAMODE
 1181                                        DEFAULTDISPLAY IS THE SAME
 1182                                        AS AVIEW - DON'T SET MSGFLG
 1183      AVW10
 1184 1552         404 S8=    0              SCROLL & NO PROMPT
 1185 1553        1110 S9=    1              KEYBOARD ALREADY BEEN RESET
 1186 1554           1 GOSUB  ARGOUT
 1186 1555           0
 1187 1556          63 GOTO   XVIEWA (1564)
*
 1189 1557 XVIEW  1555 CON    @1555          GOSUB PRT10
 1190 1560         674 CON    @674
 1191 1561         316 C=B
 1192                  ENTRY  PR10RT         FOR THE PRINTER
 1193      PR10RT                            NOTE THE REG TO BE
* VIEWED IS EXPECTED IN C WHEN THE PRT10 LOGIC RETURNS HERE
* (IT WAS IN B WHEN WE WENT OFF TO PRT10)
 1196 1562           1 GOSUB  DSPCRG
 1196 1563           0
 1197 1564 XVIEWA    1 GOSUB  STMSGF         SET MESSAGE FLAG
 1197 1565           0
 1198 1566        1614 ?S0=1                 DOES A PRINTER EXIST?
 1199 1567          57 GOC    XVW10  (1574) YES
 1200 1570         474 RCR    8              NO. CK PRINTER ENABLE FLG
 1201 1571        1530 ST=C
 1202 1572        1014 ?S2=1                 DID THE USER SET IT?
 1203 1573         547 GOC    STOPS  (1647) YES - STOP
 1204      XVW10
 1205 1574 MSGDLY    1 GOSUB  BLINK
 1205 1575           0
 1206 1576 STMSGF  106 C=0    X
* GOSUB LDSST0 MIGHT BE USED HERE IN PLACE OF THE 4 INST SEQ
* C=0 X, DADD=C, C=REGN 14, ST=C.  AN ANALYSIS OF WHO CALLS
* STMSGF AND MSGDLY MUST BE DONE TO SEE IF THEY CAN AFFORD
* ANOTHER SUBROUTINE LEVEL
 1211 1577        1160 DADD=C
 1212 1600        1670 C=REGN 14
 1213 1601        1530 ST=C
 1214 1602         210 S5=    1              SET MSGFLAG
 1215 1603         323 GOTO   RSTMS2 (1635)
 1216
 1217
 1218
*
* RSTSEQ - RESET STATUS BITS AT END OF KEY SEQUENCE
* CLEARS MSGFLG, DATAENTRY, PKSEQ, CATALOGFLAG, SHIFTSET, PSEFLAG
* ALSO CLEARS RUNNING FLAG (S13)
* CHIP 0 MUST BE ENABLED ON ENTRY
* ON EXIT, SS0 IS UP AND C CONTAINS A COPY OF THE STATUS REGISTER
* USES ONLY THE C REGISTER AND S0-S7
*
 1227                  ENTRY  RSTSEQ
 1228                  ENTRY  RSTSQ
 1229 1604 RSTSEQ 1304 S13=   0              CLEAR RUNNING
 1230 1605 RSTSQ  1670 C=REGN 14
```

```
  1231 1606          1074 RCR    2
  1232 1607          1530 ST=C                   LOAD SS 1
  1233 1610          1404 S1=    0               CLEAR PKSEQ
  1234 1611          1630 C=ST
  1235 1612          1574 RCR    12
  1236 1613          1530 ST=C                   LOAD SS0
  1237 1614          1404 S1=    0               CLEAR PAUSING
  1238 1615            53 GOTO   RSTMSC (1622)
*                             THESE COMMENTS ACCURATE    RSW  6-13-80
*
*
* RSTMSC - RESET MISCELLANEOUS STATUS BITS
* RESETS CATALOGFLAG, SHIFT, DATAENTRY, AND MSGFLAG
* ON ENTRY, REG 14 IN C EXCEPT SS0 IN ST, & CHIP 0 ENABLED.
* ON EXIT, STATUS SETS HAVE BEEN STORED BACK TO CHIP 0, CHIP 0 IS ENABLED,
*     SS 0 IS UP (AND C HAS A COPY OF THE STATUS SETS).
*
* RSTMS1 - SAME AS RSTMSC EXCEPT SETS UP C AND ST ON ENTRY
* DATOFF - EXACTLY THE SAME AS RSTMS1
* RSTMS0 - SAME AS RSTMS1, EXCEPT CALLS ENCP00 FIRST, THEREBY
*     USING AN ADDITIONAL SUBROUTINE LEVEL
*
* USES: C, S0-S7,              (NO PT, +0 SUB LEVELS[EXCEPT RSTMS0])
*
  1255                      ENTRY  RSTMS0
  1256                      ENTRY  DATOFF
  1257                      ENTRY  RSTMS1
  1258                      ENTRY  RSTMSC
  1259 1616 RSTMS0     1 GOSUB  ENCP00
  1259 1617            0
  1260      DATOFF
  1261 1620 RSTMS1 1670 C=REGN 14
  1262 1621        1530 ST=C
  1263 1622 RSTMSC  574 RCR    6
  1264 1623        1730 CST EX                 PUT UP SS 3
  1265 1624        1404 S1=    0               CLEAR CATALOGFLAG
  1266 1625        1730 CST EX
  1267 1626         374 RCR    10
  1268 1627        1730 CST EX                 PUT UP SS 1
  1269 1630        1604 S0=    0               CLEAR SHIFT
  1270 1631        1004 S2=    0               CLEAR DATAENTRY
  1271 1632        1730 CST EX
  1272 1633        1574 RCR    12
  1273 1634         204 S5=    0               CLEAR MSGFLAG
  1274 1635 RSTMS2 1630 C=ST
  1275 1636        1650 REGN=C 14
  1276 1637        1740 RTN
  1277
  1278
  1279
  1280
  1281
  1282                      ENTRY  XPRMPT
*
* PROMPT - THIS FUNCTION COMBINES AVIEW AND R/S
*
  1286 1640 XPRMPT 1605 CON    @1605          GOSUB PRT7
  1287 1641         674 CON    @674
  1288 1642           1 GOSUB  RSTMS0         CLEAR MSGFLG (IN CASE WE'RE
  1288 1643           0
```

```
1289                                                IN ALPHAMODE) & LEAVE
1290                                                SS0 UP
1291 1644          404 S8=     0                    SET UP FOR ARGOUT
1292 1645         1214 ?S7=1                        ALPHAMODE?
1293 1646          673 GONC    PATCH8 (1735)        NO.
1294       P8RTN
1295                   ENTRY   STOPS                ERROR CALLS STOPS
1296 1647 STOPS   1670 C=REGN 14                   RETRIEVE SS 0
1297 1650         1530 ST=C
1298                   ENTRY   STOPSB
1299       STOPSB                                   STOP SUBROUTINE
1300                                                STOP A RUNNING OR PAUSING
1301                                                USER PROGRAM
1302                                                ON ENTRY, SS 0 UP
1303                                                USES 1 SUBROUTINE LEVEL
1304                                                AND C. LEAVES CHIP 0
1305                                                SELECTED.
1306 1651         1404 S1=    0                    CLEAR PAUSEFLAG
1307 1652            1 GOSUB  STOST0
1307 1653            0
1308                   ENTRY   PSESTP
1309       PSESTP                                   ENTER FROM PAUSE FCN
1310 1654         1304 S13=   0                    CLEAR RUNNING FLAG
1311 1655         1740 RTN
*
*
*
1315 1656 ALPDEF   660 C=STK                       GET RIGHT DEF
1316 1657         1032 C=C+A  M
1317 1660         1460 CXISA                       GET LOW 10 BITS
1318 1661         1346 ? C#0  X                    IF ZERO DONE CAT
1319 1662          433 GONC   QUTCAT (1725)
1320 1663           34 PT=    3
1321 1664          120 LC     1                    BUILD ADR IN ROM 4
1322 1665          674 RCR    11                   MOVE TO MANTISSA
1323 1666 END2     256 AC EX                       SAVE IN A
1324 1667            1 GOSUB  CLLCDE               ENABLE AND CLEAR LCD
1324 1670            0
1325 1671          256 AC EX
1326 1672            1 GOSUB  PROMF2
1326 1673            0
1327 1674            1 GOSUB  LEFTJ                LEFT JUSTIFY STRING
1327 1675            0
1328 1676 END3       1 GOSUB  ENCP00               TURN OFF LCD
1328 1677            0
1329 1700            1 GOSUB  BLINK
1329 1701            0
1330 1702         1535 CON    @1535                SEND DISPLAY TO PRINTER
1331 1703          674 CON    @674                 GOSUB PRT12
1332 1704            1 GOSUB  RSTANN
1332 1705            0
1333 1706          114 ?S4=1                        SINGLE STEP?
1334 1707            1 GOLNC  CNTLOP               IF RUNNING CAT CONTINUE
1334 1710            2
1335 1711 CLCTMG 1670 C=REGN 14                     SET STATUS FOR RTN TO KBD
1336 1712         1530 ST=C
1337 1713          210 S5=    1
1338 1714         1630 C=ST
1339 1715          574 RCR    6
1340 1716         1530 ST=C
```

```
1341 1717          1410 S1=     1
1342 1720 KBD      1630 C=ST
1343 1721           474 RCR     8
1344 1722          1650 REGN=C  14
1345 1723             1 GOLONG  NFRKB
1345 1724             2
1346 1725 OUTCAT   1670 C=REGN  14              CATALOG FINISH
1347 1726          1530 ST=C
1348 1727           204 S5=     0
1349 1730          1630 C=ST
1350 1731           574 RCR     6
1351 1732          1530 ST=C
1352 1733          1404 S1=     0
1353 1734          1643 GOTO    KBD    (1720)
*
* PATCH8 - POST-RELEASE FIX TO AVOID PUTTING THE ALPHAREG TO THE LCD
* AND SETTING MSGFLAG WHEN PROMPT IS EXECUTED IN ALPHAMODE.  THIS IS
* DESIRABLE BECAUSE THE ALPHAREG IS THE DEFAULTDISPLAY IN ALPHAMODE.
*
1359 1735 PATCH8      1 GOSUB   ARGOUT          PUT ALPHAREG TO LCD
1359 1736             0
1360 1737             1 GOSUB   STMSGF          SET MSGFLG
1360 1740             0
1361 1741          1063 GOTO    P8RTN  (1647)
*
* PATCH4 - THIS POST-RELEASE PATCH SPEEDS UP THE EXECUTION OF THE
*          RUN PORTION OF R/S
*
1366                    ENTRY   PACH4
1367 1742 PACH4    460 LDI                     SET UP 100MS WAIT
1368 1743           247 CON     167
1369 1744 PTCH4A  1710 RST KB                  IS THE KEY STILL DOWN?
1370 1745         1714 CHK KB
1371 1746            1 GOLNC   XRS45           NO, GO RUN!
1371 1747            2
1372 1750         1146 C=C-1   X               TIME OUT OVER?
1373 1751         1733 GONC    PTCH4A (1744) NO, KEEP CHECKING THE KEY
1374 1752            1 GOLONG .LINNUM          DISPLAY THE STARTING STEP
1374 1753            2
*
* PACH10 - POST RELEASE PATCH TO FIX A BUG IN "SF IND NN"
*
1378                    ENTRY   PACH10
1379 1754 PACH10     1 GOSUB   BCDBIN
1379 1755            0
1380 1756         1366 ? C#0   XS              ADDR>255?
1381 1757            1 GOLC    ERRNE           YES
1381 1760            3
1382 1761         1034 PT=     2               RESTORE 1ST BYTE
1383 1762          230 C=G                       OF FC TO C3:2
1384 1763            1 GOLONG  P10RTN
1384 1764            2
*
* PACH11 - POST-RELEASE FIX TO DISPLAY DRIVER SYNCHRONIZATION
* PROBLEM, 3/26/79.  THE TWO DISPLAY DRIVER CHIPS RE-SYNCHRONIZE
* EACH TIME THE CPU COMES WIDE AWAKE, NO MATTER WHETHER FROM LIGHT
* SLEEP OR DEEP SLEEP.  EACH TIME THE C REGISTER CONTAINS BOTH ONES
* AND ZEROES, THE DISPLAY DRIVERS SORT THEMSELVES OUT.  THIS PROCESS
* CONTINUES UNTIL A DISPLAY READ INSTRUCTION IS EXECUTED.  HOWEVER,
* IF THE DATA LINE FLOATS WHILE THE DISPLAY DRIVERS ARE TRYING TO
```

```
* SORT THEMSELVES OUT, AND IF THE LEVEL ON THE DATA LINE DRIFTS,
* THE DISPLAY DRIVERS MAY GET CONFUSED AND TANK THE SYSTEM.
* THIS PATCH ENSURES THAT THE DISPLAY DRIVERS GET SYNCHRONIZED AND
* THEN DISABLE THE SYNCHRONIZATION LOGIC BEFORE ANY MICROCODE
* FLOATS THE DATA LINE (AS BY READING FROM A NON-EXISTENT DATA
* STORAGE CHIP IN CHKADR OR FNDEND).
*
  1400                    ENTRY  PACH11
  1401 1765 PACH11   460 LDI
  1402 1766         1375 CON2   47     13
  1403 1767         1160 DADD=C                ENABLE NON-EXISTENT DATA CHIP 2FD
  1404 1770         1760 PFAD=C                ENABLE DISPLAY
  1405 1771          270 FLLDC                 NON-DESTRUCTIVE READ
  1406 1772            1 GOLONG.MEMCHK
  1406 1773            2
*
* PACH12 - POST RELEASE FIX TO DECOMPILE ON WAKEUP WHEN MACHINE GOES
* TO SLEEP IN PROGRAM MODE.  DRC 10/20/79
*
  1411                    ENTRY  PACH12
  1412 1774 PACH12   106 C=0    X
  1413 1775         1650 REGN=C 14
  1414 1776            1 GOLONG.DECMPL
  1414 1777            2
  1415                    FILLTO END
  1416                    END

  ERRORS :       0
```

SYMBOL TABLE

```
ADRFCH     4   -
ADRGSB   114   -   111   56
ALLOK   1315   -  1306
ALPDEF  1656   -
AVWI0   1552   -  1547
BCDBIN  1343   -
BIGBRC   117   -   163
CHKRPC  1042   -
CLCTMG  1711   -
COLDST  1062   -  1034 1021  763
CONFLG  1301   -  1273
DATOFF  1620   -
DBL     1330   -  1332
DROPST   344   -   336
DROWSY   540   -   472
DRSY05   541   -
DRSY10   552   -   546
DRSY20   560   -   553
DRSY25   563   -   626  557  551  544
DRSY26   567   -   570
DRSY30   573   -   564
DRSY50   620   -   671
DRSY51   624   -
DRWSYL   472   -   407
DSWKUP   655   -
END2    1666   -
END3    1676   -
ERRIGN   273   -   343  325
ERRNE   1340   -  1367 1314 1310
ERROF    242   -   274
FCHRTN    40   -    27
FILLXL   352   -   326  320  261
FILLY    256   -   272
FLAGS   1271   -  1264 1261
GBYTR0   524   -   500
GBYTR1   521   -   501
GBYTR2   516   -   502
GBYTR3   513   -   503
GBYTR4   510   -   504
GBYTR5   505   -
GOTINT  1370   -  1364 1360
GTAI10  1420   -  1412 1410
GTAI20  1473   -  1461
GTAI22  1462   -  1427
GTAI26  1432   -
GTAI30  1441   -  1450
GTAI40  1501   -  1421
GTAI50  1511   -  1503
GTAI55  1513   -  1510
GTAI60  1520   -  1531
GTAI70  1532   -  1521
GTAINC  1404   -
IGNKEY   433   -   426
ILOOP   1125   -  1132
INCG1   1213   -  1210
INCG2   1225   -  1215
```

```
INCG3   1243  -  1226
INCGT2  1206  -
INTINT  1373  -
IOSERV   404  -   401
KBD     1720  -  1734
LOWBRT   400  -   372  370
LSWKUP   600  -
MATH     213  -   205
MEMCHK  1005  -
MSGDLY  1574  -
NEXROM   465  -   443
NFRC     361  -   311  305  301
NFRENT   304  -
NFRFST   367  -
NFRKB    307  -
NFRKB1   306  -
NFRNC    245  -
NFRNIO   406  -   403
NFRPR    356  -
NFRPU    360  -
NFRSIG   302  -
NFRX     314  -   312
NFRXY    332  -
NOPRT    533  -   530
NXBEND   527  -   523  520  515  512  507  464
NXROM1   526  -   471
NXTBT1   456  -   446
OFFXFR   653  -
OVRSTK    30  -    45   21   17   15
P10RTN  1254  -
P8RTN   1647  -  1741
PACH10  1754  -
PACH11  1765  -
PACH12  1774  -
PACH4   1742  -
PATCH8  1735  -  1646
PAUS10   634  -   643
PAUSLP   627  -   577
PCTOC    327  -
PR10RT  1562  -
PSESTP  1654  -
PSTDBL  1331  -  1327
PTCH4A  1744  -  1751
QUTCAT  1725  -  1662
REGADR   105  -   101
ROW10   1246  -
ROW7     177  -
ROWTBL   140  -
RST05    233  -
RST10    235  -   240
RSTKB    230  -   232
RSTMS0  1616  -
RSTMS1  1620  -
RSTMS2  1635  -  1603
RSTMSC  1622  -  1615
RSTSEQ  1604  -
RSTSQ   1605  -
RUNING   410  -
RUNNK    435  -   411
SHF8    1324  -  1326
```

```
STMSGF  1576  -
STOPS   1647  -  1573
STOPSB  1651  -
STOSTO   473  -
TBLGBR   500  -
TONETC   161  -   113
TONSTF   124  -
WKUP10   604  -   613
WKUP20   646  -   635  605
WKUP21   647  -
WKUP25   672  -   663
WKUP30   716  -   730
WKUP40   717  -   736
WKUP50   737  -   726  720
WKUP60   764  -   753
WKUP70   765  -
WKUP80   777  -
X<>ROW    46  -
XAVIEW  1544  -
XBAD     262  -   251
XCUTB1   221  -
XCUTE    533  -
XCUTEB   220  -   200  176  150  147
XPRMPT  1640  -
XROW0     57  -   140
XROW1    164  -   141
XROW10    61  -   152
XROW11    63  -   153
XROW12    65  -   154
XROW13    67  -   155
XROW14    71  -   156
XROW2     73  -   142
XROW3     73  -   143
XROW4    206  -   144
XROW5    201  -   145
XROW6    201  -   146
XROW9    102  -   151
XVIEW   1557  -
XVIEWA  1564  -  1556
XVW10   1574  -  1567
YBAD     264  -   255
```

ENTRY TABLE

ADRFCH	4	-
ALLOK	1315	-
ALPDEF	1656	-
BCDBIN	1343	-
BIGBRC	117	-
CHKRPC	1042	-
CLCTMG	1711	-
COLDST	1062	-
DATOFF	1620	-
DROPST	344	-
DROWSY	540	-
DRSY05	541	-
DRSY25	563	-
DRSY50	620	-
DRSY51	624	-
DSWKUP	655	-
END2	1666	-
END3	1676	-
ERRIGN	273	-
ERRNE	1340	-
ERROF	242	-
FILLXL	352	-
GOTINT	1370	-
GTAI40	1501	-
GTAINC	1404	-
INCGT2	1206	-
INTINT	1373	-
LSWKUP	600	-
MEMCHK	1005	-
MSGDLY	1574	-
NFRC	361	-
NFRENT	304	-
NFRFST	367	-
NFRKB	307	-
NFRKB1	306	-
NFRNC	245	-
NFRNIO	406	-
NFRPR	356	-
NFRPU	360	-
NFRSIG	302	-
NFRX	314	-
NFRXY	332	-
NOPRT	533	-
P10RTN	1254	-
PACH10	1754	-
PACH11	1765	-
PACH12	1774	-
PACH4	1742	-
PR10RT	1562	-
PSESTP	1654	-
QUTCAT	1725	-
ROW10	1246	-
RST05	233	-
RSTKB	230	-
RSTMS0	1616	-
RSTMS1	1620	-

```
RSTMSC  1622   -
RSTSEQ  1604   -
RSTSQ   1605   -
RUNING   410   -
RUNNK    435   -
STMSGF  1576   -
STOPS   1647   -
STOPSB  1651   -
STOST0   473   -
TONSTF   124   -
WKUP10   604   -
WKUP21   647   -
WKUP25   672   -
WKUP70   765   -
WKUP80   777   -
X<>ROW    46   -
XAVIEW  1544   -
XCUTB1   221   -
XCUTE    533   -
XCUTEB   220   -
XPRMPT  1640   -
XROW1    164   -
XVIEW   1557   -
```

EXTERNAL REFERENCES

ADRFCH	114	127	1275
ADRFCH	115	130	1276
ANNOUT	376	541	624
ANNOUT	377	542	625
ARGOUT	555	1554	1735
ARGOUT	556	1555	1736
BCDBIN	42	131	1754
BCDBIN	43	132	1755
BIGBRC	1267	1336	
BIGBRC	1270	1337	
BLINK	1574	1700	
BLINK	1575	1701	
CHK#S	211		
CHK#S	212		
CHK#S2	214		
CHK#S2	215		
CHKADR	35		
CHKADR	36		
CLLCDE	1667		
CLLCDE	1670		
CNTLOP	1707		
CNTLOP	1710		
DECMPL	1776		
DECMPL	1777		
DERUN	170		
DERUN	171		
DFRST8	547		
DFRST8	550		
DSPCRG	561	1562	
DSPCRG	562	1563	
DSWKUP	2		
DSWKUP	3		
ENCP00	1616	1676	
ENCP00	1617	1677	
ENLCD	620	1111	
ENLCD	621	1112	
ERRAD	1345		
ERRAD	1346		
ERRDE	136		
ERRDE	137		
ERRNE	1757		
ERRNE	1760		
ERROR	242	1340	
ERROR	243	1341	
GETPCA	1504	1511	
GETPCA	1505	1512	
GTAINC	172		
GTAINC	173		
INCADA	1506		
INCADA	1507		
INCGT2	50	102	1246
INCGT2	51	103	1247
INTINT	1371		
INTINT	1372		
IORUN	404		
IORUN	405		

```
RSTMS0  1643
RSTSEQ   427
RSTSEQ   430
RTJLBL  1532
RTJLBL  1533
RUN      644  1003
RUN      645  1004
STMSGF  1564  1737
STMSGF  1565  1740
STOST0   374   574  1652
STOST0   375   575  1653
TEXT     157
TEXT     160
TONE7X  1000
TONE7X  1001
TONSTF   161
TONSTF   162
WKUP70  1204
WKUP70  1205
XCUTB1   122
XCUTB1   123
XGTO      67
XGTO      70
XROM    1255
XROM    1256
XRS45   1746
XRS45   1747
XXEQ      71
XXEQ      72

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @2000-3777
     3                    FILE   CN1B
     4                    ENTRY  LDSST0
     5                    ENTRY  OFSHFT
     6                    ENTRY  ANNOUT
     7                    ENTRY  ANN+14
     8                    ENTRY  RSTANN
     9                    ENTRY  AFORMT
    10                    ENTRY  BLANK
    11                    ENTRY  CHKFUL
    12                    ENTRY  CHRLCD
    13                    ENTRY  CPGMHD
    14                    ENTRY  DEROW
    15                    ENTRY  DERW00
    16                    ENTRY  DFILLF
    17                    ENTRY  DF060
    18                    ENTRY  DF150
    19                    ENTRY  DF160
    20                    ENTRY  DF200
    21                    ENTRY  DFKBCK
    22                    ENTRY  DFRST8
    23                    ENTRY  DFRST9
    24                    ENTRY  GENNUM
    25                    ENTRY  MEMLFT
```

```
    26                  ENTRY  PROMF1
    27                  ENTRY  PROMF2
    28                  ENTRY  PROMFC
    29                  ENTRY  ROMHED
    30                  ENTRY  ROMH05
    31                  ENTRY  ROMH35
    32                  ENTRY  RW0141
    33                  ENTRY  ROW120
    34                  ENTRY  ROW933
    35                  ENTRY  ROW940
    36                  ENTRY  RW0110
    37                  ENTRY  TXRW10
    38                  ENTRY  TXTROW
    39                  ENTRY  TXTSTR
    40                  ENTRY  XMSGPR
*
* ROW JUMP TABLE
*
    44    0          213 GOTO   ROW0    (  21)
    45    1          243 GOTO   ROW1    (  25)
    46    2          253 GOTO   ROW2    (  27)
    47    3          333 GOTO   ROW3    (  36)
    48    4          263 GOTO   ROW4-8  (  32)
    49    5          253 GOTO   ROW4-8  (  32)
    50    6          243 GOTO   ROW4-8  (  32)
    51    7          233 GOTO   ROW4-8  (  32)
    52   10          223 GOTO   ROW4-8  (  32)
    53   11          373 GOTO   ROW09   (  50)
    54   12          643 GOTO   ROW10   (  76)
    55   13          363 GOTO   ROW11   (  51)
    56   14          403 GOTO   ROW12   (  54)
    57   15          453 GOTO   RO1314  (  62)
    58   16          443 GOTO   RO1314  (  62)
    59   17            1 GOLONG TXTROW
    59   20            2
    60   21 ROW0      460 LDI
    61   22          317 CON2   12      15      PROMPT STRING IN C,F
    62   23 ROW010   646 A=A-1  X               OPERAND MINUS ONE
    63                   LEGAL
    64   24          143 GOTO   DF120   (  40)
    65   25 ROW1       1 GOLONG DEROW           THIS IS A DIGIT ENTRY ROW
    65   26            2
    66   27 ROW2      460 LDI
    67   30          220 CON2   9       0       PROMPT STRING IN 9,0
    68   31           73 GOTO   DF120   (  40)
    69   32 ROW4-8     1 GOSUB  PROMFC
    69   33            0
    70   34            1 GOLONG DF150
    70   35            2
    71   36 ROW3      460 LDI
    72   37          221 CON2   9       1       PROMPT STRINE IN 9,1
    73   40 DF120      2 A=0    PT              A(1) _ 0
    74   41          206 B=A    X               SAVE THE OPERAND IN B
    75   42          406 A=C    X
    76   43            1 GOSUB  PROMFC          OUTPUT PROMPT STRING
    76   44            0
    77   45          146 AB EX  X               A.X _ OPERAND
* NEXT INSTRUCTION (S0=0) MAY NOT BE NECESSARY.
    79   46         1604 S0=    0               SAY TWO DIGITS OPERAND
    80   47          743 GOTO   ROW931 ( 143)
```

```
     81    50 ROW09    563 GOTO    ROW9    ( 126)
     82    51 ROW11    460 LDI
     83    52          320 CON2    13      0       PROMPT STRING IN 13,0
     84    53         1503 GOTO    ROW010 (  23)
     85    54 ROW12    460 LDI
     86    55          316 CON2    12      14
     87    56         1406 ? A<C   X                IS IF LBLNN ?OR X<>NN?
     88    57          543 GONC    ROW910 ( 133) YES
     89    60            1 GOLONG: ROW120
     89    61            2
     90    62 RO1314  1634 PT=     0
     91    63            2 A=0     PT
     92    64            1 GOSUB   PROMFC
     92    65            0
     93    66            1 GOSUB   NBYTA0          SKIP ONE BYTE(THREE BYTE FC)
     93    67            0
     94    70            1 GOSUB   NXTBYT
     94    71            0
     95    72         1730 CST EX
     96    73         1204 S7=     0
     97    74         1730 CST EX
     98    75          433 GOTO    ROW930 ( 140)
     99    76 ROW10    460 LDI
    100    77          250 CON2    10      8       TEST FOT XECROM FC
    101   100         1406 ? A<C   X                IS IT A XECROM FC ?
    102   101            1 GOLC    XECROM          YES
    102   102            3
    103   103          460 LDI
    104   104          256 CON2    10      14
    105   105         1406 ? A<C   X                IS IT A XEQ/GTO IND ?
    106   106          257 GOC     ROW910 ( 133) NO
    107   107            1 GOSUB   NBYTAB          GET OPERAND
    107   110            0
    108   111         1730 CST EX
    109   112            1 GOSUB   ENLCD
    109   113            0
    110   114         1214 ?S7=1                    IS IT A XEQ ?
    111   115           43 GONC    *+4     ( 121) NO
    112   116          460 LDI
    113   117          340 CON2    14      0       LOAD XEQ FC
    114   120           33 GOTO    *+3     ( 123)
    115   121          460 LDI
    116   122          320 CON2    13      0       LOAD GTO FC
    117   123            1 GOSUB   PROMF1
    117   124            0
    118   125          223 GOTO    ROW933 ( 147)
*
* NUMERICAL OPERAND
* ROW 9
*
    123   126 ROW9    1610 S0=     1
    124   127          460 LDI
    125   130          234 CON2    9       12       TEST FOR 1 OR 2 DIGIT OPERAND
    126   131         1406 ? A<C   X                1 DIGIT OPERAND ?
    127   132           23 GONC    *+2     ( 134) YES
*
* NUMERICAL OPERAND
* B[3:0] HAS ADDR POINT TO ONE BYTE BEFORE OPERAND
* IF S0=1 MEANS 1 DIGIT OPERAND
* IF S0=0 MEANS 2 DIGITS OPERAND
```

```
*
   134   133 ROW910 1604 S0=     0
   135   134           1 GOSUB   PROMFC          PROMPT THE FUNCTION FIRST
   135   135           0
   136   136           1 GOSUB   NBYTA0          LOAD OPERAND
   136   137           0
   137   140 ROW930  406 A=C     X               SAVE OPERAND IN A TEMP.
   138   141           1 GOSUB   ENLCD           ENABLE LCD CHIP
   138   142           0
   139   143 ROW931  246 AC EX   X               LOAD OPERAND BACK TO C.X
   140   144        1730 CST EX                  MOVE OPERAND TO STATUS BITS
   141   145        1214 ?S7=1                   INDIRECT ?
   142   146         163 GONC   ROW935 ( 164) NO
   143   147 ROW933 1204 S7=     0
   144   150        1730 CST EX
   145   151        1604 S0=     0               TWO DIGITS OPERAND
   146   152         346 BC EX  X
   147   153           1 GOSUB   MESSL
   147   154           0
   148   155          11 CON     9               I
   149   156          16 CON     14              N
   150   157        1004 CON     @1004           D
   151   160           1 GOSUB   BLANK           OUTPUT A BLANK
   151   161           0
   152   162         146 AB EX   X
   153   163          33 GOTO    ROW936 ( 166)
   154   164 ROW935 1730 CST EX
   155   165         406 A=C     X               A.(1:0) _ OPERAND
   156   166 ROW936   26 A=0     XS
   157   167         460 LDI
   158   170         146 CON     102
   159   171        1406 ? A<C   X               NUMERICAL OPERAND ?
   160   172         153 GONC    ROW940 ( 207) NO
   161   173          36 A=0     S
   162   174         576 A=A+1   S
   163   175        1614 ?S0=1                   1 DIGIT NUMERICAL OPERAND ?
   164   176          27 GOC     *+2     ( 200) YES
   165   177         576 A=A+1   S
   166                     LEGAL
   167   200           1 GOSUB   GENNUM          OUTPUT OPERAND
   167   201           0
*
* DFILLF EXIT POINT
*
   171   202 DF150  1414 ?S1=1                   DISPLAY FULL ?
   172   203           1 GSUBNC.LEFTJ            NO, LEFT JUSTIFY
   172   204           0
   173   205 DF160     1 GOLONG.LDSST0           ENABLE CHIP 0
   173   206           2
   174                                           % PUT UP SS0
   175   207 ROW940  460 LDI
   176   210         160 CON     112
   177   211        1406 ? A<C   X               CAPITAL A,B,C,D,E ?
   178   212         307 GOC     CAPABC ( 242) YES
   179   213        1546 ? A#C   X               IS IT A T'S ?
   180   214         213 GONC    RT      ( 235) YES
   181   215         460 LDI
   182   216         164 CON     116
   183   217        1546 ? A#C   X                IS IT A LSTX ?
   184   220         323 GONC    RL      ( 252) YES
```

```
   185  221          1406 ? A<C   X              IS IT SMALL A,B,C,D,E ?
   186  222           233 GONC    SMLABC ( 245) YES
   187  223           460 LDI                   IT IS A X,Y OR Z
   188  224           161 CON     113           BUT IN THE REVERSE ORDER
   189  225          1106 C=A-C   X
   190  226          1474 RCR     1             C.S _ OFFSET
   191  227           460 LDI
   192  230            32 CON     26            LOAD A Z'S
   193  231 ROW945   1176 C=C-1   S
   194  232            67 GOC     ROW960 ( 240)
   195  233          1146 C=C-1   X
   196                    LEGAL
   197  234          1753 GOTO    ROW945 ( 231)
*
   199  235 RT        460 LDI
   200  236           134 CON     92
   201  237 ROW950   1106 C=A-C   X
   202                    LEGAL
   203  240 ROW960   1750 SLSABC
   204  241          1413 GOTO    DF150  ( 202)
   205  242 CAPABC    460 LDI
   206  243           145 CON     101
   207  244          1733 GOTO    ROW950 ( 237)
   208  245 SMLABC    460 LDI
   209  246           172 CON     122
   210  247          1106 C=A-C   X
   211  250          1066 C=C+1   XS
   212                    LEGAL
   213  251          1673 GOTO    ROW960 ( 240)
   214  252 RL        460 LDI
   215  253           150 CON     104
   216  254          1633 GOTO    ROW950 ( 237)
*
*
* ROW 1 - INCLUDING DIGIT ENTRY AND AGTO, AXEQ
* A[2:0] HAS THE FUNCTION CODE. B[3:0] POINTING 1ST BYTE OF
* DIGIT ENTRY STRING, IF ITS A DIGIT ENTRY FC.
*
   223       DEROW
   224  255           460 LDI
   225  256            35 CON2    1       13
   226  257          1406 ? A<C   X              IS IT A DIGIT ENTRY FC ?
   227  260           713 GONC    RW0110 ( 351) NO, EITHER AGTO OR AXEQ
   228  261           473 GOTO    DERW70 ( 330)
*
* DIGIT ENTRY START HERE
*
   232  262 DERW00    460 LDI
   233  263            32 CON2    1       10
   234  264          1406 ? A<C   X              IS IT A DIGIT ?
   235  265           317 GOC     DERW50 ( 316) YES
   236  266          1546 ? A#C   X              IS IT A D.P.?
   237  267           147 GOC     DERW10 ( 303) NO
   238  270          1670 FRSABC
   239  271          1730 CST EX
   240  272           510 S6=     1              SET D.P.
   241  273           534 PT=     6              CHECK FOR EUROPEAN NOTATION
   242  274           242 AC EX   PT
   243  275           742 C=C+C   PT
   244  276            27 GOC     DERW05 ( 300)
```

```
 245  277          1210 S7=     1                SET COMMA
 246  300 DERW05   1730 CST EX
 247  301          1750 SLSABC
 248  302           213 GOTO    DERW60 ( 323)
 249  303 DERW10   1046 C=C+1   X
 250  304          1546 ? A#C   X                IS IT A EEX ?
 251  305            67 GOC     DERW20 ( 313) NO
 252  306             1 GOSUB   BLANK
 252  307             0
 253  310           460 LDI
 254  311             5 CON     @05              "E"
 255  312            73 GOTO    DERW55 ( 321)
 256  313 DERW20    460 LDI                      IT GOT BE A CHS
 257  314            55 CON     @55
 258  315            43 GOTO    DERW55 ( 321)
 259  316 DERW50    246 AC EX   X
 260  317          1434 PT=     1
 261  320           320 LC      3
 262  321 DERW55      1 GOSUB   CHRLCD
 262  322             0
 263  323 DERW60      1 GOSUB   NBYTA0            ENABLE CHIP 0
 263  324             0
 264                                             & GET NEXT BYTE
 265  325           156 AB EX                     PUT THE PCMPTR BACK TO B
 266  326           126 C=0     XS
 267  327           406 A=C     X                 A.X _ NEXT BYTE
 268  330 DERW70      1 GOSUB   ENLCD
 268  331             0
 269  332           460 LDI
 270  333            35 CON2    1       13
 271  334          1434 PT=     1
 272  335          1542 ? A#C   PT                IS THIS BYTE A ROW 1 FC ?
 273  336            37 GOC     DF190   ( 341) NO
 274  337          1406 ? A<C   X                 IS IT A DIGIT ENTRY FC ?
 275  340          1227 GOC     DERW00  ( 262) YES
 276  341 DF190     414 ?S8=1                     PROMPT ?
 277  342            53 GONC    DF200   ( 347) NO
 278  343           460 LDI
 279  344            37 CON     @37
 280  345             1 GOSUB   CHRLCD
 280  346             0
 281  347 DF200       1 GOLONG  DF150
 281  350             2
 282  351 RW0110   1746 A SL     X                CONVERT FC FROM 1D TO D0
 283  352            26 A=0     XS                       OR FROM 1E TO E0
 284  353             1 GOSUB   PRGMFC
 284  354             0
 285  355             1 GOSUB   NBYTA0
 285  356             0
 286  357           156 AB EX
 287  360 RW0140    406 A=C     X
 288  361 RW0141    404 S8=     0
*
* TXTSTR - TEXT STRING
* A[0] HAS THE LENGTH OF THE STRING. B[3:0] POINTING ONE BYTE
* BEFORE 1ST CHAR.
* IF S2=1 ALPHA STRING IS KNOWN IN ROM
* IF S2=0, STRING IS IN RAM
*
* TXTROM - SETS S2 AND DROPS INTO TXTSTR
```

```
*
* TXRW10 - IDENTICAL TO TXTSTR
*
* TXTROW - COPIES S10 (ROMFLAG) INTO S2 AND FALLS INTO TXTSTR
*
  302  362 TXTROW 1004 S2=     0
  303  363          314 ?S10=1                ROMFLAG?
  304  364           23 GONC   TXTSTR ( 366) NO
  305                   ENTRY  TXTROM
  306  365 TXTROM 1010 S2=     1              YES
  307      TXTSTR
  308  366 TXRW10 1434 PT=     1
  309  367            2 A=0    PT
  310  370          246 AC EX  X
  311  371          132 C=0    M
  312  372          126 C=0    XS
  313  373          674 RCR    11
  314  374          432 A=C    M              A.M _ CHAR COUNTER
  315  375            1 GOSUB  ENLCD
  315  376            0
  316  377         1670 FRSABC
  317  400          460 LDI
  318  401          407 CON    @407
  319  402         1750 SLSABC
  320  403 TXRW30   672 A=A-1  M              ALL DONE ?
  321  404         1357 GOC    DF190  ( 341) YES
  322  405          156 AB EX  W
  323  406            1 GOSUB  ENCP00
  323  407            0
  324  410           34 PT=    3              SET UP FOR NXBYTA
  325  411         1014 ?S2=1                 ROM?
  326  412            1 GSUBC  NXBYTO         YES
  326  413            1
  327  414         1014 ?S2=1                 SAME QUESTION
  328  415            1 GSUBNC NXBYTA         NO
  328  416            0
  329  417          156 AB EX
  330  420          406 A=C    X              A.X _ CHAR
  331  421            1 GOSUB  ENLCD
  331  422            0
  332  423          246 AC EX  X
  333  424            1 GOSUB  ASCLCD
  333  425            0
  334  426            1 GOSUB  CHKFUL          SEE IF LCD FULL
  334  427            0
  335  430         1533 GOTO   TXRW30 ( 403)
*
  337  431 ROW120   156 AB EX
  338  432            1 GOSUB  INCAD
  338  433            0
  339  434            1 GOSUB  NXTBYT         LOAD OPERAND
  339  435            0
  340  436          216 B=A    W              SAVE PC IN B
  341  437          406 A=C    X
  342  440            1 GOSUB  ENLCD
  342  441            0
  343  442         1434 PT=     1
  344  443          542 A=A+1  PT             IS IT LBL ?
  345  444          163 GONC   ROW122 ( 462) NO, ITS A END
  346  445          460 LDI
```

```
 347  446          317 CON2   12      15      LOAD LBL FC
 348  447            1 GOSUB  PROMF1          PROMPT THE FUNCTION
 348  450            0
 349  451            1 GOSUB  ENCP00          ENABLE CHIP 0
 349  452            0
 350  453          156 AB EX
 351  454            1 GOSUB  INCAD
 351  455            0
 352  456          156 AB EX
 353  457          656 A=A-1                  CHAR COUNTER -1 (SKIP KC)
 354                   LEGAL
 355  460            1 GOLONG RW0141
 355  461            2
 356  462 ROW122   252 AC EX   WPT
 357  463         1142 C=C-1   PT             RESTORE THE "END"
 358  464         1530 ST=C
 359  465          460 LDI
 360  466          300 CON2   12      0       PROMPT "END"
 361  467            1 GOSUB  PROMF1
 361  470            0
 362  471          314 ?S10=1                 ARE WE IN ROM ?
 363  472          357 GOC    ROW125 ( 527) YES, PROMPT "END" ONLY
 364  473          214 ?S5=1                  FINAL END ?
 365  474          333 GONC   ROW125 ( 527) NO
 366  475         1340 DISOFF
 367  476         1670 RABCR
 368  477         1670 RABCR
 369  500          460 LDI
 370  501          104 CON    @104
 371  502         1750 SLSABC
 372  503            1 GOSUB  REGLFT
 372  504            0
 373  505          406 A=C    X
 374  506           36 A=0    S
 375  507            1 GOSUB  ENLCD
 375  510            0
 376  511            1 GOSUB  GENNUM
 376  512            0
 377  513          460 LDI
 378  514           40 CON    @40
 379  515         1750 SLSABC
 380  516         1770 RABCL                 READ IN LEFT MOST CHAR
 381  517         1634 PT=     0
 382  520         1342 ? C#0   PT            IS IT A BLANK ?
 383  521           23 GONC    *+2    ( 523) YES, THROW IT AWAY
 384  522         1650 SRSABC                IS AN "E", PUT IT BACK
 385  523          460 LDI
 386  524          140 CON    @140           LOAD A DOT
 387  525         1650 SRSABC                SHIFT IN LEFT END
 388  526         1440 DISTOG
 389  527 ROW125  1404 S1=     0
 390  530          523 GOTO   DF040  ( 602)
*
* DFILLF _ DISPLAY ONE PROGRAM STEP
*
* CALLING SEQUENCE:
*          PGMPTR _ POINT TO LAST BYTE OF PREVIOUS STEP
*          GOSUB  DFILLF
*          IF PRIVATE, DISPLAY "PRIVATE" AND RETURN
*          ELSE DISPLAY ONE LINE OF PROGRAM MEMORY
```

```
* FOUR ENTRY POINTS :
* 1. DFILLF - NORMAL ENTRY
* 2. DFRST9 - RESET S9 REMEMBER KEYBOARD NOT BEEN RESET YET
*             RESET S8 SAY NO PROMPT & SCROLL
* 3. DFRST8 - ONLY RESET S8
* 4. DFKBCK - SPEND APPROXIMATELY 100 MILLISEC CHECKING FOR
*             KEY UP BEFORE DROPPING INTO DFRST9
* USED S0,S1,S2, A,B,C. ASSUMED NOTHING.
* NOT TRUE! CALLS LINNUM.  SEE COMMENTS ON LINNUM.
* USES AT LEAST TWO SUBROUTINE LEVELS
* RETURN WITH CHIP ENABLE & STATUS SET TO ENABLE
* EXCEPT ON THE KEY UP PATH OUT OF DFKBCK THE CHIP ENABLE AND
* STATUS SET ARE UNCHANGED.
*
  413  531 DFKBCK  460 LDI
  414  532          310 CON    200
  415  533         1110 S9=    1              ASSUME KB WILL BE RESET
  416  534 DF010   1710 RST KB
  417  535         1714 CHK KB
  418  536         1640 RTN NC
  419  537         1146 C=C-1  X
  420  540         1743 GONC   DF010  ( 534)
  421  541 DFRST9  1104 S9=    0              SAY KEYBOARD NOT RESET YET
  422  542 DFRST8   404 S8=    0              SAY NO PROMPT, SCROLLING
  423  543 DFILLF  1404 S1=    0              SAY LCD NOT FULL YET
  424  544         1604 S0=    0              ASSUME 2D OPERAND
  425  545            1 GOSUB  ENCP00
  425  546            0
  426  547            1 GOSUB  LINNUM         LOAD LINE #
  426  550            0
  427  551          406 A=C    X              A.X _ LINE #
  428  552          206 B=A    X              SAVE LINE # IN B.X
  429  553         1514 ?S12=1                 PRIVATE?
  430  554           53 GONC   DF030  ( 561) NOT PRIVATE
  431  555 XMSGPR    1 GOSUB  MSG
  431  556            0
  432  557            0 XDEF   MSGPR          SAY PRIVATE
  433  560          223 GOTO   DF040  ( 602)
  434  561 DF030     1 GOSUB  CLLCDE
  434  562            0
  435  563           36 A=0    S
  436  564            1 GOSUB  GENNUM         OUTPUT LINE #
  436  565            0
  437  566         1306 ? B#0  X              LINE# = 0 ?
  438  567          157 GOC    DF050  ( 604) NO
  439  570          314 ?S10=1                 ARE WE IN ROM
  440  571          117 GOC    DF040  ( 602) YES, NO PROMPT FOR LINE#=0
  441  572            1 GOSUB  REGLFT
  441  573            0
  442  574          406 A=C    X              A.X _ MEM LEFT
  443  575           36 A=0    S
  444  576            1 GOSUB  ENLCD
  444  577            0
  445  600            1 GOSUB  GENNUM
  445  601            0
  446  602 DF040     1 GOLONG DF150
  446  603            2
  447  604 DF050   460 LDI
  448  605           40 CON    @40
  449  606         1750 SLSABC                OUTPUT A BLANK
```

```
 450  607 DF060     1 GOSUB  ENCP00          ENABLE CHIP 0
 450  610           0
 451  611        1670 C=REGN 14              SET UP FOR D.P.(COMMA) CHECK
 452  612         416 A=C
 453  613           1 GOSUB  GETPC           LOAD PROGRAM POINTER
 453  614           0
 454  615 DF100     1 GOSUB  NXTBYT          NEXT BYTE
 454  616           0
 455  617        1434 PT=    1
 456  620        1352 ? C#0  WPT             IS IT A NULL ?
 457  621        1743 GONC   DF100  ( 615) YES, SKIP IT
 458  622         216 B=A                    SAVE THE PGMPTR IN B
 459  623         126 C=0    XS
 460  624         406 A=C    X               A.X _ FUNCTION CODE
 461  625        1074 RCR    2
 462  626         460 LDI                    JUMP TABLE START FROM
 463  627         100 CON    @100              QUAD 1
 464  630         374 RCR    10
 465  631         740 GOTOC
*
* REGLFT - PUSHES " REG " INTO LCD FROM RIGHT END & FALLS INTO
*     MEMLFT
* ASSUMES LCD ENABLED ON ENTRY
* SEE MEMLFT FOR EXIT CONDITIONS
* USES ONE ADDITIONAL SUBROUTINE LEVEL AND USES C[6:0] - SEE
*     MEMLFT FOR ADDITIONAL REGISTER USAGE
*
 474                 ENTRY  REGLFT
 475  632 REGLFT    1 GOSUB  MESSL
 475  633           0
 476  634          40 CON    32              BLANK
 477  635          22 CON    @22             R
 478  636           5 CON    5               E
 479  637           7 CON    7               G
 480  640        1040 CON    @1040           BLANK
*
* MEMLFT - COMPUTE HOW MANY UNUSED REG LEFT IN MEM
* ASSUME NOTHING.
* RETURN WITH # OF REG LEFT IN C[2:0] AND CHIP 0 ENABLED.
* USES A AND C. USES ONE ADDITIONAL SUBROUTINE LEVEL.
*
 487  641 MEMLFT    1 GOSUB  ENCP00
 487  642           0
 488  643        1570 C=REGN 13              LOAD CHAIN HEAD
 489  644         132 C=0    M
 490  645         416 A=C    W
 491  646         103 GOTO   MEMLF2 ( 656)
 492  647 MEMLF1 1146 C=C-1  X               POINT TO NEXT REG.
 493  650         416 A=C    W
 494  651        1160 DADD=C
 495  652          70 C=DATA                 LOAD THE REG.
 496  653        1356 ? C#0  W               ZERO IN IT ?
 497  654         107 GOC    MEMLF3 ( 664) NO, REACH END OF MEM
 498  655         572 A=A+1  M               COUNT 1
 499  656 MEMLF2  460 LDI
 500  657         300 CON2   12      0
 501  660        1546 ? A#C  X               REACH REG.(C,0) ?
 502  661          33 GONC   MEMLF3 ( 664) YES
 503  662         256 AC EX  W
 504  663        1643 GOTO   MEMLF1 ( 647)
```

```
   505  664 MEMLF3  256 AC EX
   506  665          74 RCR    3
   507  666        1740 RTN
*
* CHRLCD - OUTPUT A CHAR TO LCD AND CHECK SCROLLING
* IF S1=1 MEANS DISPLAY ALREADY FULL, THEN AFTER SENDING THE CHAR
* TO DISPLAY CHECK IF A DELAY IS REQUIRED BY CALLING SCROLL ROUTINE.
* THE LCD CODE IS EXPECTED IN C[2:0], ASSUMED LCD ENABLE.
* USES A,X, C    MAY SET S1,S9  MAY RTN VIA SCROL0
* MAY USE A SUBROUTINE LEVEL
*
   516  667 BLANK   460 LDI
   517  670          40 CON    @40           OUTPUT A BLANK
   518  671 CHRLCD 1750 SLSABC
   519  672 CHKFUL 1414 ?S1=1                 LCD ALREADY FULL ?
   520  673         127 GOC    CKFL10 ( 705) YES, DO DELAY BEFORE RETURN
   521  674         460 LDI
   522  675          40 CON    @40
   523  676         406 A=C    X
   524  677        1770 RABCL                 READ THE LEFT MOST CHAR
   525  700        1650 SRSABC                PUT IT BACK
   526  701         126 C=0    XS
   527  702        1546 ? A#C  X              IS IT A BLANK ?
   528  703        1640 RTN NC                YES, NO NEED FOR SCROLLING YET
   529  704        1410 S1=    1              REMEMBER LCD FULL
   530  705 CKFL10    1 GOLONG :SCROL0
   530  706          2
*
* PROMFC - OUTPUT A PROMPT STRING FOR A MICROCODE FUNCTION
*
* PROMFC ENTRY: A[1:0]=MAINFRAME FC, LCD NEED NOT BE ENABLED
* PROMF1 ENTRY: C[1:0]=MAINFRAME FC, LCD MUST BE ENABLED
* PROMF2 ENTRY: C[6:3]=XADR, LCD ENABLED
* ALL ENTRY POINTS USE C AND LEAVE S8=0 AND LCD ENABLED
* PROMFC AND PROMF1 LEAVE PT=2
* PROMFC USES A SUBROUTINE LEVEL TO CALL ENLCD
*
   541  707 PROMFC    1 GOSUB  ENLCD
   541  710          0
   542  711        246 C=A    X              C.X _ FC
   542  712        406
   543  713 PROMF1 1074 RCR    2
   544  714        460 LDI                   MAIN FUNCTION TABLE
   545  715         24 CON    @24             START FROM @12000
   546  716       1174 RCR    9
   547  717       1460 CXISA                 LOAD XADR
   548  720         34 PT=    3
   549  721        120 LC     1
   550  722        674 RCR    11
   551  723 PROMF2  410 S8=    1             INITIALIZE FINAL CHAR FLAG
   552  724 PMPT20 1172 C=C-1  M
   553  725       1460 CXISA                 GET CHARACTER
   554  726        126 C=0    XS
   555  727       1730 CST EX
   556  730        514 ?S6=1                 SPECIAL CHARACTER?
   557  731         33 GONC   PMPT30 ( 734) NO
   558  732       1066 C=C+1  XS             YES, SET BIT FOR DISPLAY CREG
   559  733        504 S6=    0
   560  734 PMPT30 1214 ?S7=1                 FINAL CHARACTER?
   561  735         33 GONC   PMPT40 ( 740)
```

```
   562  736          404 S8=     0              YES
   563  737         1204 S7=     0
   564  740 PMPT40 1730 CST EX
   565  741         1750 SLSABC                 PUT CHAR TO LCD
   566  742          414 ?S8=1                  MORE CHARS?
   567  743         1617 GOC     PMPT20 ( 724) YES
   568  744          460 LDI
   569  745           40 CON     @40
   570  746         1750 SLSABC                 OUTPUT A BLANK
   571  747         1740 RTN
*
* GENNUM - CONVERT A HEX NUMBER TO DECIMAL & OUTPUT TO LCD
* CALLING SEQUENCE:
*         A.X _ HEX NUMBER
*         A.S _ # OF OUTPUT DIGITS. IF A.S=0, # OF OUTPUT
*               DIGITS WILL BE:EITHER 2,3 OR 4.
*         IF OUTPUT TO LCD IS DESIRED, ENTER WITH LCD CHIP ENABLED.
*         IF LCD IS TO REMAIN UNCHANGED, ENTER WITH A NON-EXISTENT
*            DATA STORAGE CHIP (I.E. CHIP 1) ENABLED.
*         GOSUB  GENNUM
* LEAVES # OF DIGITS IN B.S
* LEAVES DIGIT STRING IN A.M LEFT-JUSTIFIED
* RETURNS ACTIVE POINTER=0 FOR HISTORICAL REASONS
* USED A,C,B[13]. DOESN'T CALL ANY SUBROUTINES.
* DOESN'T CHANGE WHICH CHIP (SLEEPER OR LCD) IS ENABLED.
*
   588  750 GENNUM  236 B=A     S
   589  751          116 C=0     W
   590  752         1240 SETDEC
   591  753          246 AC EX   X
   592  754          416 A=C     W
   593  755         1074 RCR     2              C(0) _ MOST SIGN. DIGIT
   594  756         1046 C=C+1   X              CONVERT IF TO DECIMAL
   595  757         1146 C=C-1   X
   596  760          756 C=C+C                  MULTIPLY IT BY 16
   597  761          756 C=C+C
   598  762          756 C=C+C
   599  763          756 C=C+C
   600  764         1746 A SL    X
   601  765          246 AC EX   X
   602  766         1074 RCR     2              C(0) _ SECOND DIGIT
   603  767         1046 C=C+1   X              CONVERT IT TO DECIMAL
   604  770         1146 C=C-1   X
   605  771         1006 C=A+C   X
   606  772          276 AC EX   S              A.S _ LEAST SIG. DIGIT
   607  773          756 C=C+C                  MULTIPLY 16
   608  774          756 C=C+C
   609  775          756 C=C+C
   610  776          756 C=C+C
   611  777            6 A=0     X
   612 1000          256 AC EX   W
   613 1001         1374 RCR     13             C(0) _ LEAST SIGN. DIGIT
   614 1002         1056 C=C+1                  CONVERT IT TO DECIMAL
   615 1003         1156 C=C-1
   616 1004         1016 C=A+C   W
   617 1005         1140 SETHEX
   618 1006         1336 ? B#0   S              OUTPUT DIGITS = 0 ?
   619 1007          167 GOC     GENN20 (1025) NO
   620 1010         1334 PT=     13
   621 1011          420 LC      4
```

```
622 1012          436 A=C     S              DETERMINE MIN. OUTPUT DIGITS
623 1013          174 RCR     4
624 1014         1376 ? C#0   S              NEEDS 4 DIGITS ?
625 1015          177 GOC     GENN40 (1034)  YES
626 1016         1374 RCR     13
627 1017          676 A=A-1   S
628 1020         1376 ? C#0   S              NEEDS THREE DIGITS ?
629 1021          137 GOC     GENN40 (1034)  YES
630 1022         1374 RCR     13
631 1023          676 A=A-1   S              TWO DIGITS
632                   LEGAL
633 1024          103 GOTO    GENN40 (1034)
634 1025 GENN20   176 A=B     S
634 1026          236
635 1027 GENN25   676 A=A-1   S
636 1030           37 GOC     GENN30 (1033)
637 1031         1474 RCR     1
638 1032         1753 GOTO    GENN25 (1027)
639 1033 GENN30   176 AB EX   S
640 1034 GENN40  1474 RCR     1              COPY DIGIT STRING TO A.M
641 1035          432 A=C     M
642 1036          236 B=A     S              COPY # OF DIGITS TO B.S
643 1037         1374 RCR     13             LEFT-JUSTIFY DIGIT STRING IN C
644 1040         1634 PT=     0              AS ADVERTISED FOR EXIT
645 1041 GENN55   676 A=A-1   S
646 1042         1540 RTN C
647 1043          460 LDI
648 1044            3 CON     3
649 1045         1374 RCR     13
650 1046         1750 SLSABC
651 1047         1723 GOTO    GENN55 (1041)
652                   EJECT
```

```
*
* AFORMT - FORMAT A NUMBER AND PUT IT TO ALPHA STRING
* CALLED BY ARCL, THE NUMBER IS EXPECTED IN B
* ASSUMED NOTHING. USED A,B,C. RETURN WITH CHIP 0 ENABLE.
* CALLED APPEND TO PUT THE CHAR IN ALPHA REG.
* CALLED FORMAT. 2 SUB LEVELS.
*
  660 1050 AFORMT  106 C=0    X
  661 1051        1160 DADD=C                ENABLE CHIP 0
  662 1052         316 C=B    W              LOAD THE NUMBER
  663 1053           1 GOSUB  FORMAT
  663 1054           0
  664 1055         404 S8=    0              ASSUME FIX MODE
  665 1056          24 ? PT=  3              FIX MODE ?
  666 1057          23 GONC   *+2    (1061) YES
  667 1060         410 S8=    1              SCI OR ENG MODE
  668 1061         256 AC EX                 LOAD DISPLAY REG.A
  669 1062         530 M=C                   SAVE IN M
  670 1063        1376 ? C#0  S              MANTISSA NEGATIVE ?
  671 1064           1 GSUBC  APND-          YES
  671 1065           1
  672 1066         340 SEL Q
  673 1067        1534 PT=    12             Q=12
  674 1070 AFMT10  340 SEL Q
  675 1071 AFMT11 1324 ? PT=  13             JUST DONE WITH EXP ?
  676 1072        1540 RTN C                 YES, WE ARE ALL DONE
  677 1073 AFMT12  320 LC     3
  678 1074        1734 INC PT
  679 1075         142 AB EX  PT
  680 1076        1402 ? A<C  PT             ENCOUNTER A BLANK ?
  681 1077         327 GOC    AFMT30 (1131) YES, END OF MANTISSA
  682 1100        1542 ? A#C  PT             IS IT A DIGIT ONLY ?
  683 1101         223 GONC   AFMT20 (1123) YES
  684 1102         142 AB EX  PT
  685 1103           1 GOSUB  APNDDG         OUTPUT THR DIGIT FIRST
  685 1104           0
  686 1105         340 SEL Q
  687 1106         302 C=B    PT
  688 1107         742 C=C+C  PT             IS A COMMA ?
  689 1110          43 GONC   *+4    (1114) NO, IS A D.P.
  690 1111         460 LDI
  691 1112          54 CON    @54            COMMA
  692 1113          33 GOTO   *+3    (1116)
  693 1114         460 LDI
  694 1115          56 CON    @56            D.P.
  695 1116        1724 DEC PT
  696 1117         240 SEL P
  697 1120           1 GOSUB  APND10
  697 1121           0
  698 1122        1463 GOTO   AFMT10 (1070)
  699 1123 AFMT20    1 GOSUB  APNDDG         OUTPUT THE DIGIT
  699 1124           0
  700 1125         340 SEL Q
  701 1126        1724 DEC PT
  702 1127        1024 ? PT=  2              END OF MANTISSA ?
  703 1130        1403 GONC   AFMT10 (1070) NOT YET
  704 1131 AFMT30  414 ?S8=1                 FIX MODE ?
  705 1132        1640 RTN NC                YES, ALL DONE
  706 1133        1434 PT=    1
```

```
   707 1134          630 C=M
   708 1135         1342 ? C#0  PT
   709 1136           27 GOC    *+2    (1140)
   710 1137         1724 DEC PT
   711 1140          240 SEL P
   712 1141          460 LDI
   713 1142          105 CON    @105          E
   714 1143            1 GOSUB  APND10
   714 1144            0
   715 1145          630 C=M
   716 1146         1366 ? C#0  XS             EXP NEGATIVE ?
   717 1147            1 GSUBC  APND-          YES
   717 1150            1
   718 1151         1173 GOTO   APMT10 (1070)
*
* APNDDG (INCLUDING APND-, APND10, APND20) HAS BEEN MOVED TO
* QUAD 0 TO FILL UP A HOLE THERE
*
*  ROMHED - LOCATE ROM HEAD ADDRESS
*- RETURNS THE ADDRESS OF THE BEGIN STATEMENT AT
*- THE START OF A PROGRAM IN ROM
*- IN:  CHIP 0 SELECTED
*- OUT: A[3:0]= ROM HEAD ADDRESS
*- USES: C[13:0], STATUS BIT 12, & A[3:0]
*-
*  ENTRY POINT- ROMH05
*- IN: PT= 3
*-     C[6:3]= ROM ADDRESS
   733
   734
   735
   736
   737
   738
   739
   740 1152 ROMHED   34 PT=     3              -
   741 1153         1470 C=REGN 12             GET PGMCTR
   742 1154 ROMH05   674 RCR    11             -
   743 1155         1504 S12=   0              -
   744 1156           23 GOTO   *+2    (1160) -
   745 1157 ROMH06  1172 C=C-1  M              FIND BEGIN STMT
   746 1160         1460 CXISA                 -
   747 1161         1166 C=C-1  XS             -
   748 1162         1757 GOC    ROMH06 (1157)  -
   749 1163         1166 C=C-1  XS             -
   750 1164         1737 GOC    ROMH06 (1157)  -
   751 1165         1166 C=C-1  XS             SET PRIVACY BIT
   752 1166           27 GOC    *+2    (1170)  -
   753 1167         1510 S12=   1              -
   754 1170 ROMH35   74 RCR    3              A[3:0]_HEAD ADDR
   755 1171          412 A=C    WPT            -
   756 1172         1740 RTN                   -
   757
   758
   759
   760
*  CPGMHD - CURRENT PROGRAM HEAD
*- RETURNS THE ADDRESS OF THE BEGIN STATEMENT IN
*- ROM AND THE ADDRESS OF THE FIRST STEP OF A
*- PROGRAM IN RAM
```

```
*- IN:  A[3:0]= PROGRAM COUNTER (MUST BE THE ADDRESS OF A LINK,
*              I.E., THE FIRST BYTE OF A GLOBAL LBL OR END)
*       NO PERIPHERAL ENABLED.
*-      PT= 3
*- OUT: A[3:0]= CURRENT PROGRAM HEAD ADDRESS
*-      PT= 3
*- USES: A[3:0], C[13:0], B[4:0]
*- USES: 1 SUBROUTINE LEVEL
   773
   774
   775
   776 1173 CPGMHD  314 ?S10=1                  ROMFLAG?
   777 1174          33 GONC   CPGM10 (1177) NOPE
   778 1175         252 AC EX  WPT              -
   779 1176        1563 GOTO   ROMH05 (1154) -
   780                   ENTRY  CPGM10          FOR CARD READER & PRINTER
   781 1177 CPGM10    1 GSBLNG:GTLINK           GET LINK
   781 1200           0
   782 1201 CPGM15 1346 ? C#0  X                CHAIN END?
   783 1202           1 GOLNC  FSTIN            YES
   783 1203           2
   784 1204           1 GSBLNG UPLINK           NO, TRAVERSE CHAIN
   784 1205           0
   785 1206        1076 C=C+1  S                ALPHA LBL?
   786 1207        1727 GOC    CPGM15 (1201) YES
   787 1210           1 GOLONG INCAD2           A[3:0]_HEAD ADDRESS
   787 1211           2
   788
   789
   790
   791
   792
   793
   794                ENTRY  ALCL00
   795                ENTRY  KEYOP
   796                ENTRY  RAK60
*
* KEYOP - KEYCODE OPERAND - PARSE LOGIC FOR ASSIGN FCN
*
   800      KEYOP                               ON ENTRY, CHIP 0 IS ON,
   801                                          PTR=1, C.X=H01F,
   802                                          A[1:0]=H1F
   803 1212           1 GOSUB  OFSHFT
   803 1213           0
   804 1214           1 GOSUB  ENLCD
   804 1215           0
   805 1216         460 LDI
   806 1217          40 CON    32
   807 1220        1750 SLSABC                  INSERT BLANK
   808 1221 KYOP10    1 GOSUB  NEXT1
   808 1222           0
   809                                          ON RETURN FROM NEXT, PT=1,
   810                                          LCD CHIP ON, SS PTEMP1 UP
   811                                          & B.X=" "
   812                                          & N[2:1]=LOGICAL KC(0-79)
   813                ENTRY  KYOPCK             FOR WAND 11/26/79
   814      KYOPCK
   815 1223           0 NOP                     BKARROW IS A LEGAL OPERAND
   816 1224         514 ?S6=1                   SHIFT KEY?
   817 1225         163 GONC   KYOP40 (1243) NO
```

```
   818 1226          260 C=N                         RETRIEVE LOGICAL KC TO C[2:1]
   819 1227          742 C=C+C   PT                  SHIFT ALREADY ON?
   820 1230           57 GOC     KYOP11 (1235) YES
   821 1231          460 LDI                         NO.
   822 1232           55 CON     45                  "-"
   823 1233         1750 SLSABC                       PUT HYPHEN TO LCD
   824 1234           23 GOTO    KY11A  (1236)
   825 1235 KYOP11  1670 RABCR                       SHIFT OFF HYPHEN
   826      KY11A
   827 1236            1 GOSUB   TOGSHF              TOGGLE THE SHIFT FLAG
   827 1237            0
   828 1240            1 GOSUB   ENLCD
   828 1241            0
   829 1242         1573 GOTO    KYOP10 (1221)
*
   831      KYOP40
   832 1243          460 LDI
   833 1244          303 CON2    12       3          HEX C3
   834 1245          416 A=C
   835 1246         1040 C=KEYS
   836 1247           74 RCR     3                   KC TO C[1:0]
   837 1250         1412 ? A<C   WPT                 KC>C3?
   838 1251           43 GONC    KYOP50 (1255) NO. LEGITIMATE KEY
   839 1252            1 GOSUB   BLINK               YES. USER,PRGM,OR ALPHA KEY
   839 1253            0
   840 1254         1453 GOTO    KYOP10 (1221)
*
   842      KYOP50
   843 1255          116 C=0
   844 1256         1040 C=KEYS
   845 1257           74 RCR     3
   846 1260          320 LC      3
   847 1261         1046 C=C+1   X
   848 1262         1750 SLSABC                       SEND ROW TO LCD
   849 1263          406 A=C     X                   COPY ASCII ROW TO A.X
   850 1264          460 LDI
   851 1265           64 CON     @64                 "4"
   852 1266          404 S8=     0                   ASSUME ROW#4
   853 1267         1546 ? A#C   X                   ROW#4?
   854 1270           27 GOC     KYOP60 (1272) YES, NOT "ENTER" ROW
   855 1271          410 S8=     1                   "ENTER" ROW
   856 1272 KYOP60   260 C=N                         RECOVER LOG KC TO C[2:1]
   857 1273         1706 C SR    X                   LOG KC TO C[1:0], 0 TO C[2]
   858 1274          406 A=C     X                   SAVE LOG KC IN A.X
   859 1275         1706 C SR    X                   LOG COL TO C[0]
   860 1276         1434 PT=     1
   861 1277          320 LC      3
   862 1300          414 ?S8=1                       "ENTER" ROW
   863 1301           33 GONC    KYOP70 (1304) NO
   864 1302         1342 ? C#0   PT                  A KEY TO THE RIGHT OF "ENTER"?
   865 1303           27 GOC     KYOP80 (1305) YES - DON'T INC COLUMN #
   866 1304 KYOP70  1042 C=C+1   PT                  INCREMENT COLUMN #
   867 1305 KYOP80  1750 SLSABC                       SEND COL TO LCD
   868 1306          546 A=A+1   X                   KC INTERNAL FORM (1-80)
   869                   LEGAL
   870 1307            1 GOLONG NULT#3
   870 1310            2
*
* ALCL00 - LOGIC TO MAP LOCAL ALPHA OPERANDS ONTO NUMERIC OPERANDS
*
```

```
 874       ALCL00
 875 1311           416 A=C                     CHARACTER TO A.[1:0]
 876                                            REMAINDER OF A IS ZERO
 877 1312           460 LDI
 878 1313           101 CON     @101            "A"
 879 1314          1406 ? A<C   X               CHAR<"A"?
 880 1315          1540 RTN C                   NOT LOCAL
 881 1316           460 LDI
 882 1317           113 CON     @113            "K"
 883 1320          1406 ? A<C   X               CHAR<"K"?
 884 1321           363 GONC    ALCL50 (1357) NO. TEST FOR LOWER CASE
 885 1322           460 LDI
 886 1323            45 CON     37              MAP 65 ONTO 102
 887 1324 ALCL10   1006 C=A+C   X
 888 1325          1374 RCR     13
 889 1326           346 BC EX   X               ARGUMENT TO B[2:1],
 890                                            FC TO C[1:0]
 891 1327          1434 PT=     1
 892 1330           412 A=C     WPT             FC TO A[1:0]
 893 1331           460 LDI
 894 1332            36 CON2    1        14     FC FOR AXEQ
 895 1333          1552 ? A#C   WPT             FC#AXEQ?
 896 1334            43 GONC    ALCL20 (1340) THIS IS AXEQ
 897 1335          1146 C=C-1   X               CONVERT AXEQ TO AGTO
 898 1336          1552 ? A#C   WPT             FC#AGTO?
 899 1337            67 GOC     ALCL30 (1345) NOT AGTO
 900 1340 ALCL20    374 RCR     10              NEW FC TO C[4:3]
 901 1341           416 A=C                     NEW FC TO A[4:3]
 902 1342           146 AB EX   X               MERGE ARGUMENT WITH
 903 1343             1 GOLONG: NLT020           IN A[4:1]
 903 1344             2
*
 905 1345 ALCL30    460 LDI
 906 1346           315 CON2    12       13     FC FOR ALBL
 907 1347          1552 ? A#C   WPT             FC#ALBL?
 908 1350            57 GOC     ALCL40 (1355) NOT ALBL.
 909 1351          1474 RCR     1
 910 1352          1076 C=C+1   S
 911 1353          1076 C=C+1   S               LBL NN FC (CF) TO C[0:13]
 912                    LEGAL
 913 1354          1643 GOTO    ALCL20 (1340)
*
 915 1355 ALCL40    146 AB EX   X               FC BACK TO B.X
 916 1356          1740 RTN
*
 918 1357 ALCL50    460 LDI                     TEST FOR LOWER CASE A...F
 919 1360           141 CON     @141            SMALL A
 920 1361          1406 ? A<C   X               CHAR<SMALL A?
 921 1362          1540 RTN C                   YES. NOT LOCAL
 922 1363           460 LDI
 923 1364           146 CON     @146            SMALL F
 924 1365          1406 ? A<C   X               CHAR<SMALL F?
 925 1366          1640 RTN NC                  NO. NOT LOCAL
 926 1367           460 LDI
 927 1370            32 CON     26              MAP 97 TO 123
 928 1371          1333 GOTO    ALCL10 (1324)
*
* ENTER HERE FROM PARSE NEWFCN LOGIC IN USER MODE WHEN THE
* BIT IN THE BIT MAP IS SET.
 932       RAK60                               BIT SET IN BIT MAP
```

```
   933 1372          260 C=N                     RECOVER KC FROM N
   934 1373         1474 RCR     1               SETUP
   935 1374          416 A=C                      FOR
   936 1375          546 A=A+1   X                -
   937 1376         1404 S1=     0                 GPCKC
   938 1377            1 GOSUB   GCPKC           FIND REASSIGNED FCN
   938 1400            0
   939 1401           14 ?S3=1                    RAM?
   940 1402          417 GOC     RAK100 (1443)   YES
   941 1403           34 PT=     3
   942 1404         1342 ? C#0   PT               XROM FC?
   943 1405           57 GOC     RAK70  (1412)   YES
   944 1406          416 A=C                      -
   945 1407           26 A=0     XS              MUST BE MAINFRAME
   946 1410            1 GOLONG  NAME4A
   946 1411            2
*
   948                  ENTRY   RAK70             FOR WAND XROM
* ENTRY POINT ADD FOR WAND ON 3-13-79
*
   951       RAK70                               XROM
   952 1412          160 N=C                     SAVE FC IN N
   953 1413            1 GOSUB   GTRNAD
   953 1414            0
* GTRNAD RETURNS XADR IN A[3:0]
   955 1415          123 GOTO    RAK90  (1427)   MISSING ROM
   956 1416          256 AC EX
   957 1417          730 NC EX                   PUT XADR TO M
   958 1420           14 ?S3=1                   USER LANGUAGE?
   959 1421           47 GOC     RAK80  (1425)   YES
   960 1422          260 C=N                     RETRIEVE FC FROM N
   961 1423            1 GOLONG  NAME4D
   961 1424            2
*
   963       RAK80                               ROM USER LANGUAGE
   964                                           XROM FC IN N[3:0]
   965                                           XADR IN M[3:0]
   966 1425         1010 S2=     1               STRING IN ROM
   967 1426          613 GOTO    NM44@X (1507)
*
   969 1427 RAK90      1 GOSUB   CLLCDE          MISSING ROM
   969 1430            0
   970 1431            1 GOSUB   XROMNF
   970 1432            0
   971 1433            1 GOSUB   ENCP00
   971 1434            0
   972 1435         1104 S9=     0               SAY ADDR UNKNOWN
   973 1436          260 C=N                     XROM TO C
   974 1437            1 GOSUB   STORFC
   974 1440            0
   975 1441            1 GOLONG  NM44@5
   975 1442            2
*
   977       RAK100                              RAM
   978 1443          530 M=C                     SAVE ADDR IN M
   979 1444         1635 CON     @1635           GOSUB PRT4
   980 1445          674 CON     @674             PRINT DATAENTRY, IF ANY
   981 1446          630 C=N                     RECOVER ADDRESS
   982 1447           34 PT=     3
   983 1450            1 GOSUB   GTLNKA          GET # OF CHARS
```

```
   983 1451            0
   984 1452         1374 RCR     13              # OF CHARS TO
   985 1453          436 A=C     S                A.S
   986 1454          676 A=A-1   S               SKIP OVER KEYCODE
   987 1455          676 A=A-1   S
   988                   LEGAL
   989 1456            1 GOSUB   NXBYT3          MOVE PTR TO KEYCODE
   989 1457            0
   990 1460          116 C=0                     INITIALIZE STRING
   991 1461 RAK110   160 N=C                     SAVE STRING IN N
   992 1462            1 GOSUB   NXBYTA
   992 1463            0
   993 1464         1730 CST EX
   994 1465          260 C=N
   995 1466         1730 CST EX
   996 1467         1074 RCR     2
   997 1470          676 A=A-1   S
   998 1471         1703 GONC    RAK110 (1461)
   999 1472            1 GOSUB   RTJLBL
   999 1473            0
  1000 1474          160 N=C
  1001 1475          106 C=0     X
  1002 1476         1160 DADD=C
  1003 1477          260 C=N
  1004 1500         1150 REGN=C 9
  1005 1501          460 LDI
  1006 1502           36 CON2    1         14     FC FOR AXEQ
  1007 1503         1574 RCR     12
  1008 1504            1 GOSUB   STORFC
  1008 1505            0
  1009 1506         1004 S2=     0               RAM
  1010 1507 NM440X     1 GOLONG  NAM440
  1010 1510            2
  1011
  1012
* OFSHFT - TURN OFF SHIFTSET AND SHIFT ANNUNCIATOR
* REQUIRES CHIP 0 ENABLED ON INPUT
* DESTROYS C
* USES ONE SUBROUTINE LEVEL
* RETURNS VIA ENCP00
*
  1019 1511 OFSHFT 1670 C=REGN 14
  1020 1512         1474 RCR     1
  1021 1513         1730 CST EX                 GET STATUS SET 1/2
  1022 1514          104 S4=     0              CLEAR SHIFTSET
  1023 1515         1730 CST EX
  1024 1516         1374 RCR     13
  1025 1517         1650 REGN=C 14
  1026 1520            1 GOSUB   ENLCD
  1026 1521            0
  1027 1522          570 READEN
  1028 1523         1730 CST EX
  1029 1524         1204 S7=     0              RESET BIT FOR SHIFT ANNUNCIATOR
  1030 1525         1730 CST EX
  1031 1526         1360 WRTEN
  1032 1527            1 GOLONG  ENCP00
  1032 1530            2
*
*************************************************
*THIS ROUTINE SETS ALL ANNUNCIATORS.
```

```
* ON ENTRY, ANY DATA STORAGE OR PERIPHERAL CHIP MAY BE ENABLED.
* ON EXIT, CHIP 0 IS ENABLED, REG 14 IS IN C, AND
*     SS 0 IS IN ST
* USES 0 SUBROUTINE LEVELS.  USES A.X
*********************************************************
  1041 1531 RSTANN     1 GOSUB  RSTMS1
  1041 1532            0
  1042 1533 ANN+14  1650 REGN=C 14              SAVE REG 14
  1043 1534 ANNOUT   460 LDI                    LOAD LOW BAT CONST
  1044 1535          200 CON    @200
  1045 1536          246 AC EX  X
  1046 1537         1746 A SL   X
  1047 1540          116 C=0
  1048 1541         1760 PFAD=C
  1049 1542         1160 DADD=C
  1050 1543         1670 C=REGN 14
  1051 1544         1530 ST=C                   BRING UP SS0
  1052 1545         1314 ?S13=1                 RUNNING?
  1053 1546           37 GOC    SETPGM (1551) YES. TURN ON PRGM ANNUN
  1054 1547           14 ?S3=1                  PGM MODE
  1055 1550           33 GONC   LOWBAT (1553) NO
  1056 1551 SETPGM   546 A=A+1  X
  1057 1552          546 A=A+1  X
  1058 1553 LOWBAT   514 ?S6=1                  LOW BATTERY?
  1059 1554           27 GOC    ALPHA  (1556) YES
  1060 1555           26 A=0    XS            CLEAR LOW BAT
  1061 1556 ALPHA   1214 ?S7=1
  1062 1557           23 GONC   SHIFT  (1561)
  1063 1560          556 A=A+1
  1064 1561 SHIFT   1074 RCR    2
  1065 1562         1530 ST=C
  1066 1563         1614 ?S0=1
  1067 1564           43 GONC   RAD    (1570)
  1068 1565          460 LDI
  1069 1566          200 CON    @200
  1070 1567          506 A=A+C  X
  1071 1570 RAD      114 ?S4=1
  1072 1571           57 GOC    RADSET (1576)
  1073 1572 GRAD     214 ?S5=1
  1074 1573           43 GONC   USER   (1577)
  1075 1574          566 A=A+1  XS
  1076 1575          566 A=A+1  XS
  1077 1576 RADSET   566 A=A+1  XS
  1078 1577 USER     274 RCR    5
  1079 1600         1530 ST=C
  1080 1601         1614 ?S0=1
  1081 1602           53 GONC   FLAGS  (1607)
  1082 1603          566 A=A+1  XS
  1083 1604          566 A=A+1  XS
  1084 1605          566 A=A+1  XS
  1085 1606          566 A=A+1  XS
  1086 1607 FLAGS    274 RCR    5
  1087 1610          126 C=0    XS
  1088 1611          756 C=C+C
  1089 1612         1474 RCR    1
  1090 1613          126 C=0    XS
  1091 1614          756 C=C+C
  1092 1615          756 C=C+C
  1093 1616          516 A=A+C
  1094 1617          460 LDI
```

```
1095 1620           20 CON    @20
1096 1621         1160 DADD=C
1097 1622          460 LDI
1098 1623          375 CON    @375
1099 1624         1760 PFAD=C
1100 1625          256 AC EX
1101 1626         1360 WRTEN
1102 1627 LDSST0   106 C=0    X
1103 1630         1760 PFAD=C
1104 1631         1160 DADD=C
1105 1632         1670 C=REGN 14
1106 1633         1530 ST=C
1107 1634         1740 RTN
*
*
1110                   ENTRY  XR/S
1111       XR/S                              EXECUTE R/S
1112 1635          574 RCR    6
1113 1636         1730 CST EX                PUT UP SS 3
1114 1637         1414 ?S1=1                 CATALOG FLAG?
1115 1640            1 GOLC   R/SCAT         YES. GOTO CATALOG FCN.
1115 1641            3
1116 1642         1530 ST=C                  RETRIEVE SS0
1117 1643           14 ?S3=1                 PROGRAM MODE?
1118 1644           53 GONC   XRS20  (1651) NO
1119       XRS10
1120 1645          460 LDI
1121 1646          204 CON2   8       4      FC FOR STOP
1122 1647            1 GOLONG PARS56
1122 1650            2
*
1124 1651 XRS20   1414 ?S1=1                 PAUSEFLAG?
1125 1652         1737 GOC    XRS10  (1645) YES
1126 1653            1 GOSUB  PACH4          CHECK FOR KEY DOWN FOR ABOUT 100MS.
1126 1654            0
*
* IF KEY IS LET UP, GO RUN. OTHERWISE PUT UP DESCRIPTION OF STEP.
* THIS IS A PATCH TO SPEED UP EXECUTION OF R/S.
*
1131 1655         1514 ?S12=1                PRIVACY?
1132 1656           63 GONC   XRS25  (1664) NO
1133 1657          404 S8=    0              YES
1134 1660            1 GOSUB  MSGA
1134 1661            0
1135 1662            0 XDEF   MSGPR          "PRIVATE"
1136 1663          113 GOTO   XRS40  (1674)
*
1138 1664 XRS25   1770 C=REGN 15
1139 1665         1346 ? C#0  X              LINE NUMBER # 0?
1140 1666           37 GOC    XRS30  (1671) YES, NON-ZERO
1141 1667         1046 C=C+1  X              ZERO. SET TO 1
1142 1670         1750 REGN=C 15
1143 1671 XRS30      1 GOSUB  DFKBCK         DISPLAY NEXT STEP
1143 1672            0
1144 1673         1114 ?S9=1                 KEYBOARD RESET YET?
1145 1674 XRS40      1 GSUBNC NULTST         NO
1145 1675            0
1146                   ENTRY  XRS45
1147 1676 XRS45   1575 CON    @1575          GOSUB PRT8
1148 1677          674 CON    @674
```

```
1149 1700           1 GOSUB  RSTANN
1149 1701           0
*
1151                  ENTRY  RUN
1152      RUN                                GET A USER PROGRAM RUNNING
1153 1702        1310 S13=    1              SET RUNNING FLAG
1154 1703        1770 C=REGN 15              SET LINE # TO FFF
1155 1704         106 C=0    X
1156 1705        1146 C=C-1  X
1157 1706        1750 REGN=C 15
1158 1707        1670 C=REGN 14
1159 1710        1530 ST=C                   PUT UP SS0
1160 1711         766 C=C+C  XS
1161 1712         766 C=C+C  XS              DATA ENTRY FLAG?
1162 1713          53 GONC   RUN11  (1720)   NO
1163                                         YES, MUST BE PAUSE
1164                                         TERMINATION
1165 1714        1635 CON    @1635           GOSUB PRT4
1166 1715         674 CON    @674             PRINT DATAENTRY STRING
1167 1716           1 GOSUB  RSTMS1          CLEAR MSGFLG, DATAENTRY FLAG, ETC.
1167 1717           0
1168 1720 RUN11  1404 S1=    0              CLEAR PAUSING
1169 1721        1670 C=REGN 14              PUT
1170 1722        1630 C=ST                    SS0
1171 1723        1650 REGN=C 14                BACK
*
* LOGIC FOR CLD ENTERS AT NWGOOS.
* ENTRY CONDITION: SS0 UP
*
1176                  ENTRY  NWGOOS
1177 1724 NWGOOS    1 GOSUB  PGMAON          TURN ON PRGM ANNUNCIATOR
1177 1725           0
1178                                         & ENABLE LCD
1179 1726         214 ?S5=1                  MSGFLAG?
1180                                         MSGFLG CAN ONLY BE SET
1181                                         HERE ON PAUSE TERMINATION
1182 1727         107 GOC    RUN20  (1737)   YES
1183 1730           1 GOSUB  CLLCDE
1183 1731           0
1184 1732         460 LDI
1185 1733          56 CON2   2       14      EAST GOOSE
1186 1734        1650 SRSABC
1187 1735           1 GOSUB  ENCP00
1187 1736           0
1188 1737 RUN20     1 GOLONG NFRPU           CAN'T BE A RTN BECAUSE
1188 1740           2
* XR/S IS XKD AND DOESN'T HAVE NFRPU ON THE STACK
*
* INTARG - ZERO THE ALPHA REG AND STORE THE CHAR IN G AS THE
*          FIRST CHAR.
*
1194                  ENTRY  INTARG
1195 1741 INTARG  116 C=0    W
1196 1742        1050 REGN=C 8
1197 1743         750 REGN=C 7
1198 1744         650 REGN=C 6
1199 1745         230 C=G
1200 1746         550 REGN=C 5
1201 1747        1740 RTN
1202                  ENTRY  STORFC
```

```
*
* STORFC - STORE FUNCTION CODE TO REG 10
* ON ENTRY, DESIRED FC IS IN C[3:0], LEFT JUSTIFIED IN THAT FIELD.
* ON EXIT, FC (4 DIGITS) STORED TO REG 10[4:1]
*     REG 10[0] IS SCRATCH, A[4:0] AND C ARE USED, AND PT=4.
*
  1209 1750 STORFC 1374 RCR    13
  1210 1751         134 PT=    4
  1211 1752         412 A=C    WPT
  1212 1753        1270 C=REGN 10
  1213 1754         252 AC EX  WPT
  1214 1755        1250 REGN=C 10
  1215 1756        1740 RTN
*
* MESSL - LEFT SHIFT INTO LCD FROM RIGHT END
* CALLING SEQUENCE: GOSUB MESSL
*                   CON   1ST CHAR, LCD FORM
*                   CON   2ND CHAR, ...
*                   ...
*                   CON   FINAL CHAR + @1000
* SPECIAL CHARACTERS (THOSE HAVING LCD CREG=1) CAN ONLY BE USED
* AS THE FINAL CHARACTER OF THE MESSAGE.
* ASSUMES LCD ENABLED ON ENTRY.
* USES C[6:0] AND LEAVES LCD ENABLED ON EXIT
*
  1228                   ENTRY  MESSL
  1229 1757 MESSL   660 C=STK
  1230 1760 MESS10 1460 CXISA
  1231 1761        1750 SLSABC
  1232 1762        1072 C=C+1  M
  1233 1763        1366 ? C#0  XS
  1234 1764        1743 GONC   MESS10 (1760)
  1235 1765         740 GOTOC
*
* ENLCD - ENABLE LCD DRIVER CHIP
* USES C.X ONLY
*
  1240                   ENTRY  ENLCD
  1241 1766 ENLCD   460 LDI
  1242 1767          20 CON2   1       0
  1243 1770        1160 DADD=C                 DISABLE SLEEPER CHIPS
  1244 1771         460 LDI
  1245 1772         375 CON2   15      13
  1246 1773        1760 PFAD=C                 TURN ON LCD DRIVER CHIP
  1247 1774        1740 RTN
  1248                   UNLIST
  1251                   END

  ERRORS :      0
```

SYMBOL TABLE

AFMT10	1070	-	1151	1130	1122	
AFMT11	1071	-				
AFMT12	1073	-				
AFMT20	1123	-	1101			
AFMT30	1131	-	1077			
AFORMT	1050	-				
ALCL00	1311	-				
ALCL10	1324	-	1371			
ALCL20	1340	-	1354	1334		
ALCL30	1345	-	1337			
ALCL40	1355	-	1350			
ALCL50	1357	-	1321			
ALPHA	1556	-	1554			
ANN+14	1533	-				
ANNOUT	1534	-				
BLANK	667	-				
CAPABC	242	-	212			
CHKFUL	672	-				
CHRLCD	671	-				
CKFL10	705	-	673			
CPGM10	1177	-	1174			
CPGM15	1201	-	1207			
CPGMHD	1173	-				
DEROW	255	-				
DERW00	262	-	340			
DERW05	300	-	276			
DERW10	303	-	267			
DERW20	313	-	305			
DERW50	316	-	265			
DERW55	321	-	315	312		
DERW60	323	-	302			
DERW70	330	-	261			
DF010	534	-	540			
DF030	561	-	554			
DF040	602	-	571	560	530	
DF050	604	-	567			
DF060	607	-				
DF100	615	-	621			
DF120	40	-	31	24		
DF150	202	-	241			
DF160	205	-				
DF190	341	-	404	336		
DF200	347	-	342			
DFILLF	543	-				
DFKBCK	531	-				
DFRST8	542	-				
DFRST9	541	-				
ENLCD	1766	-				
FLAGS	1607	-	1602			
GENN20	1025	-	1007			
GENN25	1027	-	1032			
GENN30	1033	-	1030			
GENN40	1034	-	1024	1021	1015	
GENN55	1041	-	1047			
GENNUM	750	-				
GRAD	1572	-				

INTARG	1741	-					
KEYOP	1212	-					
KY11A	1236	-	1234				
KYOP10	1221	-	1254	1242			
KYOP11	1235	-	1230				
KYOP40	1243	-	1225				
KYOP50	1255	-	1251				
KYOP60	1272	-	1270				
KYOP70	1304	-	1301				
KYOP80	1305	-	1303				
KYOPCK	1223	-					
LDSST0	1627	-					
LOWBAT	1553	-	1550				
MEMLF1	647	-	663				
MEMLF2	656	-	646				
MEMLF3	664	-	661	654			
MEMLFT	641	-					
MESS10	1760	-	1764				
MESSL	1757	-					
NM440X	1507	-	1426				
NWGOOS	1724	-					
OFSHFT	1511	-					
PMPT20	724	-	743				
PMPT30	734	-	731				
PMPT40	740	-	735				
PROMF1	713	-					
PROMF2	723	-					
PROMFC	707	-					
RAD	1570	-	1564				
RADSET	1576	-	1571				
RAK100	1443	-	1402				
RAK110	1461	-	1471				
RAK60	1372	-					
RAK70	1412	-	1405				
RAK80	1425	-	1421				
RAK90	1427	-	1415				
REGLFT	632	-					
RL	252	-	220				
RO1314	62	-	16	15			
ROMH05	1154	-	1176				
ROMH06	1157	-	1164	1162			
ROMH35	1170	-					
ROMHED	1152	-					
ROW0	21	-	0				
ROW010	23	-	53				
ROW09	50	-	11				
ROW1	25	-	1				
ROW10	76	-	12				
ROW11	51	-	13				
ROW12	54	-	14				
ROW120	431	-					
ROW122	462	-	444				
ROW125	527	-	474	472			
ROW2	27	-	2				
ROW3	36	-	3				
ROW4-8	32	-	10	7	6	5	4
ROW9	126	-	50				
ROW910	133	-	106	57			
ROW930	140	-	75				
ROW931	143	-	47				

ENTRY TABLE

AFORMT	1050	-
ALCL00	1311	-
ANN+14	1533	-
ANNOUT	1534	-
BLANK	667	-
CHKFUL	672	-
CHRLCD	671	-
CPGM10	1177	-
CPGMHD	1173	-
DEROW	255	-
DERW00	262	-
DF060	607	-
DF150	202	-
DF160	205	-
DF200	347	-
DFILLF	543	-
DFKBCK	531	-
DFRST8	542	-
DFRST9	541	-
ENLCD	1766	-
GENNUM	750	-
INTARG	1741	-
KEYOP	1212	-
KYOPCK	1223	-
LDSST0	1627	-
MEMLFT	641	-
MESSL	1757	-
NWGOOS	1724	-
OFSHFT	1511	-
PROMF1	713	-
PROMF2	723	-
PROMFC	707	-
RAK60	1372	-
RAK70	1412	-
REGLFT	632	-
ROMH05	1154	-
ROMH35	1170	-
ROMHED	1152	-
ROW120	431	-
ROW933	147	-
ROW940	207	-
RSTANN	1531	-
RUN	1702	-
RW0110	351	-
RW0141	361	-
STORFC	1750	-
TXRW10	366	-
TXTROM	365	-
TXTROW	362	-
TXTSTR	366	-
XMSGPR	555	-
XR/S	1635	-
XRS45	1676	-

EXTERNAL REFERENCES

APND-	1064	1147										
APND-	1065	1150										
APND10	1120	1143										
APND10	1121	1144										
APNDDG	1103	1123										
APNDDG	1104	1124										
ASCLCD	424											
ASCLCD	425											
BLANK	160	306										
BLANK	161	307										
BLINK	1252											
BLINK	1253											
CHKFUL	426											
CHKFUL	427											
CHRLCD	321	345										
CHRLCD	322	346										
CLLCDE	561	1427	1730									
CLLCDE	562	1430	1731									
DEROW	25											
DEROW	26											
DF150	34	347	602									
DF150	35	350	603									
DFKBCK	1671											
DFKBCK	1672											
ENCP00	406	451	545	607	641	1433	1527	1735				
ENCP00	407	452	546	610	642	1434	1530	1736				
ENLCD	112	141	330	375	421	440	507	576	707	1214	1240	1520
ENLCD	113	142	331	376	422	441	510	577	710	1215	1241	1521
FORMAT	1053											
FORMAT	1054											
FSTIN	1202											
FSTIN	1203											
GCPKC	1377											
GCPKC	1400											
GENNUM	200	511	564	600								
GENNUM	201	512	565	601								
GETPC	613											
GETPC	614											
GTLINK	1177											
GTLINK	1200											
GTLNKA	1450											
GTLNKA	1451											
GTRMAD	1413											
GTRMAD	1414											
INCAD	432	454										
INCAD	433	455										
INCAD2	1210											
INCAD2	1211											
LDSST0	205											
LDSST0	206											
LEFTJ	203											
LEFTJ	204											
LINNUM	547											
LINNUM	550											
MESSL	153	632										
MESSL	154	633										

```
RW0141   461
SCROL0   705
SCROL0   706
STORFC  1437  1504
STORFC  1440  1505
TOGSHF  1236
TOGSHF  1237
TXTROW    17
TXTROW    20
UPLINK  1204
UPLINK  1205
XECROM   101
XECROM   102
XROMNF  1431
XROMNF  1432

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @4000-5777
*
*
     5                    FILE   CN2B
     6                    ENTRY  CAT##2
     7                    ENTRY  XCAT
     8                    ENTRY  CNTLOP
     9                    ENTRY  GTCNTR
    10                    ENTRY  SSTCAT
    11                    ENTRY  R/SCAT
    12                    ENTRY  BSTCAT
    13                    ENTRY  CAT##1
    14                    ENTRY  BAKAPH
    15                    ENTRY  BAKDE
    16                    ENTRY  BLINK
    17                    ENTRY  BLINK1
    18                    ENTRY  DEEXP
    19                    ENTRY  DEROVF
    20                    ENTRY  DERUN
    21                    ENTRY  DIGENT
    22                    ENTRY  DIGST*
    23                    ENTRY  DSPCA
    24                    ENTRY  DSPCRG
    25                    ENTRY  FIX57
    26                    ENTRY  FORMAT
    27                    ENTRY  GTRMAD
    28                    ENTRY  INPTDG
    29                    ENTRY  LDD.P.
    30                    ENTRY  NOREG9
    31                    ENTRY  NOTFIX
    32                    ENTRY  RFDS55
    33                    ENTRY  RG9LCD
    34                    ENTRY  ROUND
    35                    ENTRY  RSTST
    36                    ENTRY  SETQ=P
    37                    EJECT
```

```
*
* GTRMAD - GET XEQ ROM FUNCTION ENTRY ADDR
*
* CALLING SEQUENCE :
*   C(2:0) = LOWER 1&HALF BYTES OF THE XEQ ROM FUNCTION CODE
*   GOSUB GTRMAD
*   <RETURN HERE IF ROM NOT PLUGGED IN OR FC # TOO BIG>
*   <RETURN HERE IF ROM PLUGGED IN AND FC # IN LIMIT>
*   WHEN RETURN REG.B ALWAYS HAS:
*       B(2:0) = FUNCTION NUMBER
*       B(4:3) = ROM ID NUMBER
*   IF THE FUNCTION FOUND IN THE ROM THEN
*       A.[3:0] = AUXILIARY ROM FUNCTION EXECUTION ADDRESS
*       S2  = BIT 8 OF THE UPPER WORD IN FUNCTION TABLE
*       S3  = BIT 9 OF THE UPPER WORD IN FUNCTION TABLE
*       USED A,C,B(6:0), STATUS.SET, AND ACTIVE POINTER
*
    55    0 GTRMAD  132 C=0     M
    56    1          756 C=C+C   W
    57    2          756 C=C+C   W              ROM ID IN C(3:2) NOW
    58    3         1374 RCR     13             C(4:3) _ ROM ID
    59    4         1706 C SR    X
    60    5          746 C=C+C   X
    61    6          746 C=C+C   X
    62    7         1706 C SR    X              C.X _ FC #
    63   10           74 RCR     3             C.X _ ROM ID
    64   11          406 A=C     X              A.X _ ROM ID
    65   12          674 RCR     11
    66   13          534 PT=     6
    67   14          352 BC EX   WPT            B(4:0) _ ROM ID & FC #
    68   15          132 C=0     M
    69   16          520 LC      5              START FROM HEX 5000 ( ASL 1)
    70   17          534 PT=     6
    71   20 RMAD10 1460 CXISA                   READ ID FROM ONE PORT
    72   21         1546 ? A#C   X              IS THE ID MATCH ?
    73   22           43 GONC    RMAD20 (  26) YES
    74   23 RMAD15 1042 C=C+1    PT             ADDR _ ADDR + HEX 1000
    75   24         1743 GONC    RMAD10 (  20) CHECK ANOTHER PORT
    76   25         1740 RTN                    ROM NOT PLUGGED IN
    77   26 RMAD20 1072 C=C+1    M              POINT TO 2ND WORD OF ROM
    78   27          306 C=B     X              LOAD THE FC #
    79   30          416 A=C
    80   31         1460 CXISA                  LOAD # OF FC'S IN THE ROM
    81   32         1046 C=C+1   X
    82   33         1406 ? A<C   X              IS THE FC IN THE ROM ?
    83   34          303 GONC    RMAD30 (  64) NO, FC # TOO BIG
    84   35          246 AC EX   X              C.X _ FC #
    85   36          746 C=C+C   X              MULTIPLY FC # BY 2
    86   37          572 A=A+1   M              POINT TO BEGINNING OF FC TABLE
    87   40          132 C=0     M
    88   41          674 RCR     11
    89   42         1032 C=A+C   M              C.M _ FUNCTION TABLE ENTRY
    90   43         1460 CXISA
    91   44          766 C=C+C   XS
    92   45          766 C=C+C   XS
    93   46         1074 RCR     2
    94   47         1530 ST=C                   SET TOP 2 BITS TO S3,S2
    95   50          374 RCR     10
    96   51          416 A=C                    A(3:2) _ UPPER BYTE OF XADR
```

```
    97    52          1074 RCR     2
    98    53          1072 C=C+1   M              POINT TO LOWER BYTE OF XADR
    99    54          1460 CXISA                  GET LOWER BYTE
   100    55          1434 PT=     1
   101    56           412 A=C     WPT            A(3:0) _ XADR
   102    57            74 RCR     3
   103    60           532 A=A+C   M              COMPUTE CHIP ADDRESS
   104    61           660 C=STK
   105    62          1072 C=C+1   M              POINT TO P+2
   106    63           740 GOTOC                  RETURN TO P+2
*
   108    64 RMAD30   1172 C=C-1   M
   109                     LEGAL
   110    65          1363 GOTO    RMAD15 (  23)
*
*
*
* DIGIT ENTRY
*       DIGIT ENTRY USE REG.9 & STATUS SET IN REG.10
*   TO REMEMBER ALL THE KEYS ENTERED.
*   FORMAT OF REG.9 :
*
*   DIGIT 13  : D.P. POSITION, WHICH IS THE # OF DIGITS
*               BETWEEN D.P. AND DIGIT 3. ITS INITIAL
*               VALUE IS 10.
*   DIGIT 12-3: MANTISSA DIGITS, INITIAL VALUE ARE F'S
*   DIGIT 2   : EXP. SIGN. =0 IF EXP POSITIVE
*                          =D IF EXP NEGATIVE
*   DIGIT 1-0 : EXP. DIGITS, INITIAL VALUE ARE F'S
*
*   STATUS INFORMATION :
*          S0 = 1 IF D.P. HIT, OTHERWISE = 0
*          S1 = 1 IF EEX HIT, OTHERWISE = 0
*          S2 = 1 IF MANTISSA NEGATIVE, OTHERWISE = 0
*          S3 = 1 IF MANTISSA NONZERO
* IF S9=1 MEANS THIS CALL IS FROM DERUN(DIGENT IN RUN TIME),
* THEN CHS SHALL NOT CHECK IF MANTISSA ZERO.
*
   135                    ENTRY  DGENS8
   136    66 DGENS8   404 S8=    0              SAY NO CHS WHEN X=0
   137    67 DIGENT  1070 C=REGN 8
   138    70          674 RCR    11
   139    71         1530 ST=C                  RESTORE DIGENT STATUS SET
   140    72         1534 PT=    12
   141    73          230 C=G                   PUT THE DIGIT TO C(13)
   142    74         1376 ? C#0  S              IS THIS A BACK ARROW ?
   143    75            1 GOLNC  BAKDE          YES
   143    76            2
   144    77         1374 RCR    13
   145   100         1420 LC     12             LOAD CHS
   146   101         1320 LC     11             LOAD EEX
   147   102         1220 LC     10             LOAD D.P.
   148   103          416 A=C    W              COPY C TO A
   149   104         1756 A SL   W              GET READY FOR COMPARISON
   150   105         1576 ? A#C  S              IS IT A CHS ?
   151   106          623 GONC   DECHS  ( 170)  YES
   152   107         1756 A SL
   153   110         1414 ?S1=1                 EEX HIT ?
   154   111            1 GOLC   DEEXP          YES
   154   112            3
```

```
155  113          1576 ? A#C   S                IS IT A EEX ?
156  114           333 GONC    DEEEX  ( 147) YES
157  115          1756 A SL
158  116          1576 ? A#C   S                IS IT A D.P. ?
159  117           243 GONC    DEDP   ( 143) YES
160  120          1376 ? C#0   S                IT A NONZERO DIGIT ?
161  121            23 GONC    DE200  ( 123) NO
162  122            10 S3=     1                REMEMBER MANTISSA NONZERO
163  123 DE200      34 PT=     3                FIND A PLACE IN MANTISSA
164  124          1170 C=REGN  9
165  125 DE210    1042 C=C+1   PT
166  126            33 GONC    DE220  ( 131) FOUND THE LAST DIGIT
167  127          1734 INC PT                   POINT TO LEFT NEXT DIGIT
168                    LEGAL
169  130          1753 GOTO    DE210  ( 125)
170  131 DE220      24 ? PT=   3                MANTISSA FULL ?
171  132             1 GOLC    BLINK1           YES, IGNORE THIS ENTRY
171  133             3
172  134          1614 ?S0=1                    D.P. HIT ?
173  135            47 GOC     INDGJ  ( 141) YES, PUT IT TO MANTISSA
174  136          1170 C=REGN  9                MOVE THE POTENTIAL D.P.
175  137          1176 C=C-1   S                  TO RIGHT ONE DIGIT
176  140          1150 REGN=C  9
177  141 INDGJ       1 GOLONG  INPTDG
177  142             2
178  143 DEDP     1614 ?S0=1                    D.P. HIT ALREADY ?
179  144           657 GOC     BLINK1 ( 231) YES, IGNORE THIS D.P.
180  145          1610 S0=     1                SAY D.P. HIT
181  146           333 GOTO    RSTSTJ ( 201) PUT THE STATUS BACK
182  147 DEEEX    1170 C=REGN  9                SEE.DO WE ALLOW EEX NOW
183  150           416 A=C
184  151          1334 PT=     13
185  152           220 LC      2
186  153          1436 ? A<C   S                HAVE WE GONE TOO FAR ?
187  154           557 GOC     BLINK1 ( 231) YES, NOT EXCEPT EEX NOW
188  155          1410 S1=     1                SAY EEX HIT
189  156            14 ?S3=1                    MANTISSA ZERO ?
190  157           707 GOC     RSTST  ( 247) NO
191  160           116 C=0                     SET MANTISSA TO 1
192  161          1156 C=C-1
193  162           126 C=0     XS
194  163          1334 PT=     13
195  164          1120 LC      9                D.P. POSITION = 9
196  165           120 LC      1                MANTISSA _ 1
197  166            10 S3=     1                REMEMBER MANTISSA NONZERO
198  167           573 GOTO    RSTOR9 ( 246)
199  170 DECHS    1414 ?S1=1                    EEX HIT ?
200  171           137 GOC     CHSEXP ( 204) YES, CHS OF EXP.
201  172           414 ?S8=1                   CHECK X=0 ?
202  173            37 GOC     DECHS1 ( 176) NO
203  174            14 ?S3=1                    MANTISSA NONZERO
204  175           343 GONC    BLINK1 ( 231) YES, IGNORE CHS
205  176 DECHS1   1014 ?S2=1                    CHS HIT ?
206  177            37 GOC     *+3    ( 202)   YES
207  200          1010 S2=     1
208  201 RSTSTJ    463 GOTO    RSTST  ( 247) PUT STATUS BACK
209  202          1004 S2=     0
210  203           443 GOTO    RSTST  ( 247) PUT STATUS BACK
211  204 CHSEXP   1170 C=REGN  9
212  205           416 A=C     W
```

```
   213  206          126 C=0     XS              ASSUME EXP WAS NEGATIVE
   214  207         1034 PT=     2
   215  210         1526 ? A#0   XS              WAS EXP NEGATIVE ?
   216  211           27 GOC     *+2     ( 213) YES
   217  212         1520 LC      13              LOAD A "D" TO REG.9(2)
   218  213 RSTO9J   333 GOTO    RSTOR9  ( 246) RESTORE REG.9
   219  214 DEEXP   1576 ? A#C   S               IS IT A EEX ?
   220  215          143 GONC    BLINK1  ( 231) YES, IGNORE IT
   221  216         1756 A SL
   222  217         1576 ? A#C   S               IS IT A D.P. ?
   223  220          113 GONC    BLINK1  ( 231) YES, IGNORE IT
   224  221         1634 PT=     0               FIND A PLACE IN EXP
   225  222         1170 C=REGN  9
   226  223 EXPDG1  1042 C=C+1   PT
   227  224           33 GONC    EXPDG2  ( 227) FOUND THE LAST EXP DIGIT
   228  225         1734 INC PT
   229                  LEGAL
   230  226         1753 GOTO    EXPDG1  ( 223)
   231  227 EXPDG2  1624 ? PT=   0               EXP FULL ?
   232  230          103 GONC    INPTDG  ( 240) NOT YET
*
   234       BLINK1
   235       BLINK                               DISOFF IGNORE A KEY, TURN DISPLAY O
   236  231         1340 DISOFF
   237  232          460 LDI
   238  233          320 CON     208
   239  234         1146 C=C-1   X
   240  235         1773 GONC    *-1     ( 234)
   241  236         1440 DISTOG
   242  237         1740 RTN
   243  240 INPTDG  1724 DEC PT                 INSERT A DIGIT TO REG.9
   244  241            0 NOP
   245  242          230 C=G
   246  243          402 A=C     PT
   247  244         1170 C=REGN  9
   248  245          242 AC EX   PT
   249  246 RSTOR9  1150 REGN=C  9
   250  247 RSTST   1070 C=REGN  8
   251  250          674 RCR     11
   252  251         1630 C=ST                   PUT THE STATUS BITS BACK
   253  252           74 RCR     3
   254  253         1050 REGN=C  8
   255  254         1740 RTN
*
* DERUN - ENTRY POINT OF DIGIT ENTRY IN RUN TIME
*  COME IN FROM MAINLOOP WITH THE 1ST DIGIT IN A[3:2], PC POINT
*  TO 1ST BYTE OF DIGIT ENTRY IN MEM.
*
   261  255 DERUN   1034 PT=     2
   262  256          256 AC EX
   263  257          130 G=C                    SAVE THE DIGIT IN G
   264  260          410 S8=     1              REMEMBER IN RUN TIME
   265                                          TELL DIGENT CALLING FROM DERUN
   266  261           23 GOTO    DIGST1  ( 263)
*
* DIGST* - DIGIT ENTRY INITIALIZATION
* SET UP REG.9(REFER THE FORMAT TO DIGENT)
* RESET DIGENT STATUS(CHS,D.P.,EEX) AND SAVE IT IN REG.10[1:0]
* PUSH THE STACK IF PUSHFLAG SET
* IF NOT IN PROGRAM, CLEAR X
```

```
* CALLED BY DATAENTRY WITH DIGIT CODE IN G
* ASSUME CHIP 0 ENABLE
* NOT A SUBROUTINE, RETURN TO VARIES PLACE
*
   277  262 DIGST*  404 ST8=     0              REMEMBER NOT IN RUN TIME
   278  263 DIGST1  116 C=0      W              INITIALIZE REG.9
   279  264        1156 C=C-1    W
   280  265         126 C=0      XS             EXP POSITIVE
   281  266        1334 PT=      13
   282  267        1220 LC       10             INITIAL D.P. POSITION
   283  270        1150 REGN=C   9
   284  271           1 GOSUB    STBT10         MOVE STATUS BITS TO REG.10
   284  272           0
   285  273        1670 C=REGN   14
   286  274        1530 ST=C                    LOAD SET #0
   287  275          14 ?S3=1                   PROGMODE ?
   288  276          53 GONC     DIGST2 ( 303) NO
   289  277           1 GOSUB    INSSUB         INCREMENT LINE# BY 1
   289  300           0
   290  301           1 GOLONG   DAT320         RETURN TO DATAENTRY
   290  302           2
   291  303 DIGST2  614 ?S11=1                   PUSH FLAG SET ?
   292  304           1 GSUBC    R^SUB          YES, PUSH STACK
   292  305           1
   293  306         610 S11=     1
   294  307         116 C=0
   295  310         350 REGN=C   3              CLEAR X
   296  311         414 ?ST8=1                 RUNNING ?
   297  312           1 GOLNC    DAT231         NO, RETURN TO DATAENTRY
   297  313           2
   298                                          DROP THRU TO DERUN
*
* DIGIT ENTRY DURING RUN TIME
*
   302  314           1 GOSUB    GETPC
   302  315           0
   303  316         212 B=A      WPT
   304  317 DERUN5    1 GOSUB    ENCP00
   304  320           0
   305  321           1 GOSUB    DIGENT
   305  322           0
   306  323           1 GOSUB    NOREG9         NORMALIZE DIGIT ENTRY
   306  324           0
   307  325           1 GOSUB    NBYTAB
   307  326           0
   308  327         152 AB EX    WPT            SAVE PC IN B
   309  330        1434 PT=      1
   310  331         412 A=C      WPT            A[2:0] _ NEXT PC
   311  332         460 LDI
   312  333          35 CON2     1       13
   313  334        1542 ? A#C    PT             IS A ROW 1 FC ?
   314  335          77 GOC      DERNRT ( 344) NO, EXIT
   315  336        1412 ? A<C    WPT            IS A DIGIT FC ?
   316  337          53 GONC     DERNRT ( 344) NO, EXIT
   317  340         256 AC EX
   318  341        1634 PT=      0
   319  342         130 G=C                     PUT THE DIGIT TO G
   320  343        1543 GOTO     DERUN5 ( 317)
* END OF DIGIT ENTRY UPDATE PC
*
```

```
   323  344 DERRRT   156 AB EX
   324  345             1 GOSUB  DECAD          POINT TO LAST BYTE OF DIGITENTRY
   324  346             0
   325  347 DERRT1      1 GOSUB  PUTPC
   325  350             0
   326  351             1 GOLONG NFRPU
   326  352             2
*
* OVERFLOW- OVERFLOW DETECT BY DIGIT ENTRY ROUTINE
*
   330  353 DEROVF   156 AB EX
   331  354          1140 SETHEX
   332  355            34 PT=     3
   333  356          1713 GOTO    DERRT1 ( 347)
*
* CONSTRUCT DIGIT ENTRY DISPLAY FROM REG. 9
* (PLEASE REFER THE REG.9 FORMAT TO DIGENT)
* CALLED BY DATAENTRY. DIGENT ROUTINE ITSELF WON'T REFRESH
* THE DISPLAY, IT ONLY UPDATE THE REG.9. SO, DURING DIGIT
* ENTRY, DATAENTRY HAVE TO CALL THIS ROUTINE FOR EACH DIGIT
* TO REFRESH DISPLAY.
* STATUS BITS MEANING:
* S0 - D.P. HIT                S1 - EEX HIT
* S2 - CHS HIT                 S4 - DIGIT GROUPING FLAG
* S5 - DECIMAL POINT FLAG
*
* RG9LCD BUILDS REGS A & C AND SETS UP P AND Q FOR A SUBSEQUENT
* CALL TO RFDS55. RFDS55 IS THE ONE THAT ACTUALLY SENDS STUFF TO
* THE LCD.
*
   350  357 RG9LCD 1070 C=REGN 8             LOAD FLAGS - S2:CHS
   351  360         674 RCR    11
   352  361        1530 ST=C                    S1 : EEX   S0:D.P.
   353  362        1170 C=REGN 9
   354  363         416 A=C    W               A _ REG.9
   355  364           1 GOSUB  ENLCD           ENABLE LCD CHIP
   355  365           0
   356  366           1 GOSUB  LOAD3           LOAD ALL 3'S INTO C
   356  367           0
   357  370          34 PT=     3              START FROM END OF MANTISSA
   358  371 RFDS10  542 A=A+1   PT              FIND THE LAST DIGIT ?
   359  372          53 GONC    RFDS15 ( 377) YES
   360  373        1142 C=C-1   PT              C(PT) _ 2
   361  374         676 A=A-1   S               DECREMENT D.P. POS COUNTER
   362  375        1734 INC PT                  POINT TO LEFT NEXT DIGIT
   363                  LEGAL
   364  376        1733 GOTO    RFDS10 ( 371)
   365  377 RFDS15  642 A=A-1   PT              RESTORE THE DIGIT
   366  400        1414 ?S1=1                   EEX HIT ?
   367  401         107 GOC     RFDS17 ( 411) YES, DON'T PROMPT MANTISSA
   368  402          24 ? PT=   3               MANTISSA FULL ?
   369  403          67 GOC     RFDS17 ( 411) YES, DON'T PROMPT
   370  404        1724 DEC PT                  POINT TO PROMPT POSITION
   371  405         642 A=A-1   PT              A(PT) _ 1
   372  406         120 LC      1                UNDER SCORE = "1F"
   373  407        1734 INC PT
   374  410        1734 INC PT                  RESTORE THE POINTER
   375  411 RFDS17 1614 ?S0=1                   D.P. HIT ?
   376  412         133 GONC    RFDS25 ( 425) NO, DON'T LOOK FOT D.P.
   377  413 RFDS19  676 A=A-1   S               LOOK FOR D.P.
```

```
378  414           37 GOC     RFDS20 ( 417) FOUND IT !
379  415         1734 INC PT                 POINT TO LEFT NEXT DIGIT
380                   LEGAL
381  416         1753 GOTO    RFDS19 ( 413)
382  417 RFDS20   214 ?S5=1                 LOAD THE D.P. TO C
383  420           33 GONC    *+3    ( 423) LOAD A COMMA INSTEAD OF
384  421          720 LC      7
385  422           23 GOTO    *+2    ( 424)
386  423         1720 LC      15
387  424         1734 INC PT                 RESTORE THE POINTER
388  425 RFDS25   114 ?S4=1                 GROUPING FLAG SET ?
389  426          233 GONC    RFDS35 ( 451) NO
390  427         1324 ? PT=   13
391  430          177 GOC     RFDS30 ( 447)
392  431 RFDS26   436 A=C     S             A(13) _ 3
393  432 RFDS27   676 A=A-1   S             COUNT 3 FROM LEFT
394  433           57 GOC     RFDS28 ( 440) SHALL WE PUT A COMMA HERE ?
395  434         1524 ? PT=   12             REACH LEFT END OF MANTISSA ?
396  435          147 GOC     RFDS35 ( 451) YES, WE ARE DONE
397  436         1734 INC PT                 POINT TO LEFT NEXT DIGIT
398                   LEGAL
399  437         1733 GOTO    RFDS27 ( 432)
400  440 RFDS28   214 ?S5=1                 LOAD A COMMA TO C
401  441           33 GONC    *+3    ( 444)
402  442         1720 LC      15
403  443           23 GOTO    *+2    ( 445)
404  444          720 LC      7              LOAD A D.P. INSTEAD OF
405  445         1734 INC PT                 RESTORE POINTER
406                   LEGAL
407  446         1633 GOTO    RFDS26 ( 431)
408  447 RFDS30   276 AC EX   S
409  450           23 GOTO    *+2    ( 452)
410  451 RFDS35   436 A=C     S             TAKE CARE OF THE SIGN
411  452          676 A=A-1   S             A(13) _ 2
412  453          136 C=0     S             ASSUME POSITIVE MANTISSA
413  454         1334 PT=     13
414  455         1014 ?S2=1                 CHS HIT ?
415  456           23 GONC    *+2    ( 460) NO, MANTISSA POSITIVE
416  457         1520 LC      13             "-" = 2D
417  460          276 AC EX   S
418  461          340 SEL Q
419  462         1334 PT=     13             Q= 13
420  463          240 SEL P
421  464         1166 C=C-1   XS             C(2) _ 2
422  465         1414 ?S1=1                 EEX HIT ?
423  466          203 GONC    RFDS50 ( 506) NO, LET'S GOTO DISPLAY
424  467         1434 PT=     1              LOOK AT DIGIT 1
425  470          542 A=A+1   PT             IS THERE A DIGIT THERE ?
426  471          107 GOC     RFDS40 ( 501) NO, LET'S PROMPT AT DIGIT 1
427  472          642 A=A-1   PT             RESTORE DIGIT 1
428  473         1634 PT=     0              LOOK AT DIGIT 0
429  474          542 A=A+1   PT             IS THERE A DIGIT ?
430  475           57 GOC     RFDS42 ( 502) NO, LET'S PROMPT AT DIGIT 0
431  476          642 A=A-1   PT             RESTORE DIGIT 0
432  477         1042 C=C+1   PT             C(0) _ 3
433                   LEGAL
434  500           43 GOTO    RFDS45 ( 504) WE ARE READY FOR LCD
435  501 RFDS40    12 A=0     WPT
436  502 RFDS42   642 A=A-1   PT
437  503          120 LC      1
```

```
   438  504 RFDS45   34 PT=    3              SAY DISPLAY EXP
   439  505        1740 RTN
   440  506 RFDS50   26 A=0    XS
   441  507        1634 PT=    0              SAY ONLY DISPLAY MANTISSA
   442  510        1740 RTN
   443  511 RFDS55 1722 C SR   PQ             DISPLAY ONLY 12 DIGITS
   444  512        1722 C SR   PQ
   445  513         150 SRLDB                 SHIFT INTO DISPLAY REG.B
   446  514         256 AC EX  W
   447  515        1722 C SR   PQ
   448  516        1722 C SR   PQ
   449  517          50 SRLDA                 SHIFT INTO DISPLAY REG.A
   450  520         116 C=0    W
   451  521         250 SRLDC                 CLEAR DISPLAY REG.C
   452  522 ENCP00  106 C=0    X              ENABLE CHIP 0 & RETURN
   453                 ENTRY  ENCP00
   454  523        1760 PFAD=C               DISABLE PERIPHERALS
   455  524        1160 DADD=C               ENABLE CHIP 0
   456  525        1740 RTN
*
* PGMAON - TURN ON PROGRAM ANNUNCIATOR
* NO ENTRY REQUIREMENTS
* LEAVES CHIP 0 ENABLED ON EXIT
* USES C AND ONE SUBROUTINE LEVEL
*
   463                 ENTRY  PGMAON
   464  526 PGMAON    1 GOSUB  ENLCD
   464  527           0
   465  530         570 READEN
   466  531        1730 CST EX
   467  532        1410 S1=    1              TURN ON PRGM ANNUNCIATOR
   468  533        1730 CST EX
   469  534        1360 WRTEN
   470  535        1653 GOTO   ENCP00 ( 522)
*
*
* NOREG9 - NORMALIZE THE DIGIT ENTRY STRIN IN REG.9 AND STORE
*          IT TO X-REG
* (PLEASE REFER THE INFORMATION TO DIGIT ENTRY)
* ASSUMED CHIP 0 ENABLE. USED A,C. 1 SUB LEVEL.
* RETURN IN HEX MODE, CHIP 0 ENABLE.
* STATUS BITS MEANING :
* S1 - EEX HIT              S2 - CHS HIT
* S9 - RUNNING OR SST
*
   482  536 NOREG9 1170 C=REGN 9
   483  537          34 PT=    3              LOOK FOR LAST DIGIT
   484  540 NORG05 1042 C=C+1  PT
   485  541          33 GONC   NORG10 ( 544)
   486  542        1734 INC PT                POINT TO LEFT NEXT DIGIT
   487                 LEGAL
   488  543        1753 GOTO   NORG05 ( 540)
   489  544 NORG10 1142 C=C-1  PT             RESTORE THE DIGIT
   490  545         406 A=C    X              NORMALIZE EXP
   491  546         126 C=0    XS
   492  547        1634 PT=    0
   493  550 NORG20  542 A=A+1  PT             SHIFT BLANK OUT OF EXP
   494  551          53 GONC   NORG30 ( 556)
   495  552        1706 C SR   X
   496  553        1734 INC PT
```

```
497  554          1024 ? PT=   2
498  555          1733 GONC    NORG20 ( 550)
499  556 NORG30   1240 SETDEC
500  557          1526 ? A#0   XS              EXP SIGN NEGATIVE ?
501  560            23 GONC    *+2     ( 562) NO
502  561          1206 C=-C    X               COMPLIMENT EXP
503  562           416 A=C     W               COPT C TO A
504  563          1334 PT=     13
505  564          1120 LC      9
506  565           276 AC EX   S               C(13)=# OF DIGITS AFTER D.P.
507  566           736 A=A-C   S               A(13)=# OF DIGITS BEFORE D.P..
508  567           167 GOC     NORG50 ( 605)
509  570 NORG40   1502 ? A#0   PT              LEADING ZERO ?
510  571           167 GOC     NORG51 ( 607) NO
511  572          1772 A SL    M               SHIFT OUT LEADING ZERO
512  573           676 A=A-1   S               PASS D.P. ?
513  574          1743 GONC    NORG40 ( 570) NOT YET
514  575 NORG42    646 A=A-1   X               ZERO FOLLOWS BY D.P.
515  576 NORG45   1502 ? A#0   PT              LEADING ZERO PASS D.P. ?
516  577           157 GOC     NORG55 ( 614) NO
517  600          1176 C=C-1   S               END OF MANTISSA ?
518  601           407 GOC     NORG65 ( 641) YES, EXIT
519  602           646 A=A-1   X               EXP _ EXP-1
520  603          1772 A SL    M               SHIFT OUT LEADING ZERO
521  604          1723 GOTO    NORG45 ( 576)
522  605 NORG50     36 A=0     S
523  606          1673 GOTO    NORG42 ( 575)
524  607 NORG51    676 A=A-1   S               PASSED D.P. ?
525  610            47 GOC     NORG55 ( 614) YES
526  611           546 A=A+1   X
527  612          1753 GONC    NORG51 ( 607) USUALLY NO CARRY HERE
528  613          1743 GOTO    NORG51 ( 607) CATCHES CARRIES
529  614 NORG55     36 A=0     S               ASSUME MENTISSA POSITIVE
530  615          1014 ?S2=1                   CHS HIT ?
531  616            23 GONC    *+2     ( 620) NO
532  617           676 A=A-1   S
533  620           256 AC EX   W
534  621          1414 ?S1=1                   EEX HIT ?
535  622           203 GONC    NORG70 ( 642) NO, DON'T CHECK OVERFLOW
536  623             1 GOSUB   OVFL10
536  624             0
537  625           350 REGN=C  3
538  626          1524 ? PT=   12              OVERFLOW ?
539  627           147 GOC     NORG75 ( 643) NO
540  630           414 ?S8=1                   RUNNING ?
541  631             1 GOLC    DEROVF          YES
541  632             3
542  633          1525 CON     @1525           GOSUB PRT13
543  634           674 CON     @674
544  635             1 GOSUB   DATOFF
544  636             0
545  637             1 GOLONG  NFRKB
545  640             2
546  641 NORG65    116 C=0     W
547  642 NORG70    350 REGN=C  3
548  643 NORG75   1140 SETHEX
549  644          1740 RTN
*
*
*
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* BAKDE - BACK SPACE DURING DIGIT ENTRY
* BAKDE LIKES DIGENT ONLY UPDATE THE DIGIT ENTRY STRING IN REG.9.
* ASSUMED CHIP 0 ENABLE. USED A,C. RETURN WITH CHIP 0 ENABLE.
*
  557  645 BAKDE  1170 C=REGN 9
  558  646          340 SEL Q
  559  647         1534 PT=    12
  560  650          240 SEL P
  561  651          436 A=C    S              A(13) _ D.P. POSITION
  562  652         1414 ?S1=1                  EEX HIT ?
  563  653           33 GONC   BKMANT ( 656) NO, LOOK AT MANTISSA
  564  654 BKEXP  1634 PT=    0              LAST DIGIT IN EXP
  565  655           23 GOTO   BKDE10 ( 657) LOOK FOR LAST DIGIT IN EXP
  566  656 BKMANT   34 PT=    3              LAST DIGIT IN MANTISSA
  567  657 BKDE10 1042 C=C+1  PT
  568  660           53 GONC   BKDE20 ( 665) FOUND THE LAST DIGIT !
  569  661         1142 C=C-1  PT             C(PT) _ F
  570  662          676 A=A-1  S
  571  663         1734 INC PT                POINT TO LEFT NEXT DIGIT
  572                   LEGAL
  573  664         1733 GOTO   BKDE10 ( 657)
  574  665 BKDE20 1414 ?S1=1                  EEX HIT ?
  575  666          203 GONC   BKMN20 ( 706) NO
  576  667 BKEX10 1024 ? PT=  2              OVER EXP ?
  577  670          107 GOC    BKEX20 ( 700) YES, EXP OUT
  578  671 BKDG     102 C=0    PT             TAKE THE DIGIT OUT
  579  672         1362 ? C#0  PQ             MANTISSA ZERO ?
  580  673           37 GOC    BKDG1  ( 676) NO
  581  674         1004 S2=    0              MANT. CAN'T BE NEGATIVE ZERO
  582  675            4 S3=    0              REMEMBER MANTISSA ZERO
  583  676 BKDG1  1720 LC     15
  584  677          413 GOTO   RSTRG9 ( 740) RESTORE REG.9
  585  700 BKEX20 1166 C=C-1  XS
  586  701         1166 C=C-1  XS             WAS EXP NEGATIVE ?
  587  702           23 GONC   BKEX30 ( 704) YES
  588  703         1404 S1=    0              SAY EEX NOT HIT
  589  704 BKEX30  126 C=0    XS
  590  705          333 GOTO   RSTRG9 ( 740) RESTORE REG.9
  591  706 BKMN20 1324 ? PT=  13             PASSED LAST DIGIT ?
  592  707          137 GOC    BKMN30 ( 722) YES,DIGENT OFF
  593  710         1614 ?S0=1                 D.P. HIT ?
  594  711           57 GOC    BKMN25 ( 716) YES
  595  712         1524 ? PT=  12             LAST DIGIT IN MANTISSA ?
  596  713           77 GOC    BKMN30 ( 722) YES DIGENT OUT
  597  714         1076 C=C+1  S              D.P. POS _ D.P. POS-1
  598                   LEGAL
  599  715         1543 GOTO   BKDG   ( 671) BACK OUT ONE DIGIT
  600  716 BKMN25  676 A=A-1  S              IS THIS A D.P. ?
  601  717         1523 GONC   BKDG   ( 671) NO, BACK OUT ONE DIGIT
  602  720         1604 S0=    0
  603  721          203 GOTO   RSTSS  ( 741)
  604  722 BKMN30 1670 C=REGN 14
  605  723         1530 ST=C                  LOAD SET #0
  606  724           14 ?S3=1                 PROGMODE ?
  607  725           53 GONC   BKDE30 ( 732) NO
  608  726            1 GOSUB  DATOFF
  608  727            0
  609  730            1 GOLONG ERR120
  609  731            2
  610  732 BKDE30  116 C=0    W
```

```
   611  733          350 REGN=C 3              CLEAR X
   612  734           40 SPOPND
   613  735          460 LDI
   614  736          167 CON2   7       7      LOAD THE "CLX" FC
   615  737         1740 RTN                   GO BACK TO PARSE
   616  740 RSTRG9  1150 REGN=C 9              RESTORE REGISTER 9
   617  741 RSTSS      1 GOLONG RSTST          PUT STATUS BACK TO REG.10
   617  742            2
*
* BAKAPH - BACK SPACE DURING ALPHA ENTRY(ONLY IN NROMAL MODE)
* ASSUMED CHIP 0 ENABLE.
* USED A,C. N[13] & B[13] USED AS LCD COUNTER.
*
   623  743 BAKAPH  1104 S9=     0             KEY BOARD HAS NOT BEEN RESET
   624  744          570 C=REGN 5
   625  745         1434 PT=     1
   626  746         1352 ? C#0   WPT            IS ANY CHAR IN ALPHA REG. ?
   627  747            1 GOLNC   DATI06         NO. DO A CLA
   627  750            2
   628  751          416 A=C     W              SHIFT THE LAST CHAR OUT
   629  752          670 C=REGN 6
   630  753          252 AC EX   WPT
   631  754          256 AC EX   W
   632  755         1074 RCR     2
   633  756          550 REGN=C 5
   634  757          770 C=REGN 7
   635  760          252 AC EX   WPT
   636  761          256 AC EX   W
   637  762         1074 RCR     2
   638  763          650 REGN=C 6
   639  764         1070 C=REGN 8
   640  765          252 AC EX   WPT
   641  766          256 AC EX   W
   642  767         1074 RCR     2
   643  770          750 REGN=C 7
   644  771         1070 C=REGN 8
   645  772          574 RCR     6
   646  773          112 C=0     WPT
   647  774          374 RCR     10
   648  775         1050 REGN=C 8
   649  776         1170 C=REGN 9
   650  777         1376 ? C#0   S              LCD FULL ?
   651 1000          473 GONC    BKPH50 (1047) YES, DO ARGOUT AGAIN
   652 1001            1 GOSUB   ROLBAK
   652 1002            0
   653 1003         1670 FRSABC                READ LAST CHAR FROM LCD
   654 1004         1730 CST EX                TEST FOR PUNC. CHAR
   655 1005          514 ?S6=1
   656 1006          127 GOC     BKPH20 (1020)
   657 1007         1214 ?S7=1
   658 1010          107 GOC     BKPH20 (1020)
   659 1011         1730 CST EX
   660 1012 BKPH10   336 C=B     S
   661 1013         1076 C=C+1   S
   662 1014          376 CB EX   S
   663 1015 PROMPT     1 GOSUB   OPROMT          OUT PUT PROMPT CHAR
   663 1016            0
   664 1017 NFRKB1   363 GOTO    NFRKB0 (1055)
   665 1020 BKPH20   504 S6=     0
   666 1021         1204 S7=     0
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```
   667 1022          1730 CST EX
   668 1023           406 A=C     X
   669 1024           460 LDI
   670 1025            40 CON     @40             LOAD A BLANK
   671 1026          1546 ? A#C   X               IS LAST CHAR A BLANK ?
   672 1027           127 GOC     BKPH30 (1041) NO
   673 1030           106 C=0     X
   674 1031          1760 PFAD=C
   675 1032          1160 DADD=C
   676 1033          1070 C=REGN 8               LOAD LAST CHAT FROM AREG.
   677 1034           126 C=0     XS
   678 1035          1546 ? A#C   X               IS IT A BLANK ?
   679 1036            67 GOC     BKPH40 (1044) NO
   680 1037             1 GOSUB   ENLCD
   680 1040             0
   681 1041 BKPH30    246 AC EX   X
   682 1042          1750 SLSABC                 PUT THE LAST CHAR BACK
   683 1043          1523 GOTO    PROMPT (1015)
   684 1044 BKPH40      1 GOSUB   ENLCD
   684 1045             0
   685 1046          1443 GOTO    BKPH10 (1012)
   686 1047 BKPH50    410 S8=     1               NO SCROLL, PROMPT
   687 1050             1 GOSUB   ARGOUT
   687 1051             0
   688 1052           316 C=B
   689 1053             1 GOSUB   STOLCC
   689 1054             0
   690 1055 NFRKB0      1 GOLONG  NFRKB1
   690 1056             2
   691                    ENTRY   XRND
*
* RND FUNCTION
*
   695 1057 XRND     1670 C=REGN 14              LOAD DISPLAY FORMAT
   696 1060          1074 RCR    2
   697 1061          1530 ST=C                   LOAD STATUS SET 1
   698 1062           406 A=C    X
   699 1063           370 C=REGN 3                 LOAD THE X
   700 1064           404 S8=    0
*
*
* ROUNDING ROUTINE
*   CALLING SEQUENCE :
*           C    = NORMALIZED NUMBER
*           A(2) = DSP #
*           S8   = 1 IF CALLED FROM "FORMAT"
*                  0 IF CALLED FROM "XRND"
*           GOSUB  ROUND
*   RETURN WITH ROUNDED NUMBER IN REG.C
*   USED A,B,C
*
   713 1065 ROUND    1240 SETDEC
   714 1066           226 B=A     XS
   715 1067 ROUNDA   1534 PT=     12              MOVE POINTER TO 12-(DSP# +1)
   716 1070 RND20    1024 ? PT=   2               END OF MANTISSA ?
   717 1071           447 GOC     RND90  (1135) YES, NO ROUNDING
   718 1072          1724 DEC PT
   719 1073           666 A=A-1   XS              STOP ?
   720 1074          1743 GONC    RND20  (1070) NO, KEEP GOING
   721 1075           416 A=C     W               COPY THE NUMBER TO A
```

```
722 1076         1366 ? C#0  XS             EXP POSITIVE ?
723 1077          453 GONC   RND30  (1144) YES
724 1100         1214 ?S7=1                 FIX MODE ?
725 1101          143 GONC   RND60  (1115) NO, LET'S ROUND IT UP
726 1102 RND40   1734 INC PT
727 1103         1524 ? PT=  12             PASS LEFT END OF MANTISSA?
728 1104          437 GOC    RND100 (1147) YES, FIX MODE INFEASIBLE
729 1105          546 A=A+1  X              KEEP MOVING TO ROUNDING POINT
730 1106         1743 GONC   RND40  (1102)
731 1107           63 GOTO   RND60  (1115) LET'S ROUND IT NOW
732 1110 RND70   1724 DEC PT               EXP POSITIVE
733 1111 RND75   1024 ? PT=  2              PASS END OF MANTISSA ?
734 1112          517 GOC    RND120 (1163) YES, FIX MODE INFEASIBLE
735 1113          646 A=A-1  X
736 1114         1743 GONC   RND70  (1110)
737 1115 RND60     56 B=0    W              HERE IS THE ROUNDING
738 1116          212 B=A    WPT
739 1117          472 A=A+B  M
740 1120          133 GONC   RND50  (1133) ROUNDING OK !
741 1121 RND45    416 A=C    W              SAVE THE # IN CASE OF OVERFLOW
742 1122           12 A=0    WPT
743 1123          406 A=C    X
744 1124         1434 PT=    1              TEST FOR OVERFLOW NUMBER
745 1125         1052 C=C+1  WPT
746 1126          117 GOC    RND95  (1137) OVERFLOW
747 1127 RND47     16 A=0    W
748 1130          576 A=A+1  S
749 1131         1616 A SR   W              SET MANTISSA TO 1
750 1132          634 PT=    11
751 1133 RND50     12 A=0    WPT
752 1134          272 AC EX  M              C_ROUNDED NUMBER
753 1135 RND90   1140 SETHEX
754 1136         1740 RTN
755 1137 RND95    256 AC EX  W              NO ROUNDING FOR OVERFLOW #
756 1140         1526 ? A#0  XS             EXP NEGATIVE ?
757 1141         1743 GONC   RND90  (1135) NO
758 1142          106 C=0    X              IT'S NOT REALLY A OVERFLW
759 1143         1643 GOTO   RND47  (1127)
760 1144 RND30   1214 ?S7=1                 FIX MODE ?
761 1145         1503 GONC   RND60  (1115) NO, LET'S ROUND IT UP
762 1146         1433 GOTO   RND75  (1111)
763 1147 RND100   546 A=A+1  X
764 1150           43 GONC   RND105 (1154)
765 1151          232 B=A    M
766 1152          472 A=A+B  M
767 1153         1467 GOC    RND45  (1121)
768 1154 RND105   414 ?S8=1                 CALLED FROM "FORMAT" ?
769 1155           37 GOC    RND110 (1160) YES
770 1156          116 C=0    W              RETURN ZERO
771 1157         1563 GOTO   RND90  (1135)
772 1160 RND110  1204 S7=    0              DISPLAY THE # IN SCI MODE
773 1161          166 AB EX  XS
774 1162         1053 GOTO   ROUNDA (1067) ROUND IT AGAIN
775 1163 RND120   414 ?S8=1                 CALLED FROM "FORMAT" ?
776 1164         1513 GONC   RND90  (1135) NO, NO DOUNDING THEN
777 1165            6 A=0    X              IS FIX MODE FEASIBLE ?
778 1166         1634 PT=    0
779 1167          642 A=A-1  PT             A(1) _ 9
780 1170         1406 ? A<C  X              EXP < 9
781 1171         1677 GOC    RND110 (1160) NO, FIX MODE INFEASIBLE
```

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   782 1172          1433 GOTO   RND90  (1135) FIX MODE , NO ROUNDING
*
*
* FORMAT ROUTINE - FORMAT A NORMALIZED NUMBER
* CALLING SEQUENCE :
*         C= NORMALIZED NUMBER
*         GOSUB FORMAT
* RETURN  < A : READY FOR DISPLAY REG.A >
*         < B : READY FOR DISPLAY REG.B >
* USED A,B,C. ASSUMED CHIP 0 ENABLE
* USED STATUS BITS 0-8
* S4 = DIGIT GROUPING FLAG
* S5 = DECIMAL POINT FLAG
* S6 = ENG MODE FLAG
* S7 = FIX MODE FLAG
* S8 = FIX MODE FEASIBLE FLAG
*
* CALLS STBT10, ROUND, LOAD3, LDD.P., SETQ=P
* PROBABLY USES ONLY ONE ADDITIONAL SUBROUTINE LEVEL
*
   802 1173 FORMAT  356 BC EX  W              SAVE THE NUMBER TO B
   803 1174         1140 SETHEX
   804 1175            1 GOSUB  STBT10         MOVE STATUS BITS TO REG.10
   804 1176            0
   805 1177          316 C=B    W              GET THE NUMBER BACK
   806 1200          410 S8=    1              SIGNAL ROUNDING ROUTINE
   807 1201            1 GOSUB  ROUND          ROUND THE NUMBER
   807 1202            0
   808 1203          356 BC EX  W              MOVE THE NUMBER TO B TEMP.
   809 1204            1 GOSUB  LOAD3          LOAD ALL 3'S TO C
   809 1205            0
   810 1206         1056 C=C+1                 C(0) _ 3
   811 1207          416 A=C    W              A _ ALL 3'S
   812 1210         1240 SETDEC
   813 1211         1670 C=REGN 14
   814 1212          274 RCR    5              C(13) _ DSP #
   815 1213          356 BC EX  W              B(13)_DSP# , C_ROUNDED NO.
   816 1214          176 AB EX  S              A(13)_DSP# , B(13)_3
   817 1215          346 B=C    X              COPY EXP TO B
   817 1216          306
   818 1217         1376 ? C#0  S              MANTISSA POSITIVE ?
   819 1220           33 GONC   *+3    (1223) YES
   820 1221         1334 PT=    13
   821 1222         1520 LC     13             LOAD THE MINUS SIGN
   822 1223         1214 ?S7=1                 FIX MODE ?
   823 1224            1 GOLNC  NOTFIX         NO
   823 1225            2
   824 1226 FIX00   1534 PT=    12
   825 1227         1366 ? C#0  XS             EXP POSITIVE ?
   826 1230          133 GONC   FIX20  (1243) YES
   827 1231            1 GOSUB  LDD.P.         LOAD DECIMAL POINT
   827 1232            0
   828 1233            1 GOSUB  SETQ=P
   828 1234            0
   829 1235 FIX10   1724 DEC PT
   830 1236         1732 C SR   M              SHIFT IN LEADING ZERO
   831 1237          676 A=A-1  S              DECREMENT DSP #
   832 1240         1046 C=C+1  X              UNTIL EXP = 0
   833 1241         1743 GONC   FIX10  (1235)
   834 1242          173 GOTO   FIX40  (1261) PUT IN THE TAIL BLANKS
```

```
835 1243 FIX20   1146 C=C-1   X                PASSING D.P. ?
836 1244           37 GOC     FIX30   (1247) YES, GOTO LOAD D.P.
837 1245         1724 DEC PT
838                   LEGAL
839 1246         1753 GOTO    FIX20   (1243)
840 1247 FIX30    106 C=0     X
841 1250          676 A=A-1   S
842 1251          477 GOC     FIX60   (1320) FIX MODE, DSP# = 0
843 1252            1 GOSUB   LOD.P.          LOAD THE D.P.
843 1253            0
844 1254            1 GOSUB   SETQ=P          SET Q=P
844 1255            0
845 1256 FIX35   1724 DEC PT                   PASSING THE DSP #
846 1257         1024 ? PT=   2                END OF MANTISSA ?
847 1260          107 GOC     FIX50   (1270) YES
848 1261 FIX40    676 A=A-1   S                DSP# _ DSP# -1
849 1262         1743 GONC    FIX35   (1256)
850 1263 FIX45   1724 DEC PT
851 1264         1024 ? PT=   2                END OF MANTISSA ?
852 1265           37 GOC     FIX50   (1270)
853 1266          642 A=A-1   PT               FILLING TAILING BLANK
854                   LEGAL
855 1267         1743 GOTO    FIX45   (1263)
856 1270 FIX50   1634 PT=     0
857 1271          340 SEL Q
858 1272          114 ?S4=1                    GROUPING FLAG SET ?
859 1273          103 GONC    FIX57   (1303) NO
860 1274 SETCOM   176 A=B     S                A.S _ 3(COMMA COUNTER)
860 1275          236
861 1276 FIX55    676 A=A-1   S                COUNT 3 AND LOAD A COMMA
862 1277          107 GOC     LDCOMA  (1307)
863 1300         1734 INC PT                   MOVE THE POINTER TO LEFT
864 1301         1324 ? PT=   13
865 1302         1743 GONC    FIX55   (1276)
866 1303 FIX57   1334 PT=     13               Q _ 13
867 1304          240 SEL P
868 1305          176 AB EX   S                A(13) _ 3
869 1306          203 GOTO    FMTRTN  (1326)
870 1307 LDCOMA   242 AC EX   PT
871 1310          214 ?S5=1                    LOAD A COMMA
872 1311           33 GONC    *+3     (1314)
873 1312         1720 LC      15
874 1313           23 GOTO    *+2     (1315)
875 1314          720 LC      7                LOAD A D.P. INSTEAD OF
876 1315         1734 INC PT
877 1316          242 AC EX   PT
878 1317         1553 GOTO    SETCOM  (1274)
879 1320 FIX60     1 GOSUB   SETQ=P
879 1321           0
880 1322          114 ?S4=1
881 1323            1 GSUBC  LOD.P.
881 1324            1
882 1325         1363 GOTO    FIX45   (1263)
883 1326 FMTRTN   676 A=A-1   S                A(13) _ 2
884 1327          666 A=A-1   XS               A(2) _ 2
885 1330          256 AC EX   W
886 1331         1140 SETHEX
887 1332          356 BC EX
888 1333            1 GOLONG.LDSST0
888 1334            2
```

```
889 1335 NOTFIX 1534 PT=    12
890 1336         514 ?S6=1                  ENG MODE ?
891 1337         623 GONC   SCI00  (1421)  NO, SCI MODE
892 1340         406 A=C    X               A.X _ EXP
893 1341         460 LDI
894 1342           3 CON    3
895 1343        1526 ? A#0  XS              EXP NEGATIVE ?
896 1344          57 GOC    ENG10  (1351)  YES
897 1345         706 A=A-C  X               COMPUTE EXP MOD 3
898 1346        1773 GONC   *-1    (1345)
899 1347         506 A=A+C  X
900 1350         447 GOC    ENG60  (1414)
901 1351 ENG10   506 A=A+C  X               ADD 3 TO NEGATIVE EXP
902 1352        1773 GONC   *-1    (1351)
903 1353 ENG20   306 C=B    X               COPY EXP BACK TO C.X
904 1354        1206 C=-C   X               COMPLIMENT NEGATIVE EXP
905 1355        1006 C=C+A  X
906 1356 ENG25   646 A=A-1  X               MOVE THE D.P. TO RIGHT
907 1357          67 GOC    ENG30  (1365)
908 1360        1724 DEC PT
909 1361         676 A=A-1  S               DECREMENT THE DSP #
910 1362        1743 GONC   ENG25  (1356)
911 1363          36 A=0    S               DSP# _ 0
912 1364        1723 GOTO   ENG25  (1356)
913 1365 ENG30    1 GOSUB  LDD.P.
913 1366          0
914 1367 ENG35  1724 DEC PT                PASSING DSP #
915 1370        1024 ? PT=  2
916 1371          77 GOC    ENG45  (1400)
917 1372         676 A=A-1  S
918 1373        1743 GONC   ENG35  (1367)
919 1374 ENG40   642 A=A-1  PT              A(PT)_2, FILL TAILING BLANK
920 1375        1724 DEC PT
921 1376        1024 ? PT=  2               END OF MANTISSA ?
922 1377        1753 GONC   ENG40  (1374)
923 1400 ENG45  1326 ? B#0  XS              EXP NEGATIVE ?
924 1401          33 GONC   ENG50  (1404)  NO
925 1402        1034 PT=    2
926 1403        1520 LC     13              LOAD THE MINUS SIGN
927 1404 ENG50    34 PT=    3
928 1405         246 AC EX  X
929 1406         460 LDI
930 1407        1463 CON    @1463
931 1410         246 AC EX  X
932 1411         340 SEL Q
933 1412           1 GOLONG FIX57
933 1413           2
934 1414 ENG60   306 C=B    X               C.X _ EXP
935 1415         246 AC EX  X
936 1416         706 A=A-C  X
937 1417         246 AC EX  X
938 1420        1363 GOTO   ENG25  (1356)
939 1421 SCI00    6 A=0    X
940 1422        1366 ? C#0  XS              EXP POSITIVE ?
941 1423        1307 GOC    ENG20  (1353)  NO
942 1424        1413 GOTO   ENG30  (1365)
943 1425 SETQ=P  340 SEL Q
944 1426        1334 PT=    13
945 1427 SETQ10  440 ? P=Q
946 1430          37 GOC    SETQ20 (1433)
```

```
   947 1431          1724 DEC PT
   948                    LEGAL
   949 1432          1753 GOTO   SETQ10 (1427)
   950 1433 SETQ20    240 SEL P
   951 1434          1740 RTN
   952 1435 LDD.P.    242 AC EX  PT
   953                    ENTRY  LDDP10         FOR PRINTER ROM
   954 1436 LDDP10    214 ?S5=1
   955 1437            33 GONC   *+3    (1442)
   956 1440           720 LC     7
   957 1441            23 GOTO   *+2    (1443)
   958 1442          1720 LC     15             LOAD A COMMA INSTEAD OF
   959 1443          1734 INC PT
   960 1444           242 AC EX  PT
   961 1445          1740 RTN
*
* DSPCRG - OUTPUT REG.C TO LCD
* IF C[13] = 0 OR 9 IT MEANS A NORMALIZED NUMBER
* IF C[13] = 1 IT MEANS A ALPHA STRING
* ASSUMED CHIP 0 ENABLE.
* USED A,B,C,N, STATUS BITS 0-8. RETURN CHIP 0 ENABLE.
* 2 SUB LEVELS.
*
   970 1446 DSPCRG    240 SEL P
   971 1447            36 A=0    S
   972 1450           576 A=A+1  S              A.S _ 1
   973 1451          1576 ? A#C  S              IS IT A STRING ?
   974 1452           103 GONC   VIEW05 (1462) YES
   975 1453             1 GOSUB  FORMAT
   975 1454             0
   976 1455             1 GOSUB  ENLCD
   976 1456             0
   977 1457           356 CB EX  W
   978 1460             1 GOLONG RFDS55
   978 1461             2
   979 1462 VIEW05   1334 PT=    13
   980 1463          1420 LC     12
   981 1464           376 BC EX  S
   982 1465 DSPCA    1340 DISOFF
   983 1466          1334 PT=    13
   984 1467          1720 LC     15
   985 1470          1720 LC     15
   986 1471          1574 RCR    12             C(1:0) _ FF:DELIMINATOR
   987 1472           160 N=C                   SAVE THE REG. IN N
   988 1473             1 GOSUB  ENLCD
   988 1474             0
   989 1475 VIEW20    260 C=N
   990 1476          1574 RCR    12             C(1:0) _ OUT GOING CHAR
   991 1477           160 N=C
   992 1500           406 A=C    X
   993 1501          1434 PT=    1
   994 1502          1512 ? A#0  WPT            LEADING ZERO ?
   995 1503          1723 GONC   VIEW20 (1475) YES, IGNORE IT
   996 1504           552 A=A+1  WPT            HIT DELIMINATOR ?
   997 1505            47 GOC    VIEW30 (1511) YES
   998 1506             1 GOSUB  ASCLCD         SEND IT TO LCD
   998 1507             0
   999 1510          1653 GOTO   VIEW20 (1475)
  1000 1511 VIEW30    460 LDI
  1001 1512            40 CON    @40
```

```
 1002 1513          336 C=B    S              LEFT JUSTIFY
 1003 1514 VIEW35  1176 C=C-1  S
 1004 1515           43 GONC   VIEW40 (1521)
 1005 1516         1440 DISTOG
 1006 1517            1 GOLONG ENCF00
 1006 1520            2
 1007 1521 VIEW40  1750 SLSABC
 1008 1522         1723 GOTO   VIEW35 (1514)
 1009
 1010
 1011
*************************************************************
*THIS IS THE START OF THE CATALOG ROUTINE. CATALOG 2
*DISPLAYS PLUG IN ROM FUNCTIONS.
*************************************************************
 1016 1523 CAT##2   116 C=0
 1017 1524          146 AB EX  X
 1018 1525          646 A=A-1  X              GET NUMBER
 1019 1526         1072 C=C+1  M              ADDR= 2ND WORD OF ROM
 1020 1527          534 PT=    6              2ND WORD= # FUNCTIONS IN ROM
 1021 1530          420 LC     4
 1022 1531          534 PT=    6
 1023 1532 NXTROM  1042 C=C+1  PT             ADDR= 2ND WORD OF NEXT ROM
 1024 1533            1 GOLC   OUTCAT
 1024 1534            3
 1025 1535         1460 CXISA                 GET 2ND WORD= # FUNCTIONS
 1026 1536          706 A=A-C  X
 1027 1537         1733 GONC   NXTROM (1532)
 1028 1540          506 A=A+C  X              A IS NUMBER IN ROM
 1029 1541           32 A=0    M              ADD A TO STRT DEF ADRS
 1030 1542          256 AC EX
 1031 1543          674 RCR    11
 1032 1544          772 C=C+C  M              DOUBLE DISTANCE
 1033 1545         1032 C=C+A  M              ADDRESS OF DEF - 1
 1034 1546         1072 C=C+1  M              GET ADDRESS OF CHARACTERS
 1035 1547         1460 CXISA
 1036 1550          346 BC EX  X
 1037 1551         1072 C=C+1  M
 1038 1552         1460 CXISA
 1039 1553         1074 RCR    2
 1040 1554          306 C=B    X
 1041 1555         1434 PT=    1              BUILD ADDRESS
 1042 1556           74 RCR    3
 1043 1557          242 AC EX  PT
 1044 1560          674 RCR    11
 1045 1561         1002 C=C+A  PT
 1046 1562          766 C=C+C  XS
 1047 1563          766 C=C+C  XS
 1048 1564          766 C=C+C  XS
 1049 1565           47 GOC    USLNG  (1571) USLNG CODE
 1050 1566         1174 RCR    9              MICRO DONE
 1051 1567            1 GOLONG END2           PUT OUT PROMPT
 1051 1570            2
 1052       USLNG
 1053 1571         1574 RCR    12
 1054 1572          256 AC EX
 1055 1573         1010 S2=    1
 1056 1574            1 GOSUB  TXTLB1
 1056 1575            0
 1057 1576            1 GOLONG END3
```

```
  1057 1577            2
*****************************************************
*CATALOG SUBROUTINES AND ENTRY LOGIC.
*****************************************************
  1061 1600 XCAT     256 AC EX                  GET CATALOG NUMBER
  1062 1601         1530 ST=C
  1063 1602            1 GOSUB  TONSTF
  1063 1603            0
**IN THE NEXT PART, THE CONTENTS OF THE C REG WILL BE SHOWN.
**"C"= CATALOG #, "E"= DIGIT OF ENTRY #, "A"= ALPHA CHARACTER.
  1066 1604           16 A=0
  1067 1605         1070 C=REGN 8                C= "* *******AAA AAA"
  1068 1606          234 PT=    5                 *= DON'T KNOW OR DON'T CARE (OR BO
  1069 1607          412 A=C    WPT               SAVE ALPHA IN A
  1070 1610         1630 C=ST                    GET CATALOG #
  1071 1611         1474 RCR    1                C= "C ********** ***"
  1072 1612          276 AC EX  S                 SAVE CATALOG # IN A(S)
  1073 1613          256 AC EX                    C= "C 0000000AAA AAA"
  1074 1614         1050 REGN=C 8
  1075 1615 GTCNTR  1070 C=REGN 8                 GET CAT # AND ENTRY #, "E"=ENTRY#
  1076 1616          374 RCR    10               C= "0 000AAAAAAC EEE"
  1077 1617 NOCHG   1046 C=C+1  X                 MOVE TO NEXT ENTRY
  1078 1620         1604 S0=    0                CLEAR BST FLAG
  1079 1621 BSTCNT   346 B=C    X                SAVE ENTRY #
  1079 1622          306
  1080 1623          174 RCR    4                C= "C EEE0000AAA AAA"
  1081 1624         1050 REGN=C 8
  1082 1625         1176 C=C-1  S                CHECK FOR CAT 0
  1083 1626         1176 C=C-1  S                CHECK FOR CAT 1
  1084 1627          547 GOC    CAT##1 (1703)
  1085 1630         1176 C=C-1  S                CHECK FOR CAT 2
  1086 1631            1 GOLC   CAT##2
  1086 1632            3
  1087 1633            1 GOLONG CAT##3
  1087 1634            2
*****************************************************
  1089 1635 CNTLOP   460 LDI                     LOAD TIME OUT CONSTANT
  1090 1636          400 CON    @400
  1091 1637 KPCNT    356 BC EX
  1092 1640         1714 CHK KB
  1093 1641          173 GONC   DECCNT (1660)
  1094 1642         1040 C=KEYS
  1095 1643           74 RCR    3
  1096 1644          126 C=0    XS
  1097 1645          406 A=C    X
  1098 1646         1634 PT=    0
  1099 1647          742 C=C+C  PT                CHECK FOR "ON" KEY
  1100 1650            1 GOLC   OFF
  1100 1651            3
  1101 1652          460 LDI
  1102 1653          207 CON    135               R/S KEY?
  1103 1654         1546 ? A#C  X
  1104 1655 XCCTMG     1 GOLNC  CLCTMG            CLEAR CATALOG AND MESSAGE
  1104 1656            2
  1105 1657 RSTKBD  1710 RST KB
  1106 1660 DECCNT   356 BC EX
  1107 1661         1146 C=C-1  X
  1108 1662         1553 GONC   KPCNT  (1637)
  1109 1663         1323 GOTO   GTCNTR (1615)
  1110 1664 SSTCAT     1 GOSUB  SETSST            SET SST FLAG
```

```
1110 1665           0
1111 1666        1273 GOTO   GTCNTR (1615) INC CNT IN B
1112 1667 R/SCAT    1 GOSUB  RSTKB         CLEAR KEYBOARD
1112 1670           0
1113 1671        1243 GOTO   GTCNTR (1615)
1114 1672 BSTCAT    1 GOSUB  SETSST        SET SST FLAG
1114 1673           0
1115 1674        1610 S0=    1             SET BST FLAG
1116 1675        1070 C=REGN 8
1117 1676         374 RCR    10            BST COUNTER
1118 1677        1146 C=C-1  X
1119 1700        1346 ? C#0  X             INDEX#0?
1120 1701        1207 GOC    BSTCNT (1621)
1121 1702        1153 GOTO   NOCHG  (1617)
*********************************************************
*THE ROUTINES WHICH GET AND DISPLAY THE CHARACTERS
*FOR THE THREE TYPES OF CATALOGS ARE LISTED BELOW.
*********************************************************
1126 1703 CAT##1   34 PT=    3
1127 1704         304 S10=   0             SET RAM FLAG
1128 1705         346 BC EX  X             CHK FOR FIST TIME
1129 1706        1146 C=C-1  X
1130 1707        1146 C=C-1  X
1131 1710         113 GONC   PC     (1721)
1132 1711           1 GOSUB  FSTIN
1132 1712           0
1133 1713         420 LC     4
1134 1714        1604 S0=    0               CLEAR BST FLAG
1135 1715          34 PT=    3
1136 1716         356 CB EX
1137 1717           1 GOSUB  CLRSB2          CLR STK,L#,SAVE NEW PC
1137 1720           0
1138 1721 PC        1 GOSUB  GETPC           FETCH PC TO A(0,3)
1138 1722           0
1139 1723        1570 C=REGN 13
1140 1724         620 LC     6
1141 1725          34 PT=    3
1142 1726        1614 ?S0=1
1143 1727         107 GOC    OVRINC (1737) DO BST?
1144 1730        1552 ? A#C  WPT
1145 1731           1 GOLNC  QUTCAT
1145 1732           2
1146 1733           1 GOSUB  INCAD2
1146 1734           0
1147 1735           1 GOSUB  INCAD           GET BY START OF LINK
1147 1736           0
1148 1737 OVRINC    1 GOSUB  FLINKA
1148 1740           0
1149 1741        1614 ?S0=1                   BST
1150 1742          37 GOC    OVRROT (1745)  LEAVE A(0:3) ALONE
1151 1743         174 RCR    4
1152 1744         252 AC EX  WPT
1153 1745 OVRROT    1 GOSUB  PUTPCD
1153 1746           0
1154 1747           1 GOSUB  CLLCDE
1154 1750           0
1155 1751        1404 S1=    0             NO SCROLLING
1156 1752           1 GOSUB  DF060
1156 1753           0
1157 1754           1 GOLONG_END3
```

```
 1157 1755            2
*************************************************************
 1159                    ENTRY  NFRST+
*************************************************
*THIS CODE FINISHES REGISTER ARITHMETIC.
*************************************************
 1163 1756 NFRST+     1 GSBLNG OVFL10          CHECK OVERFLOW
 1163 1757            0
 1164 1760          356 BC EX
 1165 1761          324 ? PT=  10              IF PT = 10 OVERFLOW
 1166 1762          113 GONC   NOOVF  (1773)
 1167 1763          106 C=0    X               RE-ENABLE CHIP 0
 1168 1764         1160 DADD=C
 1169 1765         1670 C=REGN 14
 1170 1766          574 RCR    6
 1171 1767         1530 ST=C
 1172 1770         1214 ?S7=1                 RANGE ERROR IGNORE?
 1173 1771            1 GOLNC  ERRIGN         NO. GO TEST ERROR IGNORE FLAG
 1173 1772            2
 1174 1773 NOOVF    260 C=N
 1175 1774         1160 DADD=C
 1176 1775          356 BC EX
 1177 1776         1360 DATA=C
 1178 1777         1740 RTN
 1179
 1180
 1181
 1182                    UNLIST

 ERRORS :       0
```

SYMBOL TABLE

BAKAPH	743	-					
BAKDE	645	-					
BKDE10	657	-	664	655			
BKDE20	665	-	660				
BKDE30	732	-	725				
BKDG	671	-	717	715			
BKDG1	676	-	673				
BKEX10	667	-					
BKEX20	700	-	670				
BKEX30	704	-	702				
BKEXP	654	-					
BKMANT	656	-	653				
BKMN20	706	-	666				
BKMN25	716	-	711				
BKMN30	722	-	713	707			
BKPH10	1012	-	1046				
BKPH20	1020	-	1010	1006			
BKPH30	1041	-	1027				
BKPH40	1044	-	1036				
BKPH50	1047	-	1000				
BLINK	231	-					
BLINK1	231	-	220	215	175	154	144
BSTCAT	1672	-					
BSTCNT	1621	-	1701				
CAT##1	1703	-	1627				
CAT##2	1523	-					
CHSEXP	204	-	171				
CNTLOP	1635	-					
DE200	123	-	121				
DE210	125	-	130				
DE220	131	-	126				
DECCNT	1660	-	1641				
DECHS	170	-	106				
DECHS1	176	-	173				
DEDP	143	-	117				
DEEEX	147	-	114				
DEEXP	214	-					
DERNRT	344	-	337	335			
DEROVF	353	-					
DERRT1	347	-	356				
DERUN	255	-					
DERUN5	317	-	343				
DGENS8	66	-					
DIGENT	67	-					
DIGST*	262	-					
DIGST1	263	-	261				
DIGST2	303	-	276				
DSPCA	1465	-					
DSPCRG	1446	-					
ENCP00	522	-	535				
ENG10	1351	-	1344				
ENG20	1353	-	1423				
ENG25	1356	-	1420	1364	1362		
ENG30	1365	-	1424	1357			
ENG35	1367	-	1373				
ENG40	1374	-	1377				

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ENG45   1400   -  1371
ENG50   1404   -  1401
ENG60   1414   -  1350
EXPDG1   223   -   226
EXPDG2   227   -   224
FIX00   1226   -
FIX10   1235   -  1241
FIX20   1243   -  1246 1230
FIX30   1247   -  1244
FIX35   1256   -  1262
FIX40   1261   -  1242
FIX45   1263   -  1325 1267
FIX50   1270   -  1265 1260
FIX55   1276   -  1302
FIX57   1303   -  1273
FIX60   1320   -  1251
FMTRTN  1326   -  1306
FORMAT  1173   -
GTCNTR  1615   -  1671 1666 1663
GTRMAD     0   -
INDSJ    141   -   135
INPTDG   240   -   230
KPCNT   1637   -  1662
LDCOMA  1307   -  1277
LDD.P.  1435   -
LDDP10  1436   -
NFRKB0  1055   -  1017
NFRKB1  1017   -
NFRST+  1756   -
NOCHG   1617   -  1702
NOOVF   1773   -  1762
NOREG9   536   -
NORG05   540   -   543
NORG10   544   -   541
NORG20   550   -   555
NORG30   556   -   551
NORG40   570   -   574
NORG42   575   -   606
NORG45   576   -   604
NORG50   605   -   567
NORG51   607   -   613  612  571
NORG55   614   -   610  577
NORG65   641   -   601
NORG70   642   -   622
NORG75   643   -   627
NOTFIX  1335   -
NXTROM  1532   -  1537
OVRINC  1737   -  1727
OVRROT  1745   -  1742
PC      1721   -  1710
PGMAON   526   -
PROMPT  1015   -  1043
R/SCAT  1667   -
RFDS10   371   -   376
RFDS15   377   -   372
RFDS17   411   -   403  401
RFDS19   413   -   416
RFDS20   417   -   414
RFDS25   425   -   412
RFDS26   431   -   446
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RFDS27   432  -   437
RFDS28   440  -   433
RFDS30   447  -   430
RFDS35   451  -   435  426
RFDS40   501  -   471
RFDS42   502  -   475
RFDS45   504  -   500
RFDS50   506  -   466
RFDS55   511  -
RG9LCD   357  -
RMAD10    20  -    24
RMAD15    23  -    65
RMAD20    26  -    22
RMAD30    64  -    34
RND100  1147  -  1104
RND105  1154  -  1150
RND110  1160  -  1171 1155
RND120  1163  -  1112
RND20   1070  -  1074
RND30   1144  -  1077
RND40   1102  -  1106
RND45   1121  -  1153
RND47   1127  -  1143
RND50   1133  -  1120
RND60   1115  -  1145 1107 1101
RND70   1110  -  1114
RND75   1111  -  1146
RND90   1135  -  1172 1164 1157 1141 1071
RND95   1137  -  1126
ROUND   1065  -
ROUNDA  1067  -  1162
RSTKBD  1657  -
RSTO9J   213  -
RSTOR9   246  -   213  167
RSTRG9   740  -   705  677
RSTSS    741  -   721
RSTST    247  -   203  201  157
RSTSTJ   201  -   146
SCI00   1421  -  1337
SETCOM  1274  -  1317
SETQ10  1427  -  1432
SETQ20  1433  -  1430
SETQ=P  1425  -
SSTCAT  1664  -
USLNG   1571  -  1565
VIEW05  1462  -  1452
VIEW20  1475  -  1510 1503
VIEW30  1511  -  1505
VIEW35  1514  -  1522
VIEW40  1521  -  1515
XCAT    1600  -
XCCTMG  1655  -
XRND    1057  -
```

ENTRY TABLE

BAKAPH	743	-
BAKDE	645	-
BLINK	231	-
BLINK1	231	-
BSTCAT	1672	-
CAT##1	1703	-
CAT##2	1523	-
CNTLOP	1635	-
DEEXP	214	-
DEROVF	353	-
DERUN	255	-
DGENS8	66	-
DIGENT	67	-
DIGST*	262	-
DSPCA	1465	-
DSPCRG	1446	-
ENCP00	522	-
FIX57	1303	-
FORMAT	1173	-
GTCNTR	1615	-
GTRMAD	0	-
INPTDG	240	-
LDD.P.	1435	-
LDDP10	1436	-
NFRST+	1756	-
NOREG9	536	-
NOTFIX	1335	-
PGMAON	526	-
R/SCAT	1667	-
RFDS55	511	-
RG9LCD	357	-
ROUND	1065	-
RSTST	247	-
SETQ=P	1425	-
SSTCAT	1664	-
XCAT	1600	-
XRND	1057	-

EXTERNAL REFERENCES

ARGOUT	1050					
ARGOUT	1051					
ASCLCD	1506					
ASCLCD	1507					
BAKDE	75					
BAKDE	76					
BLINK1	132					
BLINK1	133					
CAT##2	1631					
CAT##2	1632					
CAT##3	1633					
CAT##3	1634					
CLCTMG	1655					
CLCTMG	1656					
CLLCDE	1747					
CLLCDE	1750					
CLRSB2	1717					
CLRSB2	1720					
DAT106	747					
DAT106	750					
DAT231	312					
DAT231	313					
DAT320	301					
DAT320	302					
DATOFF	635	726				
DATOFF	636	727				
DECAD	345					
DECAD	346					
DEEXP	111					
DEEXP	112					
DEROVF	631					
DEROVF	632					
DF060	1752					
DF060	1753					
DIGENT	321					
DIGENT	322					
ENCP00	317	1517				
ENCP00	320	1520				
END2	1567					
END2	1570					
END3	1576	1754				
END3	1577	1755				
ENLCD	364	526	1037	1044	1455	1473
ENLCD	365	527	1040	1045	1456	1474
ERR120	730					
ERR120	731					
ERRIGN	1771					
ERRIGN	1772					
FIX57	1412					
FIX57	1413					
FLINKA	1737					
FLINKA	1740					
FORMAT	1453					
FORMAT	1454					
FSTIN	1711					
FSTIN	1712					

```
TONSTF  1602
TONSTF  1603
TXTLB1  1574
TXTLB1  1575

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @6000-7777
*
     4                    FILE   CN3B
     5                    ENTRY  DSPLN+
     6                    ENTRY  ABTSEQ
     7                    ENTRY  ABTS10
     8                    ENTRY  AJ2
     9                    ENTRY  AJ3
    10                    ENTRY  FDIGIT
    11                    ENTRY  FDIG20
    12                    ENTRY  IND
    13                    ENTRY  MIDDIG
    14                    ENTRY  NEXT
    15                    ENTRY  NEXT1
    16                    ENTRY  NEXT2
    17                    ENTRY  NEXT3
    18                    ENTRY  NLT000
    19                    ENTRY  NLT020
    20                    ENTRY  NULT#
    21                    ENTRY  NULT#3
    22                    ENTRY  NULT#5
    23                    ENTRY  NULTST
    24                    ENTRY  PAR112
    25                    ENTRY  PARSE
    26                    ENTRY  PARSEB
    27                    ENTRY  PARS56
    28                    ENTRY  PARA60
    29                    ENTRY  PARS75
    30                    ENTRY  STK
*
* CLRSB2 - CLEAR USER SUBROUTINE STACK AND CLOBBER LINE NUMBER
* ON ENTRY - PT=3, CHIP 0 ENABLED, NEW PC IN B[3:0] IN MM FORM
* USES B[3:0], A[3:0], C
* EXITS VIA PUTPCX, WHICH CLOBBERS THE LINE NUMBER ONLY IF S13=0.
*
* CLRSB3 - ENTRY POINT TO FINISH PUSHING THE SUBROUTINE STACK
* ON ENTRY - C[13:4] HAS WHAT SHOULD GO INTO REG 12[13:4],
*     PT=3, CHIP 0 ENABLED, NEW PC IN B[3:0] IN MM FORM
* OTHERWISE THE SAME AS CLRSB2
*
    42                    ENTRY  CLRSB2
    43                    ENTRY  CLRSB3
    44    0 CLRSB2   116 C=0
    45    1          1350 REGN=C 11
    46    2 CLRSB3   1450 REGN=C 12
    47    3           152 AB EX  WPT
    48    4           263 GOTO   CLRSBX (  32)
    49                    FILLTO @4
*
```

```
* PARSE - KEY SEQUENCE PARSER
* ENTRY CONDITIONS: CHIP 0 SELECTED, HEX, P SEL
*
    54       PARSE
    55     5         1670 C=REGN 14             LOAD STATUS SET 1/2
    56     6         1474 RCR    1
    57     7         1530 ST=C
    58    10          640 CLRABC
    59    11         1040 C=KEYS
    60    12          274 RCR    5              KC TO C[13:12]
    61    13          460 LDI
    62    14          301 CON    @301           @6020%16
    63    15          374 RCR    10
    64    16           34 PT=    3
    65    17          740 GOTOC
    66                    FILLTO:@17
    67    20            0 NOP                   CAUSES COL 0 TO MAP
    68                                          ONTO COLUMN 1
    69    21           20 LC     0              1
    70    22          133 GOTO   PAR003 (  35) 2
    71    23          120 LC     1              3
    72    24          113 GOTO   PAR003 (  35) 4
    73    25 PAR001   220 LC     2              5
    74    26           73 GOTO   PAR003 (  35) 6
    75    27         1763 GOTO   PAR001 (  25) 7
    76    30          320 LC     3              8
    77    31           43 GOTO   PAR003 (  35) 9
    78    32 CLRSBX     1 GOLONG:PUTPCX
    78    33            2
    79                    FILLTO:@33
    80    34          420 LC     4              C
    81    35 PAR003  1474 RCR    1              C[2:1]=LOGCOL,ROW
    82    36          406 A=C    X              A[2:1]=LOGCOL,ROW
    83    37          114 ?S4=1                 SHIFTSET?
    84    40           43 GONC   PAR005 (  44) NO
    85    41          460 LDI
    86    42          200 CON2   8       0      ADJ ROW FOR SHIFT
    87    43         1006 C=A+C  X
    88    44 PAR005   160 N=C                   N[2:1]=LOG KC
    89    45          214 ?S5=1                 PKSEQ?
    90    46          603 GONC   NEWFCN ( 126) NO
*
    92                                          CONTINUING KEY SEQUENCE
    93                                          A[2:1]=LOGCOL, ROW
    94                                          A[0]=0, A.M=0
    95                                          ROW DOES NOT HAVE SHIFT
    96                                          ADJUSTMENT IN IT
    97    47          256 AC EX
    98    50         1434 PT=    1
    99    51          742 C=C+C  PT
   100    52          756 C=C+C
   101    53          756 C=C+C
   102    54          756 C=C+C
   103    55         1374 RCR    13
   104    56          534 PT=    6
   105    57          120 LC     1              PKTTAB IS AT @10000
   106    60         1460 CXISA
   107    61         1474 RCR    1              CONSTRUCT PTEMP1
   108    62          746 C=C+C  X
   109    63          746 C=C+C  X
```

```
  110                   ENTRY  PARS05
* ENTRY POINT FOR WAND ON 3-13-79
*
  113       PARS05
  114   64          416 A=C
  115   65         1634 PT=     0
  116   66         1770 C=REGN 15
  117   67           74 RCR    3
  118   70          130 G=C                    RESTORE PTEMP2 TO G
  119   71          502 A=A+C  PT              MERGE OPERAND TYPE INFO
  120   72          246 AC EX  X
  121   73         1530 ST=C                   PUT UP PTEMP1
  122   74         1104 S9=     0              SAY ADDRESS NOT FOUND YET
  123   75            1 GOSUB  ENLCD           TURN ON LCD CHIP
  123   76            0
  124   77          460 LDI
  125  100           40 CON    32             BLANK
  126  101          406 A=C    X              BLANK TO A.X
  127  102          206 B=A    X               AND B.X
  128  103         1434 PT=     1
  129  104 PARS10 1670 RABCR                   RIGHT JUSTIFY LCD
  130  105         1552 ? A#C  WPT
  131  106         1763 GONC   PARS10 ( 104)
  132  107          652 A=A-1  WPT             TURN BLANK INTO PROMPT
  133  110 PARS20 1552 ? A#C  WPT              NOT A PROMPT?
  134  111           67 GOC    PARS30 ( 117) NOT A PROMPT
  135  112          306 C=B    X              RETRIEVE BLANK
  136  113         1750 SLSABC                 GET RID OF PROMPT
  137  114         1650 SRSABC
  138  115         1670 RABCR                  SHIFT OFF SOMETHING
  139  116         1723 GOTO   PARS20 ( 110)
  140  117 PARS30 1770 RABCL
*
  142  120          576 A=A+1  S               CHECK FOR BACKARROW
  143  121         1540 RTN C
  144  122          676 A=A-1  S
  145  123          660 C=STK
  146  124         1072 C=C+1  M               INCREMENT RETURN ADDRESS
  147  125          740 GOTOC                  ON EXIT, PT=1, LCD CHIP ON,
  148                                          SS PTEMP1 UP, B.X=BLANK
*
* NEWFCN - NEW FUNCTION
* FIRST KEY OF A NEW KEY SEQUENCE
  152       NEWFCN                            ON ENTRY, SS1/2 UP, CHIP 0
  153                                         ON, KC IN C[2:1], B=0
  154  126          406 A=C    X               A[2:1]=LOG KC
  155  127         1670 C=REGN 14
  156  130         1530 ST=C                   PUT UP SS0
  157  131         1214 ?S7=1                  ALPHAMODE?
  158  132           43 GONC   PARS50 ( 136) NO
  159  133          460 LDI
  160  134          525 CON    @525            H1550\16=@525
  161  135          563 GOTO   PARS55 ( 213)
*
  163  136 PARS50  574 RCR    6
  164  137         1530 ST=C                   PUT UP SS3
  165  140          114 ?S4=1                  USERMODE?
  166  141          463 GONC   PARS52 ( 207) NO
  167  142            1 GOSUB  TBITMP          YES. TEST BIT MAP
  167  143            0
```

```
   168  144          1356 ? C#0                    KEY REASSIGNED?
   169  145             1 GOLC    RAK60            YES
   169  146             3
   170  147          1670 C=REGN 14
   171  150          1530 ST=C                     PUT UP SS0 AGAIN
   172  151            14 ?S3=1                    PRGMMODE?
   173  152           337 GOC     RAK10  ( 205) YES - SKIP AUTO-ASSIGN TESTS
   174  153           260 C=N
   175  154           132 C=0     M
   176  155          1074 RCR     2                LOG ROW TO C.S
   177  156           406 A=C     X                LOG COL TO A.X
   178  157           460 LDI
   179  160           146 CON2    6       6        ROW 0 OFFSET
   180  161          1176 C=C-1   S                ROW 0?
   181  162           147 GOC     RAK05  ( 176) YES
   182  163          1634 PT=     0
   183  164          1320 LC      11               SET UP ROW 1 OFFSET
   184  165          1376 ? C#0   S                ROW#1?
   185  166           103 GONC    RAK05  ( 176) ROW 1
   186  167          1434 PT=     1
   187  170           720 LC      7                SET UP SHIFTED ROW 0 OFFSET
   188  171          1076 C=C+1   S
   189  172           776 C=C+C   S                SHIFTED?
   190  173           123 GONC    RAK10  ( 205) NO
   191  174          1376 ? C#0   S                NOT SHIFTED ROW 0?
   192  175           107 GOC     RAK10  ( 205) NOT AUTO-ASSIGNED
   193  176 RAK05    1006 C=A+C   X                C.X=IMPLIED LOCAL LABEL
*
   195                    ENTRY   RAK06
* ENTRY POINT ADD FOR WAND ON 3-13-79
*
   198       RAK06
   199  177           530 M=C                      SAVE OPERAND IN M
   200  200           416 A=C                      SET UP A[1:0] FOR SEARCH
   201  201             1 GOSUB   SEARCH
   201  202             0
   202  203          1356 ? C#0                    FOUND?
   203  204           607 GOC     PARS60 ( 264) YES
   204       RAK10                                KEY IS NOT REASSIGNED
   205  205           260 C=N                      RETRIEVE LOGICAL KC
   206  206           416 A=C                      RESTORE LOG KC TO A[2:1]
   207  207 PARS52   1670 C=REGN 14
   208  210          1530 ST=C                     PUT UP SS0
   209  211           460 LDI
   210  212           520 CON     @520             H1500\16=@520
   211                                            NORMAL MODE DEFAULT TABLE
   212       PARS55                               ST HAS SS0
   213                                            LOG KC IN A[2:1]
   214                                            DEFAULT TABLE ADDR\16 IN C.X
   215  213           136 C=0     S
   216  214          1574 RCR     12
   217  215          1006 C=A+C   X
   218  216          1574 RCR     12               C[6:3]=TABLE ADDRESS
   219  217          1460 CXISA
*
   221                    ENTRY   PARSDE
* ENTRY POINT FOR WAND TO EXECUTE DATA ENTRY KEY (3-15-79)
*
   224       PARSDE
   225  220          1166 C=C-1   XS               DATA ENTRY KEY?
```

```
226  221            1 GSUBC  DATENT         GOES TO DATENT W/ ASCII
226  222            1
227                                          OR DE FC OR 0 FOR BKARROW
228                                          IN C[1:0] & W/ SS0 UP
229       PARS56                             CHS, CLX, DELETE,
230                                          STORAGE ARITHMETIC,
231                                          AND STOP RE-ENTER HERE.
232                                          ENTRY REQUIREMENTS:
233                                          FC IN C.X, CHIP 0 ON,
234                                          SS 0 UP
235  223          674 RCR     11             FC TO DIGITS 4,3
236  224          356 BC EX                  SAVE IN B
237  225         1270 C=REGN 10
238  226          134 PT=     4
239  227          312 C=B     WPT            MERGE FC TO DIGITS 4,3 OF REG 10
240  230          106 C=0     X
241  231         1250 REGN=C 10
242  232           14 ?S3=1                  PROGRAM MODE?
243  233           53 GONC    PARS57 ( 240)
244  234         1342 ? C#0   PT             PROGRAMMABLE?
245  235           33 GONC    PARS57 ( 240) NOT PROGRAMMABLE
246  236         1434 PT=     1
247  237         1042 C=C+1   PT             SET INSERT BIT
248  240 PARS57  1634 PT=     0              SAVE PTEMP2 IN G
249  241          130 G=C
250  242         1530 ST=C                   PUT UP PTEMP2
251  243          316 C=B                    RECOVER FC TO C[4:3]
252  244          274 RCR     5              FC TO DIGITS 13:12
253  245          460 LDI
254  246           24 DEF     @24     (  24) @24=@12000\256 MAIN FCN TABLE
255  247         1174 RCR     9
256  250         1460 CXISA                  GET XADR
257  251           34 PT=     3
258  252          120 LC      1
259  253          674 RCR     11             FULL XADR IN C[6:3]
260  254          530 M=C                    SAVE XADR IN M
261  255          560 STK=C                   AND ON SUBR STACK
262  256         1460 CXISA                  GET C(XADR)
263  257         1346 ? C#0   X              NOT XKD?
264  260          347 GOC     PARS70 ( 314) NOT XKD.
265  261         1670 C=REGN 14
266  262         1530 ST=C                   PUT UP SS 0
267  263         1740 RTN                    GO EXECUTE IMMEDIATELY
*
269       PARS60
270  264          730 CM EX                  SAVE ADR IN M,
271                                          RETRIEVE ARGUMENT TO C
272  265          246 AC EX   X              PUT ARG TO A.X FOR ROW940
273  266          206 B=A     X               & SAVE ARG IN B.X
274  267            1 GOSUB   OFSHFT
274  270            0
275  271            1 GOSUB   CLLCDE
275  272            0
276  273          460 LDI
277  274          340 CON2    14      0      FC FOR XEQ
278  275            1 GOSUB   PROMF1         PROMPT "XEQ "
278  276            0
279  277         1404 S1=     0              SET UP FOR ROW940
280  300            1 GOSUB   ROW940         PROMPT ARGUMENT
280  301            0
```

```
   281  302          460 LDI                    SET UP FOR NLT020
   282  303          340 CON2    14      0      FC FOR XEQNN
   283  304         1634 PT=     0              CLEAR INSERT BIT IN G
   284  305          130 G=C                     FOR NLT020
   285  306          674 RCR     11
   286  307          416 A=C
   287  310          146 AB EX   X              NOW FC IN A[4:3],
   288                                          ARG IN A[1:0]
* ARG IS PRESERVED HERE FOR THE BENEFIT OF THE PRINTER.  SINCE S9 IS
* SET WHEN WE GET TO XEQ NN, XEQNN NEVER LOOKS AT THE ARGUMENT AT ALL.
   291  311         1110 S9=     1              TELL XEQNN THAT ADDRESS
   292                                          IS ALREADY KNOWN IN M
   293  312            1 GOLONG  NULT#5
   293  313            2
*
   295  314 PARS70 1104 S9=     0              INITIALIZE S9.
   296                                          S9=1 TELLS AXEQ & XEQNN
   297                                          THAT THEIR ADDRESS HAS
   298                                          ALREADY BEEN FOUND AND IS
   299                                          IN M.
   300       PARS75                             RETURN FROM AXEQ & RASNKY
   301                                          FOR MICROCODED XROM FCNS
   302                                          * ENTRY REQ FOR PARS75:
   303                                          * PTEMP2 IN STATUS BITS
   304                                          * & M=XADR
   305  315            1 GOSUB   OFSHFT         TURN OFF SHIFT
   305  316            0
   306  317            1 GOSUB   DSPLN+         ENABLE AND CLEAR LCD
   306  320            0
   307                                          IF INSERT THEN INC & DSP LINE#
   308  321          630 C=M                    RETRIEVE XADR
   309  322            1 GOSUB   PROMF2         PROMF2 RETURNS S8=0
   309  323            0
   310                                          XROM MICROCODE FCNS RELY ON
   311                                          S8=0 HERE
   312                                          (WHEN S9 IS SET, S8 TELLS
   313                                          XROM WHETHER THE FCN IS
   314                                          MICROCODE OR USER LANG)
   315  324          630 C=M                    RETRIEVE XADR AGAIN
   316  325         1172 C=C-1   M              POINT TO XADR-1
   317  326         1460 CXISA                  OP1 TO C.XS
   318  327         1366 ? C#0   XS             OP1#0?
   319  330            1 GOLNC   NLT000         NO OPERAND
   319  331            2
   320  332          766 C=C+C   XS
   321  333          766 C=C+C   XS
   322  334          426 A=C     XS             A.XS=4*OP1
   323  335         1172 C=C-1   M              POINT TO XADR-2
   324  336         1460 CXISA                  C.XS=OP2
   325  337         1026 C=A+C   XS
   326  340         1074 RCR     2
   327  341         1530 ST=C
   328  342            4 S3=     0              CLEAR OP1 BIT 1
   329  343         1730 CST EX                 OP1 BIT 1 STILL EXISTS
   330                                          IN ST, BUT IS CLEAR IN C
   331  344         1634 PT=     0
   332  345          242 AC EX   PT
   333  346          230 C=G
   334  347          242 AC EX   PT             MERGE OPTYPE INTO PTEMP2
   335  350          130 G=C                    PUT PTEMP2 BACK TO G
```

```
   336  351           14 ?S3=1                    OP1 BIT 1?
   337  352          623 GONC   PARSEA ( 434) NO
*
*
   340  353 PAR110    1 GOSUB  NEXT2
   340  354           0
   341                   ENTRY  PAR111          ADDED FOR WAND 11/5/79
   342      PAR111
   343  355          453 GOTO   ABTSEQ ( 422) MUST BE SHORT GTO!!!
   344  356          114 ?S4=1                  A...J?
   345  357            1 GOLC   AJ2              YES
   345  360            3
   346  361           14 ?S3=1                  DIGIT?
   347  362           63 GONC   PAR115 ( 370) NO
   348  363            1 GOSUB  FDIGIT
   348  364            0
   349  365 PAR112     1 GOSUB  BLINK
   349  366            0
   350  367         1643 GOTO   PAR110 ( 353)
   351  370 PAR115  1014 ?S2=1                  OP1 BIT 0?
   352  371            1 GOLC   PARSEB          YES
   352  372            3
   353  373          514 ?S6=1  SHIFT?
   354  374            1 GOLC   IND              YES
   354  375            3
   355  376         1414 ?S1=1                  OP2 BIT 1?
   356  377         1667 GOC    PAR112 ( 365) YES
   357  400 PAR130  1214 ?S7=1                  DP?
   358  401            1 GOLC   STK              YES
   358  402            3
   359  403         1614 ?S0=1                  OP2 BIT 0?
   360  404         1617 GOC    PAR112 ( 365)
   361                                         MUST BE STO
   362  405         1536 ? A#0  S               +-*/ ?
   363  406         1573 GONC   PAR112 ( 365) NO
   364  407          460 LDI                    YES
   365  410          221 CON    145
   366  411          256 AC EX
   367  412         1374 RCR    13
   368  413         1634 PT=    0
   369  414          502 A=A+C  PT
   370                   LEGAL
   371  415            1 GOSUB  LDSST0
   371  416            0
   372  417          256 AC EX
   373  420            1 GOLONG PARS56          START OVER WITH NEW FC
   373  421            2
*
* ABTSEQ - ABORT PARTIAL KEY SEQUENCE
*
* NOTE THAT ABTSEQ DOESN'T CLEAR ALPHAMODE, WHICH MAY BE SET IF WE'RE
* IN THE MIDDLE OF KEYING IN AN ALPHA OPERAND.  IF IT IS DESIRED TO
* ENSURE THAT THE ALPHAMODE FLAG AND ANNUNCIATOR ARE CLEARED, THE
* DO A GOLONG TO NAME33, WHICH CLEARS ALPHAMODE AND THEN JUMPS TO
* ABTSEQ.
*
   383  422 ABTSEQ    1 GOSUB  CLLCDE          CLEAR DISPLAY
   383  423           0
   384  424           1 GOSUB  ANNOUT
   384  425           0
```

```
385  426 ABTS10 1635 CON     @1635
386  427         674 CON     @674          GOSUB PRT4
387  430           1 GOSUB   RSTSEQ        CLEAR SHIFTSET, PKSEQ,
387  431           0
388                                         MSGFLG, DATAENTRY,
389                                         CATALOGFLAG, & PAUSING
390  432           1 GOLONG  NFRKB
390  433           2
*
392       PARSEA                            ALPHA NAME ALPHA
393                                         1 DIGIT NUMERIC
394                                         3 DIGIT NUMERIC
395  434        1614 ?S0=1                  OP2 BIT 0?
396  435          33 GONC    PARA05 ( 440)
397                                         1 DIG OR 3 DIG NUMERIC
398  436        1414 ?S1=1                  OP2 BIT 1?
399  437         263 GONC    PARA50 ( 465)
*
*
402                                         1 DIGIT NUMERIC
403                                         ALPHA NAME ALPHA
404  440 PARA05    1 GOSUB   NEXT1
404  441           0
405                 ENTRY   PARA06          ADDED FOR WAND 11/5/79
406       PARA06
407  442        1603 GOTO    ABTSEQ ( 422) MUST BE SHORT GTO!!
408  443        1614 ?S0=1                  OP2 BIT 0?
409  444         153 GONC    PARA45 ( 461)
410  445         114 ?S4=1                  A...J?
411  446           1 GOLC    FDIG20         YES
411  447           3
412  450          14 ?S3=1                  DIGIT?
413  451           1 GOLC    FDIG20         YES
413  452           3
414  453         514 ?S6=1                  SHIFT?
415  454           1 GOLC    IND            YES
415  455           3
416  456 PARA10    1 GOSUB   BLINK
416  457           0
417  460        1603 GOTO    PARA05 ( 440)
*
419       PARA45                            ALPHA NAME ALPHA
420  461         214 ?S5=1                  ALPHA KEY?
421  462           1 GOLC    NAMEA          YES
421  463           3
422  464        1723 GOTO    PARA10 ( 456)
*
424       PARA50                            3 DIGIT NUMERIC
425  465 PARA60    1 GOSUB   NEXT3
425  466           0
426                 ENTRY   PARA61          FOR THE WAND
427       PARA61
428  467        1333 GOTO    ABTSEQ ( 422)
429  470         114 ?S4=1                  A..J?
430  471           1 GOLC    AJ3            YES
430  472           3
431  473          14 ?S3=1                  DIGIT?
432  474          63 GONC    PARA70 ( 502) NO
433  475           1 GOSUB   MIDDIG
433  476           0
```

```
 434  477 PARA65    1 GOSUB  BLINK
 434  500           0
 435  501        1643 GOTO   PARA60 ( 465)
*
*
 438  502 PARA70 1040 C=KEYS                CHECK FOR EEX
 439  503          74 RCR    3
 440  504         412 A=C    WPT
 441  505         460 LDI
 442  506         203 CON2   8        3     KC FOR EEX
 443  507        1552 ? A#C  WPT
 444  510         177 GOC    PRA110 ( 527)
*
 446                 ENTRY  PARA75
* ENTRY POINT ADD FOR WAND ON 3-13-79
*
 449      PARA75
 450  511         460 LDI
 451  512          61 CON    @61
 452  513        1750 SLSABC
 453  514 PARA80    1 GOSUB  NEXT3
 453  515           0
 454  516          73 GOTO   PRA100 ( 525)
 455  517          14 ?S3=1                 DIGIT?
 456  520           1 GSUBC  MIDDIG
 456  521           1
 457  522 PARA90    1 GOSUB  BLINK
 457  523           0
 458  524        1703 GOTO   PARA80 ( 514)
*
 460  525 PRA100 1670 RABCR
 461  526        1373 GOTO   PARA60 ( 465)
*
 463  527 PRA110 1414 ?S1=1                 OP2 BIT 1? (GTO.?)
 464  530        1473 GONC   PARA65 ( 477) NO
 465  531        1214 ?S7=1                DP KEY?
 466  532         147 GOC    PRA115 ( 546) YES
 467  533         214 ?S5=1                ALPHA KEY?
 468  534        1433 GONC   PARA65 ( 477) NO
 469  535           1 GOSUB  ENCP00        YES
 469  536           0
 470  537           6 A=0    X
 471  540         646 A=A-1  X
 472  541         646 A=A-1  X             GENERATE FFE IN A.X
 473  542        1270 C=REGN 10
 474  543         246 AC EX  X             MERGE FFE WITH REG 10
 475  544        1250 REGN=C 10
 476  545         403 GOTO   XFRNMA ( 605)
 477      PRA115                           GTO..
 478  546        1670 RABCR                RETRIEVE DP FROM LCD
 479  547        1770 RABCL                PUT BACK FIRST DP
 480  550        1750 SLSABC               ADD A SECOND DP
 481  551           6 A=0    X             SET ARGUMENT
 482  552         646 A=A-1  X              TO FFF
 483  553           1 GOLC   NULT#3
 483  554           3
*
 485      PARSEB                           INPUT: SS=PTEMP1, LCD ON,
 486                                        HEX, PSEL, P=1
 487                                       GTO,LBL, AND XEQ
```

```
 488  555            1 GOSUB  ENCP00          RE-ENABLE CHIP 0
 488  556            0
 489  557         1270 C=REGN 10               GET PARSE TEMPS
 490  560           74 RCR    3                FC NOW IN DIGITS 1:0
 491  561          416 A=C                     SAVE REG 10 IN A
 492
 493  562         1614 ?S0=1                    OP2 BIT 0?
 494  563          247 GOC    PARB20 ( 607) YES
 495                                           LBL
 496  564          460 LDI                     LOAD FC FOR ALBL
 497  565          315 CON2   12       13
 498  566 PARB10   214 ?S5=1                   ALPHA KEY?
 499  567           57 GOC    PARB15 ( 574)
 500  570            1 GOSUB  ENLCD
 500  571            0
 501  572            1 GOLONG PAR112
 501  573            2
*
 503  574 PARB15   252 AC EX  WPT
 504  575          256 AC EX
 505  576          674 RCR    11
 506  577         1250 REGN=C 10
 507  600          230 C=G                     PT=1 HERE FROM NEXT
 508  601         1530 ST=C                    SET BIT 1 OF PTEMP2
 509  602          210 S5=    1                 (SAY NULL STRING NOT ALLOWED)
 510  603         1630 C=ST
 511  604          130 G=C
 512  605 XFRNMA     1 GOLONG NAMEA
 512  606            2
*
 514  607 PARB20   514 ?S6=1                   SHIFT?
 515  610          123 GONC   PARB30 ( 622)
 516  611          460 LDI                     LOAD FC FOR GTO/IND
 517  612          256 CON2   10       14
 518  613          252 AC EX  WPT
 519  614          256 AC EX
 520  615          674 RCR    11
 521  616         1250 REGN=C 10
 522  617         1414 ?S1=1                   OP2 BIT 1?
 523  620          527 GOC    INDGTO ( 672)
 524  621          433 GOTO   INDXEQ ( 664)
*
 526  622 PARB30   460 LDI
 527  623           36 CON2   1        14     FC FOR AXEQ
 528  624         1414 ?S1=1                   OP2 BIT 1?
 529  625         1413 GONC   PARB10 ( 566) XEQ
 530  626         1146 C=C-1  X                CONVERT TO FC FOR AGTO
 531  627         1214 ?S7=1                   GTO   DP KEY?
 532  630         1363 GONC   PARB10 ( 566)
*
 534                      ENTRY  PARB40
* ENTRY POINT FOR WAND  (3-15-79)
*
 537                                          GTO .NNN
 538      PARB40
 539  631         1634 PT=    0                RESET INSERT BIT
 540  632          230 C=G                      IN PTEMP2
 541  633         1730 CST EX
 542  634          104 S4=    0
 543  635         1730 CST EX
```

```
544  636          130 G=C
545  637         1434 PT=     1
546  640          460 LDI                        FC FOR GTOL
547  641            1 CON     1
548  642          252 AC EX   WPT
549  643          256 AC EX
550  644          674 RCR     11
551  645         1250 REGN=C  10
552  646            1 GOSUB   CLLCDE
552  647            0
553  650          460 LDI
554  651          320 CON2    13      0          FC FOR GTO
555  652            1 GOSUB   PROMF1
555  653            0
556  654         1650 SRSABC
557  655          460 LDI
558  656          140 CON     @140               " ."
559  657         1750 SLSABC
560  660            1 GOLONG  PARA60
560  661            2
561                   EJECT
```

```
* IND - TAKES CARE OF INDIRECT OPERANDS
*
   564   662 IND         1 GOSUB  ENCF00
   564   663             0
   565   664 INDXEQ   1634 PT=     0
   566   665           230 C=G
   567   666          1730 CST EX
   568   667           510 S6=     1              INDIRECT
   569   670          1730 CST EX
   570   671           130 G=C
   571       INDGTO
   572   672             1 GOSUB  ENLCD
   572   673             0
   573   674             1 GOSUB  MESSL
   573   675             0
   574   676            11 CON    9              I
   575   677            16 CON    14             N
   576   700             4 CON    4              D
   577   701          1040 CON    @1040          BLANK
*
*
   580   702 IND20       1 GOSUB  NEXT2
   580   703             0
   581                     ENTRY  IND21           ADDED FOR WAND 11/5/79
   582       IND21
   583   704           553 GOTO   ABTXF3 ( 761) MUST BE SHORT GTO!!
   584   705           114 ?S4=1                 A...J?
   585   706           167 GOC    AJ2    ( 724)
   586   707          1214 ?S7=1                 DP?
   587   710           537 GOC    STK    ( 763)
   588   711            14 ?S3=1                 DIGIT?
   589   712            33 GONC   IND30  ( 715)
   590   713             1 GOSUB  FDIGIT
   590   714             0
   591   715 IND30       1 GOSUB  BLINK
   591   716             0
   592   717          1633 GOTO   IND20  ( 702)
   593                     EJECT
```

```
* AJ3 AND AJ2 - TAKE CARE OF A...J KEYS FOR 3 AND 2 DIGIT OPERANDS
*
   596      AJ3                                  GTO.--- OR FC---
   597  720          460 LDI
   598  721           60 CON    @60               ZERO
   599  722         1750 SLSABC
   600  723           33 GOTO   AJ210  ( 726)
*
   602      AJ2                                  FC IND-- OR FC--
   603  724          460 LDI
   604  725           60 CON    @60               ZERO
   605  726 AJ210   1536 ? A#0  S
   606  727           27 GOC    AJ220  ( 731)
   607  730         1056 C=C+1
   608  731 AJ220   1750 SLSABC
   609  732         1474 RCR    1
   610  733          276 AC EX  S
   611  734         1374 RCR    13
   612  735         1750 SLSABC
   613  736            1 GOLONG NULT#
   613  737            2
*
   615      MIDDIG
   616  740          276 AC EX  S
   617  741         1374 RCR    13
   618  742          320 LC     3
   619  743          126 C=0    XS
   620  744         1750 SLSABC
   621  745 MID10      1 GOSUB  NEXT2
   621  746            0
   622  747          103 GOTO   MID20  ( 757)
   623  750           14 ?S3=1                   DIGIT?
   624  751           33 GONC   MID15  ( 754)
   625  752            1 GOSUB  FDIGIT
   625  753            0
   626  754 MID15      1 GOSUB  BLINK
   626  755            0
   627  756         1673 GOTO   MID10  ( 745)
*
   629      MID20
   630  757         1670 RABCR
   631  760         1740 RTN
*
   633  761 ABTXF3     1 GOLONG ABTSEQ
   633  762            2
*
* STK - HANDLES STACK REGISTER OPERANDS X,Y,Z,T,L
*
   637      STK
   638  763 STK03      1 GOSUB  MESSL
   638  764            0
   639  765           23 CON    @23                S
   640  766           24 CON    @24                T
   641  767         1040 CON    @1040              BLANK
   642  770            1 GOSUB  NEXT1
   642  771            0
   643                   ENTRY  STK00              FOR THE WAND
   644      STK00
   645  772         1673 GOTO   ABTXF3 ( 761) MUST BE SHORT GOTO!!
```

```
 646  773          460 LDI
 647  774           40 CON    32             BLANK
 648  775         1650 SRSABC
 649  776         1650 SRSABC
 650  777         1650 SRSABC
*
 652                   ENTRY  STK04
* ENTRY POINT FOR WAND (3-16-79)
*
 655       STK04
 656 1000              1 GOSUB  GTACOD        GET ALPHACODE[KEYCODE]
 656 1001              0
 657 1002           1334 PT=    13
 658 1003            420 LC     4              SET FOR LASTX
 659 1004            416 A=C                   REG INDEX IN A.S, CHAR IN A.X
 660 1005            460 LDI
 661 1006            114 CON    @114           "L"
 662 1007           1546 ? A#C  X
 663 1010            317 GOC    STK20  (1041)
 664 1011 STK05       1 GOSUB  MASK           PUT CHAR OUT TO LCD
 664 1012             0
 665 1013             1 GOSUB  LEFTJ
 665 1014             0
 666 1015             1 GOSUB  ENCP00
 666 1016             0
 667 1017           1634 PT=    0              GET PTEMP2
 668 1020            230 C=G
 669 1021           1530 ST=C
 670 1022           1270 C=REGN 10
 671 1023           1034 PT=    2
 672 1024            720 LC     7
 673 1025            514 ?S6=1                 INDIRECT?
 674 1026             33 GONC   STK10  (1031)
 675 1027           1034 PT=    2
 676 1030           1720 LC     15
 677       STK10
 678 1031            256 AC EX
 679 1032           1574 RCR    12
 680 1033            242 AC EX  PT
 681 1034              1 GOLONG NLT020
 681 1035              2
*
 683 1036 STK15       1 GOSUB  BLINK
 683 1037             0
 684 1040           1233 GOTO   STK03  ( 763)
*
 686 1041 STK20     460 LDI
 687 1042           127 CON    87             "W"
 688 1043 STK30     676 A=A-1  S
 689 1044          1536 ? A#0  S
 690 1045            53 GONC   STK40  (1052)
 691 1046          1046 C=C+1  X
 692 1047          1546 ? A#C  X
 693 1050          1737 GOC    STK30  (1043)
 694 1051          1403 GOTO   STK05  (1011)
*
 696 1052 STK40     460 LDI
 697 1053           124 CON    @124           "T"
 698 1054          1546 ? A#C  X
 699 1055          1343 GONC   STK05  (1011)
```

```
700 1056        1603 GOTO   STK15  (1036)
701                  EJECT
```

```
* FDIGIT - FINAL DIGIT
* ENTRY CONDITIONS: A.S=SECOND TO LAST DIGIT, HEX, P SEL,
*     LCD CHIP ON, STATUS SET PTEMP1 UP
   705       FDIGIT                                SHIFT PROMPTS OFF RIGHT END OF LCD
   706 1057           116 C=0
   707 1060           276 AC EX  S
   708 1061          1374 RCR    13
   709 1062          1434 PT=    1
   710 1063           320 LC     3
   711 1064          1750 SLSABC                   SEND DIGIT TO DISPLAY
   712       FDIG10
   713 1065             1 GOSUB  NEXT1
   713 1066             0
   714 1067           143 GOTO   FDIG30 (1103) BACKARROW RETURN (SHORT GOTO!!!)
   715 1070            14 ?S3=1                    DIGIT?
   716 1071            47 GOC    FDIG20 (1075) YES
   717 1072             1 GOSUB  BLINK
   717 1073             0
   718 1074          1713 GOTO   FDIG10 (1065)
   719       FDIG20
   720 1075           116 C=0
   721 1076           276 AC EX  S
   722 1077          1374 RCR    13
   723 1100           320 LC     3
   724 1101          1750 SLSABC                   SEND DIGIT TO DISPLAY
   725 1102           433 GOTO   NULT#  (1145)
*
   727       FDIG30
   728 1103          1670 RABCR                    SHIFT DIGIT OFF
   729 1104          1740 RTN
*
*
   732 1105 NEXT1     460 LDI
   733 1106            37 CON    31
   734 1107           103 GOTO   NXT1E  (1117)
   735 1110 NEXT2     460 LDI
   736 1111            37 CON    31
   737 1112            43 GOTO   NXT2E  (1116)
   738 1113 NEXT3     460 LDI
   739 1114            37 CON    31
   740 1115          1750 SLSABC
   741 1116 NXT2E    1750 SLSABC
   742 1117 NXT1E    1750 SLSABC
   743 1120 NEXT        1 GOSUB  LEFTJ
   743 1121             0
   744 1122             1 GOSUB  ENCP00
   744 1123             0
   745 1124          1770 C=REGN 15                SAVE PTEMP2 IN
   746 1125            34 PT=    3                  REG 15[4:3]
   747 1126           230 C=G
   748 1127          1750 REGN=C 15
   749 1130          1670 C=REGN 14
   750 1131          1474 RCR    1
   751 1132          1530 ST=C
   752 1133           210 S5=    1                  SET PKSEQ
   753 1134          1410 S1=    1                  SET MSGFLG
   754 1135          1630 C=ST
   755 1136          1374 RCR    13
   756 1137             1 GOSUB  ANN+14
```

```
   756 1140            0
   757 1141            1 GOSUB  RSTKB
   757 1142            0
   758 1143            1 GOLONG WKUP10
   758 1144            2
*
* NULT# - NULL TEST FOLLOWING NUMERIC OPERAND
* ENTRY CONDITIONS: P SEL, LCD ON
   762       NULT#
   763 1145         1334 PT=     13             INITIALIZE # OF DIGITS COUNTER
   764 1146         1720 LC      15
   765 1147         1434 PT=     1
   766 1150          416 A=C                    # OF DIGITS COUNTER IN A.S
   767 1151 NULT#1  1670 RABCR
   768 1152          576 A=A+1   S
   769 1153         1530 ST=C
   770 1154          114 ?S4=1
   771 1155         1747 GOC     NULT#1 (1151) SHIFT UNTIL " " OR " ."
   772 1156            6 A=0     X              INITIALIZE SUM
   773 1157 NULT#2  1770 RABCL
   774 1160          102 C=0     PT
   775 1161          126 C=0     XS
   776 1162          506 A=A+C   X
   777 1163          676 A=A-1   S              DECREMENT # OF DIGITS
   778 1164          107 GOC     NULT#3 (1174)
   779 1165          246 AC EX   X              MULTIPLY BY 10
   780 1166          746 C=C+C   X
   781 1167          406 A=C     X
   782 1170          746 C=C+C   X
   783 1171          746 C=C+C   X
   784 1172          506 A=A+C   X
   785                   LEGAL
   786 1173         1643 GOTO    NULT#2 (1157)
*
   788       NULT#3
   789 1174         1634 PT=     0
   790 1175          230 C=G
   791 1176         1530 ST=C                  PUT UP PTEMP2
   792 1177          514 ?S6=1                 INDIRECT?
   793 1200           43 GONC    NULT#4 (1204) NO
   794 1201          460 LDI
   795 1202          200 CON     128
   796 1203          506 A=A+C   X              SET INDIRECT BIT
   797 1204 NULT#4   206 B=A     X              SAVE ARG IN B.X
   798 1205            1 GOSUB   LEFTJ
   798 1206            0
   799 1207            1 GOSUB   ENCP00
   799 1210            0
   800 1211         1270 C=REGN  10             GET FC
   801 1212          416 A=C                    FC TO A[4...]
   802 1213          214 ?S5=1                  XROM?
   803 1214          247 GOC     NLT020 (1240) YES, ARG IN B.X ONLY
   804 1215          146 A=B     X              COPY ARG TO A.X
   804 1216          206
   805 1217 NULT#5  1746 A SL    X               & COZY UP TO FC
   806 1220          203 GOTO    NLT020 (1240) FC,ARG IN A[4:1]
   807                   EJECT
```

```
808       NLT000
809 1221            1 GOSUB  LEFTJ
809 1222            0
810 1223            1 GOSUB  ENCP00
810 1224            0
811 1225         1270 C=REGN 10
812 1226          416 A=C                  SAVE FC IN A
813 1227          460 LDI
814 1230          310 CON    200
815 1231         1340 DISOFF
816 1232 NLT010  1710 RST KB
817 1233         1714 CHK KB
818 1234           73 GONC   NLT030 (1243)
819 1235         1146 C=C-1  X
820 1236         1743 GONC   NLT010 (1232)
821 1237         1440 DISTOG
822       NLT020                           FOR ENTRY HERE,
823                                        FC, ARG IN A[4:1]
824 1240            1 GOSUB  NULTST
824 1241            0
825 1242          103 GOTO   NLT040 (1252)
826 1243 NLT030     1 GOSUB  RST05         DEBOUNCE KEY UP
826 1244            0
827 1245            1 GOSUB  CLLCDE
827 1246            0
828 1247         1440 DISTOG
829 1250            1 GOSUB  ENCP00
829 1251            0
830                  ENTRY   NLT040
831       NLT040                           KEY IS UP. GO EXECUTE FCN
832 1252         1625 CON    @1625         FIRST GIVE PRINTER A CHANCE
833 1253          674 CON    @674          GOSUB PRT5
834 1254            1 GOSUB  RSTSEQ        CLEAR SHIFTSET, PKSEQ,
834 1255            0
835                                        MSGFLAG, DATAENTRY,
836                                        CATALOGFLAG, & PAUSING
837                                        LEAVES SS0 UP
838 1256         1634 PT=    0
839 1257          230 C=G
840 1260         1730 CST EX               GET PTEMP2
841 1261          114 ?S4=1                INSERT?
842 1262           73 GONC   NLT050 (1271) NO
843 1263         1514 ?S12=1               PRIVATE?
844 1264          437 GOC    AB10XF (1327) YES
845 1265          256 AC EX
846 1266          274 RCR    5
847 1267            1 GOLONG INSLIN
847 1270            2
*
849 1271 NLT050  1730 CST EX               BRING BACK SS 0
850 1272          116 C=0
851 1273          134 PT=    4
852 1274         1720 LC     15            PUT NFRPU (@360)
853 1275          560 STK=C                 ON THE SUBROUTINE STACK
854 1276          256 AC EX
855 1277          274 RCR    5
856 1300         1376 ? C#0  S
857 1301            1 GOLC   XCUTE
857 1302            3
```

```
   858 1303          146 AB EX  X              RETRIEVE 3 DIGIT ARGUMENT
   859 1304            1 GOLONG XCUTB1          FROM B.X TO A.X
   859 1305            2
*
* NULTST - NULL TEST
*
   863       NULTST                             NULL TEST
   864 1306          460 LDI
   865 1307         1100 CON     576            INITIALIZE NULL TIMER
   866 1310          746 C=C+C   X
   867 1311 NULT10  1710 RST KB
   868 1312         1714 CHK KB                 KEY UP YET?
   869 1313            1 GOLNC  RST05           GO DEBOUNCE
   869 1314            2
   870 1315         1146 C=C-1  X              NO. DECREMENT COUNTER
   871 1316         1733 GONC   NULT10 (1311)
   872 1317          404 S8=    0               DON'T PRINT MESSAGE
   873 1320            1 GOSUB  MSGA            KEY DOWN TOO LONG
   873 1321            0
   874 1322            0 XDEF   MSGNL
   875 1323          460 LDI
   876 1324         1750 CON    1000
   877 1325 NULT20  1146 C=C-1  X              310 MILLISEC DELAY
   878 1326         1773 GONC   NULT20 (1325)  SO "NULL" CAN BE SEEN
   879 1327 AB10XF     1 GOLONG ABTS10
   879 1330            2
   880                   ENTRY  NAME20
   881                   ENTRY  NAMEA
   882                   ENTRY  NAME21
   883                   ENTRY  NAM40
   884                   ENTRY  NAM44@
   885                   ENTRY  NM44@5
   886                   ENTRY  NAME4A
   887                   ENTRY  NAME4D
*
* PARSE LOGIC FOR ALPHA OPERANDS STARTS HERE
*
   891       NAMEA                              ON ENTRY, SS IS SCRATCH
   892 1331            1 GOSUB  ENCP00
   892 1332            0
   893 1333         1645 CON    @1645           GOSUB PRT3
   894 1334          674 CON    @674
   895                   ENTRY  PR3RT           FOR PRINTER
   896       PR3RT
   897 1335         1670 C=REGN 14
   898 1336         1730 CST EX
   899 1337         1210 S7=    1              SET ALPHAMODE
   900 1340         1730 CST EX
   901 1341         1650 REGN=C 14
   902 1342          116 C=0                   INITIALIZE ALPHA OPERAND
   903 1343         1150 REGN=C 9
   904 1344 NAME10     1 GOSUB  ENLCD
   904 1345            0
   905 1346 NAME20     1 GOSUB  NEXT1
   905 1347            0
   906 1350          163 GOTO   NAME30 (1366) BACKARROW
   907       NAME21                             ON ENTRY HERE, PT=1,
   908                                          LCD CHIP ON, SS PTEMP1 UP
   909 1351          514 ?S6=1                  SHIFT KEY?
   910 1352            1 GOLNC  NAM40
```

```
   910 1353            2
   911 1354            1 GOSUB  TOGSHF          TOGGLE SHIFT KEY
   911 1355            0
   912 1356         1663 GOTO   NAME10 (1344)
*
   914                   ENTRY  NAME33          USED BY CARD RDR LOGIC
   915                                           TO ABORT A PARTIAL
   916                                           KEY SEQUENCE
   917                                           MAY ALSO BE USED BY
   918                                           PRINTER LOGIC
   919 1357 NAME33       1 GOSUB  LDSST0
   919 1360              0
   920 1361         1204 S7=     0               CLEAR ALPHAMODE
   921 1362         1630 C=ST
   922 1363         1650 REGN=C 14
   923 1364            1 GOLONG ABTSEQ
   923 1365            2
*
   925       NAME30                              ON ENTRY, PT=1, LCD CHIP ON
   926 1366            1 GOSUB  ENCP00           BKARROW HIT
   926 1367            0
   927 1370         1170 C=REGN 9
   928 1371         1356 ? C#0                  ANY CHARS TO DELETE?
   929 1372         1653 GONC   NAME33 (1357)   NO
   930 1373         1574 RCR    12              YES. DELETE ONE CHAR
   931 1374          112 C=0    WPT
   932 1375         1150 REGN=C 9
   933 1376            1 GOSUB  OFSHFT
   933 1377            0
   934 1400            1 GOSUB  ENLCD
   934 1401            0
   935 1402         1670 RABCR                  SHIFT OFF ONE CHARACTER
   936 1403 NAME31  1433 GOTO   NAME20 (1346)
*
   938 1404 NAME34  1414 ?S1=1                 OP2 BIT 1?
   939                                           (IS EMPTY OPERAND AN ERROR?)
   940 1405          713 GONC   NAME42 (1476)   NO
*
   942 1406 NAME35       1 GOSUB  BLINK
   942 1407              0
   943 1410         1343 GOTO   NAME10 (1344)
*
   945                   ENTRY  NAME37
* ENTRY POINT ADD FOR WAND ON 3-13-79
*
   948 1411 NAME37       1 GOSUB  GTACOD
   948 1412              0
   949 1413          406 A=C    X               COPY CHARACTER TO A.X
   950 1414            1 GOSUB  OFSHFT
   950 1415            0
   951 1416          666 A=A-1  XS              IS IT A CHARACTER?
   952 1417         1673 GONC   NAME35 (1406)   NO
   953 1420         1434 PT=    1
   954 1421          460 LDI
   955 1422          177 CON    127             LAZY T
   956 1423         1552 ? A#C  WPT
   957 1424         1623 GONC   NAME35 (1406)
   958 1425          460 LDI
   959 1426           72 CON    58              COLON
   960 1427         1552 ? A#C  WPT
```

```
 961 1430          1563 GONC   NAME35 (1406)
 962 1431           460 LDI
 963 1432            56 CON    46              D.P.
 964 1433          1552 ? A#C  WPT
 965 1434          1523 GONC   NAME35 (1406)
 966 1435           460 LDI
 967 1436            54 CON    44              COMMA
 968 1437          1552 ? A#C  WPT
 969 1440          1463 GONC   NAME35 (1406)
 970 1441          1170 C=REGN 9
 971 1442          1352 ? C#0  WPT             FULL ALREADY?
 972 1443          1437 GOC    NAME35 (1406) FULL
 973 1444           252 AC EX  WPT             ADD CHARACTER TO REG 9
 974 1445           412 A=C    WPT             RESTORE CHARACTER TO A.X
 975 1446          1074 RCR    2               -
 976 1447          1150 REGN=C 9               -
 977                                           ADD CHAR TO DISPLAY
 978 1450           356 BC EX                  SAVE OPERAND IN B
 979 1451             1 GOSUB  ENLCD
 979 1452             0
 980 1453             1 GOSUB  MASK            TRANSLITERATE CHAR AND
 980 1454             0
 981                                           SEND TO DISPLAY
 982                                           NOTE MASK DECREMENTS B.S
 983 1455          1263 GOTO   NAME31 (1403)
 984                    FILLTO @1463           PRESERVE ENTRY TABLE
     1456          0000 NOP
     1457          0000 NOP
     1460          0000 NOP
     1461          0000 NOP
     1462          0000 NOP
     1463          0000 NOP
*
 986 1464 NAM40       1 GOSUB  ENCP00
 986 1465             0
 987 1466           214 ?S5=1                  ALPHA KEY?
 988 1467          1223 GONC   NAME37 (1411)
 989 1470          1434 PT=    1
 990 1471          1170 C=REGN 9
 991 1472          1356 ? C#0                 ANY CHARS IN OPERAND?
 992 1473          1113 GONC   NAME34 (1404) NO
 993 1474             1 GOSUB  RTJLBL          RIGHT JUSTIFY OPERAND
 993 1475             0
 994 1476 NAME42   1150 REGN=C 9               PUT BACK RIGHT-JUSTIFIED
 995                                           OPERAND
 996 1477          1670 C=REGN 14              PUT UP SS 0
 997 1500          1530 ST=C
 998 1501          1204 S7=    0               CLEAR ALPHAMODE
 999 1502          1630 C=ST
1000 1503             1 GOSUB  ANN+14          STORE STATUS SETS AND
1000 1504             0
1001                                           UPDATE ALPHA ANNUNCIATOR
1002 1505          1270 C=REGN 10
1003 1506            74 RCR    3
1004 1507           406 A=C    X               FC TO A.X
1005 1510           460 LDI
1006 1511            17 CON2   0        15     FC FOR ASN
1007 1512          1552 ? A#C  WPT             FC#ASN?
1008 1513             1 GOLNC  KEYOP           THIS IS ASN
1008 1514             2
```

```
1009 1515          206 B=A    X              SAVE FC IN B.X
1010 1516            1 GOSUB  ENLCD          THIS IS NOT ASN
1010 1517            0
1011 1520            1 GOSUB  LEFTJ
1011 1521            0
1012 1522            1 GOSUB  ENCF00
1012 1523            0
1013 1524         1170 C=REGN 9
1014 1525          340 SEL Q
1015 1526         1334 PT=    13
1016 1527          240 SEL P
1017 1530         1034 PT=    2
1018 1531         1362 ? C#0  PQ             MORE THAN 1 CHAR IN LABEL?
1019 1532            1 GSUBNC ALCL00         NO. TEST FOR LOCAL ALPHA LBL
1019 1533            0
1020 1534          146 AB EX  X              RETRIEVE FC FROM B
1021 1535          460 LDI
1022 1536           36 CON2   1        14    FC FOR AXEQ
1023 1537         1434 PT=    1
1024 1540         1552 ? A#C  WPT            FC#AXEQ?
1025 1541          717 GOC    NAME46 (1632) NOT AXEQ
1026 1542         1170 C=REGN 9
1027 1543          530 M=C
1028 1544            1 GOSUB  ASRCH
1028 1545            0
1029 1546         1356 ? C#0                 FOUND?
1030 1547          217 GOC    NAME44 (1570) YES
1031 1550         1670 C=REGN 14             RESTORE SS 0
1032 1551         1530 ST=C
1033 1552         1770 C=REGN 15             RESTORE PTEMP2 TO G
1034 1553           74 RCR    3
1035 1554         1634 PT=    0
1036 1555          130 G=C
1037 1556           14 ?S3=1                 PROGRAM MODE?
1038 1557          537 GOC    NAME46 (1632) YES
1039 1560         1270 C=REGN 10             RESTORE FC TO A
1040 1561          416 A=C                   FOR PRTS
1041 1562         1625 CON    @1625          GOSUB PRTS
1042 1563          674 CON    @674
1043 1564            1 GOSUB  RSTSEQ
1043 1565            0
1044 1566            1 GOLONG ERRNE
1044 1567            2
*
1046 1570 NAME44 1114 ?S9=1                 MICROCODE FCN?
1047 1571          467 GOC    NAME48 (1637) YES
* USER PROGRAM. PC IN C[3:0].
* IF IN ROM THEN S2=1 AND XROM IN C[7:4]
1050 1572          530 M=C                  SAVE PC IN M
1051 1573          174 RCR    4
1052 1574          160 N=C                  PUT XROM TO N[3:0]
1053       NAM44@
* ENTRY CONDITIONS FOR NAM44@:
* S2=1 FOR ROM, S2=0 FOR RAM
* PC IN M[3:0]
* IF ROM, THEN XROM IN N[3:0]
* IF RAM, THEN AXEQ ALREADY IN PLACE IN REG 10
1059 1575         1110 S9=    1            SAY ADDRESS ALREADY KNOWN
1060       NM44@5
* INSTRUCTIONS BELOW TO CLEAR AND SET S5 MAY NOT BE NECESSARY
```

```
* BECAUSE NLT020 DOESN'T LOOK AT S5.
  1063 1576          204 S5=     0              CLEAR ROM BIT FOR NLT020
  1064 1577         1014 ?S2=1                  ROM?
  1065 1600           53 GONC    NAM44A (1605) NO
  1066 1601          210 S5=     1              SET ROM BIT FOR NLT020
  1067 1602          260 C=N                    GET XROM TO C[3:0]
  1068 1603            1 GOSUB   STORFC
  1068 1604            0
  1069 1605 NAM44A   104 S4=     0              CLEAR INSERT BIT FOR NLT020
  1070 1606         1670 C=REGN 14
  1071 1607         1730 CST EX                 PUT UP SS0
  1072 1610           14 ?S3=1                  PROGRAM MODE?
  1073 1611           43 GONC    NAM44B (1615) NO
  1074 1612         1530 ST=C
  1075 1613          110 S4=     1              SET INSERT BIT FOR NLT020
  1076 1614         1630 C=ST
  1077 1615 NAM44B 1530 ST=C                    TEMP STATUS UP & IN C
  1078 1616         1634 PT=     0
  1079 1617          130 G=C                    TEMP STATUS TO G FOR NLT020
  1080 1620         1114 ?S9=1                  IS ADDRESS KNOWN?
  1081 1621          113 GONC    NAME46 (1632) NO
  1082 1622            1 GOSUB   DSPLN+         ENABLE AND CLEAR DISPLAY
  1082 1623            0
  1083                                          IF S4 THEN INC & DSP LINE#
  1084 1624            1 GOSUB   ENCP00
  1084 1625            0
  1085 1626          630 C=M                    PUT LABEL ADDR TO
  1086 1627          416 A=C                     A[3:0]
  1087 1630            1 GOSUB   TXTLBL
  1087 1631            0
  1088 1632 NAME46 1270 C=REGN 10
  1089 1633          416 A=C                    FC TO A[4:1]
  1090 1634          206 B=A     X              IN CASE THIS IS GTO .ALPHA
  1091 1635            1 GOLONG  NLT020
  1091 1636            2
*
*
  1094       NAME48                             MICROCODE FCN
  1095 1637          214 ?S5=1                  MAINFRAME?
  1096 1640          123 GONC    NAME4C (1652) NO
  1097                                          YES. FC IS IN C[4:5]
  1098 1641          174 RCR     4              FC TO C.X
  1099 1642          126 C=0     XS
  1100 1643          416 A=C                    NEW FC TO A.X
  1101 1644 NAME4A 1670 C=REGN 14
  1102 1645         1530 ST=C                   PUT UP SS 0
  1103 1646          256 AC EX                  BRING BACK FC TO C
  1104 1647         1104 S9=     0              RESTORE S9=0
  1105                                          (NOT AN AUTO-REASSIGNED FCN)
  1106 1650            1 GOLONG  PARS56
  1106 1651            2
*
  1108       NAME4C
* WE COME TO NAME4C FROM ASRCH IN THE AXEQ LOGIC
* XADR IS IN C[3:0] AND XROM IS IN C[7:4]
  1111 1652          530 M=C                    SAVE XADR IN M[3:0]
  1112 1653          174 RCR     4              MOVE XROM TO C[3:0]
  1113       NAME4D
* REPARSE LOGIC FOR MICROCODED XROM FUNCTIONS
* ON ENTRY, XADR IS IN M[3:0] AND XROM IS IN C[3:0]
```

```
1116 1654           1 GOSUB  STORFC          PUT XROM TO REG 10
1116 1655           0
1117 1656        1670 C=REGN 14               GET SS 0
1118 1657        1530 ST=C
1119 1660        1434 PT=    1
1120 1661         630 C=M                     GET XADR
1121 1662         674 RCR    11               PUT XADR TO C.M
1122 1663         530 M=C                     PUT XADR TO M[6:3]
1123 1664          14 ?S3=1                   PROGRAM MODE?
1124 1665         133 GONC   NAME4F (1700) NO
1125 1666        1460 CXISA
1126 1667        1346 ? C#0  X                PROGRAMMABLE?
1127 1670          33 GONC   NAME4E (1673) NO
1128 1671         320 LC     3                SET XROM BIT(5)
1129                                          & INSERT BIT(4)
1130 1672          73 GOTO   NAME4G (1701)
* FOR MICROCODE FCNS IN PLUG-IN ROMS, IF C(XADR)=0 THEN WE LOOK
* AT C(XADR+1) TO DETERMINE WHETHER THE FCN SHOULD BE EXECUTED ON
* KEY DOWN.  IF C(XADR+1)=0 THEN THE FCN IS XKD ELSE THE FCN IS
* A NORMAL NON-PROGRAMMABLE FUNCTION.
1135 1673 NAME4E 1072 C=C+1  M
1136 1674        1460 CXISA
1137 1675        1346 ? C#0  X                IS C(XADR+1) NON-ZERO?
1138 1676          27 GOC    NAME4F (1700)
1139 1677         740 GOTOC                   XKD FCN - GO DO IT
*
1141 1700 NAME4F  220 LC     2               SET XROM BIT(5) ONLY
1142 1701 NAME4G   20 LC     0
1143 1702        1530 ST=C                   INITIALIZE PTEMP2
1144 1703        1634 PT=    0
1145 1704         130 G=C                     & SAVE IN G
1146 1705           1 GOLONG PARS75
1146 1706           2
1147
*
* DSPLN+ - DISPLAY (LINE#+1)
* ON ENTRY, LINE NUMBER MUST BE VALID IN REG 15, AND CHIP 0 MUST
*     BE ENABLED.
* 1. GETS LINE NUMBER FROM REG 15
* 2. CLEARS LCD
* IF S4 IS CLEAR, THEN RETURNS IMMEDIATELY
* 3. INCREMENTS LINE NUMBER (BUT DOESN'T STORE BACK TO REG 15)
* 4. IF PRIVATE, REPLACES LINE NUMBER WITH 0
* 5. CALLS GENNUM TO PUT LINE NUMBER TO LCD
* 6. SHIFTS ON A BLANK FOLLOWING THE LINE NUMBER
* ON EXIT, THE DISPLAY CHIP IS ENABLED AND THE PT=0
* USES A, B.X, B.S, C, & ONE SUBROUTINE LEVEL
*
1162 1707 DSPLN+ 1770 C=REGN 15             GET LINE NUMBER
1163 1710         346 BC EX  X
1164 1711           1 GOSUB  CLLCDE
1164 1712           0
1165 1713         114 ?S4=1
1166 1714        1640 RTN NC
1167 1715         146 AB EX  X                BRING LINE # TO A.X
1168 1716         546 A=A+1  X                INCREMENT IT
1169 1717        1514 ?S12=1                  PRIVATE?
1170 1720          23 GONC   DSPL10 (1722) NO
1171 1721           6 A=0    X                YES - ZERO OUT LINE#
1172 1722 DSPL10   36 A=0    S                SET UP FOR GENNUM
```

```
1173 1723           1 GOSUB  GENNUM
1173 1724           0
1174 1725         460 LDI
1175 1726          40 CON    32
1176 1727        1750 SLSABC                SHIFT IN A BLANK
1177 1730        1740 RTN
*
* GOLONG - LONG BRANCH ROUTINE FOR PLUG IN ROMS
* SAME AS GOSUB EXCEPT USES 1 SUBROTINE LEVEL TEMPORARILY.
*
* GOSUB - SUBROUTINE ROUTINE FOR PORT ADDRESSED PLUG IN ROMS
* THIS SUBROUTINE ALLOWS SUBROUTINE CALLS IN PORT ADDRESSED
*- PLUG IN ROMS.
* THE CALLING SEQUENCE IS:
*       GOSUB  GOSUB      MUST BE IN HEX MODE ON ENTRY!!
*       DEF    <NAME>
* WHERE NAME IS IN THE SAME 1024 WORD ROM AS THE CALLING ROUTINE.
*
* WARNING!!! - CALLING A SUBROUTINE IN ANOTHER 1024 ROM FROM THE
* CURRENT ONE WILL NOT WORK. USE GOSUB[0-3].
*
* USES ONLY C, NO ADDITIONAL SUBROUTINE LEVELS
*
* GOLNGH - SAME AS GOLONG EXCEPT SETS HEX MODE ON ENTRY.
* GOSUBH - SAME AS GOSUB EXCEPT SETS HEX MODE ON ENTRY.
*
1198                    ENTRY  GOLNGH
1199                    ENTRY  GOLONG
1200                    ENTRY  GOSUBH
1201                    ENTRY  GOSUB
1202 1731 GOLNGH  1140 SETHEX
1203 1732 GOLONG   660 C=STK                GET ADDRESS OF CALLING ROUTINE
1204 1733         1460 CXISA                GET DESTINATION ADDRESS
1205 1734           63 GOTO   GOSUBA (1742) GO CREATE THE CORRECT 16 BIT ADDRES
1206
1207 1735 GOSUBH  1140 SETHEX
1208 1736 GOSUB    660 C=STK                GET ADDRESS OF CALLING ROUTINE
1209 1737         1460 CXISA                GET THE DESTINATION ADDRESS
1210 1740         1072 C=C+1   M            ADVANCE ADDRESS BEYOND ARGUMENT FOR
1211 1741          560 STK=C                PUT RETURN ADDRESS BACK
1212 1742 GOSUBA   756 C=C+C                MOVE OVER BOTH ADDRESSES TWO BITS
1213 1743          756 C=C+C                SO THAT THE DESIRED 10 BIT BOUNDARY
1214 1744         1732 C SR    M            FALLS ON A DIGIT BOUNDARY C[2-3]
1215 1745         1732 C SR    M            COMBINE 10 BITS FROM ARGUMENT
1216 1746         1732 C SR    M            WITH 6 BITS FROM SUBROUTINE STACK
1217 1747          756 C=C+C                TO FORM A 16 BIT ADDRESS
1218 1750          756 C=C+C                AND POSITION PROPERLY FOR GOTOC
1219 1751         1574 RCR     12
1220 1752          740 GOTOC                GO TO THE DESIRED ADDRESS.
*
1222
1223                    ENTRY  GT3DBT
1224 1753 GT3DBT     1 GSBLNG GETPC          STATUS_3RD BYTE
1224 1754           0
1225 1755         530 M=C                   -
1226 1756           1 GSBLNG INCAD2         -
1226 1757           0
1227 1760           1 GSBLNG GTBYTA         -
1227 1761           0
1228 1762        1730 CST EX                -
```

```
  1229 1763          1740 RTN
  1230
  1231
  1232                    ENTRY  XSIGN
*********************************************************
* THE SIGN FUNCTION RETURNS ONE FOR POSITIVE
* NUMBERS AND -1 FOR NEGATIVE NUMBERS AND ZERO FOR
* ALPHA DATA.
*********************************************************
  1238
  1239 1764 XSIGN   1534 PT=     12
  1240 1765          370 C=REGN 3
  1241 1766          112 C=0    WPT
  1242 1767          416 A=C
  1243 1770          676 A=A-1  S
  1244 1771          676 A=A-1  S
  1245 1772           27 GOC    DONSGN (1774) MAKES USE OF OVFL10
  1246                                        AT NFRX TO ZERO OUT
  1247                                        WHOLE WORD BECAUSE
  1248                                        MANTISSA IS ZERO
  1249 1773          120 LC     1
  1250 1774 DONSGN     1 GOLONG NFRX
  1250 1775            2
  1251
*
* MUST HAVE AT LEAST 2 WORDS AT THE END OF CN3 FOR CHECKSUM AND
* TRAILER.
  1255
  1256
  1257
*
  1259
  1260
  1261                    FILLTO @1775
  1262 1776 REVLEV     7 CON    7              REV LEVEL= G
  1263 1777 CKSUM0     0 CON    @0000
  1264                    END

  ERRORS :       0
```

SYMBOL TABLE

```
AB10XF  1327  -  1264
ABTS10   426  -
ABTSEQ   422  -   467  442  355
ABTXF3   761  -   772  704
AJ2      724  -   706
AJ210    726  -   723
AJ220    731  -   727
AJ3      720  -
CKSUM0  1777  -
CLRSB2     0  -
CLRSB3     2  -
CLRSBX    32  -     4
DONSGN  1774  -  1772
DSPL10  1722  -  1720
DSPLN+  1707  -
FDIG10  1065  -  1074
FDIG20  1075  -  1071
FDIG30  1103  -  1067
FDIGIT  1057  -
GOLNGH  1731  -
GOLONG  1732  -
GOSUB   1736  -
GOSUBA  1742  -  1734
GOSUBH  1735  -
GT3DBT  1753  -
IND      662  -
IND20    702  -   717
IND21    704  -
IND30    715  -   712
INDGTO   672  -   620
INDXEQ   664  -   621
MID10    745  -   756
MID15    754  -   751
MID20    757  -   747
MIDDIG   740  -
NAM40   1464  -
NAM44@  1575  -
NAM44A  1605  -  1600
NAM44B  1615  -  1611
NAME10  1344  -  1410 1356
NAME20  1346  -  1403
NAME21  1351  -
NAME30  1366  -  1350
NAME31  1403  -  1455
NAME33  1357  -  1372
NAME34  1404  -  1473
NAME35  1406  -  1443 1440 1434 1430 1424 1417
NAME37  1411  -  1467
NAME42  1476  -  1405
NAME44  1570  -  1547
NAME46  1632  -  1621 1557 1541
NAME48  1637  -  1571
NAME4A  1644  -
NAME4C  1652  -  1640
NAME4D  1654  -
NAME4E  1673  -  1670
```

```
NAME4F  1700   -  1676 1665
NAME4G  1701   -  1672
NAMEA   1331   -
NEWFCN   126   -    46
NEXT    1120   -
NEXT1   1105   -
NEXT2   1110   -
NEXT3   1113   -
NLT000  1221   -
NLT010  1232   -  1236
NLT020  1240   -  1220 1214
NLT030  1243   -  1234
NLT040  1252   -  1242
NLT050  1271   -  1262
NM44@5  1576   -
NULT#   1145   -  1102
NULT#1  1151   -  1155
NULT#2  1157   -  1173
NULT#3  1174   -  1164
NULT#4  1204   -  1200
NULT#5  1217   -
NULT10  1311   -  1316
NULT20  1325   -  1326
NULTST  1306   -
NXT1E   1117   -  1107
NXT2E   1116   -  1112
PAR001    25   -    27
PAR003    35   -    31   26   24   22
PAR005    44   -    40
PAR110   353   -   367
PAR111   355   -
PAR112   365   -   406  404  377
PAR115   370   -   362
PAR130   400   -
PARA05   440   -   460  435
PARA06   442   -
PARA10   456   -   464
PARA45   461   -   444
PARA50   465   -   437
PARA60   465   -   526  501
PARA61   467   -
PARA65   477   -   534  530
PARA70   502   -   474
PARA75   511   -
PARA80   514   -   524
PARA90   522   -
PARB10   566   -   630  625
PARB15   574   -   567
PARB20   607   -   563
PARB30   622   -   610
PARB40   631   -
PARS05    64   -
PARS10   104   -   106
PARS20   110   -   116
PARS30   117   -   111
PARS50   136   -   132
PARS52   207   -   141
PARS55   213   -   135
PARS56   223   -
PARS57   240   -   235  233
```

```
PARS60   264   -   204
PARS70   314   -   260
PARS75   315   -
PARSDE   220   -
PARSE      5   -
PARSEA   434   -   352
PARSEB   555   -
PR3RT   1335   -
PRA100   525   -   516
PRA110   527   -   510
PRA115   546   -   532
RAK05    176   -   166  162
RAK06    177   -
RAK10    205   -   175  173  152
REVLEV  1776   -
STK      763   -   710
STK00    772   -
STK03    763   -  1040
STK04   1000   -
STK05   1011   -  1055 1051
STK10   1031   -  1026
STK15   1036   -  1056
STK20   1041   -  1010
STK30   1043   -  1050
STK40   1052   -  1045
XFRNMA   605   -   545
XSIGN   1764   -
```

ENTRY TABLE

ABTS10	426	-
ABTSEQ	422	-
AJ2	724	-
AJ3	720	-
CLRSB2	0	-
CLRSB3	2	-
DSPLN+	1707	-
FDIG20	1075	-
FDIGIT	1057	-
GOLNGH	1731	-
GOLONG	1732	-
GOSUB	1736	-
GOSUBH	1735	-
GT3DBT	1753	-
IND	662	-
IND21	704	-
MIDDIG	740	-
NAM40	1464	-
NAM44@	1575	-
NAME20	1346	-
NAME21	1351	-
NAME33	1357	-
NAME37	1411	-
NAME4A	1644	-
NAME4D	1654	-
NAMEA	1331	-
NEXT	1120	-
NEXT1	1105	-
NEXT2	1110	-
NEXT3	1113	-
NLT000	1221	-
NLT020	1240	-
NLT040	1252	-
NM44@5	1576	-
NULT#	1145	-
NULT#3	1174	-
NULT#5	1217	-
NULTST	1306	-
PAR111	355	-
PAR112	365	-
PARA06	442	-
PARA60	465	-
PARA61	467	-
PARA75	511	-
PARB40	631	-
PARS05	64	-
PARS56	223	-
PARS75	315	-
PARSDE	220	-
PARSE	5	-
PARSEB	555	-
PR3RT	1335	-
RAK06	177	-
STK	763	-
STK00	772	-
STK04	1000	-

EXTERNAL REFERENCES

ABTS10	1327											
ABTS10	1330											
ABTSEQ	761	1364										
ABTSEQ	762	1365										
AJ2	357											
AJ2	360											
AJ3	471											
AJ3	472											
ALCL00	1532											
ALCL00	1533											
ANN+14	1137	1503										
ANN+14	1140	1504										
ANNOUT	424											
ANNOUT	425											
ASRCH	1544											
ASRCH	1545											
BLINK	365	456	477	522	715	754	1036	1072	1406			
BLINK	366	457	500	523	716	755	1037	1073	1407			
CLLCDE	271	422	646	1245	1711							
CLLCDE	272	423	647	1246	1712							
DATENT	221											
DATENT	222											
DSPLN+	317	1622										
DSPLN+	320	1623										
ENCP00	535	555	662	1015	1122	1207	1223	1250	1331	1366	1464	1522
ENCP00	1624											
ENCP00	536	556	663	1016	1123	1210	1224	1251	1332	1367	1465	1523
ENCP00	1625											
ENLCD	75	570	672	1344	1400	1451	1516					
ENLCD	76	571	673	1345	1401	1452	1517					
ERRNE	1566											
ERRNE	1567											
FDIG20	446	451										
FDIG20	447	452										
FDIGIT	363	713	752									
FDIGIT	364	714	753									
GENNUM	1723											
GENNUM	1724											
GETPC	1753											
GETPC	1754											
GTACOD	1000	1411										
GTACOD	1001	1412										
GTBYTA	1760											
GTBYTA	1761											
INCAD2	1756											
INCAD2	1757											
IND	374	454										
IND	375	455										
INSLIN	1267											
INSLIN	1270											
KEYOP	1513											
KEYOP	1514											
LDSST0	415	1357										
LDSST0	416	1360										
LEFTJ	1013	1120	1205	1221	1520							
LEFTJ	1014	1121	1206	1222	1521							

```
RSTKB   1142
RSTSEQ   430  1254  1564
RSTSEQ   431  1255  1565
RTJLBL  1474
RTJLBL  1475
SEARCH   201
SEARCH   202
STK      401
STK      402
STORFC  1603  1654
STORFC  1604  1655
TBITMP   142
TBITMP   143
TOGSHF  1354
TOGSHF  1355
TXTLBL  1630
TXTLBL  1631
WKUP10  1143
WKUP10  1144
XCUTB1  1304
XCUTB1  1305
XCUTE   1301
XCUTE   1302

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @10000-11777
* CONTENTS:
* 1. EXECUTION POINTS FOR MAINFRAME FUNCTIONS (MUST BE IN
*    @10000-11736)
*
     7                  FILE   CN4B
     8                  ENTRY  CAT##3
     9                  ENTRY  +
    10                  ENTRY  -
    11                  ENTRY  -DEC
    12                  ENTRY  -OCT
    13                  ENTRY  (*)
    14                  ENTRY  ADVNCE
    15                  ENTRY  /
    16                  ENTRY  (10)^X
    17                  ENTRY  ABS
    18                  ENTRY  ACOS
    19                  ENTRY  AGTO
    20                  ENTRY  AOFF
    21                  ENTRY  AON
    22                  ENTRY  ARCL
    23                  ENTRY  ASHF
    24                  ENTRY  ASIN
    25                  ENTRY  ASN
    26                  ENTRY  ASTO
    27                  ENTRY  ATAN
    28                  ENTRY  AVIEW
    29                  ENTRY  AXEQ
    30                  ENTRY  BEEP
    31                  ENTRY  BST
```

```
32                ENTRY  CAT
33                ENTRY  CF
34                ENTRY  CHS
35                ENTRY  CLA
36                ENTRY  CLDSP
37                ENTRY  CLP
38                ENTRY  CLREG
39                ENTRY  CLSIG
40                ENTRY  CLST
41                ENTRY  CLX
42                ENTRY  COPY
43                ENTRY  COS
44                ENTRY  D-R
45                ENTRY  DEG
46                ENTRY  DEL
47                ENTRY  DELETE
48                ENTRY  DSE
49                ENTRY  END
50                ENTRY  ENG
51                ENTRY  ENTER^
52                ENTRY  E^X
53                ENTRY  E^X-1
54                ENTRY  FACT
55                ENTRY  FC?
56                ENTRY  FC?C
57                ENTRY  FIX
58                ENTRY  FRAC
59                ENTRY  FS?
60                ENTRY  FS?C
61                ENTRY  GRAD
62                ENTRY  GTO
63                ENTRY  GTOL
64                ENTRY  HMS+
65                ENTRY  HMS-
66                ENTRY  HMS-H
67                ENTRY  H-HMS
68                ENTRY  INT
69                ENTRY  ISG
70                ENTRY  LASTX
71                ENTRY  LBL
72                ENTRY  LN
73                ENTRY  LN1+X
74                ENTRY  LOG
75                ENTRY  MEAN
76                ENTRY  MOD
77                ENTRY  MODE
78                ENTRY  OFF
79                ENTRY  ONE/X
80                ENTRY  P-R
81                ENTRY  PACK
82                ENTRY  PCT
83                ENTRY  PCTCH
84                ENTRY  PI
85                ENTRY  PROMPT
86                ENTRY  PSE
87                ENTRY  R-D
88                ENTRY  R-P
89                ENTRY  R/S
90                ENTRY  RAD
91                ENTRY  RCL
```

```
    92                  ENTRY  RDN
    93                  ENTRY  RND
    94                  ENTRY  RTN
    95                  ENTRY  R^
    96                  ENTRY  SCI
    97                  ENTRY  SF
    98                  ENTRY  SHIFT
    99                  ENTRY  SIGMA+
   100                  ENTRY  SIGMA-
   101                  ENTRY  SIGN
   102                  ENTRY  SIGREG
   103                  ENTRY  SIN
   104                  ENTRY  SIZE
   105                  ENTRY  SQRT
   106                  ENTRY  SST
   107                  ENTRY  STAYON
   108                  ENTRY  STDEV
   109                  ENTRY  STO
   110                  ENTRY  STO+
   111                  ENTRY  STO-
   112                  ENTRY  STO*
   113                  ENTRY  STO/
   114                  ENTRY  STOP
   115                  ENTRY  TAN
   116                  ENTRY  TONE
   117                  ENTRY  VIEW
   118                  ENTRY  X#0?
   119                  ENTRY  X#Y?
   120                  ENTRY  X<0?
   121                  ENTRY  X<=0?
   122                  ENTRY  X<=Y?
   123                  ENTRY  X<>
   124                  ENTRY  X<>Y
   125                  ENTRY  X<Y?
   126                  ENTRY  X=0?
   127                  ENTRY  X=Y?
   128                  ENTRY  X>0?
   129                  ENTRY  X>Y?
   130                  ENTRY  XEQ
   131                  ENTRY  XGOIND
   132                  ENTRY  X^2
   133                  ENTRY  Y^X
   134
*
* PKTTAB - PARSE KEY TYPE TABLE
* MUST START AT 0 IN QUAD 4 (1000=@10000)
* LOGICAL COLUMN 0
   139    0          101 CON    65           A
   140    1          106 CON    70           F
   141    2          400 CON    256          SHIFT
   142    3            0 CON    0
   143    4            2 CON    2            -
   144    5            1 CON    1            +
   145    6            3 CON    3            *
   146    7            4 CON    4            /
* LOGICAL COLUMN 1
   148   10          102 CON    66           B
   149   11          107 CON    71           G
   150   12            0 CON    0
   151   13            0 CON    0
```

```
   152   14            47 CON     39              7
   153   15            44 CON     36              4
   154   16            41 CON     33              1
   155   17            40 CON     32              0
* LOGICAL COLUMN 2
   157   20           103 CON     67              C
   158   21           110 CON     72              H
   159   22             0 CON     0
   160   23             0 CON     0
   161   24            50 CON     40              8
   162   25            45 CON     37              5
   163   26            42 CON     34              2
   164   27          1000 CON     512             DP
* LOGICAL COLUMN 3
   166   30           104 CON     68              D
   167   31           111 CON     73              I
   168   32             0 CON     0
   169   33             0 CON     0
   170   34            51 CON     41              9
   171   35            46 CON     38              6
   172   36            43 CON     35              3
   173   37             0 CON     0
* LOGICAL COLUMN 4
   175   40           105 CON     69              E
   176   41           100 CON     64              J
   177   42             0 CON     0
   178   43            17 CON     15              BACKARROW
   179   44           200 CON     128             ALPHA
   180   45             0 CON     0
   181   46             0 CON     0
   182                                            OFF KEY IS SPECIAL
   183   47           230 CON     @230
   184   50            36 CON     @36
   185   51            31 CON     @31
   186   52 Y^X       260 C=N
   187   53             1 GSBLGX  XY^X
   187   54             0
   188   55           543 GOTO    NFRXY* ( 131 )
   189   56           253 CON     @253
   190   57            23 CON     @23
   191   60            15 CON     @15
   192   61            10 CON     @10
   193   62 HMS+      260 C=N
   194   63             1 GSBLGX  XTOHRS
   194   64             0
   195   65           360 NC EX
   196   66           270 C=REGN 2
   197   67             1 GSBLGX  XTOHRS
   197   70             0
   198   71           416 A=C     W
   199   72           260 C=N
   200   73             1 GSBLGX  AD2-10
   200   74             0
   201   75           210 S5=     1
   202   76             1 GSBLGX  XTOHRS
   202   77             0
   203  100           313 GOTO    NFRXY* ( 131 )
   204  101           255 CON     @255
   205  102            23 CON     @23
   206  103            15 CON     @15
```

```
207  104           10 CON    @10
208  105 HMS-     260 C=N
209  106        1276 C=-C-1 S
210  107         360 CN EX
211  110        1523 GOTO   HMS+   ( 62)
212  111         253 CON    @253
213  112 +       260 C=N
214  113         143 GOTO   ADD210 ( 127)
215  114         204 CON    @204
216  115          17 CON    @17
217  116          15 CON    @15
218  117 MOD     260 C=N
219  120           1 GSBLGX MOD10
219  121           0
220  122          73 GOTO   NFRXY* ( 131)
221  123         255 CON    @255
222  124 -       260 C=N
223  125        1276 C=-C-1 S
224  126           0 NOP
225  127 ADD210    1 GSBLGX AD2-10
225  130           0
226  131 NFRXY*    1 GOLNGX NFRXY
226  132           2
227  133         252 CON    @252
228  134 (*)     260 C=N
229  135           1 GSBLGX MP2-10
229  136           0
230  137        1723 GOTO   NFRXY* ( 131)
231  140         245 CON    @245
232  141 PCT     646 A=A-1  X
233  142         646 A=A-1  X
234  143         260 C=N
235  144 TIMES     1 GSBLGX MP2-10
235  145           0
236  146           1 GOLNGX NFRX
236  147           2
237  150         262 CON    @262
238  151          36 CON    @36
239  152          30 CON    @30
240  153 X^2     260 C=N
241  154         416 A=C
242  155        1673 GOTO   TIMES  ( 144)
243  156         257 CON    @257
244  157 /       260 C=N
245  160           1 GSBLGX DV2-10
245  161           0
246  162        1473 GOTO   NFRXY* ( 131)
247  163         223 CON    @223
248  164           2 CON    @2
249  165           1 CON    @1
250  166 ABS     260 C=N
251  167         136 C=0    S
252  170        1740 RTN
253  171         223 CON    @223
254  172          17 CON    @17
255  173           3 CON    @3
256  174           1 CON    @1
257  175 ACOS      1 GSBLGX TRGSET
257  176           0
258  177        1610 S0=    1
```

```
259  200 ASIN1  1410 S1=    1
260  201 ATAN1  1010 S2=    1
261  202           1 GOLNGX BRT100
261  203           2
262  204           0 CON    @0
263  205 AGTO   1204 S7=    0
264  206 XGAXFR    1 GOLONG .XGA00
264  207           2
265  210         214 CON    @214
266  211           3 CON    @3
267  212         422 CON    @422
268  213        1001 CON    @1001
269  214 ARCL      1 GOLNGX XARCL
269  215           2
270  216         206 CON    @206
271  217          10 CON    @10
272  220          23 CON    @23
273  221           1 CON    @1
274  222 ASHF      1 GOLNGX XASHF
274  223           2
275  224         216 CON    @216
276  225          11 CON    @11
277  226          23 CON    @23
278  227           1 CON    @1
279  230 ASIN      1 GSBLGX TRGSET
279  231           0
280  232        1463 GOTO   ASIN1  ( 200)
281  233         216 CON    @216
282  234          23 CON    @23
283  235         401 CON    @401
284  236 ASN       1 GOLNGX .XASN
284  237           2
285  240         217 CON    @217
286  241          24 CON    @24
287  242         423 CON    @423
288  243        1001 CON    @1001
289  244 ASTO      1 GOLNGX XASTO
289  245           2
290  246         216 CON    @216
291  247           1 CON    @1
292  250          24 CON    @24
293  251           1 CON    @1
294  252 ATAN      1 GSBLGX TRGSET
294  253           0
295  254        1253 GOTO   ATAN1  ( 201)
296  255         227 CON    @227
297  256           5 CON    @5
298  257          11 CON    @11
299  260          26 CON    @26
300  261           1 CON    @1
301  262 AVIEW     1 GOLNGX XAVIEW
301  263           2
302  264           0 CON    @0
303  265 AXEQ   1210 S7=    1
304  266        1203 GOTO   XGAXFR ( 206)
305  267         220 CON    @220
306  270           5 CON    @5
307  271           5 CON    @5
308  272           2 CON    @2
309  273 BEEP    460 LDI
```

```
   310  274            7 CON    7
   311  275            1 GOLONG XBEEP
   311  276            2
   312  277          224 CON    @224
   313  300           23 CON    @23
   314  301            2 CON    @2
   315  302 BST        0 NOP                    XKD
   316  303            1 GOLONG XBST
   316  304            2
   317  305          224 CON    @224
   318  306         1401 CON    @1401
   319  307          403 CON    @403
   320  310 CAT        1 GOLNGX XCAT
   320  311            2
   321  312         1206 CON    @1206
   322  313         1003 CON    @1003
   323  314 CF         1 GOLNGX XCF
   323  315            2
   324  316          201 CON    @201
   325  317           14 CON    @14
   326  320            3 CON    @3
   327  321 CLA      116 C=0
   328  322          550 REGN=C 5
   329  323          650 REGN=C 6
   330  324          750 REGN=C 7
   331  325         1050 REGN=C 8
   332  326 NFRPUL  1740 RTN
   333  327          217 CON    @217
   334  330           24 CON    @24
   335  331         1023 CON    @1023
   336  332 STO      630 C=M
   337  333         1360 DATA=C
   338  334         1740 RTN
   339  335          204 CON    @204
   340  336           14 CON    @14
   341  337            3 CON    @3
   342  340 CLDSP      1 GOSUB  DATOFF          CLEAR MSGFLG
   342  341            0
* DATOFF ALSO CLEARS DATAENTRY FLAG, BUT THERE'S NO HARM DONE.
   344  342            1 GOLONG NWGOOS
   344  343            2
* IN KEYBOARD MODE, PUTTING UP A NEW GOOSE ISN'T VERY USEFUL,
* BUT SINCE THE DEFAULT DISPLAY LOGIC WRITES OVER IT, NO HARM
* IS DONE.
   348  344          220 CON    @220
   349  345           14 CON    @14
   350  346          403 CON    @403
   351  347 CLP        1 GOLONG CLRPGM
   351  350            2
   352  351          207 CON    @207
   353  352           22 CON    @22
   354  353           14 CON    @14
   355  354            3 CON    @3
   356  355 CLREG    410 S8=    1
   357  356            1 GOLNGX CLR
   357  357            2
   358  360          316 CON    @316
   359  361           14 CON    @14
   360  362            3 CON    @3
   361  363 CLSIG      1 GOLNGX XCLSIG
```

```
361  364            2
362  365          224 CON     @224
363  366           23 CON     @23
364  367           14 CON     @14
365  370            3 CON     @3
366  371 CLST     116 C=0
367  372           50 REGN=C  0
368  373          150 REGN=C  1
369  374          250 REGN=C  2
370  375           53 GOTO    XCLX1   ( 402)
371  376          230 CON     @230
372  377           14 CON     @14
373  400            3 CON     @3
374  401 CLX      116 C=0
375                 ENTRY   XCLX1          USED BY SIGMA+ AND SIGMA-
376  402 XCLX1    350 REGN=C 3              STORE NEW X
377  403            1 GOLONG NFRSIG
377  404            2
378  405          231 CON     @231
379  406           20 CON     @20
380  407           17 CON     @17
381  410          403 CON     @403
382  411 COPY       1 GOLNGX  XCOPY
382  412            2
383  413          222 CON     @222
384  414           55 CON     @55
385  415            4 CON     @4
386  416 D-R      260 C=N
387  417            1 GOLNGX  DTOR
387  420            2
388  421          207 CON     @207
389  422            5 CON     @5
390  423            4 CON     @4
391  424 DEG        1 GOLNGX  XDEG
391  425            2
392  426          204 CON     @204
393  427            1 CON     @1
394  430           22 CON     @22
395  431            7 CON     @7
396  432 GRAD       1 GOLONG .XGRAD
396  433            2
397  434          204 CON     @204
398  435            1 CON     @1
399  436           22 CON     @22
400  437 RAD        1 GOLONG  XRAD
400  440            2
401  441          214 CON     @214
402  442          405 CON     @405
403  443          404 CON     @404
404  444 DEL        1 GOLNGX  DELNNN
404  445            2
405  446            0 CON     @0
406  447 DELETE     0 NOP
407  450            1 GOLONG  XDELET
407  451            2
408  452          205 CON     @205
409  453          423 CON     @423
410  454         1004 CON     @1004
411  455 DSE        1 GOLNGX  XDSE
411  456            2
```

```
412  457          204 CON     @204
413  460           16 CON     @16
414  461            5 CON     @5
415       END
416  462          207 CON     @207
417  463         1416 CON     @1416
418  464          405 CON     @405
419  465 ENG      510 S6=     1
420  466            1 GOLNGX XSCI
420  467            2
421  470          236 CON     @236
422  471           22 CON     @22
423  472            5 CON     @05
424  473           24 CON     @24
425  474           16 CON     @16
426  475            5 CON     @5
427  476 ENTER^     1 GOSUB   R^SUB
427  477            0
428  500          270 C=REGN 2
429  501          350 REGN=C 3
430  502            1 GOLONG NFRENT
430  503            2
431  504          230 CON     @230
432  505           36 CON     @36
433  506            5 CON     @5
434  507 E^X      260 C=N
435  510            1 GOLNGX EXP10
435  511            2
436  512          226 CON     @226
437  513            4 CON     @4
438  514            1 CON     @1
439  515 ADVNCE  1565 CON     @1565          GOSUB PRT9
440  516          674 CON     @674
441  517         1740 RTN
442  520          224 CON     @224
443  521            3 CON     @3
444  522            1 CON     @1
445  523            6 CON     @6
446  524 FACT     260 C=N
447  525            1 GOLNGX XFT100
447  526            2
448  527          277 CON     @277
449  530         1003 CON     @1003
450  531         1006 CON     @1006
451  532 FC?      256 AC EX
452  533         1256 C=-C-1
453  534          256 AC EX
454  535          453 GOTO    FS?     ( 602)
455  536          261 CON     @261
456  537           55 CON     @55
457  540           30 CON     @30
458  541           36 CON     @36
459  542            5 CON     @5
460  543 E^X-1    110 S4=     1
461  544          260 C=N
462  545            1 GOLONG EXP10
462  546            2
463  547          203 CON     @203
464  550           77 CON     @77
465  551         1003 CON     @1003
```

```
466  552          1006 CON    @1006
467  553 FC?C        1 GOSUB  XCF
467  554             0
468  555          1553 GOTO   FC?     ( 532)
469  556           230 CON    @230
470  557          1411 CON    @1411
471  560           406 CON    @406
472  561 FIX      1210 S7=    1
473  562             1 GOLNGX XSCI
473  563             2
474  564           224 CON    @224
475  565            16 CON    @16
476  566            11 CON    @11
477  567 INT       210 S5=    1
478  570            43 GOTO   FRAC    ( 574)
479  571           203 CON    @203
480  572            22 CON    @22
481  573             6 CON    @6
482  574 FRAC      260 C=N
483  575             1 GOLNGX INTFRC
483  576             2
484  577           277 CON    @277
485  600          1023 CON    @1023
486  601          1006 CON    @1006
487  602 FS?         1 GOLNGX XFS?
487  603             2
488  604           203 CON    @203
489  605            77 CON    @77
490  606          1023 CON    @1023
491  607          1006 CON    @1006
492  610 FS?C        1 GOSUB  XCF
492  611             0
493  612          1703 GOTO   FS?     ( 602)
494  613             0 CON    0
495  614 GTOL        1 GOLONG GTONN
495  615             2
496  616           217 CON    @217
497  617          1424 CON    @1424
498  620          1407 CON    @1407
499       GTO                                CAN'T BE FOLLOWED BY 0
500  621           222 CON    @222
501  622            10 CON    @10
502  623 HMS-H     260 C=N
503  624             1 GOLNGX XTOHRS
503  625             2
504  626           223 CON    @223
505  627            15 CON    @15
506  630            10 CON    @10
507  631 H-HMS     210 S5=    1
508  632          1713 GOTO   HMS-H   ( 623) SAVE CODE HERE
509  633           207 CON    @207
510  634           423 CON    @423
511  635          1011 CON    @1011
512  636 ISG      1604 S0=    0
513  637             1 GOLNGX XISG
513  640             2
514  641           214 CON    @214
515  642             2 CON    @2
516  643          1414 CON    @1414
517       LBL                                CAN'T BE FOLLOWED BY 0
```

```
518  644          216 CON    @216
519  645           14 CON    @14
520  646 LN       260 C=N
521  647            1 GOLNGX LN10
521  650            2
522  651          207 CON    @207
523  652           17 CON    @17
524  653           14 CON    @14
525  654 LOG      210 S5=    1
526  655         1713 GOTO   LN      ( 646) SAVE SPACE HERE
527  656          226 CON    @226
528  657            5 CON    @5
529  660            4 CON    @4
530  661           23 CON    @023
531  662 STDEV      1 GSBLGX SD
531  663            0
532  664           73 GOTO   NFRNC* ( 673)
533  665          216 CON    @216
534  666            1 CON    @1
535  667            5 CON    @5
536  670           15 CON    @15
537  671 MEAN       1 GSBLGX XBAR
537  672            0
538  673 NFRNC*     1 GOLNGX NFRNC
538  674            2
539  675          220 CON    @220
540  676           55 CON    @55
541  677           22 CON    @22
542  700 R-P        1 GSBLGX TRGSET
542  701            0
543  702            1 GSBLGX TOPOL
543  703            0
544  704         1673 GOTO   NFRNC* ( 673)
545  705          206 CON    @206
546  706            6 CON    @6
547  707           17 CON    @17
548  710 OFF     1340 DISOFF
549  711          460 LDI
550  712           11 CON    9
551  713            1 GOSUB  ROMCHK
551  714            0
552  715            1 GOSUB  MEMCHK
552  716            0
553  717            1 GOSUB  RSTKB
553  720            0
554  721            1 GOLONG DRSY50
554  722            2
555  723          230 CON    @230
556  724           57 CON    @57
557  725           61 CON    @61
558  726 ONE/X    260 C=N
559  727            1 GOLNGX 1/X10
559  730            2
560  731          222 CON    @222
561  732           55 CON    @55
562  733           20 CON    @20
563  734 P-R        1 GSBLGX TRGSET
563  735            0
564  736         1410 S1=    1
565  737         1010 S2=    1
```

```
566  740           1 GSBLGX TOREC
566  741           0
567  742        1313 GOTO   NFRNC* ( 673)
568  743         213 CON    @213
569  744           3 CON    @3
570  745           1 CON    @1
571  746          20 CON    @20
572  747 PACK      1 GOLONG XPACK
572  750           2
573  751         210 CON    @210
574  752           3 CON    @3
575  753          45 CON    @45
576  754 PCTCH   276 AC EX  S
577  755        1276 C=-C-1 S
578  756         276 AC EX  S
579  757         260 C=N
580  760           1 GSBLGX AD2-10
580  761           0
581  762         546 A=A+1  X
582  763         546 A=A+1  X
583  764         270 C=REGN 2
584  765           1 GSBLGX DV1-10
584  766           0
585  767           1 GOLNGX NFRX
585  770           2
586  771         205 CON    @205
587  772          23 CON    @23
588  773          20 CON    @20
589  774 PSE    1314 ?S13=1                 RUNNING?
590  775          43 GONC   PSE10  (1001) NO
591  776        1410 S1=    1              SET PAUSEFLAG
592  777           1 GOSUB  STOST0         PUT SS 0 BACK
592 1000           0
593 1001 PSE10     1 GOLONG PSESTP
593 1002           2
594 1003         224 CON    @224
595 1004          20 CON    @20
596 1005          15 CON    @15
597 1006          17 CON    @17
598 1007          22 CON    @22
599 1010          20 CON    @20
600 1011 PROMPT    1 GOLNGX XPRMPT
600 1012           2
601 1013         204 CON    @204
602 1014          55 CON    @55
603 1015          22 CON    @22
604 1016 R-D     260 C=N
605 1017           1 GOLNGX RTOD
605 1020           2
606 1021         220 CON    @220
607 1022          17 CON    @17
608 1023          24 CON    @24
609 1024          23 CON    @23
610 1025 STOP      1 GOLONG STOPSB
610 1026           2
611 1027           0 CON    @0             NO PROMPTING
612 1030 R/S       0 NOP                   XKD
613 1031           1 GOLNGX XR/S
613 1032           2
614 1033         230 CON    @230
```

```
615 1034           53 CON    @53
616 1035           61 CON    @61
617 1036           16 CON    @16
618 1037           14 CON    @14
619 1040 LN1+X    260 C=N
620 1041            1 GOLONG .XLN1+X
620 1042            2
621 1043          230 CON    @230
622 1044           24 CON    @24
623 1045           23 CON    @23
624 1046            1 CON    @1
625 1047           14 CON    @14
626 1050 LASTX    470 C=REGN 4
627 1051 LXEX     356 CB EX
628 1052           43 GOTO   RCL     (1056)
629 1053          214 CON    @214
630 1054          403 CON    @403
631 1055         1022 CON    @1022
632 1056 RCL      614 ?S11=1
633 1057            1 GSUBCX R^SUB
633 1060            1
634 1061 NPRCL    116 C=0
635 1062         1160 DADD=C
636 1063          356 CB EX
637 1064          350 REGN=C 3
638 1065 NFRPRL     1 GOLNGX NFRPR
638 1066            2
639 1067          223 CON    @223
640 1070           10 CON    8
641 1071            3 CON    3
642 1072 CHS      260 C=N                    GET X
643 1073         1372 ? C#0   M
644 1074           33 GONC   DONCHS (1077) X IS ZERO DO NOTHING
645 1075         1276 C=-C-1 S              DO CHS
646 1076          350 REGN=C 3
647 1077 DONCHS  1663 GOTO   NFRPRL (1065)
648 1100          211 CON    @211
649 1101           20 CON    @20
650 1102 PI      1240 SETDEC
651 1103            1 GSBLGX PI/2
651 1104            0
652 1105          756 C=C+C  W
653 1106         1072 C=C+1  M
654 1107          106 C=0    X
655 1110         1413 GOTO   LXEX   (1051)
656 1111          276 CON    @276
657 1112          474 CON    @474
658 1113         1030 CON    @1030
659 1114 X<>      630 C=M
660 1115         1360 DATA=C
661 1116         1433 GOTO   NPRCL  (1061)
662 1117          216 CON    @216
663 1120            4 CON    @4
664 1121           22 CON    @22
665 1122 RDN        1 GOLNGX XRDN
665 1123            2
666 1124          204 CON    @204
667 1125           16 CON    @16
668 1126           22 CON    @22
669 1127 RND        1 GOLNGX XRND
```

```
669 1130                2
670 1131              216 CON     @216
671 1132               24 CON     @24
672 1133               22 CON     @22
673 1134 RTN            1 GOLNGX  XRTN
673 1135                2
674 1136              236 CON     @236
675 1137               22 CON     @22
676 1140 R^             1 GOLNGX  XR^
676 1141                2
677 1142              211 CON     @211
678 1143             1403 CON     @1403
679 1144              423 CON     @423
680 1145 SCI            1 GOLNGX  XSCI
680 1146                2
681 1147             1206 CON     @1206
682 1150             1023 CON     @1023
683 1151 SF             1 GOLNGX  XSF
683 1152                2
684 1153              253 CON     @253
685 1154              116 CON     @116
686 1155 SIGMA+         1 GOLNGX  SIGMA
686 1156                2
687 1157              255 CON     @255
688 1160              116 CON     @116
689 1161 SIGMA-       210 S5=     1
690 1162             1733 GOTO    SIGMA+ (1155) SAVE CODE HERE
691 1163              207 CON     @207
692 1164                5 CON     @5
693 1165             1022 CON     @1022
694 1166             1116 CON     @1116
695 1167 SIGREG         1 GOLNGX  XSGREG
695 1170                2
696 1171              223 CON     @223
697 1172               17 CON     @17
698 1173                3 CON     @3
699 1174 COS            1 GSBLGX  TRGSET
699 1175                0
700 1176              153 GOTO    COS1   (1213)
701 1177              216 CON     @216
702 1200                1 CON     @1
703 1201               24 CON     @24
704 1202 TAN            1 GSBLGX  TRGSET
704 1203                0
705 1204              103 GOTO    XTRIG  (1214)
706 1205              216 CON     @216
707 1206               11 CON     @11
708 1207               23 CON     @23
709 1210 SIN            1 GSBLGX  TRGSET
709 1211                0
710 1212             1610 S0=     1
711 1213 COS1        1410 S1=     1
712 1214 XTRIG          1 GOLNGX  TRG100
712 1215                2
713 1216              205 CON     @205
714 1217               32 CON     @32
715 1220              411 CON     @411
716 1221              423 CON     @423
717 1222 SIZE           1 GOLNGX  XSIZE
717 1223                2
```

```
718 1224          224 CON     @224
719 1225           22 CON     @22
720 1226           21 CON     @21
721 1227           23 CON     @23
722 1230 SQRT     260 C=N
723 1231            1 GOLNGX  SQR10
723 1232            2
724 1233          224 CON     @224
725 1234           23 CON     @23
726 1235           23 CON     @23
727 1236 SST        0 NOP                          XKD
728 1237            1 GOLNGX  XSST
728 1240            2
729 1241          216 CON     @216
730 1242           17 CON     @17
731 1243 STAYON     1 GOLONG  XSTYON
731 1244            2
732 1245          252 CON     @252
733 1246          424 CON     @424
734 1247         1023 CON     @1023
735 1250 STO*       1 GSBLGX  SEPXY
735 1251            0
736 1252            1 GSBLGX  MP2-10
736 1253            0
737 1254          103 GOTO    NFRST  (1264)
738 1255          253 CON     @253
739 1256          424 CON     @424
740 1257         1023 CON     @1023
741 1260 STO+       1 GSBLGX  SEPXY
741 1261            0
742 1262            1 GSBLGX  AD2-10
742 1263            0
743 1264 NFRST      1 GOLONG  NFRST+
743 1265            2
744 1266          255 CON     @255
745 1267          424 CON     @424
746 1270         1023 CON     @1023
747 1271 STO-     630 C=M
748 1272         1240 SETDEC
749 1273         1276 C=-C-1 S
750 1274          530 M=C
751 1275         1633 GOTO    STO+   (1260)
752 1276          257 CON     @257
753 1277          424 CON     @424
754 1300         1023 CON     @1023
755 1301 STO/       1 GSBLGX  SEPXY
755 1302            0
756 1303            1 GSBLGX  DV2-10
756 1304            0
757 1305         1573 GOTO    NFRST  (1264)
758 1306          230 CON     @230
759 1307           36 CON     @36
760 1310           60 CON     @60
761 1311           61 CON     @61
762 1312 (10)^X     1 GOLNGX  10TOX
762 1313            2
763 1314          205 CON     @205
764 1315           16 CON     @16
765 1316         1417 CON     @1417
766 1317          424 CON     @424
```

```
767 1320 TONE       1 GOLNGX XTONE
767 1321            2
768 1322          227 CON    @227
769 1323            5 CON    @5
770 1324          411 CON    @411
771 1325         1026 CON    @1026
772 1326 VIEW       1 GOLNGX XVIEW
772 1327            2
773 1330          277 CON    @277
774 1331           60 CON    @60
775 1332          115 CON    @115
776 1333           30 CON    @30
777 1334 X#0?       1 GOLNGX XX#0?
777 1335            2
778 1336          277 CON    @277
779 1337           31 CON    @31
780 1340          115 CON    @115
781 1341           30 CON    @30
782 1342 X#Y?       1 GOLNGX XX#Y?
782 1343            2
783 1344          277 CON    @277
784 1345           60 CON    @60
785 1346           74 CON    @74
786 1347           30 CON    @30
787 1350 X<0?       1 GOLNGX XX<0?
787 1351            2
788 1352          277 CON    @277
789 1353           60 CON    @60
790 1354           75 CON    @75
791 1355           74 CON    @74
792 1356           30 CON    @30
793 1357 X<=0?      1 GOLONG XX<=0A
793 1360            2
794 1361          277 CON    @277
795 1362           31 CON    @31
796 1363           75 CON    @75
797 1364           74 CON    @74
798 1365           30 CON    @30
799 1366 X<=Y?      1 GOLNGX XX<=Y?
799 1367            2
800 1370          231 CON    @231
801 1371           76 CON    @76
802 1372           74 CON    @74
803 1373           30 CON    @30
804 1374 X<>Y     370 C=REGN 3
805 1375          256 AC EX
806 1376          270 C=REGN 2
807 1377          350 REGN=C 3
808 1400          256 AC EX
809 1401          250 REGN=C 2
810 1402            1 GOLNGX NFRPR
810 1403            2
811 1404          277 CON    @277
812 1405           31 CON    @31
813 1406           74 CON    @74
814 1407           30 CON    @30
815 1410 X<Y?       1 GOLONG XX<Y?
815 1411            2
816 1412          277 CON    @277
817 1413           60 CON    @60
```

```
818 1414            75 CON     @75
819 1415            30 CON     @30
820 1416 X=0?        1 GOLNGX  XX=0?
820 1417             2
821 1420           277 CON     @277
822 1421            31 CON     @31
823 1422            75 CON     @75
824 1423            30 CON     @30
825 1424 X=Y?        1 GOLNGX  XX=Y?
825 1425             2
826 1426           277 CON     @277
827 1427            60 CON     @60
828 1430            76 CON     @76
829 1431            30 CON     @30
830 1432 X>0?        1 GOLNGX  XX>0?
830 1433             2
831 1434           277 CON     @277
832 1435            31 CON     @31
833 1436            76 CON     @76
834 1437            30 CON     @30
835 1440 X>Y?        1 GOLNGX  XX>Y?
835 1441             2
836 1442             0 CON     0
837 1443 XGOIND      1 GOLONG  XGI
837 1444             2
838 1445           221 CON     @221
839 1446           405 CON     @0405
840 1447          1430 CON     @1430
841       XEQ                                CAN'T BE FOLLOWED BY 0
842 1450           203 CON     @203
843 1451             5 CON     5
844 1452             4 CON     4
845 1453 -DEC      110 S4=     1
846 1454            43 GOTO    -OCT    (1460)
847 1455           224 CON     @224
848 1456             3 CON     3
849 1457            17 CON     15
850 1460 -OCT      260 C=N
851 1461             1 GOLNGX  TOOCT
851 1462             2
852 1463           216 CON     @216
853 1464             7 CON     7
854 1465            11 CON     9
855 1466            23 CON     19
856 1467 SIGN        1 GOLONG  XSIGN
856 1470             2
*
*
859 1471           216 CON     @216           N
860 1472            17 CON     15             O
861 1473             1 CON     1              A
862 1474 AON      1210 S7=     1              SET ALPHAMODE
863 1475 AON10       1 GOSUB   STOSTO
863 1476             0
864 1477             1 GOLONG  ANNOUT
864 1500             2
*
*
867 1501           206 CON     @206           F
868 1502             6 CON     6              F
```

```
   869 1503           17 CON     15             0
   870 1504            1 CON     1              A
   871 1505 AOFF    1204 S7=     0              CLEAR ALPHAMODE
   872 1506         1673 GOTO    AON10  (1475)
*
*
   875 1507            0 CON     @0             NO PROMPTING
   876 1510 SHIFT      0 NOP                    XKD
   877 1511            1 GOSUB   TGSHF1         TOGGLE SHIFT FLAG
   877 1512            0
   878 1513          253 GOTO    USCOM1 (1540)
*
*
   881 1514            0 CON     @0             NO PROMPTING
   882 1515 MODE       0 NOP                    XKD
   883 1516         1040 C=KEYS
*
   885                  ENTRY   MODE1            FOR WAND ALPHA,PRGM,USER
* ENTRY POINT ADD FOR WAND ON 3-13-79
*
   888       MODE1
   889 1517           34 PT=     3
   890 1520          742 C=C+C   PT
   891 1521          742 C=C+C   PT
   892 1522          742 C=C+C   PT
   893 1523          203 GONC    ALFPRG (1543)
   894                                         USER KEY
   895 1524         1670 C=REGN  14
   896 1525          574 RCR     6
   897 1526         1730 CST EX                 PUT UP SS 3
   898 1527          114 ?S4=1                  USERMODE?
   899 1530           37 GOC     USEROF (1533) YES
   900 1531          110 S4=     1              SET USERMODE
   901 1532           23 GOTO    USERC  (1534)
   902 1533 USEROF   104 S4=     0              CLEAR USERMODE
   903 1534 USERC   1730 CST EX
   904 1535          474 RCR     8
   905 1536 USCOM   1630 C=ST                   MERGE SS 0 WITH OTHER SETS
   906 1537         1650 REGN=C  14
   907 1540 USCOM1  1104 S9=     0              KEYBOARD NOT RESET YET
   908 1541            1 GOLONG  DRSY51         REFRESH ANNUNCIATORS ONLY
   908 1542            2
*
*
   911 1543 ALFPRG  1515 CON     @1515          GOSUB PRT14
   912 1544          674 CON     @674
   913                  ENTRY   PR14RT           FOR PRINTER
   914       PR14RT
   915 1545         1342 ? C#0   PT             PRGM KEY?
   916 1546          177 GOC     PRGM   (1565) YES
   917 1547            1 GOSUB   RSTMS1         ALPHA KEY
   917 1550            0
   918 1551         1214 ?S7=1                  ALPHAMODE
   919 1552           73 GONC    ALPHON (1561) NO
   920 1553         1204 S7=     0              CLEAR ALPHAMODE
   921 1554 APCOM   1630 C=ST                   MERGE SS0 W/ OTHER SETS
   922 1555         1650 REGN=C  14             PUT STATUS SETS BACK
   923 1556 D05XFR  1104 S9=     0              KEYBOARD NOT RESET YET
   924 1557            1 GOLONG  DRSY05         REFRESH MAIN DISPLAY
   924 1560            2
```

```
   925 1561 ALPHON 1210 S7=     1              SET ALPHAMODE
   926 1562          14 ?S3=1                  PROGRAM MODE?
   927 1563        1713 GONC    APCOM  (1554) NO
   928 1564        1523 GOTO    USCOM  (1536) YES
*
*
   931 1565 PRGM      1 GOSUB   RSTMS1
   931 1566           0
   932 1567        1404 S1=     0              CLEAR PAUSEFLAG
   933 1570        1204 S7=     0              CLEAR ALPHAMODE
   934 1571          14 ?S3=1                  PRGMMODE?
   935 1572          37 GOC     PRGMOF (1575) YES
   936 1573          10 S3=     1              NO. SET PRGMMODE
   937 1574        1603 GOTO    APCOM  (1554)
   938 1575 PRGMOF    4 S3=     0              CLEAR PRGMMODE
   939 1576        1630 C=ST
   940 1577        1650 REGN=C 14              PUT STATUS SETS BACK
   941 1600           1 GOSUB   DECMPL         DECOMPILE
   941 1601           0
   942 1602        1543 GOTO    D05XFR (1556)
   943
   944
   945
*****************************************************
   947 1603 CAT##3  116 C=0                    MOVE # TO A MANT
   948 1604         346 BC EX   X
   949 1605         674 RCR     11
   950 1606         256 AC EX
   951 1607           1 GOSUB   ALPDEF         SEL.CORECT DEF
   951 1610           0
   952 1611           0 NOP
   953 1612         112 DEF     +       ( 112)
   954 1613         124 DEF     -       ( 124)
   955 1614         134 DEF     (*)     ( 134)
   956 1615         157 DEF     /       ( 157)
   957 1616         726 DEF     ONE/X   ( 726)
   958 1617        1312 DEF     (10)^X  (1312)
   959 1620         166 DEF     ABS     ( 166)
   960 1621         175 DEF     ACOS    ( 175)
   961 1622         515 DEF     ADVNCE  ( 515)
   962 1623        1505 DEF     AOFF    (1505)
   963 1624        1474 DEF     AON     (1474)
   964 1625         214 DEF     ARCL    ( 214)
   965 1626         222 DEF     ASHF    ( 222)
   966 1627         230 DEF     ASIN    ( 230)
   967 1630         236 DEF     ASN     ( 236)
   968 1631         244 DEF     ASTO    ( 244)
   969 1632         252 DEF     ATAN    ( 252)
   970 1633         262 DEF     AVIEW   ( 262)
   971 1634         273 DEF     BEEP    ( 273)
   972 1635         302 DEF     BST     ( 302)
   973 1636         310 DEF     CAT     ( 310)
   974 1637         314 DEF     CF      ( 314)
   975 1640        1072 DEF     CHS     (1072)
   976 1641         321 DEF     CLA     ( 321)
   977 1642         340 DEF     CLDSP   ( 340)
   978 1643         347 DEF     CLP     ( 347)
   979 1644         355 DEF     CLREG   ( 355)
   980 1645         363 DEF     CLSIG   ( 363)
   981 1646         371 DEF     CLST    ( 371)
```

```
 982 1647          401 DEF     CLX     ( 401)
 983 1650          411 DEF     COPY    ( 411)
 984 1651         1174 DEF     COS     (1174)
 985 1652          416 DEF     D-R     ( 416)
 986 1653         1453 DEF     -DEC    (1453)
 987 1654          424 DEF     DEG     ( 424)
 988 1655          444 DEF     DEL     ( 444)
 989 1656          455 DEF     DSE     ( 455)
 990 1657          462 DEF     END     ( 462)
 991 1660          465 DEF     ENG     ( 465)
 992 1661          476 DEF     ENTER^  ( 476)
 993 1662          507 DEF     E^X     ( 507)
 994 1663          543 DEF     E^X-1   ( 543)
 995 1664          524 DEF     FACT    ( 524)
 996 1665          532 DEF     FC?     ( 532)
 997 1666          553 DEF     FC?C    ( 553)
 998 1667          561 DEF     FIX     ( 561)
 999 1670          574 DEF     FRAC    ( 574)
1000 1671          602 DEF     FS?     ( 602)
1001 1672          610 DEF     FS?C    ( 610)
1002 1673          432 DEF     GRAD    ( 432)
1003 1674          621 DEF     GTO     ( 621)
1004 1675          631 DEF     H-HMS   ( 631)
1005 1676           62 DEF     HMS+    (  62)
1006 1677          105 DEF     HMS-    ( 105)
1007 1700          623 DEF     HMS-H   ( 623)
1008 1701          567 DEF     INT     ( 567)
1009 1702          636 DEF     ISG     ( 636)
1010 1703         1050 DEF     LASTX   (1050)
1011 1704          644 DEF     LBL     ( 644)
1012 1705          646 DEF     LN      ( 646)
1013 1706         1040 DEF     LN1+X   (1040)
1014 1707          654 DEF     LOG     ( 654)
1015 1710          671 DEF     MEAN    ( 671)
1016 1711          117 DEF     MOD     ( 117)
1017 1712         1460 DEF     -OCT    (1460)
1018 1713          710 DEF     OFF     ( 710)
1019 1714         1243 DEF     STAYON  (1243)
1020 1715          734 DEF     P-R     ( 734)
1021 1716          747 DEF     PACK    ( 747)
1022 1717          141 DEF     PCT     ( 141)
1023 1720          754 DEF     PCTCH   ( 754)
1024 1721         1102 DEF     PI      (1102)
1025 1722         1011 DEF     PROMPT  (1011)
1026 1723          774 DEF     PSE     ( 774)
1027 1724         1140 DEF     R^      (1140)
1028 1725         1016 DEF     R-D     (1016)
1029 1726          700 DEF     R-P     ( 700)
1030 1727          437 DEF     RAD     ( 437)
1031 1730         1056 DEF     RCL     (1056)
1032 1731         1122 DEF     RDN     (1122)
1033 1732         1127 DEF     RND     (1127)
1034 1733         1134 DEF     RTN     (1134)
1035 1734          662 DEF     STDEV   ( 662)
1036 1735         1145 DEF     SCI     (1145)
1037 1736         1151 DEF     SF      (1151)
1038 1737         1155 DEF     SIGMA+  (1155)
1039 1740         1161 DEF     SIGMA-  (1161)
1040 1741         1167 DEF     SIGREG  (1167)
1041 1742         1210 DEF     SIN     (1210)
```

```
  1042 1743          1467 DEF     SIGN    (1467)
  1043 1744          1222 DEF     SIZE    (1222)
  1044 1745          1230 DEF     SQRT    (1230)
  1045 1746          1236 DEF     SST     (1236)
  1046 1747          1260 DEF     STO+    (1260)
  1047 1750          1271 DEF     STO-    (1271)
  1048 1751          1250 DEF     STO*    (1250)
  1049 1752          1301 DEF     STO/    (1301)
  1050 1753           332 DEF     STO     ( 332)
  1051 1754          1025 DEF     STOP    (1025)
  1052 1755          1202 DEF     TAN     (1202)
  1053 1756          1320 DEF     TONE    (1320)
  1054 1757          1326 DEF     VIEW    (1326)
  1055 1760          1416 DEF     X=0?    (1416)
  1056 1761          1334 DEF     X#0?    (1334)
  1057 1762          1350 DEF     X<0?    (1350)
  1058 1763          1357 DEF     X<=0?   (1357)
  1059 1764          1432 DEF     X>0?    (1432)
  1060 1765          1424 DEF     X=Y?    (1424)
  1061 1766          1342 DEF     X#Y?    (1342)
  1062 1767          1410 DEF     X<Y?    (1410)
  1063 1770          1366 DEF     X<=Y?   (1366)
  1064 1771          1440 DEF     X>Y?    (1440)
  1065 1772          1114 DEF     X<>     (1114)
  1066 1773          1374 DEF     X<>Y    (1374)
  1067 1774          1450 DEF     XEQ     (1450)
  1068 1775           153 DEF     X^2     ( 153)
  1069 1776            52 DEF     Y^X     (  52)
  1070 1777             0 CON     0
  1071
  1072
  1073
*
*
*
*****************************************************************
* NOTE: NO EXECUTION POINT MAY BE LOCATED AFTER @1736 IN THIS
* QUAD.  THE SEARCH ALGORITHM USES ENTRIES > @1736 IN THE
* MAIN FUNCTION TABLE AS DELIMITERS OF HOLES IN THE TABLE.
*****************************************************************
  1082                    UNLIST

  ERRORS :       0
```

SYMBOL TABLE

```
(*)       134   -  1614
(10)^X   1312   -  1617
+         112   -  1612
-         124   -  1613
-DEC     1453   -  1653
-OCT     1460   -  1712  1454
/         157   -  1615
ABS       166   -  1620
ACOS      175   -  1621
ADD210    127   -   113
ADVNCE    515   -  1622
AGTO      205   -
ALFPRG   1543   -  1523
ALFHON   1561   -  1552
AOFF     1505   -  1623
AON      1474   -  1624
AON10    1475   -  1506
APCON    1554   -  1574  1563
ARCL      214   -  1625
ASHF      222   -  1626
ASIN      230   -  1627
ASIN1     200   -   232
ASN       236   -  1630
ASTO      244   -  1631
ATAN      252   -  1632
ATAN1     201   -   254
AVIEW     262   -  1633
AXEQ      265   -
BEEP      273   -  1634
BST       302   -  1635
CAT       310   -  1636
CAT##3   1603   -
CF        314   -  1637
CHS      1072   -  1640
CLA       321   -  1641
CLDSP     340   -  1642
CLP       347   -  1643
CLREG     355   -  1644
CLSIG     363   -  1645
CLST      371   -  1646
CLX       401   -  1647
COPY      411   -  1650
COS      1174   -  1651
COS1     1213   -  1176
D-R       416   -  1652
D05XFR   1556   -  1602
DEG       424   -  1654
DEL       444   -  1655
DELETE    447   -
DONCHS   1077   -  1074
DSE       455   -  1656
END       462   -  1657
ENG       465   -  1660
ENTER^    476   -  1661
E^X       507   -  1662
E^X-1     543   -  1663
```

FACT	524	-	1664				
FC?	532	-	1665	555			
FC?C	553	-	1666				
FIX	561	-	1667				
FRAC	574	-	1670	570			
FS?	602	-	1671	612	535		
FS?C	610	-	1672				
GRAD	432	-	1673				
GTO	621	-	1674				
GTOL	614	-					
H-HMS	631	-	1675				
HMS+	62	-	1676	110			
HMS-	105	-	1677				
HMS-H	623	-	1700	632			
INT	567	-	1701				
ISG	636	-	1702				
LASTX	1050	-	1703				
LBL	644	-	1704				
LN	646	-	1705	655			
LN1+X	1040	-	1706				
LOG	654	-	1707				
LXEX	1051	-	1110				
MEAN	671	-	1710				
MOD	117	-	1711				
MODE	1515	-					
MODE1	1517	-					
NFRNC*	673	-	742	704	664		
NFRPRL	1065	-	1077				
NFRPUL	326	-					
NFRST	1264	-	1305	1254			
NFRXY*	131	-	162	137	122	100	55
NPRCL	1061	-	1116				
OFF	710	-	1713				
ONE/X	726	-	1616				
P-R	734	-	1715				
PACK	747	-	1716				
PCT	141	-	1717				
PCTCH	754	-	1720				
PI	1102	-	1721				
PR14RT	1545	-					
PRGM	1565	-	1546				
PRGMOF	1575	-	1572				
PROMPT	1011	-	1722				
PSE	774	-	1723				
PSE10	1001	-	775				
R-D	1016	-	1725				
R-P	700	-	1726				
R/S	1030	-					
RAD	437	-	1727				
RCL	1056	-	1730	1052			
RDN	1122	-	1731				
RND	1127	-	1732				
RTN	1134	-	1733				
R^	1140	-	1724				
SCI	1145	-	1735				
SF	1151	-	1736				
SHIFT	1510	-					
SIGMA+	1155	-	1737	1162			
SIGMA-	1161	-	1740				
SIGN	1467	-	1743				

```
SIGREG  1167  -  1741
SIN     1210  -  1742
SIZE    1222  -  1744
SQRT    1230  -  1745
SST     1236  -  1746
STAYON  1243  -  1714
STDEV    662  -  1734
STO      332  -  1753
STO*    1250  -  1751
STO+    1260  -  1747 1275
STO-    1271  -  1750
STO/    1301  -  1752
STOP    1025  -  1754
TAN     1202  -  1755
TIMES    144  -   155
TONE    1320  -  1756
USCOM   1536  -  1564
USCOM1  1540  -  1513
USERC   1534  -  1532
USEROF  1533  -  1530
VIEW    1326  -  1757
X#0?    1334  -  1761
X#Y?    1342  -  1766
X<0?    1350  -  1762
X<=0?   1357  -  1763
X<=Y?   1366  -  1770
X<>     1114  -  1772
X<>Y    1374  -  1773
X<Y?    1410  -  1767
X=0?    1416  -  1760
X=Y?    1424  -  1765
X>0?    1432  -  1764
X>Y?    1440  -  1771
XCLX1    402  -   375
XEQ     1450  -  1774
XGAXFR   206  -   266
XGOIND  1443  -
XTRIG   1214  -  1204
X^2      153  -  1775
Y^X       52  -  1776
```

ENTRY TABLE

(*)	134	-
(10)^X	1312	-
+	112	-
-	124	-
-DEC	1453	-
-OCT	1460	-
/	157	-
ABS	166	-
ACOS	175	-
ADVNCE	515	-
AGTO	205	-
AOFF	1505	-
AON	1474	-
ARCL	214	-
ASHF	222	-
ASIN	230	-
ASN	236	-
ASTO	244	-
ATAN	252	-
AVIEW	262	-
AXEQ	265	-
BEEP	273	-
BST	302	-
CAT	310	-
CAT##3	1603	-
CF	314	-
CHS	1072	-
CLA	321	-
CLDSP	340	-
CLP	347	-
CLREG	355	-
CLSIG	363	-
CLST	371	-
CLX	401	-
COPY	411	-
COS	1174	-
D-R	416	-
DEG	424	-
DEL	444	-
DELETE	447	-
DSE	455	-
END	462	-
ENG	465	-
ENTER^	476	-
E^X	507	-
E^X-1	543	-
FACT	524	-
FC?	532	-
FC?C	553	-
FIX	561	-
FRAC	574	-
FS?	602	-
FS?C	610	-
GRAD	432	-
GTO	621	-
GTOL	614	-

H-HMS	631	-
HMS+	62	-
HMS-	105	-
HMS-H	623	-
INT	567	-
ISG	636	-
LASTX	1050	-
LBL	644	-
LN	646	-
LN1+X	1040	-
LOG	654	-
MEAN	671	-
MOD	117	-
MODE	1515	-
MODE1	1517	-
OFF	710	-
ONE/X	726	-
P-R	734	-
PACK	747	-
PCT	141	-
PCTCH	754	-
PI	1102	-
PR14RT	1545	-
PROMPT	1011	-
PSE	774	-
R-D	1016	-
R-P	700	-
R/S	1030	-
RAD	437	-
RCL	1056	-
RDN	1122	-
RND	1127	-
RTN	1134	-
R^	1140	-
SCI	1145	-
SF	1151	-
SHIFT	1510	-
SIGMA+	1155	-
SIGMA-	1161	-
SIGN	1467	-
SIGREG	1167	-
SIN	1210	-
SIZE	1222	-
SQRT	1230	-
SST	1236	-
STAYON	1243	-
STDEV	662	-
STO	332	-
STO*	1250	-
STO+	1260	-
STO-	1271	-
STO/	1301	-
STOP	1025	-
TAN	1202	-
TONE	1320	-
VIEW	1326	-
X#0?	1334	-
X#Y?	1342	-
X<0?	1350	-
X<=0?	1357	-

```
X<=Y?   1366   -
X<>     1114   -
X<>Y    1374   -
X<Y?    1410   -
X=0?    1416   -
X=Y?    1424   -
X>0?    1432   -
X>Y?    1440   -
XCLX1    402   -
XEQ     1450   -
XGOIND  1443   -
X^2      153   -
Y^X       52   -
```

EXTERNAL REFERENCES

1/X10	727			
1/X10	730			
10TOX	1312			
10TOX	1313			
AD2-10	73	127	760	1262
AD2-10	74	130	761	1263
ALPDEF	1607			
ALPDEF	1610			
ANNOUT	1477			
ANNOUT	1500			
BRT100	202			
BRT100	203			
CLR	356			
CLR	357			
CLRPGM	347			
CLRPGM	350			
DATOFF	340			
DATOFF	341			
DECMPL	1600			
DECMPL	1601			
DELNNN	444			
DELNNN	445			
DRSY05	1557			
DRSY05	1560			
DRSY50	721			
DRSY50	722			
DRSY51	1541			
DRSY51	1542			
DTOR	417			
DTOR	420			
DV1-10	765			
DV1-10	766			
DV2-10	160	1303		
DV2-10	161	1304		
EXP10	510	545		
EXP10	511	546		
GTONN	614			
GTONN	615			
INTFRC	575			
INTFRC	576			
LN10	647			
LN10	650			
MEMCHK	715			
MEMCHK	716			
MOD10	120			
MOD10	121			
MP2-10	135	144	1252	
MP2-10	136	145	1253	
NFRENT	502			
NFRENT	503			
NFRNC	673			
NFRNC	674			
NFRPR	1065	1402		
NFRPR	1066	1403		
NFRSIG	403			
NFRSIG	404			

```
XTOHRS     63     67     76    624
XTOHRS     64     70     77    625
XTONE    1320
XTONE    1321
XVIEW    1326
XVIEW    1327
XX#0?    1334
XX#0?    1335
XX#Y?    1342
XX#Y?    1343
XX<0?    1350
XX<0?    1351
XX<=0A   1357
XX<=0A   1360
XX<=Y?   1366
XX<=Y?   1367
XX<Y?    1410
XX<Y?    1411
XX=0?    1416
XX=0?    1417
XX=Y?    1424
XX=Y?    1425
XX>0?    1432
XX>0?    1433
XX>Y?    1440
XX>Y?    1441
XY^X       53
XY^X       54

End of VASM assembly
```

Printing Error. "QUAD" is missing. Most of this is missing. rjn

See next pages.

```
VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @12000-13777
*
     4                    FILE   CNSB
     5                    ENTRY  FCNTBL
     6                    ENTRY  ERRAD
     7                    ENTRY  PCKDUR
     8                    ENTRY  STFLGS        SET MSGFLG & DATAENTRY FLAG
     9                    ENTRY  XSTYON
    10                    ENTRY  FIND#1
    11                    ENTRY  CLR
    12                    ENTRY  FNDEND
    13                    ENTRY  CHKADR
    14                    ENTRY  LOAD3
    15                    ENTRY  XASHF
    16                    ENTRY  XBEEP
    17                    ENTRY  XCLSIG
    18                    ENTRY  XRAD
    19                    ENTRY  XGRAD
    20                    ENTRY  DEGDO
    21                    ENTRY  XDEG
    22                    ENTRY  XTONE
    23                    ENTRY  TONE?
    24                    ENTRY  TONEB
    25                    ENTRY  GETLIN
    26                    ENTRY  FLGANN
    27                    ENTRY  XSCI
    28                    ENTRY  XARCL
    29                    ENTRY  XASTO
    30                    ENTRY  XDSE
    31                    ENTRY  XISG
    32                    ENTRY  XSIZE
    33                    ENTRY  XSCREG
    34                    ENTRY  XR^
    35                    ENTRY  XRDN
    36                    ENTRY  RDNSUB
    37                    ENTRY  R^SUB
    38                    ENTRY  XX=0?
    39                    ENTRY  XX#0?
    40                    ENTRY  XX<0?
    41                    ENTRY  XX>0?
    42                    ENTRY  XX<=0?
    43                    ENTRY  XX<=0A
    44                    ENTRY  XX=Y?
    45                    ENTRY  XX#Y?
    46                    ENTRY  XX>Y?
    47                    ENTRY  XX<Y?
    48                    ENTRY  XX<=Y?
    49                    ENTRY  XCF
    50                    ENTRY  XSF
    51                    ENTRY  XFS?
    52                    ENTRY  Y-X
    53                    ENTRY  SEPXY
    54                    ENTRY  CHK#S
    55                    ENTRY  CHK#S2
    56                    ENTRY  SUMCHK
```

[Missing Pages From 339 Page VASM ROM ASSEMBLY for addresses shown on this page. (32 pages total)]

```
    57                    ENTRY  SUMCK2
*
    59       FCNTBL                                  MAIN FUNCTION TABLE
    60     0              0 XDEF   CAT               00
    61     1              0 XDEF   GTOL              01
    62     2              0 XDEF   DEL               02
    63     3              0 XDEF   COPY              03
    64     4              0 XDEF   CLP               04
    65     5              0 XDEF   R/S               05
    66     6              0 XDEF   SIZE              06
    67     7              0 XDEF   BST               07
    68    10              0 XDEF   SST               08
    69    11              0 XDEF   STAYON            09
    70    12              0 XDEF   PACK              0A
    71    13              0 XDEF   DELETE            0B
    72    14              0 XDEF   MODE              0C
    73    15           1740 CON    @1740
    74    16              0 XDEF   SHIFT             0E
    75    17              0 XDEF   ASN               0F
    76    20           1754 CON    @1754             DIGIT ENTRY (13)
    77    21 XSTYON    1670 C=REGN 14                SET THE STAYON FLAG
    78    22           1074 RCR    2
    79    23           1530 ST=C
    80    24             10 S3=    1                 SET STAYON
    81    25           1630 C=ST
    82    26           1574 RCR    12
    83    27           1650 REGN=C 14
    84    30           1740 RTN
    85    31 GETLIN     116 C=0
    86    32           1160 DADD=C
    87    33           1770 C=REGN 15
    88    34           1740 RTN
    89                      FILLTO:@34
    90    35              0 XDEF   AGTO
    91    36              0 XDEF   AXEQ
    92    37           1740 CON    @1740
    93    40           1777 CON    @1777             ROWS 2 AND 3
**************************************************
*THIS ROUTINE DOES SUBTRACT FOR COMPARES.
**************************************************
    97    41 Y-X       1240 SETDEC
    98    42            260 C=N
    99    43           1276 C=-C-1 S
   100    44              0 NOP
   101    45              1 GOSUB  AD2-10
   101    46              0
   102    47            160 N=C
   103    50           1740 RTN
   104                      ENTRY  OVFL10
*
* CHECK OVERFLOW/UNDERFLOW
* C HAS THE NUMBER
*   RETURN WITH :
*                PT= 12  OK
*                PT= 10  OVERFLOW
*                PT= 11  UNDERFLOW
*   RETURN IN DEC MODE
   113    51 OVFL10 1372 ? C#0  M
   114    52             27 GOC    OVFL15 (  54)
   115    53            116 C=0    W
```

```
116   54 OVFL15  1240 SETDEC
117   55          1534 PT=     12
118   56          1366 ? C#0   XS
119   57          1640 RTN NC
120   60          1146 C=C-1   X
121   61          1066 C=C+1   XS
122   62          1166 C=C-1   XS
123   63            33 GONC    OVFL30 (   66)
124   64          1046 C=C+1   X
125               LEGAL
126   65 OVFL20  1740 RTN
127   66 OVFL30   766 C=C+C   XS
128   67            33 GONC    OVFL40 (   72)
129   70           116 C=0     W
130   71            53 GOTO    OVFL50 (   76)
131   72 OVFL40   112 C=0     WPT
132   73          1152 C=C-1   WPT
133   74           126 C=0     XS
134   75          1724 DEC PT
135   76 OVFL50  1724 DEC PT
136   77          1740 RTN
137               FILLTO:@77
138  100             0 XDEF    +              ROW 4
139  101             0 XDEF    -
140  102             0 XDEF    (*)
141  103             0 XDEF    /
142  104             0 XDEF    X<Y?
143  105             0 XDEF    X>Y?
144  106             0 XDEF    X<=Y?
145  107             0 XDEF    SIGMA+
146  110             0 XDEF    SIGMA-
147  111             0 XDEF    HMS+
148  112             0 XDEF    HMS-
149  113             0 XDEF    MOD
150  114             0 XDEF    PCT
151  115             0 XDEF    PCTCH
152  116             0 XDEF    P-R
153  117             0 XDEF    R-P
154  120             0 XDEF    LN             ROW 5
155  121             0 XDEF    X^2
156  122             0 XDEF    SQRT
157  123             0 XDEF    Y^X
158  124             0 XDEF    CHS
159  125             0 XDEF    E^X
160  126             0 XDEF    LOG
161  127             0 XDEF    (10)^X
162  130             0 XDEF    E^X-1
163  131             0 XDEF    SIN
164  132             0 XDEF    COS
165  133             0 XDEF    TAN
166  134             0 XDEF    ASIN
167  135             0 XDEF    ACOS
168  136             0 XDEF    ATAN
169  137             0 XDEF    -DEC
170  140             0 XDEF    ONE/X          ROW 6
171  141             0 XDEF    ABS
172  142             0 XDEF    FACT
173  143             0 XDEF    X#0?
174  144             0 XDEF    X>0?
175  145             0 XDEF    LN1+X
```

```
176  146          0 XDEF   X<0?
177  147          0 XDEF   X=0?
178  150          0 XDEF   INT
179  151          0 XDEF   FRAC
180  152          0 XDEF   D-R
181  153          0 XDEF   R-D
182  154          0 XDEF   H-HMS
183  155          0 XDEF   HMS-H
184  156          0 XDEF   RND
185  157          0 XDEF   -OCT
186  160          0 XDEF   CLSIG          ROW 7
187  161          0 XDEF   X<>Y
188  162          0 XDEF   PI
189  163          0 XDEF   CLST
190  164          0 XDEF   R^
191  165          0 XDEF   RDN
192  166          0 XDEF   LASTX
193  167          0 XDEF   CLX
194  170          0 XDEF   X=Y?
195  171          0 XDEF   X#Y?
196  172          0 XDEF   SIGN
197  173          0 XDEF   X<=0?
198  174          0 XDEF   MEAN
199  175          0 XDEF   SDEV
200  176          0 XDEF   AVIEW
201  177          0 XDEF   CLDSP
202  200          0 XDEF   DEG            ROW 8
203  201          0 XDEF   RAD
204  202          0 XDEF   GRAD
205  203          0 XDEF   ENTER^
206  204          0 XDEF   STOP
207  205          0 XDEF   RTN
208  206          0 XDEF   BEEP
209  207          0 XDEF   CLA
210  210          0 XDEF   ASHF
211  211          0 XDEF   PSE
212  212          0 XDEF   CLREG
213  213          0 XDEF   AOFF
214  214          0 XDEF   AON
215  215          0 XDEF   OFF
216  216          0 XDEF   PROMPT
217  217          0 XDEF   ADVNCE
218  220          0 XDEF   RCL            ROW 9
219  221          0 XDEF   STO
220  222          0 XDEF   STO+
221  223          0 XDEF   STO-
222  224          0 XDEF   STO*
223  225          0 XDEF   STO/
224  226          0 XDEF   ISG
225  227          0 XDEF   DSE
226  230          0 XDEF   VIEW
227  231          0 XDEF   SIGREG
228  232          0 XDEF   ASTO
229  233          0 XDEF   ARCL
230  234          0 XDEF   FIX
231  235          0 XDEF   SCI
232  236          0 XDEF   ENG
233  237          0 XDEF   TONE
234  240       1747 CON    @1747          XROM (8)
235               ENTRY    TSTMAP
```

```
* TSTMAP - TEST BIT MAP
*- A SUBROUTINE USED TO ELIMINATE DUPLICATE CODE.
*- TEST BIT MAP FOR A SPECIFIED KEYCODE AND CLEAR
*- ITS CORRESPONDING BIT IF SET.
*- IN:  A[1:0]= LOGICAL KEYCODE + 1
*-      CHIP 0 SELECTED
*- OUT: CHIP 0 SELECTED
*- USES: A[13:0], C[13:0], M[13:0]
*- USES: 1 SUBROUTINE LEVEL
*
   246  241 TSTMAP    1 GSBLNG TBITMA         TEST BIT MAP
   246  242           0
   247  243        1356 ? C#0                 BIT SET?
   248  244           1 GOLNC  NFRFU          NOPE
   248  245           2
   249  246           1 GOLONG SRBMAP         RESET BIT MAP
   249  247           2
   250                   FILLTO @247
   251  250           0 XDEF   SF
   252  251           0 XDEF   CF
   253  252           0 XDEF   FS?C
   254  253           0 XDEF   FC?C
   255  254           0 XDEF   FS?
   256  255           0 XDEF   FC?
   257  256           0 XDEF   XGOIND
   258  257        1760 CON    @1760
   259                                        ROW 11
*****************************************************
*THIS CODE CLEARS THE SIGMA REGISTERS
*****************************************************
   263  260 XCLSIG    1 GOSUB  SUMCHK         LEGAL AND GET ADDRESS
   263  261           0
   264                                        SUMCHK RETURNS ADDRESS OF
   265                                        LAST SIGMA REG IN C.X
   266  262         534 PT=    6
   267  263          16 A=0
   268  264 CLRNXT  256 AC EX
   269  265        1360 DATA=C
   270  266         256 AC EX
   271  267        1156 C=C-1
   272  270        1160 DADD=C
   273  271        1724 DEC PT
   274  272        1624 ? PT=  0
   275  273        1713 GONC   CLRNXT ( 264)
   276  274        1740 RTN
*********************************************
*THE ROLE UP FUNCTION HAPPENS HERE.
*********************************************
   280  275 XRDN      1 GOSUB  RDNSUB
   280  276           0
   281  277         503 GOTO   NFRPRL ( 347)
   282                   FILLTO @277
   283  300           0 XDEF   END
   284  301        1754 CON    @1754
   285                   ENTRY  FSTIN
* FSTIN - FIRST INSTRUCTION
* SETS A[0-3] TO THE ADDRESS IN MM FORMAT OF THE FIRST LOCATION
*-IN PROGRAM MEMORY MINUS 1 BYTE. (IN PACKED MEMORY THIS IS THE
*-ADDRESS OF THE FIRST INSTRUCTION.)
* USES A[0-3],AND C
```

```
* EXPECTS PT-3 IN AND OUT
*
   293  302 FSTIN   116 C=0                    SET A TO REG0 ADDRESS.
   294  303        1160 DADD=C
   295  304        1570 C=REGN 13
   296  305          74 RCR    3
   297  306         406 A=C    X
   298  307           2 A=0    PT
   299  310        1740 RTN
*
   301                  ENTRY  RTJLBL
*
* RTJLBL - RIGHT JUSTIFY ALPHA OPERAND
* ON ENTRY, C HAS A NON-ZERO ALPHA STRING IN THE FORM
*     "CBA0000" WHERE THE STRING IS "ABC"
* RTJLBL MOVES ZEROES TO THE LEFT SIDE: "0000CBA"
* USES THE PTR AND C ONLY.
* ON EXIT, PT=1.
*
   310  311 RTJLBL 1434 PT=    1
   311  312 RTJ10  1352 ? C#0  WPT
   312  313        1540 RTN C
   313  314        1074 RCR    2
   314  315        1753 GOTO   RTJ10  ( 312)
   315                  FILLTO @315
   316  316           0 XDEF   X<>
   317  317           0 XDEF   LBL
   318  320           0 XDEF   GTO            ROW 13
   319  321        1756 CON    @1756
*****************************************************
*THIS ROUTINE CHECKS FOR CHARACTER DATA.
*****************************************************
   323  322 SEPXY   156 AB EX
   324  323         630 C=M
   325                  ENTRY  CHK#S1
   326  324 CHK#S1  256 AC EX
   327  325           1 GOSUB  CHK#S
   327  326           0
   328  327         256 AC EX
   329  330 CHK#S  1240 SETDEC
   330  331 CHK#S2 1376 ? C#0  S
   331  332        1640 RTN NC
   332  333        1076 C=C+1  S
   333  334          63 GONC   ERRAD  ( 342)
   334  335        1176 C=C-1  S
   335  336        1740 RTN
   336                  FILLTO @337
        337        0000 NOP
   337  340           0 XDEF   XEQ            ROW 14
   338  341           0 CON    0              END OF MAIN FUNCTION TABLE
   339  342 ERRAD     1 GOSUB  ERROR
   339  343           0
   340  344           0 XDEF   MSGAD
   341                  EJECT
```

```
*****************************************************
*THIS ROUTINE DOES A ROLL DOWN.
*****************************************************
   345  345 XR^         1 GOSUB  R^SUB
   345  346             0
   346  347 NFRPRL      1 GOLONG NFRPR
   346  350             2
   347  351 RDNSUB      1 GOSUB  R^SUB
   347  352             0
   348  353             1 GOSUB  R^SUB
   348  354             0
   349  355 R^SUB     116 C=0
   350  356          1160 DADD=C
   351  357            70 C=DATA
   352  360           256 AC EX
   353  361           170 C=REGN 1
   354  362            50 REGN=C 0
   355  363           270 C=REGN 2
   356  364           150 REGN=C 1
   357  365           370 C=REGN 3
   358  366           250 REGN=C 2
   359  367           256 AC EX
   360  370           350 REGN=C 3
   361  371          1740 RTN
   362
   363
*
* LOAD3 - SET REG.C = 33333333333332
*
   367  372 LOAD3    1240 SETDEC                 SET TO DECIMAL MODE
   368  373           116 C=0     W
   369  374          1156 C=C-1   W               GET ALL 9'S IN C
   370  375          1140 SETHEX                 PUT BACK TO HEX MODE
   371  376           756 C=C+C   W               C _ 33333333333332
   372  377          1740 RTN
   373
   374                    FILLTO @377
*
* DCTAB - DEFAULTCODE TABLE
* THERE ARE TWO TYPES OF ENTRIES.  ENTRY TYPE IS ENCODED IN
* BITS 8 AND 9:
* BITS 9,8 = 00 DATA ENTRY (DIGIT ENTRY AND ALPHA ENTRY KEYS)
* BITS 9,8 = 01 FUNCTION IN MAIN FCN TABLE
* FOR FCN ENTRIES, THE INDEX TO THE TABLE IS ENCODED IN BITS 7-0.
* FOR DATA ENTRY ENTRIES, BITS 7-0 CONTAIN EITHER THE ASCII
* CHARACTER (ALPHA ENTRY), OR THE FCN CODE FOR THE DIGIT ENTRY FCN.
* DCTAB MUST START AT @400 IN QUAD 5 (H1500=@12400).
*
* LOGICAL COL 0,  UNSHIFTED, NORMAL
   387  400          507 CON     327            SIGMA+
   388  401          561 CON     369            X<>Y
   389  402          416 CON     @0416          SHIFT
   390  403          603 CON     387            ENTER
   391  404          501 CON     321            -
   392  405          500 CON     320            +
   393  406          502 CON     322            *
   394  407          503 CON     323            /
* LOGICAL COL 0,  SHIFTED, NORMAL
   396  410          510 CON     328            SIGMA-
```

```
   397  411          560 CON    368          CLSIGMA
   398  412          416 CON    @0416        SHIFT
   399  413          400 CON    256          CATALOG
   400  414          570 CON    376          X=Y?
   401  415          506 CON    326          X<=Y?
   402  416          505 CON    325          X>Y?
   403  417          547 CON    359          X=0?
* LOGICAL COL 1,  UNSHIFTED, NORMAL
   405  420          540 CON    352          1/X
   406  421          565 CON    373          RDN
   407  422          740 CON    480          XEQ
   408  423            0 CON    0            RIGHT HALF OF ENTER KEY
   409  424           27 CON    23           7
   410  425           24 CON    20           4
   411  426           21 CON    17           1
   412  427           20 CON    16           0
* LOGICAL COL 1,  SHIFTED, NORMAL
   414  430          523 CON    339          Y^X
   415  431          514 CON    332          %
   416  432          417 CON    @417         ASN
   417  433            0 CON    0            RIGHT HALF OF ENTER KEY
   418  434          650 CON    424          SF
   419  435          606 CON    390          BEEP
   420  436          634 CON    412          FIX
   421  437          562 CON    370          PI
* LOGICAL COL 2,  UNSHIFTED, NORMAL
   423  440          522 CON    338          SQRT
   424  441          531 CON    345          SIN
   425  442          621 CON    401          STO
   426  443           34 CON    28           CHS
   427  444           30 CON    24           8
   428  445           25 CON    21           5
   429  446           22 CON    18           2
   430  447           32 CON    26           DECIMAL POINT
* LOGICAL COL 2,  SHIFTED, NORMAL
   432  450          521 CON    337          X^2
   433  451          534 CON    348          ASIN
   434  452          717 CON    463          LBL
   435  453          626 CON    406          ISG
   436  454          651 CON    425          CF
   437  455          516 CON    334          P-R
   438  456          635 CON    413          SCI
   439  457          566 CON    374          LASTX
* LOGICAL COL 3,  UNSHIFTED, NORMAL
   441  460          526 CON    342          LOG
   442  461          532 CON    346          COS
   443  462          620 CON    400          RCL
   444  463           33 CON    27           EEX
   445  464           31 CON    25           9
   446  465           26 CON    22           6
   447  466           23 CON    19           3
   448  467          405 CON    @405         R/S
* LOGICAL COL 3,  SHIFTED, NORMAL
   450  470          527 CON    343          10^X
   451  471          535 CON    349          ACOS
   452  472          720 CON    464          GTO
   453  473          605 CON    389          RTN
   454  474          654 CON    428          FS?
   455  475          517 CON    335          R-P
   456  476          636 CON    414          ENG
```

```
   457  477          630 CON    408          VIEW
* LOGICAL COL 4,  UNSHIFTED, NORMAL MODE
   459  500          520 CON    336          LN
   460  501          533 CON    347          TAN
   461  502          410 CON    @410         SST
   462  503            0 CON    0            BACKARROW
   463  504          414 CON    @414         MODE (ALPHA)
   464  505          414 CON    @414         MODE (PRGM)
   465  506          414 CON    @414         MODE (USER)
   466  507            0 NOP                  OFF KEY IS SPECIAL
* LOGICAL COL 4,  SHIFTED, NORMAL MODE
   468  510          525 CON    341          E^X
   469  511          536 CON    350          ARCTAN
   470  512          407 CON    @407         BST
   471  513          567 CON    375          CLX
   472  514          414 CON    @414         MODE (ALPHA)
   473  515          414 CON    @414         MODE (PRGM)
   474  516          414 CON    @414         MODE (USER)
   475  517            0 NOP                  OFF KEY IS SPECIAL
*
* LOGICAL COL 0,  UNSHIFTED, ALPHA MODE
   478  520          101 CON    65           A
   479  521          106 CON    70           F
   480  522          416 CON    @0416        SHIFT
   481  523          116 CON    78           N
   482  524          121 CON    81           Q
   483  525          125 CON    85           U
   484  526          131 CON    89           Y
   485  527           72 CON    58           :
* LOGICAL COL 0,  SHIFTED, ALPHA MODE
   487  530          141 CON    97           LOWER CASE A
   488  531          176 CON    126          SIGMA
   489  532          416 CON    @0416        SHIFT
   490  533          136 CON    94           ^
   491  534           55 CON    45           -
   492  535           53 CON    43           +
   493  536           52 CON    42           *
   494  537           57 CON    47           /
* LOGICAL COL 1,  UNSHIFTED, ALPHA MODE
   496  540          102 CON    66           B
   497  541          107 CON    71           G
   498  542          113 CON    75           K
   499  543            0 CON    0            RIGHT HALF OF ENTER KEY
   500  544          122 CON    82           R
   501  545          126 CON    86           V
   502  546          132 CON    90           Z
   503  547           40 CON    32           SPACE
* LOGICAL COL 1,  SHIFTED, ALPHA MODE
   505  550          142 CON    98           LOWER CASE B
   506  551           45 CON    37           %
   507  552          177 CON    127          LAZY T (APPEND)
   508  553            0 CON    0            RIGHT HALF OF ENTER KEY
   509  554           67 CON    55           7
   510  555           64 CON    52           4
   511  556           61 CON    49           1
   512  557           60 CON    48           0
* LOGICAL COL 2,  UNSHIFTED, ALPHA MODE
   514  560          103 CON    67           C
   515  561          110 CON    72           H
   516  562          114 CON    76           L
```

```
   517  563          117 CON    79            0
   518  564          123 CON    83            S
   519  565          127 CON    87            W
   520  566           75 CON    61            =
   521  567           54 CON    44            COMMA
* LOGICAL COL 2,  SHIFTED, ALPHA MODE
   523  570          143 CON    99            LOWER CASE C
   524  571           35 CON    29            NOT EQUAL SIGN
   525  572          632 CON    410           ASTO
   526  573           15 CON    13            ANGLE SIGN
   527  574           70 CON    56            8
   528  575           65 CON    53            5
   529  576           62 CON    50            2
   530  577           56 CON    46            DECIMAL POINT
* LOGICAL COL 3,  UNSHIFTED, ALPHA MODE
   532  600          104 CON    68            D
   533  601          111 CON    73            I
   534  602          115 CON    77            M
   535  603          120 CON    80            P
   536  604          124 CON    84            T
   537  605          130 CON    88            X
   538  606           77 CON    63            ?
   539  607          405 CON    @405          R/S
* LOGICAL COL 3,  SHIFTED, ALPHA MODE
   541  610          144 CON    100           LOWER CASE D
   542  611           74 CON    60            <
   543  612          633 CON    411           ARCL
   544  613           44 CON    36            $
   545  614           71 CON    57            9
   546  615           66 CON    54            6
   547  616           63 CON    51            3
   548  617          576 CON    382           AVIEW
* LOGICAL COL 4,  UNSHIFTED, ALPHA MODE
   550  620          105 CON    69            E
   551  621          112 CON    74            J
   552  622          410 CON    @410          SST
   553  623            0 CON    000           BACKARROW
   554  624          414 CON    @414          MODE (ALPHA)
   555  625          414 CON    @414          MODE(PRGM)
   556  626          414 CON    @414          MODE (USER)
   557  627            0 NOP                   OFF KEY IS SPECIAL
* LOGICAL COL 4,  SHIFTED, ALPHA MODE
   559  630          145 CON    101           LOWER CASE E
   560  631           76 CON    62            >
   561  632         1007 CON    519           BST
   562  633          607 CON    391           CLA
   563  634          414 CON    @414          MODE (ALPHA)
   564  635          414 CON    @414          MODE (PRGM)
   565  636          414 CON    @414          MODE (USER)
   566                                        OFF KEY IS SPECIAL
*************************************************
*ISG AND DSE ARE DONE HERE. THE ROUTINE BREAKS
*THE INPUT IN B INTO ITS THREE PARTS - INT,
*COMPARE, AND INC. IT ADDS THE INC, STORES THE
*RESULT AND BRANCHES TO THE COMPARE ROUTINE
*TO DECIDE WHETHER  TO SKIP OR NOT.
*************************************************
   574  637 XDSE   1610 S0=    1              SET DSE FLAG
   575  640 XISG    356 BC EX                 GET CONTENT OF RNN
   576  641           1 GOSUB  CHK#S          CHECK FOR ALPHA
```

```
 576  642           0
 577  643          33 GOTO   NOFRAC ( 646)
 578  644 ELMFRC 1732 C SR   M              CHANGE TO FIX NOTATION
 579  645        1046 C=C+1  X
 580  646 NOFRAC 1366 ? C#0  XS
 581  647        1757 GOC    ELMFRC ( 644)
 582  650           1 GSBLNG SINFR          DO INT AND FRC
 582  651           0
 583  652         630 C=M                   GET INT PART
* NEXT TWO STATES (?PT=0, GOC OVRDEC) ARE VESTIGIAL FROM WHEN
* SINFR WORKED FOR 13 DIGIT MANTISSAS IN ANOTHER MACHINE.  THESE
* TWO STATES CAN BE REMOVED WITHOUT HARM.
 587  653        1624 ? PT=  0              PREVNT CLEAR FOR LARGE VALUES
 588  654          27 GOC    OVRDEC ( 656)
 589  655        1724 DEC PT
 590  656 OVRDEC  112 C=0    WPT            CLEAR FRACTIONAL PART
 591  657         372 BC EX  M              JOIN MANTISSA WITH EXP AND SIGN
 592  660         356 BC EX  W              BRING COMPLETE INT TO C
 593  661         530 M=C                   SAVE FOR LATER
 594  662         256 C=A                   PUT FRAC IN C
 594  663         416
 595  664        1360 DATA=C
 596  665        1234 PT=    7              SET TO CLR TRAIL DIGITS
 597  666         112 C=0    WPT
 598  667        1134 PT=    9              PICK OFF INC
 599  670        1352 ? C#0  WPT            DUMMY ONE FOR ZERO
 600  671          47 GOC    SEPA   ( 675)
 601  672         434 PT=    8
 602  673         120 LC     1
 603  674        1134 PT=    9
 604  675 SEPA     16 A=0
 605  676         412 A=C    WPT            PICK OFF INC
 606  677         112 C=0    WPT            LEAVE COMPARE VAL
 607  700        1756 A SL
 608  701        1756 A SL
 609  702        1756 A SL                  INCREMENT LEFT JUST
 610  703        1534 PT=    12             POINT TO DIGIT ONE
 611  704        1046 C=C+1  X              EXP COMPARE
 612  705        1046 C=C+1  X
 613  706         546 A=A+1  X              EXP INC
 614  707        1502 ? A#0  PT             IS INC EXP OK?
 615  710          37 GOC    TSTEXP ( 713) YES
 616  711        1772 A SL   M
 617  712           6 A=0    X
 618  713 TSTEXP 1342 ? C#0  PT             EXP 2 TOO LARGE?
 619  714         107 GOC    ADDIT  ( 724) NO, JUST RIGHT
 620  715        1374 RCR    13             SHIFT COMPARE LEFT
 621  716         106 C=0    X              EXP=1?
 622  717        1046 C=C+1  X
 623  720        1342 ? C#0  PT             EXP COMP OK NOW?
 624  721          37 GOC    ADDIT  ( 724) YES
 625  722        1374 RCR    13             SHIFT LEFT
 626  723         106 C=0    X              EXP MUST BE ZERO
 627  724 ADDIT  1614 ?S0=1                 DSE OR ISG?
 628  725          23 GONC   ADDEM  ( 727) ISG
 629  726         676 A=A-1  S              MAKE DEC OUT OF INC
 630  727 ADDEM   160 N=C                   SAVE FLOATING POINT COMPARE
 631  730         630 C=M                   GET INTEGER PART BACK
 632  731           1 GOSUB  AD2-10
 632  732           0
```

```
   633  733          530 M=C                    SAVE INT PART OF RESULT
   634  734          416 A=C                    DUP RESULT IN A
   635  735           70 C=DATA                 GET FRAC PART BACK
   636  736          246 C=A     X              DUP EXP
   636  737          406
   637  740 MRSHFT  1732 C SR    M              SHIFT FRAC INTO POSITION
   638  741         1146 C=C-1   X              IN POSITION YET/
   639  742           37 GOC     COMBIN ( 745) YES
   640  743         1372 ? C#0   M              FRACTION ZERO
   641  744         1747 GOC     MRSHFT ( 740) NO NOT YET
   642  745 COMBIN   106 C=0     X              SIGN AND EXP C=0
   643  746         1032 C=C+A   M
   644                  LEGAL
   645  747            1 GOSUB   SHF40
   645  750            0
   646  751         1360 DATA=C                 STORE UPDATED COUNTER
   647  752         1210 S7=     1
   648  753          630 C=M
   649  754          256 AC EX
   650  755         1614 ?S0=1                  DSE??
   651  756          123 GONC    XX>Y?  ( 770)
*************************************************
*THE COMPARISONS FOLLOW. X VALUES ENTER IN N
*WHILE Y VALUES ARE IN A.
*************************************************
   656  757 XX<Y?      1 GOSUB   Y-X            DO SUBTRACT
   656  760            0
   657  761 XX>0?   1240 SETDEC
   658  762          260 C=N
   659  763         1356 ? C#0
   660  764          723 GONC    SKP     (1056)
   661  765         1076 C=C+1   S
   662  766          433 GONC    NOSKP   (1031)
   663  767          673 GOTO    SKP     (1056)
   664  770 XX>Y?      1 GOSUB   Y-X
   664  771            0
   665  772 XX<0?   1214 ?S7=1
   666  773          227 GOC     XX<=0? (1015)
   667  774 XX<0    1240 SETDEC
   668  775          260 C=N
   669  776         1076 C=C+1   S
   670  777          573 GONC    SKP     (1056)
   671 1000          313 GOTO    NOSKP   (1031)
   672 1001 XX<=Y?    1 GOSUB   Y-X
   672 1002           0
   673 1003         1356 ? C#0
   674 1004          253 GONC    NOSKP   (1031)
   675 1005         1543 GOTO    XX>0?  ( 761)
   676 1006 XX=0?     16 A=0
   677 1007          260 C=N
   678 1010          173 GOTO    XYY     (1027)
   679 1011 XX<=0A   370 C=REGN 3              ROW LOGIC DOESN'T CHECK
   680 1012            1 GOSUB   CHK#S          FOR ALPHA DATA ON X<=0?
   680 1013            0
   681 1014          160 N=C
   682 1015 XX<=0?   260 C=N
   683 1016         1356 ? C#0
   684 1017          123 GONC    NOSKP   (1031)
   685 1020         1543 GOTO    XX<0    ( 774)
   686 1021 XX#0?     16 A=0
```

```
   687 1022          260 C=N
   688 1023          313 GOTO   XYN    (1054)
   689 1024 XX=Y?    270 C=REGN 2
   690 1025          256 AC EX
   691 1026          370 C=REGN 3
   692 1027 XYY     1556 ? A#C
   693 1030          267 GOC    SKP    (1056)
   694                   ENTRY  NOSKP
   695 1031 NOSKP   1314 ?S13=1
   696 1032          157 GOC    NOSKPO (1047)
   697 1033          116 C=0
   698 1034         1160 DADD=C
   699 1035         1670 C=REGN 14
   700 1036         1730 CST EX
   701 1037          114 ?S4=1
   702 1040           77 GOC    NOSKPO (1047)
   703 1041         1730 CST EX
   704 1042         1214 ?S7=1                 IS THIS ISG OR DSG
   705 1043           47 GOC    NOSKPO (1047)
   706 1044            1 GOSUB  MSG
   706 1045            0
   707 1046            0 XDEF   MSGYES
   708 1047 NOSKPO     1 GOLONG NFRPU          CAN'T DO A RTN HERE
   709 1050            2
* BECAUSE SOME COMPARISONS HAVE NFRX ON THE STACK INSTEAD OF NFRPU
   710 1051 XX#Y?    270 C=REGN 2
   711 1052          256 AC EX
   712 1053          370 C=REGN 3
   713 1054 XYN     1556 ? A#C
   714 1055         1547 GOC    NOSKP  (1031)
   715                   ENTRY  SKP
   716 1056 SKP     1140 SETHEX
   717 1057         1314 ?S13=1
   718 1060          103 GONC   SST?   (1070)
   719 1061 DOSKP      1 GOSUB  GETPC
   719 1062            0
   720                   ENTRY  DOSKP
   721 1063            1 GOSUB  SKPLIN
   721 1064            0
   722 1065            1 GOSUB  PUTPCX         FORCE RECALC OF LINE NUMBER
   722 1066            0
   723 1067         1603 GOTO   NOSKPO (1047)
   724 1070 SST?     116 C=0
   725 1071         1160 DADD=C
   726 1072         1670 C=REGN 14
   727 1073         1730 CST EX
   728 1074          114 ?S4=1
   729 1075         1647 GOC    DOSKP  (1061)
   730 1076         1730 CST EX
   731 1077         1214 ?S7=1                 ISG DSE?
   732 1100         1477 GOC    NOSKPO (1047)
   733 1101            1 GOSUB  MSG            NO COMP OR FLAGS
   733 1102            0
   734 1103            0 XDEF   MSGNO
   735 1104         1433 GOTO   NOSKPO (1047)
*****************************************************************
*THE FLAG CONDITIONALS FOLLOW. ENTRY IS WITH R14 IN A AND A
*MASK IN B. THE MASK CONSISTS OF ALL ZEROS EXCEPT FOR A
*ONE AT THE LOCATION OF THE SELECTED FLAG
*****************************************************************
```

```
   741 1105 XFS?     316 C=B                    GET MASK
   742 1106         1660 C=C.A                  AND R14 WITH MASK
   743 1107         1356 ? C#0                  IS ANYTHING LEFT
   744 1110         1217 GOC     NOSKP  (1031)  YES NO SKP
   745 1111 SKPIT   1453 GOTO    SKP    (1056)
   746 1112 XSF      356 BC EX                  MOVE MASK TO C
   747 1113         1560 C=CORA                 SET MASKED BIT
   748 1114           53 GOTO    FLGANN (1121)
   749 1115 XCF      316 C=B
   750 1116         1256 C=-C-1
   751 1117            0 NOP
   752 1120         1660 C=C.A
   753 1121 FLGANN  1650 REGN=C 14
   754 1122          256 AC EX
   755 1123          530 M=C
   756 1124            1 GOSUB   ANNOUT
   756 1125            0
   757 1126          630 C=M
   758 1127          256 AC EX
   759 1130         1740 RTN
*************************************************
*SUM+NN SETS THE ADDRESS OF THE REGISTER USED
*FOR SIGMA PLUS. IT CHECKS TO SEE IF THE ADDRESS
*IS IN FACT A LEGAL ADDRESS. THE SUBROUTINE
*SUMCHK IS CALLED BY THE SIGMA PLUS FUNCTION
*FOR THIS CHECK.
*************************************************
   767 1131 XSGREG   260 C=N                    ADDRESS OR SUM 1
   768 1132            1 GOSUB   SUMCK2         LEGAL?
   769 1133            0
   769 1134          260 C=N                    YES
   770 1135          256 CA EX                  PUT ADDRESS IN SCRATCH
   771 1136          116 C=0
   772 1137         1160 DADD=C
   773 1140         1570 C=REGN 13
   774 1141          674 RCR    11
   775 1142          106 C=0    X
   776 1143         1006 C=C+A  X
   777 1144           74 RCR    3
   778 1145         1550 REGN=C 13
   779 1146         1740 RTN
   780 1147 SUMCHK  1570 C=REGN 13             GET ADDRESS
   781 1150          674 RCR    11
   782 1151 SUMCK2   256 CA EX                 ADD5
   783 1152          460 LDI
   784 1153            5 CON    5
   785 1154         1140 SETHEX
   786 1155         1006 C=C+A  X
   787                   LEGAL
*************************************************
*CHKADR-CHECKS FOR VALID DATA ADDRESSES.
* IN: ADDR IN C.X
* OUT: DATA IN B, ADDR IN C.X, HEXMODE,
*      DADD=C.X (EXCEPT SOME ERROR EXITS)
* USES: ACTIVE POINTER, A, S9, DADD, C, B
* MAY EXIT TO ERRNE
*
* CHKAD4 - CHECKS TO SEE IF THE REGISTER IS THERE.
*   ON ENTRY, DADD=B=ADDRESS OF REGISTER AND C=CONTENTS OF REG
*   STATUS OF S9 ON ENTRY CONTROLS EXIT IF THE REGISTER ISN'T
```

```
*   THERE: EXITS TO ERRNE IF S9=1 ELSE GOES TO COLD START!
*   ON EXIT, ADDRESS OF REGISTER IS IN C.X AND CONTENTS ARE IN B
*   AND HEXMODE AND USES ACTIVE POINTER AND A
* NOTE - CHKAD4 IS PROBABLY OBSOLETE NOW. IT USED TO BE CALLED BY
* MEMCHK IN CNO.  DRC 10/20/79
*************************************************
  805 1156 CHKADR     1 GOLONG PATCH6
  805 1157            2
  806                   ENTRY  P6RTN
  807 1160 P6RTN    356 BC EX                   SAVE ADDRESS
  808 1161           70 C=DATA                  GET CURRENT CONTENT
  809 1162         1240 SETDEC
  810 1163         1056 C=C+1  W                LOGIC IN HERE ASSURES
  811 1164         1156 C=C-1  W                 DATA IS IN A CANONICAL
  812                                             FORM
  813 1165         1376 ? C#0  S                NON-POSITIVE?
  814 1166          103 GONC   CKAD3  (1176)    POSITIVE NUMBER
  815 1167         1076 C=C+1  S                NEGATIVE NUMBER?
  816 1170           57 GOC    CKAD2  (1175)    YES
  817 1171           70 C=DATA                  ASSUME AN ALPHA STRING
  818 1172          136 C=0    S                ASSURE A 1 IN DIGIT 13
  819 1173         1076 C=C+1  S
  820                   LEGAL
  821 1174          123 GOTO   CKAD4  (1206)
  822 1175 CKAD2   1176 C=C-1  S                RESTORE 9 IN SIGN DIGIT
  823 1176 CKAD3   1366 ? C#0  XS               NEGATIVE EXPONENT?
  824 1177           33 GONC   CKAD3J (1202)    NO.
  825 1200          126 C=0    XS               ASSURE EXP SIGN = 9
  826 1201         1166 C=C-1  XS
  827 1202 CKAD3J  1534 PT=    12
  828 1203         1342 ? C#0  PT               IS MANTISSA NORMALIZED?
  829 1204           27 GOC    CKAD4  (1206)    YES
  830 1205          116 C=0    W                FORCE WHOLE WORD TO ZERO
  831                   ENTRY  CHKAD4
  832       CHKAD4
  833 1206 CKAD4   1140 SETHEX
  834 1207          356 BC EX
  835 1210          416 A=C                      GET ADR BACK
  836 1211         1360 DATA=C                   WRITE ADR OUT
  837 1212           70 C=DATA                   BRING ADR BACK IN
  838 1213         1556 ? A#C                    GET ADR BACK?
  839 1214           63 GONC   CKAD10 (1222)     YES
  840                                            REG ISN'T THERE
  841 1215         1114 ?S9=1
  842 1216            1 GOLC   ERRNE
  842 1217            3
  843 1220            1 GOLONG COLDST
  843 1221            2
  844       CKAD10
  845 1222          316 C=B                      PUT DATA BACK
  846 1223         1360 DATA=C
  847 1224          256 AC EX                    ADR BACK TO CX
  848 1225         1740 RTN
*************************************************
  850 1226 XARCL    316 C=B
  851 1227         1176 C=C-1  S
  852 1230         1376 ? C#0  S                NUMERIC DATA?
  853 1231          273 GONC   REGALP (1260)    NO, ALPHA DATA
  854 1232            1 GOSUB  AFORMT           NUMERIC DATA
  854 1233            0
```

```
   855 1234 ARCL10 1314 ?S13=1                RUNNING?
   856 1235        1540 RTN C
   857 1236        1670 C=REGN 14
   858 1237        1530 ST=C
   859 1240         114 ?S4=1                 SSTFLG?
   860 1241        1540 RTN C
   861 1242        1214 ?S7=1                 ALPHA MODE?
   862 1243        1640 RTN NC                NO
   863 1244         410 S8=    1              SAY PROMPT & NO SCROLL
   864 1245           1 GOSUB  ARGOUT
   864 1246           0
*
* STFLGS - SET MSGFLG & DATAENTRY FLAG
* ASSUMES CHIP 0 ENABLED.  LEAVES SS 1/2 UP AND REG 14 IN C
*
   869 1247 STFLGS 1670 C=REGN 14
   870 1250        1474 RCR    1
   871 1251        1530 ST=C
   872 1252        1410 S1=    1              SET MSGFLG
   873 1253         510 S6=    1              SET DATAENTRY FLAG
   874 1254        1630 C=ST
   875 1255        1374 RCR    13
   876 1256 STFL10 1650 REGN=C 14
   877 1257        1740 RTN
*
   879 1260 REGALP  106 C=0    X              RE-ENABLE CHIP 0
   880 1261        1160 DADD=C
   881 1262        1534 PT=    12             RELIES ON P ACTIVE
   882 1263 ARCL20  240 SEL P
   883 1264        1724 DEC PT
   884 1265        1724 DEC PT                MOVE P RIGHT 1 BYTE
   885 1266        1524 ? PT=  12             WRAPAROUND?
   886 1267        1457 GOC    ARCL10 (1234) YES. DONE
   887 1270         316 C=B                   PUT CHAR TO G FOR APNDNW
   888 1271         130 G=C
   889 1272         340 SEL Q
   890 1273         634 PT=    11
   891 1274        1322 ? B#0  PQ             ANY CHARS FOUND YET?
   892 1275           1 GSUBC  APNDNW         APPEND TO ALPHA REG
   892 1276           1
* APNDNW CLOBBERS A, C, AND THE ACTIVE POINTER, WHICH IS Q HERE.
   894 1277        1643 GOTO   ARCL20 (1263)
*************************************************
*THIS ROUTINE SETS THE INTERNAL DISPLAY FORMAT
*STATUS.
*************************************************
   899 1300 XSCI   1630 C=ST                  FE00NNNN
   900 1301        1074 RCR    2              XXXXXXXX,FE00NNNN
   901 1302        1630 C=ST                  FE00NNNN,FE00NNNN
   902 1303        1374 RCR    13             FE00NNNNFE00,NNNN
   903 1304        1530 ST=C                  SAVE NNNNFE00
   904 1305        1670 C=REGN 14             GET STATUS
   905 1306          74 RCR    3              MOVE DSP TO POSITION
   906 1307        1730 CST EX                MOVE GRAD RAD TO STATUS
   907 1310        1614 ?S0=1                 IS GRAD SET
   908 1311          23 GONC   S1?    (1313)HEN RAD
   909 1312        1056 C=C+1                 SET LOW BIT
   910 1313 S1?    1414 ?S1=1                 RAD?
   911 1314          33 GONC   DSPDN  (1317)
   912 1315        1056 C=C+1                 SET BIT TWO
```

```
   913 1316          1056 C=C+1
   914 1317 DSPDN     674 RCR     11
   915 1320          1363 GOTO    STFL10 (1256)
*****************************************************************
*XBEEP-COCONUT BEEP
*SETS UP STATUS WITH A TONE NUMBER THEN CALLS TONE AS IF
*FROM KEYBOARD.
*****************************************************************
   921       XBEEP
   922 1321             1 GOSUB   TONEB
   922 1322             0
   923 1323           460 LDI                      LOAD A 5
   924 1324             5 CON     5
   925 1325             1 GOSUB   TONEB
   925 1326             0
   926 1327           460 LDI                      LOAD A 8
   927 1330            10 CON     8
   928 1331             1 GOSUB   TONEB
   928 1332             0
   929                    ENTRY   TONE7X
   930 1333 TONE7X    460 LDI
   931 1334             7 CON     7
   932 1335 TONEB    1530 ST=C                     FALL INTO TONE
*****************************************************************
*XTONE-EXECUTE 41-C TONE FUNCTION
*
*  ONE DIGIT(0-9) OPERAND FUNCTION, 0=LOW, 9=HIGH. TONES ARE NOT
*  MUSCIAL NODES. THE FREQUENCY DIFFERENCE ARE RATHER ARBITRARY.
*     TONE N      WORD TIMES/CYCLE
*           9       3
*           8       4
*           7       5
*           6       6
*           5       8
*           4      10
*           3      12
*           2      14
*           1      16
*           0      18
*  THE DURATION OF EACH TONE IS EQUALLY .25 SECONDS
*  IF THE AUDIO ENABLE FLAG IS NOT SET, SILENT RETURN.
*
* INPUT:   1. S[0:7] = OPERAND (0-9)
*          2. CHIP 0 ENABLE
*
* USES : A, C, S[0:7], FO[0:7]. NO PT.  + 1 SUB LEVEL
*
* OUTPUT: 1. HEXMODE
*         2. FO[0:7] = 0
*         3. A.X = FFF
*         4. CHIP 0 ENABLE
* SPECIAL ENTRIES :
*
* TONE7X - GENERATES TONE 7
*  SAME AS XTONE EXCEPT NO OPERAND IS REQUIRED.
*
* TONEB - SAME AS XTONE EXCEPT THE OPERAND IS IN C[0:1]
*
*****************************************************************
   969 1336 XTONE    1670 C=REGN 14              IS BEEP ENABLED
```

```
 970 1337          1274 RCR    7
 971 1340          1730 CST EX
 972 1341          1414 ?S1=1
 973 1342          1640 RTN NC                 NO NOT ENABLED
 974 1343          1704 CLR ST                 CLEAR FLAG OUT REG
 975 1344          1330 FEXSB
 976 1345          1530 ST=C                   SAVE FREQUENCY INPUT IN ST
 977 1346           116 C=0
 978 1347           460 LDI                    PUT ALL 1S IN ST
 979 1350           377 CON2   15      15
 980 1351          1730 CST EX                  & GET COUNT BACK
 981 1352           674 RCR    11              PLACE COUNT FOR LOOK UP
 982 1353           416 A=C
 983 1354           174 RCR    4               SHIFT FREQ INTO DIGIT 13
 984 1355          1240 SETDEC
 985 1356          1276 C=-C-1 S
 986 1357          1140 SETHEX
 987 1360             1 GOSUB  PCKDUR          PICK .25 S  DURATION
 987 1361             0
 988 1362           133 CON    @133            CONSTANTS MUST BE ODD
 989 1363           145 CON    @145
 990 1364           163 CON    @163
 991 1365           207 CON    @207
 992 1366           241 CON    @241
 993 1367           311 CON    @311
 994 1370           413 CON    @413
 995 1371           477 CON    @477
 996 1372           617 CON    @617
 997 1373          1025 CON    @1025
 998 1374 PCKDUR    660 C=STK
 999 1375          1032 C=C+A  M
1000 1376          1460 CXISA
1001 1377           246 AC EX  X               DURATION NOW IN A X
1002                                           TEST FOR TONE 7,8,9
1003 1400          1176 C=C-1  S
1004 1401           147 GOC    TONE9  (1415)
1005 1402          1176 C=C-1  S
1006 1403           167 GOC    TONE8  (1421)
1007 1404          1176 C=C-1  S
1008 1405           217 GOC    TONE7  (1426)
1009 1406 DELOOP    436 A=C    S               GET FREQ CNTR
1010 1407          1330 FEXSB                  TURN ON TONE
1011 1410           676 A=A-1  S               FREQ COUNT
1012 1411          1773 GONC   *-1    (1410)
1013 1412           646 A=A-1  X               COUNT DOWN DURTATION
1014 1413          1733 GONC   DELOOP (1406)
1015 1414          1740 RTN
*
1017 1415 TONE9    1330 FEXSB
1018 1416           646 A=A-1  X
1019 1417          1763 GONC   *-2    (1415)
1020 1420          1740 RTN
1021 1421 TONE8    1330 FEXSB
1022 1422             0 NOP
1023 1423           646 A=A-1  X
1024 1424          1753 GONC   *-3    (1421)
1025 1425          1740 RTN
1026 1426 TONE7    1330 FEXSB
1027 1427             0 NOP
1028 1430             0 NOP
```

```
  1029 1431          646 A=A-1  X
  1030 1432         1743 GONC   *-4     (1426)
  1031 1433         1740 RTN
*****************************************************
*THIS ROUTINE SETS DEGREES RADIANS OR GRADS.
*****************************************************
  1035 1434 XDEG       1 GOSUB  DEGDO
  1035 1435            0
  1036 1436 XDEG2   1630 C=ST
  1037 1437          674 RCR    11
  1038 1440            1 GOLONG ANN+14
  1038 1441            2
  1039 1442 XRAD       1 GOSUB  DEGDO
  1039 1443            0
  1040 1444         1610 S0=    1
  1041 1445         1713 GOTO   XDEG2  (1436)
  1042 1446 XGRAD      1 GOSUB  DEGDO
  1042 1447            0
  1043 1450         1410 S1=    1
  1044 1451         1653 GOTO   XDEG2  (1436)
  1045 1452 DEGDO   1670 C=REGN 14
  1046 1453           74 RCR    3
  1047 1454         1530 ST=C
  1048 1455         1604 S0=    0
  1049 1456         1404 S1=    0
  1050 1457         1740 RTN
*****************************************************
*FNDEND-FIND THE HIGH END OF RAM
* ROUTINE STARTS AT REG0 STORING AND RETRIEVING
* THE REGISTERS ADDRESS UNTIL THE
* RETRIVED VALUE DOEN NOT MATCH THE STORED VALUE.
* UPON RETURN  A(0:2) CONTAINS THE ADDRESS OF THE
* FIRST NON-EXISTANT REGISTER.
*IF FLAG 8 IS SET AND ENTRY IS AT CLEAR THE ROUTINE
* ALSO CLEARS ALL DATA REGISTERS.
* NOTE: FNDEND RELIES ON THE TESTED REGISTER BEING DIFFERENT FROM
* WHAT YOU GET WHEN YOU READ A NONEXISTENT REGISTER - PROBABLY AN
* OK ASSUMPTION IF NONEXISTENT REGISTERS GIVE ALL ZEROES OR ALL ONES
*****************************************************
  1064 1460 FNDEND  404 S8=    0              CLEAR CLEAR FLAG
  1065 1461         116 C=0                   ADDRESS SHIP ZERO
  1066 1462        1160 DADD=C
  1067 1463 CLR    1570 C=REGN 13             GET REG 0
  1068 1464          74 RCR    3
  1069 1465         132 C=0    M              MUST HAVE ZEROS IN TEST
  1070 1466 CLEM   1160 DADD=C                ADDRESS REGISTER
  1071 1467         256 AC EX                 SAVE ADR
  1072 1470          70 C=DATA                SAVE VALUE
  1073 1471         356 BC EX
  1074 1472         256 C=A                   DUP ADR
  1074 1473         416
  1075 1474        1360 DATA=C                SEND ADR OUT
  1076 1475          70 C=DATA                BRING IT BACK
  1077 1476        1556 ? A#C                 HAS IT CHANGED?
  1078 1477        1540 RTN C                 YES SO RTN
  1079 1500         356 BC EX                 PUT ORIGNAL VAL BACK
  1080 1501         414 ?S8=1                 CLEAR REGISTER?
  1081 1502          23 GONC   OVR0   (1504) NO
  1082 1503         116 C=0
  1083 1504 OVR0   1360 DATA=C                PUT VAL BACK
```

```
  1084 1505          556 A=A+1                  INC ADR
  1085 1506          256 AC EX                  GET ADR
  1086 1507         1573 GOTO   CLEM   (1466)
*********************************************
*THIS ROUTINE      KILLS THE FIRST SIX CHARACTERS
*IN THE ALPHA REGISTER.
*********************************************
  1091 1510 XASHF     1 GOSUB  FIND#1          FIND FIRST CHARACTER
  1091 1511           0
  1092 1512         1524 ? PT=  12             7 IN THIS REG
  1093 1513           53 GONC   REGG   (1520) NO REGULAR 6 OR LESS
  1094 1514         1034 PT=    2              CLEAR TOP SIX AND DONE
  1095 1515 INSHFT   122 C=0    PQ
  1096 1516 DONSHF  1360 DATA=C
  1097 1517         1740 RTN
  1098 1520 REGG     116 C=0
  1099 1521         1360 DATA=C                CLEAR FIRST REG
  1100 1522          324 ? PT=  10             DONE SIX
  1101 1523         1540 RTN C
  1102 1524          256 AC EX
  1103 1525         1160 DADD=C                ADDRESS NEXT REG
  1104 1526           70 C=DATA
  1105 1527         1734 INC PT                CLEAR REMAINING CHARACTERS
  1106 1530         1734 INC PT
  1107 1531         1734 INC PT
  1108 1532         1734 INC PT
  1109 1533         1623 GOTO   INSHFT (1515)
*********************************************
*THIS FUNCTION TAKES THE FIRST SIX NON NULLS
*IN THE ALPHA REGISTER AND STORES THEM.
*********************************************
  1114 1534 XASTO     1 GOSUB  FIND#1
  1114 1535           0
  1115 1536         1524 ? PT=  12             ALL IN THIS REG?
  1116 1537          113 GONC   REG    (1550) NO
  1117 1540         1074 RCR    2              SHIFT RIGHT 2
  1118 1541 DONSTO  1334 PT=    13
  1119 1542          120 LC     1              SET ONE IN 13
  1120 1543           20 LC     0               AND CLEAR 12
  1121 1544          360 NC EX                 GET DATA ADDRESS BACK
  1122 1545         1160 DADD=C
  1123 1546          360 NC EX                 GET REGISTER CONTENT BACK
  1124 1547         1473 GOTO   DONSHF (1516)
  1125 1550 REG      324 ? PT=  10             ALL IN THIS REG
  1126 1551         1707 GOC    DONSTO (1541) DONE
  1127 1552          256 AC EX                 GET ADR OF NEXT REG
  1128 1553         1160 DADD=C
  1129 1554           70 C=DATA                GET NEXT REG
  1130 1555         1734 INC PT
  1131 1556          252 AC EX  WPT            COMBINE TWO REG
  1132 1557 SHFLFT  1734 INC PT                SHIFT THE
  1133 1560         1734 INC PT
  1134 1561         1574 RCR    12
  1135 1562          624 ? PT=  11             IS THE POINTER IN POSITION
  1136 1563         1743 GONC   SHFLFT (1557)
  1137 1564         1553 GOTO   DONSTO (1541)
*********************************************
*THIS SUBROUTINE FINDS THE FIRST NON NULL IN
*THE ALPHA REGISTER.
*********************************************
```

```
*********************************************
 1143 1565 FIND#1   460 LDI                    LOAD ADDRESS
 1144 1566           10 CON    @10
 1145 1567         1160 DADD=C
 1146 1570          256 CA EX                  PUT ADDRESS IN A
 1147 1571          340 SEL Q                  SET Q AT 13 FOR TEST AND CLEARS
 1148 1572         1334 PT=    13
 1149 1573          240 SEL P                  SET P AT SIX TO CLEAR GARB
 1150 1574          534 PT=    6
 1151 1575           70 C=DATA
 1152 1576          122 C=0    PQ
 1153 1577           34 PT=    3
 1154 1600 THSIT?   656 A=A-1                  DEC ADDRESS
 1155 1601         1356 ? C#0                  ANYTHING IN THIS REG
 1156 1602          157 GOC    FOUND1 (1617) IF YES THEN OUT
 1157 1603          256 C=A                    OTHERWISE GET NEXT REG
 1157 1604          416
 1158 1605         1160 DADD=C
 1159 1606           70 C=DATA
 1160 1607         1724 DEC PT                 COUNT DOWN ON LOOP
 1161 1610         1624 ? PT=  0               DONE YET
 1162 1611         1673 GONC   THSIT? (1600)
 1163 1612         1534 PT=    12
 1164 1613         1362 ? C#0  PQ              IF 7 CHARACTERS IN LAST RTN
 1165 1614         1540 RTN C
 1166 1615          334 PT=    10              OTHERWISE DONE WITH 10
 1167 1616         1740 RTN
 1168 1617 FOUND1  1634 PT=    0
 1169 1620 FNDPT   1724 DEC PT
 1170 1621         1724 DEC PT
 1171 1622         1362 ? C#0  PQ
 1172 1623         1753 GONC   FNDPT  (1620)
 1173 1624         1740 RTN                    RTN WITH POINTER AT FIRST BYTE
*************************************************************
*THE SIZE FUNCTION PLACES R0 SUCH THAT COCONUT CONTAINS
*THE CORRECT NUMBER OF REGISTERS.
*THE NUMBER OF REGSITERS IS DELIVERED IN HEX IN AX
* ENTRY SIZSUB USES S9 TO TELL WHETHER TO GO TO PACKE OR RETURN
* IF THERE ISN'T ENOUGH ROOM - S9=1 GOES TO PACKE, S9=0 RETURNS
* WITH S9=1 IF NOT SUCCESSFUL.
*************************************************************
 1182 1625 XSIZE   1110 S9=    1             EXIT VIA PACKE IF
 1183                                        UNSUCCESSFUL
 1184                    ENTRY  SIZSUB
 1185 1626          246 AC EX  X               GET USER SPEC NUM OF REGS
 1186 1627 SIZSUB   160 N=C                    N CONTAINS THE NUMBER NEEDED
 1187 1630            1 GOSUB  MEMLFT         CALCULATE THE MEM UNUSED
 1187 1631            0
 1188 1632          530 M=C                    M=UNUSED REGISTERS
 1189 1633            1 GOSUB  FNDEND         FIND THE END OF MEM
 1189 1634            0
*****************************************************
*MORE OR LESS REGISTERS THAN WE HAVE NOW?
*****************************************************
 1193 1635          116 C=0
 1194 1636         1160 DADD=C
 1195 1637          216 B=A                    MEM END IN B
 1196 1640         1570 C=REGN 13
 1197 1641           74 RCR    3
 1198 1642          706 A=A-C  X
```

```
 1199 1643          260 C=N                    C=REGISTERS WE NEED
 1200 1644          706 A=A-C  X               COMP # 2 SHIFT LEFT POISTIVE
 1201 1645          177 GOC    LARGER (1664) USER WANTS MORE REGISTERS
*************************************************************
*CODE BELOW SETS AX=CHAIN HEAD-WHERE WE STOP
*                AM=-1 DEC
*                BX=FROM ADDRESS-WHERE WE GET DATA
*                BM=TO ADDRESS-WHERE WE PUT DATA
*************************************************************
 1208 1646          410 S9=    1               SET CLEAN UP FLAG0
 1209 1647          316 C=B                    CX=TO
 1210 1650          256 AC EX
 1211 1651          530 M=C                    SAVE SHIFT DISTANCE
 1212 1652         1116 C=A-C                  CX=FROM
 1213 1653           74 RCR    3
 1214 1654          346 BC EX  X               C=FRMXXXXXXXXTO
 1215 1655          674 RCR    11
 1216 1656          356 BC EX                  B=TOFRM
 1217 1657         1570 C=REGN 13              GET TEST ADRESS
 1218 1660          132 C=0    M
 1219 1661         1172 C=C-1  M
 1220 1662          256 AC EX                  A=INCTST
 1221 1663          303 GOTO   STRTMV (1713)
*************************************************************
*SETS UP AS FOR SMALLER EXCEPT WE STOP AT NOTHINGNESS
*AND START AT CHAIN END USING 1 FOR AN INCREMENT.
*************************************************
 1226 1664 LARGER   630 C=N                    GET UNUSED REG
 1227 1665         1006 C=C+A  X               ADD NEG SHIFT
 1228 1666           67 GOC    LARG10 (1674) MADE IT
 1229 1667         1114 ?S9=1                  EXIT MODE?
 1230 1670            1 GOLC   PACKE
 1230 1671            3
 1231 1672         1110 S9=    1               SAY DIDN'T MAKE IT
 1232 1673         1740 RTN
*
 1234 1674 LARG10  1570 C=REGN 13              A=NEGSHFT C=FROM
 1235 1675         1006 C=C+A  X               C=TO
 1236 1676          674 RCR    11
 1237 1677          356 BC EX                  C=TST B=TOXXX
 1238 1700          132 C=0    M
 1239 1701         1072 C=C+1  M               C=INCTST
 1240 1702          256 AC EX
 1241 1703          530 M=C                    SAVE NEG SHIFT
 1242 1704         1570 C=REGN 13              C=FROM
 1243 1705          346 BC EX  X               B=TOFRM
 1244 1706           53 GOTO   STRTMV (1713)
*************************************************
*THIS ROUTINE SHIFTS MEMORY EITHER LEFT OR RIGHT
*ACCORDING TO THE INPUTS IN A AND B.
*************************************************
 1249 1707 KPMVN    674 RCR    11              C=TOFRM
 1250 1710         1032 C=C+A  M               INC TO
 1251 1711          356 BC EX                  C=DATA B=TOFRM
 1252 1712         1360 DATA=C                 DATA MOVED
 1253 1713 STRTMV   356 BC EX                  A=INCTST C=TOFRM
 1254 1714          256 AC EX                  C=TOFRM A=INCTST
 1255 1715          414 ?S8=1                  SMALLER MOVE?
 1256 1716           63 GONC   CHKTOP (1724) NO
 1257 1717         1406 ? A<C  X               IS FRM<TST
```

```
1258 1720           63 GONC   GETREG (1726) IF NO CONTINUE
1259 1721 B=0      256 AC EX                GET 0 FOR TO
1260 1722           56 B=0
1261 1723          143 GOTO   DOTO   (1737)
1262 1724 CHKTOP  1546 ? A#C  X             ZEROS AFTER MEM END
1263 1725         1743 GONC   B=0    (1721)
1264 1726 GETREG   256 AC EX                A=INCTST C=TOFROM
1265 1727         1160 DADD=C               DADD=FROM
1266 1730          372 BC EX  M             SAVE TO PART
1267 1731          674 RCR    11            INC DEC FROM
1268 1732         1032 C=C+A  M
1269 1733           74 RCR    3
1270 1734          346 BC EX  X             A=INCTST B=TOFROM
1271 1735           70 C=DATA
1272 1736          356 BC EX
1273 1737 DOTO      74 RCR    3             C=FRMXX...XX0TO
1274 1740         1160 DADD=C               DADD=TO
1275 1741         1546 ? A#C  X             DONE IF TO=TST
1276 1742         1457 GOC    KPMVN  (1707) NO
1277 1743          356 BC EX                CLEAR LAST REGISTER
1278 1744         1360 DATA=C
*************************************************
*FIX POINTERS AFTER MOVE.
*************************************************
1282 1745          630 C=M                  GET MOVE DISTANCE
1283 1746          356 CB EX                SAVE
1284 1747            1 GOSUB  GETPC         ENABLE CHIP0
1284 1750            0
1285 1751          314 ?S10=1               ROM RAM?
1286 1752           27 GOC    NOTRAM (1754)
1287 1753          446 A=A+B  X             SHIFT PC
1288 1754 NOTRAM   156 AB EX                B=PC FOR CLRSB2
1289 1755         1570 C=REGN 13
1290 1756         1006 C=C+A  X
1291 1757           74 RCR    3
1292 1760         1006 C=C+A  X
1293 1761          474 RCR    8
1294 1762         1006 C=C+A  X
1295 1763           74 RCR    3
1296 1764         1550 REGN=C 13
1297 1765          156 AB EX                BRING PC BACK TO A[3:0]
1298 1766         1104 S9=    0
1299 1767            1 GOLONG DCRT10
1299 1770            2
1300                   ENTRY  SETSST
*
* SETSST - SET SINGLE STEP BIT
* REQUIRES CHIP 0 ENABLED ON INPUT
* DESTROYS C
*
1306 1771 SETSST 1670 C=REGN 14
1307 1772         1530 ST=C
1308 1773          110 S4=    1             SET SST BIT
1309 1774         1630 C=ST
1310 1775         1650 REGN=C 14
1311 1776         1740 RTN
*
1313                   UNLIST

ERRORS :       0
```

```
SYMBOL TABLE

ADDEM    727   -   725
ADDIT    724   -   721  714
ARCL10  1234   -  1267
ARCL20  1263   -  1277
B=0     1721   -  1725
CHK#S    330   -
CHK#S1   324   -
CHK#S2   331   -
CHKAD4  1206   -
CHKADR  1156   -
CHKTOP  1724   -  1716
CKAD10  1222   -  1214
CKAD2   1175   -  1170
CKAD3   1176   -  1166
CKAD3J  1202   -  1177
CKAD4   1206   -  1204 1174
CLEN    1466   -  1507
CLR     1463   -
CLRNXT   264   -   273
COMBIN   745   -   742
DECDO   1452   -
DELOOP  1406   -  1413
DONSHF  1516   -  1547
DONSTO  1541   -  1564 1551
DOSKP   1061   -  1075
DOTO    1737   -  1723
DSPDN   1317   -  1314
ELMFRC   644   -   647
ERRAD    342   -   334
FCNTBL     0   -
FIND#1  1565   -
FLGANN  1121   -  1114
FNDEND  1460   -
FNDPT   1620   -  1623
FOUND1  1617   -  1602
FSTIN    302   -
GETLIN    31   -
GETREG  1726   -  1720
INSHFT  1515   -  1533
KPMVN   1707   -  1742
LARG10  1674   -  1666
LARGER  1664   -  1645
LOAD3    372   -
MRSHFT   740   -   744
NFRPRL   347   -   277
NOFRAC   646   -   643
NOSKP   1031   -  1110 1055 1017 1004 1000  766
NOSKPD  1047   -  1104 1100 1067 1043 1040 1032
NOTRAM  1754   -  1752
OVFL10    51   -
OVFL15    54   -    52
OVFL20    65   -
OVFL30    66   -    63
OVFL40    72   -    67
OVFL50    76   -    71
OVRO    1504   -  1502
```

```
OVRDEC   656   -   654
P6RTN   1160   -
PCKDUR  1374   -
RDNSUB   351   -
REG     1550   -  1537
REGALP  1260   -  1231
REGG    1520   -  1513
RTJ10    312   -   315
RTJLBL   311   -
R^SUB    355   -
S1?     1313   -  1311
SEPA     675   -   671
SEPXY    322   -
SETSST  1771   -
SHFLFT  1557   -  1563
SIZSUB  1627   -
SKP     1056   -  1111 1030  777  767  764
SKPIT   1111   -
SST?    1070   -  1060
STFL10  1256   -  1320
STFLGS  1247   -
STRTMV  1713   -  1706 1663
SUMCHK  1147   -
SUMCK2  1151   -
THSIT?  1600   -  1611
TONE7   1426   -  1405
TONE7X  1333   -
TONE8   1421   -  1403
TONE9   1415   -  1401
TONEB   1335   -
TSTEXP   713   -   710
TSTMAP   241   -
XARCL   1226   -
XASHF   1510   -
XASTO   1534   -
XBEEP   1321   -
XCF     1115   -
XCLSIG   260   -
XDEG    1434   -
XDEG2   1436   -  1451 1445
XDSE     637   -
XFS?    1105   -
XGRAD   1446   -
XISG     640   -
XRAD    1442   -
XRDN     275   -
XR^      345   -
XSCI    1300   -
XSF     1112   -
XSGREG  1131   -
XSIZE   1625   -
XSTYON    21   -
XTONE   1336   -
XX#0?   1021   -
XX#Y?   1051   -
XX<0     774   -  1020
XX<0?    772   -
XX<=0?  1015   -   773
XX<=0A  1011   -
XX<=Y?  1001   -
```

```
XX<Y?     757   -
XX=0?    1006   -
XX=Y?    1024   -
XX>0?     761   -  1005
XX>Y?     770   -   756
XYN      1054   -  1023
XYY      1027   -  1010
Y-X        41   -
```

ENTRY TABLE

CHK#S	330	-
CHK#S1	324	-
CHK#S2	331	-
CHKAD4	1206	-
CHKADR	1156	-
CLR	1463	-
DEGDO	1452	-
DOSKP	1061	-
ERRAD	342	-
FCNTBL	0	-
FIND#1	1565	-
FLGANN	1121	-
FNDEND	1460	-
FSTIN	302	-
GETLIN	31	-
LOAD3	372	-
NOSKP	1031	-
OVFL10	51	-
P6RTN	1160	-
PCKDUR	1374	-
RDNSUB	351	-
RTJLBL	311	-
R^SUB	355	-
SEPXY	322	-
SETSST	1771	-
SIZSUB	1627	-
SKP	1056	-
STFLGS	1247	-
SUMCHK	1147	-
SUMCK2	1151	-
TONE7	1426	-
TONE7X	1333	-
TONEB	1335	-
TSTMAP	241	-
XARCL	1226	-
XASHF	1510	-
XASTO	1534	-
XBEEP	1321	-
XCF	1115	-
XCLSIG	260	-
XDEG	1434	-
XDSE	637	-
XFS?	1105	-
XGRAD	1446	-
XISG	640	-
XRAD	1442	-
XRDN	275	-
XR^	345	-
XSCI	1300	-
XSF	1112	-
XSGREG	1131	-
XSIZE	1625	-
XSTYON	21	-
XTONE	1336	-
XX#0?	1021	-
XX#Y?	1051	-

```
XX<0?     772   -
XX<=0?   1015   -
XX<=0A   1011   -
XX<=Y?   1001   -
XX<Y?     757   -
XX=0?    1006   -
XX=Y?    1024   -
XX>0?     761   -
XX>Y?     770   -
Y-X        41   -
```

EXTERNAL REFERENCES

(*)	102		
(10)^X	127		
+	100		
-	101		
-DEC	137		
-OCT	157		
/	103		
ABS	141		
ACOS	135		
AD2-10	45	731	
AD2-10	46	732	
ADVNCE	217		
AFORMT	1232		
AFORMT	1233		
AGTO	35		
ANN+14	1440		
ANN+14	1441		
ANNOUT	1124		
ANNOUT	1125		
AOFF	213		
AON	214		
APNDNW	1275		
APNDNW	1276		
ARCL	233		
ARGOUT	1245		
ARGOUT	1246		
ASHF	210		
ASIN	134		
ASN	17		
ASTO	232		
ATAN	136		
AVIEW	176		
AXEQ	36		
BEEP	206		
BST	7		
CAT	0		
CF	251		
CHK#S	325	641	1012
CHK#S	326	642	1013
CHS	124		
CLA	207		
CLDSP	177		
CLP	4		
CLREG	212		
CLSIG	160		
CLST	163		
CLX	167		
COLDST	1220		
COLDST	1221		
COPY	3		
COS	132		
D-R	152		
DCRT10	1767		
DCRT10	1770		
DEG	200		
DEGDO	1434	1442	1446

```
DEGDO    1435  1443  1447
DEL         2
DELETE     13
DSE       227
END       300
ENG       236
ENTER^    203
ERRNE    1216
ERRNE    1217
ERROR     342
ERROR     343
E^X       125
E^X-1     130
FACT      142
FC?       255
FC?C      253
FIND#1   1510  1534
FIND#1   1511  1535
FIX       234
FNDEND   1633
FNDFND   1634
FRAC      151
FS?       254
FS?C      252
GETPC    1061  1747
GETPC    1062  1750
GRAD      202
GTO       320
GTOL        1
H-HMS     154
HMS+      111
HMS-      112
HMS-H     155
INT       150
ISG       226
LASTX     166
LBL       317
LN        120
LN1+X     145
LOG       126
MEAN      174
MEMLFT   1630
MEMLFT   1631
MOD       113
MODE       14
MSG      1044  1101
MSG      1045  1102
MSGAD     344
MSGNO    1103
MSGYES   1046
NFRPR     347
NFRPR     350
NFRPU     244  1047
NFRPU     245  1050
OFF       215
ONE/X     140
P-R       116
PACK       12
PACKE    1670
PACKE    1671
```

```
TONEB    1322  1326  1332
VIEW      230
X#0?      143
X#Y?      171
X<0?      146
X<=0?     173
X<=Y?     106
X<>       316
X<>Y      161
X<Y?      104
X=0?      147
X=Y?      170
X>0?      144
X>Y?      105
XEQ       340
XGOIND    256
X^2       121
Y-X       757   770  1001
Y-X       760   771  1002
Y^X       123

End of VASM assembly
```

```
VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

     2                   FILE   CN6B
*****************************************************
*   NUT MATH ROM 1                                  *
*   STARTING ADDRESS=@14000                         *
*****************************************************
*****************************************************
*       COMMON MATH ENTRIES                        ***
*           IF NUMBER IS 2-10,                     ***
*              THEN FORM IS:                       ***
*                 A HAS 10 DIGIT FORM              ***
*                 C HAS 10 DIGIT FORM              ***
*           IF NUMBER IS 1-10,                     ***
*              THEN FORM IS:                       ***
*                 A HAS SIGN AND EXP               ***
*                 B HAS 13 DIGIT MANTISSA          ***
*                 C HAS 10 DIGIT FORM              ***
```

```
*          IF NUMBER IS 2-13,                                  ***
*             THEN FORM IS:                                    ***
*                A AND B AS IN 1-10                            ***
*                M HAS SIGN AND EXP                            ***
*                C HAS 13 DIGIT MANTISSA                       ***
*                                                              ***
*       ON EXIT, C HAS 10 DIGIT FORM                           ***
*                A AND B HAVE 13 DIGIT FORM                    ***
*                                                              ***
****************************************************************
    28                      ENTRY  AD2-10
    29                      ENTRY  AD1-10
    30                      ENTRY  AD2-13
    31                      ENTRY  MP2-10
    32                      ENTRY  MP1-10
    33                      ENTRY  MP2-13
    34                      ENTRY  MPY150
    35                      ENTRY  DV2-10
    36                      ENTRY  DV1-10
    37                      ENTRY  DV2-13
    38                      ENTRY  1/X10
    39                      ENTRY  1/X13
    40                      ENTRY  X/Y13
    41                      ENTRY  DIV120
    42                      ENTRY  DIV110
    43                      ENTRY  DIV15
    44                      ENTRY  ADDONE
    45                      ENTRY  SUBONE
    46                      ENTRY  SQR10
    47                      ENTRY  SQR13
    48                      ENTRY  ERR0
    49                      ENTRY  NRM10
    50                      ENTRY  NRM11
    51                      ENTRY  NRM12
    52                      ENTRY  NRM13
    53                      ENTRY  LN10
    54                      ENTRY  LNC10*
    55                      ENTRY  XLN1+X
    56                      ENTRY  XY^X
    57                      ENTRY  SHF10
    58                      ENTRY  SHF40
    59    0 ADDONE   116 C=0     W
    60    1           33 GOTO    SUBON1 (    4)
    61    2 SUBONE   116 C=0     W
    62    3         1276 C=-C-1  S
    63    4 SUBON1  1534 PT=     12
    64    5          120 LC      1
    65    6           33 GOTO    AD1-10 (   11)
    66    7 AD2-10    56 B=0     W
    67   10          172 AB EX   M
    68   11 AD1-10   730 MC EX                  THESE 2 STATES COULD
    69   12          630 C=M                     BE JUST "M=C"
    70   13          106 C=0     X
    71   14 AD2-13    76 B=0     S
    72   15          136 C=0     S
    73   16          730 MC EX
    74   17         1434 PT=     1
    75   20 ADD10   1724 DEC PT
    76   21          566 A=A+1   XS
    77   22         1066 C=C+1   XS
```

```
 78   23          1524 ? PT=  12
 79   24          1743 GONC   ADD10  (  20)
 80   25           356 BC EX  W
 81   26          1356 ? C#0  W
 82   27           553 GONC   ADD60  ( 104)
 83   30           730 MC EX
 84   31           156 AB EX  W
 85   32          1356 ? C#0  W
 86   33           513 GONC   ADD60  ( 104)
 87   34 ADD30    1446 ? A<B  X
 88   35           207 GOC    ADD65  (  55)
 89   36 ADD90     730 MC EX
 90   37           156 AB EX  W
 91   40          1446 ? A<B  X
 92   41          1737 GOC    ADD30  (  34)
 93   42 ADD45     256 AC EX  W
 94   43           730 MC EX
 95   44          1416 ? A<C  W
 96   45            43 GONC   ADD55  (  51)
 97   46           730 MC EX
 98   47           256 AC EX  W
 99   50            53 GOTO   ADD65  (  55)
100   51 ADD55     730 MC EX
101   52           256 AC EX  W
102   53           730 MC EX
103   54           156 AB EX  W
104   55 ADD65     636 A=A-B  S
105   56          1536 ? A#0  S
106   57           133 GONC   ADD50  (  72)
107   60 ADD40    1216 C=-C   W
108   61           436 A=C    S
109   62          1446 ? A<B  X
110   63            73 GONC   ADD50  (  72)
111   64           730 MC EX
112   65          1374 RCR    13
113   66           730 MC EX
114   67           156 AB EX  W
115   70           646 A=A-1  X
116   71           156 AB EX  W
117   72 ADD50    1446 ? A<B  X
118   73           113 GONC   ADD60  ( 104)
119   74           546 A=A+1  X
120   75          1716 C SR   W
121   76           276 AC EX  S
122   77           436 A=C    S
123  100          1724 DEC PT
124  101          1324 ? PT=  13
125  102          1703 GONC   ADD50  (  72)
126  103           116 C=0    W
127  104 ADD60     256 AC EX  W
128  105           630 C=M
129  106           356 BC EX  W
130  107           456 A=A+B  W
131  110          1166 C=C-1  XS
132  111          1166 C=C-1  XS
133  112          1166 C=C-1  XS
134  113             0 NOP
135  114           313 GOTO   MPY150 ( 145)
136  115 MP2-10     56 B=0    W
137  116           172 AB EX  M
```

```
138  117 MP1-10   730 MC EX
139  120          630 C=M
140  121          106 C=0     X
141  122 MP2-13    76 B=0     S
142  123          136 C=0     S
143  124          730 MC EX
144  125         1006 C=A+C   X
145  126         1136 C=A-C   S
146  127           23 GONC    MPY110 ( 131)
147  130         1236 C=-C    S
148  131 MPY110    16 A=0     W
149  132          730 MC EX
150  133         1334 PT=     13
151  134 MPY120  1734 INC PT
152  135         1616 A SR    W
153  136           23 GOTO    MPY140 ( 140)
154  137 MPY130   456 A=A+B   W
155  140 MPY140  1142 C=C-1   PT
156  141         1763 GONC    MPY130 ( 137)
157  142         1524 ? PT=   12
158  143         1713 GONC    MPY120 ( 134)
159  144          630 C=M
160  145 MPY150   256 AC EX   W              ***ROUND,SHIFT AND NORMALIZE
161  146          730 MC EX
162  147          630 C=M
163  150 MPY160  1376 ? C#0   S
164  151           33 GONC    SHF40  ( 154)
165  152          546 A=A+1   X
166  153         1716 C SR    W
167  154 SHF40    256 AC EX   W
168  155 SHF10   1534 PT=     12
169  156         1512 ? A#0   WPT
170  157          277 GOC     SHF20  ( 206)
171  160 NRM10    356 BC EX   W
172  161 NRM11    256 AC EX   W
173  162 NRM12   1534 PT=     12
174  163          416 A=C     W
175  164          746 C=C+C   X
176  165          153 GONC    NRM20  ( 202)
177  166         1072 C=C+1   M
178  167          133 GONC    NRM20  ( 202)
179  170          306 C=B     X
180  171         1046 C=C+1   X
181  172         1042 C=C+1   PT
182  173 NRM30    336 C=B     S
183  174          156 AB EX   W
184  175         1372 ? C#0   M
185  176         1540 RTN C
186  177          116 C=0     W
187  200           36 A=0     S
188  201 NRM40   1740 RTN
189  202 NRM20    306 C=B     X
190  203         1703 GOTO    NRM30  ( 173)
191  204 NRM13    156 AB EX   W
192  205         1543 GOTO    NRM11  ( 161)
193  206 SHF20   1502 ? A#0   PT
194  207         1517 GOC     NRM10  ( 160)
195  210         1146 C=C-1   X
196  211         1752 A SL    WPT
197  212         1743 GOTO    SHF20  ( 206)
```

```
198  213 1/X10     56 B=0     W
199  214          372 BC EX   M
200  215          256 AC EX   W
201  216 1/X13    116 C=0     W
202  217          730 MC EX
203  220          116 C=0     W
204  221         1534 PT=     12
205  222          120 LC      1
206  223 X/Y13    356 BC EX   W
207  224          256 AC EX   W
208  225          730 MC EX
209  226          256 AC EX   W
210  227           63 GOTO    DV2-13 ( 235)
211  230 DV2-10    56 B=0     W
212  231          172 AB EX   M
213  232 DV1-10   730 MC EX
214  233          630 C=M
215  234          106 C=0     X
216  235 DV2-13    76 B=0     S
217  236         1372 ? C#0   M
218  237          443 GONC    ERR0    ( 303)
219  240 DIV100   730 MC EX
220  241         1106 C=A-C   X
221  242         1136 C=A-C   S
222  243           23 GONC    DIV110 ( 245)
223  244         1236 C=-C    S
224  245 DIV110   730 MC EX
225  246          136 C=0     S
226  247          256 AC EX   W
227  250          156 AB EX   W
228  251 DIV15   1456 ? A<B   W
229  252           53 GONC    DIV120 ( 257)
230  253          730 MC EX
231  254         1756 A SL    W
232  255         1146 C=C-1   X
233  256          730 MC EX
234  257 DIV120  1534 PT=     12
235  260          116 C=0     W
236  261           23 GOTO    DIV140 ( 263)
237  262 DIV130  1042 C=C+1   PT
238  263 DIV140   616 A=A-B   W
239  264         1763 GONC    DIV130 ( 262)
240  265          456 A=A+B   W
241  266         1756 A SL    W
242  267         1724 DEC PT
243  270         1324 ? PT=   13
244  271         1723 GONC    DIV140 ( 263)
245  272          256 AC EX   W
246  273          630 C=M
247  274            1 GOLONG NRM10
247  275            2
248  276 SQR10     56 B=0     W              ***SQUARE ROOT
249  277          372 BC EX   M
250  300          256 AC EX   W
251  301 SQR13   1536 ? A#0   S
252  302           33 GONC    SQR20  ( 305)
253  303 ERR0       1 GOLONG ERRDE          **ERROR EXIT
253  304            2
254  305 SQR20     76 B=0     S
255  306          316 C=B     W
```

```
256  307          156 AB EX   W
257  310          756 C=C+C   W
258  311          756 C=C+C   W
259  312         1016 C=A+C   W
260  313          356 BC EX   W
261  314          132 C=0     M
262  315          416 A=C     W
263  316          756 C=C+C   W
264  317          746 C=C+C   X
265  320           23 GONC    SQR30  ( 322)
266  321         1272 C=-C-1  M
267  322 SQR30    516 A=A+C   W
268  323         1634 PT=     0
269  324         1502 ? A#0   PT
270  325           27 GOC     SQR50  ( 327)
271  326         1656 B SR    W
272  327 SQR50   1616 A SR    W
273  330          116 C=0     W
274  331          156 AB EX   W
275  332         1334 PT=     13
276  333          520 LC      5
277  334         1716 C SR    W
278  335          123 GOTO    SQR100 ( 347)
279  336 SQR60   1042 C=C+1   PT
280  337 SQR70    716 A=A-C   W
281  340         1763 GONC    SQR60  ( 336)
282  341          516 A=A+C   W
283  342         1756 A SL    W
284  343         1624 ? PT=   0
285  344            1 GOLC    NRM12
285  345            3
286  346         1724 DEC PT
287  347 SQR100  1712 C SR    WPT
288  350         1673 GOTO    SQR70  ( 337)
289                  ENTRY   XFT100
290  351 XFT120   646 A=A-1   X
291  352           73 GONC    XFT110 ( 361)
292  353         1303 GOTO    ERR0   ( 303)
293  354 XFT100  1376 ? C#0   S
294  355         1267 GOC     ERR0   ( 303)
295  356         1366 ? C#0   XS
296  357         1247 GOC     ERR0   ( 303)
297  360          416 A=C     W
298  361 XFT110   216 B=A     W
299  362           34 PT=     3
300  363         1756 A SL    W
301  364         1612 A SR    WPT
302  365         1534 PT=     12
303  366         1512 ? A#0   WPT
304  367         1627 GOC     XFT120 ( 351)
305  370          546 A=A+1   X
306                  LEGAL
307  371         1406 ? A<C   X
308  372           33 GONC    XFT130 ( 375)
309  373         1066 C=C+1   XS
310  374         1740 RTN
311  375 XFT130   116 C=0     W
312  376         1042 C=C+1   PT
313  377         1716 C SR    W
314  400         1076 C=C+1   S
```

```
315  401          356 BC EX  W
316  402 XFT140  1302 ? B#0  PT
317  403           33 GONC   XFT150 ( 406)
318  404         1652 B SR   WPT
319  405         1046 C=C+1  X
320  406 XFT150    16 A=0    W
321  407          702 A=A-C  PT
322  410           43 GONC   XFT170 ( 414)
323  411         1756 A SL   W
324  412 XFT160   456 A=A+B  W
325  413         1773 GONC   XFT160 ( 412)
326  414 XFT170   736 A=A-C  S
327  415           63 GONC   XFT190 ( 423)
328  416         1612 A SR   WPT
329  417          556 A=A+1  W
330  420         1046 C=C+1  X
331  421 XFT180   456 A=A+B  W
332  422         1773 GONC   XFT180 ( 421)
333  423 XFT190   152 AB EX  WPT
334  424         1142 C=C-1  PT
335  425         1553 GONC   XFT140 ( 402)
336  426         1176 C=C-1  S
337  427         1533 GONC   XFT140 ( 402)
338  430         1756 A SL   W
339  431          206 B=A    X
340  432          132 C=0    M
341  433          136 C=0    S
342  434          452 A=A+B  WPT
343  435          516 A=A+C  W
344  436          272 AC EX  M
345  437         1740 RTN
*****************************************************
*   MATH SCRATCH ROUTINES                           *
*                                                   *
*     STSCR STORES S AND 13 DIGIT MANTISSA IN       *
*           REGN 9 AND EXP IN REGN 10, LEAVING      *
*           A AND B ALONE                           *
*     RCSCR RECALLS MATH SCRATCH INTO C AND M,      *
*           LEAVING A AND B ALONE                   *
*     EXSCR EXCHANGES A AND B WITH THE MATH         *
*           SCRATCH REGISTERS, DESTROYING C         *
*****************************************************
357                      ENTRY  STSCR
358                      ENTRY  RCSCR
359                      ENTRY  EXSCR
360                      ENTRY  RCSCR*
361                      ENTRY  STSCR*
362  440 STSCR*   116 C=0    W
363  441         1160 DADD=C
364  442 STSCR    236 B=A    S
365  443          316 C=B    W
366  444         1150 REGN=C 9
367  445         1270 C=REGN 10
368  446          246 AC EX  X
369  447          406 A=C    X
370  450 STSCR1  1250 REGN=C 10
371  451         1740 RTN
372  452 EXSCR    176 AB EX  S
373  453         1170 C=REGN 9
374  454          356 BC EX  W
```

```
   375  455          1150 REGN=C 9
   376  456          1270 C=REGN 10
   377  457           246 AC EX  X
   378  460           176 AB EX  S
   379  461          1673 GOTO   STSCR1 ( 450)
   380  462 RCSCR*    116 C=0
   381  463          1160 DADD=C
   382  464 RCSCR     1170 C=REGN 9
   383  465           376 BC EX  S
   384  466           730 MC EX
   385  467          1270 C=REGN 10
   386  470           336 C=B    S
   387  471           730 CM EX
   388  472          1740 RTN
   389                    ENTRY  INTFRC
   390                    ENTRY  SINFR
   391                    ENTRY  SINFRA
   392                    ENTRY  MOD10
   393                    ENTRY  DTOR
   394                    ENTRY  RTOD
   395                    ENTRY  LD90
   396                    ENTRY  PI/2
   397                    ENTRY  TRC10
**************************************************
*     IF S5=1, THEN ROUTINE INTFRC FINDS INT     *
*     IF S5=0, INTFRC FINDS FRACTIONAL PART      *
**************************************************
   402  473 INTFRC      1 GOSUB  SINFR
   402  474            0
   403  475          214 ?S5=1
   404  476            1 GOLNC  SHF10
   404  477            2
   405  500          630 C=M
* NEXT TWO STATES ARE A HOLDOVER FROM A VERSION OF INTFRC WHICH
* WORKED FOR 13 DIGIT ARITHMETIC.  NOT NECESSARY HERE.
   408  501         1624 ? PT=  0
   409  502           37 GOC    INT30  ( 505)
   410  503         1724 DEC PT
   411  504          112 C=0    WPT
   412  505 INT30      1 GOLONG NRM12
   412  506            2
   413  507 SINFR     56 B=0    W
   414  510          372 BC EX  M
   415  511          256 AC EX  W
   416  512 SINFRA   1334 PT=    13
   417  513          316 C=B    W
   418  514          730 CM EX
   419  515          156 AB EX  W
   420  516          316 C=B    W
   421  517         1366 ? C#0  XS
   422  520         1540 RTN C
   423  521         1046 C=C+1  X
   424  522 SINFR1  1346 ? C#0  X
   425  523           73 GONC   SINFR2 ( 532)
   426  524         1146 C=C-1  X
   427  525         1756 A SL   W
   428  526           36 A=0    S
   429  527         1724 DEC PT
   430  530         1516 ? A#0  W
   431  531         1717 GOC    SINFR1 ( 522)
```

```
432  532 SINFR2 1146 C=C-1  X
433  533        1740 RTN
434  534 MOD10   566 A=A+1  XS
435  535        1372 ? C#0  M
436  536          73 GONC   MOD5   ( 545)
437  537        1066 C=C+1  XS
438  540        1576 ? A#C  S
439  541          23 GONC   MOD1   ( 543)
440  542         110 S4=    1
441       MOD1
442  543        1106 C=A-C  X
443  544          43 GONC   MOD2   ( 550)
444  545 MOD5    666 A=A-1  XS
445  546         256 AC EX  W
446  547         223 GOTO   MOD4   ( 571)
447  550 MOD2     56 B=0    W
448  551         360 CN EX
449  552         276 AC EX  S
450  553         360 CN EX
451  554          36 A=0    S
452  555           6 A=0    X
453  556         372 BC EX  M
454  557 MOD3    616 A=A-B  W
455  560        1773 GONC   MOD3   ( 557)
456  561         456 A=A+B  W
457  562        1756 A SL   W
458  563        1146 C=C-1  X
459  564        1733 GONC   MOD3   ( 557)
460  565        1616 A SR   W
461  566         260 C=N
462  567           1 GSBLGX SHF10
462  570           0
463  571 MOD4    114 ?S4=1
464  572        1640 RTN NC
465  573        1372 ? C#0  M
466  574        1640 RTN NC
467  575         416 A=C    W
468  576         370 C=REGN 3
469  577           1 GOLONG :AD2-10
469  600           2
470  601 DTOR     16 A=0
471  602           1 GOSUB  PI/2
471  603           0
472  604         356 BC EX  W
473  605         260 C=N
474  606           1 GSBLNG MP1-10
474  607           0
475  610           1 GOSUB  LD90
475  611           0
476  612           1 GOLONG DV1-10
476  613           2
477  614 RTOD    416 A=C
478  615           1 GOSUB  LD90
478  616           0
479  617           1 GSBLNG MP2-10
479  620           0
480  621           1 GOSUB  PI/2
480  622           0
481  623           1 GOLONG DV2-13
481  624           2
```

```
 482  625 LD90     116 C=0     W
 483  626         1534 PT=     12
 484  627         1046 C=C+1   X
 485  630         1120 LC      9
 486  631         1740 RTN
 487  632 PI/2     116 C=0     W
 488  633          730 CM EX
 489  634            1 GOSUB   TRC10
 489  635            0
 490  636          756 C=C+C   W
 491  637         1716 C SR    W
 492  640         1740 RTN
 493  641 TRC10   1534 PT=     12
 494  642          116 C=0     W
 495  643          720 LC      7
 496  644         1020 LC      8
 497  645          520 LC      5
 498  646          320 LC      3
 499  647         1120 LC      9
 500  650         1020 LC      8
 501  651          120 LC      1
 502  652          620 LC      6
 503  653          320 LC      3
 504  654          320 LC      3
 505  655         1120 LC      9
 506  656          720 LC      7
 507  657          520 LC      5
 508  660         1534 PT=     12
 509  661         1740 RTN
 510                   ENTRY   XTOHRS
 511                   ENTRY   HMSMP
 512                   ENTRY   HMSDV
*****************************************************
*     IF TO H.MMSS, THEN S5=1                       *
*     IF TO H.DDDD, THEN S5=0                       *
*****************************************************
 517  662 XTOHRS 1372 ? C#0   M
 518  663         1640 RTN NC
 519  664          416 A=C     W
 520  665          216 B=A     W
 521  666         1046 C=C+1   X
 522  667         1046 C=C+1   X
 523  670          406 A=C     X
 524  671         1534 PT=     12
 525  672          506 A=A+C   X
 526  673          107 GOC     HMS140 ( 703)
 527  674 HMS110 1724 DEC PT
 528  675         1624 ? PT=   0
 529  676           33 GONC    HMS130 ( 701)
 530  677 HMS120   316 C=B     W
 531  700         1740 RTN
 532  701 HMS130 1146 C=C-1    X
 533  702         1723 GONC    HMS110 ( 674)
 534  703 HMS140   116 C=0     W
 535  704          332 C=B     M
 536  705          214 ?S5=1
 537  706          223 GONC    HRS100 ( 730)
 538  707         1734 INC PT
 539  710         1324 ? PT=   13
 540  711           43 GONC    HMS150 ( 715)
```

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541  712           1 GOSUB  HMSMP
541  713           0
542  714          53 GOTO   HMS160 ( 721)
543  715 HMS150 1734 INC PT
544  716           1 GOSUB  HMSMP
544  717           0
545  720        1724 DEC PT
546  721 HMS160 1724 DEC PT
547                  LEGAL
548  722           1 GOSUB  HMSMP
548  723           0
549  724         416 A=C    W
550  725         316 C=B    W
551  726 HMS170    1 GOLONG MPY150
551  727           2
552  730 HRS100   16 A=0    W
553  731           1 GOSUB  HMSDV
553  732           0
554  733        1734 INC PT
555  734        1324 ? PT=  13
556  735          27 GOC    HRS120 ( 737)
557  736        1734 INC PT
558  737 HRS120    1 GOSUB  HMSDV
558  740           0
559  741        1756 A SL   W
560  742         516 A=A+C  W
561  743         356 BC EX  W
562  744        1623 GOTO   HMS170 ( 726)
563  745 HMSDV  1712 C SR   WPT
564  746        1012 C=A+C  WPT
565  747 HMSMP   412 A=C    WPT
566  750        1712 C SR   WPT
567  751         752 C=C+C  WPT
568  752         752 C=C+C  WPT
569  753        1112 C=A-C  WPT
570  754         214 ?S5=1
571  755          63 GONC   HMSM20 ( 763)
572  756          16 A=0    W
573  757         406 A=C    X
574  760        1016 C=A+C  W
575  761         106 C=0    X
576  762        1740 RTN
577  763 HMSM20  512 A=A+C  WPT
578  764        1712 C SR   WPT
579  765        1352 ? C#0  WPT
580  766        1757 GOC    HMSM20 ( 763)
581  767        1740 RTN
582                  ENTRY  EXP710
583                  ENTRY  LN560
584                  ENTRY  PMUL
585                  ENTRY  LNSUB
586                  ENTRY  LNSUB-
587                  ENTRY  LNC20
588                  ENTRY  LNAP
589                  ENTRY  EXP10
590                  ENTRY  EXP13
591                  ENTRY  10TOX
592                  ENTRY  LNC10
593                  ENTRY  EXP500
594                  ENTRY  EXP400
```

```
595                     ENTRY   EXP720
596   770 LNSUB-  1276  C=-C-1  S
597   771 LNSUB    156  AB EX   W
598   772           216  B=A     W
599   773           730  MC EX
600   774           630  C=M
601   775 LNSUB1   1616  A SR    W
602   776          1516  ? A#0   W
603   777            47  GOC     LNSUB2 (1003)
604  1000           630  C=M
605  1001           416  A=C     W
606  1002          1740  RTN
607  1003 LNSUB2  1046  C=C+1   X
608  1004          1713  GONC    LNSUB1 ( 775)
609  1005          1534  PT=     12
610  1006           542  A=A+1   PT
611  1007           156  AB EX   W
612  1010             1  GOLONG  DIV15
612  1011             2
613  1012 EXP10      56  B=0     W               ***EXP(X)
614  1013           372  BC EX   M
615  1014           256  AC EX   W
616  1015 EXP13       4  S3=     0
617  1016          1536  ? A#0   S
618  1017            23  GONC    EXP110 (1021)
619  1020            10  S3=     1
620  1021 EXP110     36  A=0     S
621  1022            32  A=0     M
622  1023           156  AB EX   W
623  1024           316  C=B     W
624  1025           746  C=C+C   X
625  1026           163  GONC    EXP200 (1044)
626  1027           316  C=B     W
627  1030          1536  ? A#0   S
628  1031           177  GOC     EXP120 (1050)
629  1032          1334  PT=     13
630  1033 EXP130  1724  DEC PT
631  1034           224  ? PT=   5
632  1035             1  GOLC    EXP500
632  1036             3
633  1037          1046  C=C+1   X
634  1040          1733  GONC    EXP130 (1033)
635  1041 EXP400      1  GSBLNG  LNC20
635  1042             0
636  1043           643  GOTO    EXP420 (1127)
637  1044 EXP200      1  GOSUB   LNC10
637  1045             0
638  1046           534  PT=     6
639  1047            63  GOTO    EXP220 (1055)
640  1050 EXP120   156  AB EX   W
641  1051           546  A=A+1   X
642  1052          1656  B SR    W
643  1053          1463  GOTO    EXP110 (1021)
644  1054 EXP210  1072  C=C+1   M
645  1055 EXP220   616  A=A-B   W
646  1056          1763  GONC    EXP210 (1054)
647  1057           456  A=A+B   W
648  1060          1756  A SL    W
649  1061          1146  C=C-1   X
650  1062           123  GONC    EXP230 (1074)
```

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651 1063          234 PT=    5
652 1064         1342 ? C#0  PT
653 1065           53 GONC   EXP240 (1072)
654 1066         1142 C=C-1  PT
655 1067         1342 ? C#0  PT
656 1070          117 GOC    EXP300 (1101)
657 1071         1042 C=C+1  PT
658 1072 EXP240  1534 PT=    12
659 1073          443 GOTO   EXP430 (1137)
660 1074 EXP230   256 AC EX  W
661 1075         1772 A SL   M
662 1076          256 AC EX  W
663 1077         1342 ? C#0  PT
664 1100         1553 GONC   EXP220 (1055)
665 1101 EXP300   116 C=0    W
666 1102         1534 PT=    12
667 1103         1152 C=C-1  WPT
668 1104          416 A=C    W
669 1105         1034 PT=    2
670 1106          120 LC     1
671 1107           14 ?S3=1
672 1110           23 GONC   EXP700 (1112)
673 1111         1246 C=-C-1 X
674 1112 EXP700   156 AB EX  W
675 1113          416 A=C    W
676 1114 EXP710   114 ?S4=1
677 1115           33 GONC   EXP720 (1120)
678 1116            1 GSBLNG :SUBONE
678 1117            0
679 1120 EXP720  1214 ?S7=1
680 1121           33 GONC   EXP730 (1124)
681 1122         1276 C=-C-1 S
682 1123          436 A=C    S
683 1124 EXP730     1 GOLONG :NRM13
683 1125            2
684 1126 EXP410  1042 C=C+1  PT
685 1127 EXP420   616 A=A-B  W
686 1130         1763 GONC   EXP410 (1126)
687 1131          456 A=A+B  W
688 1132          524 ? PT=  6
689 1133           77 GOC    EXP510 (1142)
690 1134         1756 A SL   W
691 1135         1146 C=C-1  X
692 1136         1724 DEC PT
693 1137 EXP430   356 BC EX  W
694 1140         1013 GOTO   EXP400 (1041)
695 1141 EXP500   356 BC EX  W
696 1142 EXP510   114 ?S4=1
697 1143           53 GONC   EXP570 (1150)
698 1144            1 GOSUB  LNAP
698 1145            0
699 1146          256 AC EX  W
700 1147          156 AB EX  W
701 1150 EXP570  1334 PT=    13
702 1151          620 LC     6
703 1152          234 PT=    5
704 1153 EXP550  1372 ? C#0  M
705 1154          633 GONC   EXP600 (1237)
706 1155         1734 INC PT
707 1156 EXP560  1342 ? C#0  PT
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708 1157          63 GONC   EXP520 (1165)
709 1160        1142 C=C-1  PT
710 1161         216 B=A    W
711 1162         730 MC EX
712 1163         630 C=M
713 1164         203 GOTO   EXP530 (1204)
714 1165 EXP520 1046 C=C+1  X
715 1166        1616 A SR   W
716 1167        1176 C=C-1  S
717 1170        1633 GONC   EXP550 (1153)
718 1171        1716 C SR   W
719 1172        1716 C SR   W
720 1173        1716 C SR   W
721 1174         542 A=A+1  PT
722 1175         156 AB EX  W
723 1176         416 A=C    W
724 1177          14 ?S3=1
725 1200           1 GSUBCX 1/X13
725 1201           1
726 1202        1123 GOTO   EXP710 (1114)
727 1203 EXP540 1656 B SR   W
728 1204 EXP530 1176 C=C-1  S
729 1205        1763 GONC   EXP540 (1203)
730 1206         456 A=A+B  W
731 1207         576 A=A+1  S
732 1210         630 C=M
733 1211        1453 GOTO   EXP560 (1156)
734 1212 LNAP    730 MC EX
735 1213         630 C=M
736 1214         216 B=A    W
737 1215         356 BC EX  W
738 1216         756 C=C+C  W
739 1217         756 C=C+C  W
740 1220        1016 C=A+C  W
741 1221         156 AB EX  W
742 1222 LNAP1  1716 C SR   W
743 1223        1356 ? C#0  W
744 1224          47 GOC    LNAP2  (1230)
745 1225         630 C=M
746 1226         256 AC EX  W
747 1227        1740 RTN
748 1230 LNAP2   546 A=A+1  X
749 1231        1713 GONC   LNAP1  (1222)
750 1232        1216 C=-C   W
751 1233         730 MC EX
752 1234        1046 C=C+1  X
753                  LEGAL
754 1235           1 GOLONG DIV110
754 1236           2
755 1237 EXP600  156 AB EX  W
756 1240         132 C=0    M
757 1241         136 C=0    S
758 1242         416 A=C    W
759 1243          14 ?S3=1
760 1244          33 GONC   EXP740 (1247)
761 1245           1 GSBLNG LNSUB-
761 1246           0
762 1247 EXP740  114 ?S4=1
763 1250          37 GOC    EXP750 (1253)
764 1251           1 GSBLNG ADDONE
```

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764 1252            0
765 1253 EXP750     1 GOLONG EXP720
765 1254            2
766 1255 LNC10*   356 BC EX   W
767 1256 LNC10   1534 PT=     12
768 1257          220 LC      2
769 1260          320 LC      3
770 1261           20 LC      0
771 1262          220 LC      2
772 1263          520 LC      5
773 1264         1020 LC      8
774 1265          520 LC      5
775 1266           20 LC      0
776 1267         1120 LC      9
777 1270          220 LC      2
778 1271         1120 LC      9
779 1272         1120 LC      9
780 1273          420 LC      4
781 1274          413 GOTO    LNCEND (1335)
782 1275 LNC20    116 C=0     W
783 1276         1524 ? PT=   12
784 1277          227 GOC     LNC30  (1321)
785 1300         1172 C=C-1   M
786 1301          420 LC      4
787 1302         1072 C=C+1   M
788 1303          324 ? PT=   10
789 1304          347 GOC     LNC40  (1340)
790 1305         1124 ? PT=   9
791 1306          477 GOC     LNC50  (1355)
792 1307          424 ? PT=   8
793 1310          617 GOC     LNC60  (1371)
794 1311         1224 ? PT=   7
795 1312          717 GOC     LNC70  (1403)
796 1313          524 ? PT=   6
797 1314          777 GOC     LNC80  (1413)
798 1315         1634 PT=     0
799 1316          320 LC      3
800 1317          534 PT=     6
801 1320          153 GOTO    LNCEND (1335)
802 1321 LNC30    620 LC      6
803 1322         1120 LC      9
804 1323          320 LC      3
805 1324          120 LC      1
806 1325          420 LC      4
807 1326          720 LC      7
808 1327          120 LC      1
809 1330         1020 LC      8
810 1331           20 LC      0
811 1332          520 LC      5
812 1333          620 LC      6
813 1334         1534 PT=     12
814 1335 LNCEND   356 BC EX   W
815 1336         1740 RTN
816 1337            0 NOP                  PRESERVE ENTRY POINT ADDRESSES
817 1340 LNC40    320 LC      3
818 1341          120 LC      1
819 1342           20 LC      0
820 1343          120 LC      1
821 1344          720 LC      7
822 1345         1120 LC      9
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823 1346          1020 LC      8
824 1347            20 LC      0
825 1350           420 LC      4
826 1351           320 LC      3
827 1352           320 LC      3
828 1353           634 PT=     11
829 1354          1613 GOTO    LNCEND (1335)
830 1355 LNC50     434 PT=     8
831 1356           320 LC      3
832 1357           320 LC      3
833 1360            20 LC      0
834 1361          1020 LC      8
835 1362           520 LC      5
836 1363           320 LC      3
837 1364           120 LC      1
838 1365           620 LC      6
839 1366          1020 LC      8
840 1367           334 PT=     10
841 1370          1453 GOTO    LNCEND (1335)
842 1371 LNC60     534 PT=     6
843 1372           320 LC      3
844 1373           320 LC      3
845 1374           320 LC      3
846 1375            20 LC      0
847 1376          1020 LC      8
848 1377           320 LC      3
849 1400           520 LC      5
850 1401          1134 PT=     9
851 1402          1333 GOTO    LNCEND (1335)
852 1403 LNC70     134 PT=     4
853 1404           320 LC      3
854 1405           320 LC      3
855 1406           320 LC      3
856 1407           320 LC      3
857 1410           120 LC      1
858 1411           434 PT=     8
859 1412          1233 GOTO    LNCEND (1335)
860 1413 LNC80    1034 PT=     2
861 1414           320 LC      3
862 1415           320 LC      3
863 1416           320 LC      3
864 1417          1234 PT=     7
865 1420          1153 GOTO    LNCEND (1335)
866 1421 XY^X       56 B=0     W
867 1422           372 BC EX    M
868 1423           256 AC EX    W
869 1424             1 GOSUB    STSCR
869 1425             0
870 1426           270 C=REGN 2
871 1427             1 GOSUB    CHK#S
871 1430             0
872 1431           416 A=C      W
873 1432           370 C=REGN 3
874 1433          1536 ? A#0    S
875 1434           273 GONC     YX13    (1463)
876 1435             6 A=0      X
877 1436           272 AC EX    M
878 1437          1366 ? C#0    XS
879 1440            63 GONC     YX11    (1446)
880 1441 ERR0*       1 GOLONG   ERR0
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880 1442           2
881 1443 YX12   1346 ? C#0   X
882 1444        1753 GONC    ERR0*  (1441)
883 1445        1146 C=C-1   X
884 1446 YX11   1756 A SL    W
885 1447        1532 ? A#0   M
886 1450        1737 GOC     YX12   (1443)
887 1451        1346 ? C#0   X
888 1452         117 GOC     YX13   (1463)
889 1453         276 AC EX   S
890 1454         436 A=C     S
891 1455         776 C=C+C   S
892 1456         776 C=C+C   S
893 1457        1036 C=A+C   S
894 1460        1376 ? C#0   S
895 1461          23 GONC    YX13   (1463)
896 1462        1210 S7=     1
897 1463 YX13    270 C=REGN .2
898 1464         136 C=0     S
899 1465 YXTEN    56 B=0     W
900 1466         372 BC EX   M
901 1467         256 AC EX   W
902 1470 YX31   1410 S1=     1
903 1471        1332 ? B#0   M
904 1472         167 GOC     LN13   (1510)
905 1473           1 GOSUB   RCSCR
905 1474           0
906 1475        1372 ? C#0   M
907 1476        1433 GONC    ERR0*  (1441)
908 1477         630 C=M
909 1500        1376 ? C#0   S
910 1501        1407 GOC     ERR0*  (1441)
911 1502          56 B=0     W
912 1503           1 GOLONG .NRM13
912 1504           2
913 1505 LN10     56 B=0     W
914 1506         372 BC EX   M
915 1507         256 AC EX   W
916 1510 LN13     76 B=0     S
917 1511        1536 ? A#0   S
918 1512        1277 GOC     ERR0*  (1441)
919 1513        1332 ? B#0   M
920 1514        1253 GONC    ERR0*  (1441)
921 1515         246 AC EX   X
922 1516         406 A=C     X
923 1517        1346 ? C#0   X
924 1520         203 GONC    LN220  (1540)
925 1521         506 A=A+C   X
926 1522          33 GONC    LN140  (1525)
927 1523        1246 C=-C-1  X
928 1524          10 S3=     1
929 1525 LN140    16 A=0     W
930 1526         136 C=0     S
931 1527         132 C=0     M
932 1530        1534 PT=     12
933 1531         612 A=A-B   WPT
934 1532        1142 C=C-1   PT
935 1533 LN310  1042 C=C+1   PT
936 1534 LN300   216 B=A     W
937 1535         730 MC EX
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938 1536          630 C=M
939 1537          613 GOTO   LN330  (1620)
940 1540 LN220   1534 PT=    12
941 1541          316 C=B    W
942 1542         1142 C=C-1  PT
943 1543          256 AC EX  W
944 1544         1516 ? A#0  W
945 1545            1 GOLNC  LN560
945 1546            2
946 1547 LN200   1502 ? A#0  PT
947 1550           47 GOC    LN210  (1554)
948 1551         1146 C=C-1  X
949 1552         1756 A SL   W
950 1553         1743 GOTO   LN200  (1547)
951 1554 LN210    730 MC EX
952 1555            1 GOSUB  DIV15
952 1556            0
953 1557          213 GOTO   LN1+X6 (1600)
954 1560 LN1+X2     1 GOSUB  ADDONE
954 1561            0
955 1562         1263 GOTO   LN13   (1510)
956 1563 XLN1+X    56 B=0    W
957 1564          372 BC EX  M
958 1565          416 A=C    W
959 1566          256 AC EX  W
960 1567          416 A=C    W
961 1570         1046 C=C+1  X
962 1571          746 C=C+C  X
963 1572         1663 GONC   LN1+X2 (1560)
964 1573         1536 ? A#0  S
965 1574          127 GOC    LN1+X3 (1606)
966 1575          256 AC EX  W
967 1576            1 GOSUB  LNSUB
967 1577            0
968 1600 LN1+X6  1534 PT=    12
969 1601          116 C=0    W
970 1602          246 AC EX  X
971 1603          416 A=C    W
972 1604          156 AB EX  W
973 1605           73 GOTO   LN1+X7 (1614)
974 1606 LN1+X3    10 S3=    1
975 1607         1713 GOTO   LN1+X6 (1600)
976 1610 LN1+X8   524 ? PT=   6
977 1611          767 GOC    LN410  (1707)
978 1612         1724 DEC PT
979 1613         1076 C=C+1  S
980 1614 LN1+X7  1046 C=C+1  X
981 1615         1733 GONC   LN1+X8 (1610)
982 1616         1163 GOTO   LN300  (1534)
983 1617 LN320   1616 A SR   W
984 1620 LN330   1176 C=C-1  S
985 1621         1763 GONC   LN320  (1617)
986 1622          630 C=M
987 1623          456 A=A+B  W
988 1624          676 A=A-1  S
989 1625         1063 GONC   LN310  (1533)
990 1626         1076 C=C+1  S
991 1627          156 AB EX  W
992 1630         1756 A SL   W
993 1631         1724 DEC PT
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 994 1632          224 ? PT=   5
 995 1633         1013 GONC    LN300  (1534)
 996 1634          256 AC EX   W
 997 1635          216 B=A     W
 998 1636         1752 A SL    WPT
 999 1637         1752 A SL    WPT
1000 1640         1752 A SL    WPT
1001 1641          256 AC EX   W
1002 1642         1634 PT=     0
1003 1643          720 LC      7
1004 1644         1206 C=-C    X
1005 1645         1306 ? B#0   X
1006 1646          743 GONC    LN420  (1742)
1007 1647          534 PT=     6
1008 1650 LN460   1616 A SR    W
1009 1651 LN430    356 BC EX   W
1010 1652 LN431      1 GOSUB   LNC20
1010 1653            0
1011 1654            1 GOSUB   PMUL
1011 1655            0
1012 1656         1372 ? C#0   M
1013 1657          343 GONC    LN530  (1713)
1014 1660         1324 ? PT=   13
1015 1661         1673 GONC    LN460  (1650)
1016 1662           56 B=0     W
1017 1663         1634 PT=     0
1018 1664          202 B=A     PT
1019 1665          456 A=A+B   W
1020 1666         1616 A SR    W
1021 1667 LN500      1 GOSUB   LNC10*
1021 1670            0
1022 1671           14 ?S3=1
1023 1672           67 GOC     LN570  (1700)
1024 1673          156 AB EX   W
1025 1674          616 A=A-B   W
1026 1675          156 AB EX   W
1027 1676          456 A=A+B   W
1028 1677          156 AB EX   W
1029 1700 LN570     34 PT=     3
1030 1701 LN520      1 GOSUB   PMUL
1030 1702            0
1031 1703         1372 ? C#0   M
1032 1704           73 GONC    LN530  (1713)
1033 1705         1616 A SR    W
1034 1706         1733 GOTO    LN520  (1701)
1035 1707 LN410    356 BC EX   W
1036 1710          333 GOTO    LN400  (1743)
1037 1711 LN540   1616 A SR    W
1038 1712           43 GOTO    LN550  (1716)
1039 1713 LN530   1536 ? A#0   S
1040 1714         1757 GOC     LN540  (1711)
1041 1715         1146 C=C-1   X
1042 1716 LN550    136 C=0     S
1043 1717           14 ?S3=1
1044 1720           33 GONC    LN560  (1723)
1045 1721         1276 C=-C-1  S
1046 1722            0 NOP
1047 1723 LN560      1 GOSUB   SHF10
1047 1724            0
1048 1725         1414 ?S1=1
```

```
1049 1726           313 GONC   LN580  (1757)
1050 1727             1 GOSUB  RCSCR
1050 1730             0
1051 1731             1 GOSUB  MP2-13
1051 1732             0
1052 1733 YTOX50    630 C=M
1053 1734 YTOX60   1376 ? C#0  S
1054 1735             1 GOLNC  EXP13
1054 1736             2
1055 1737           646 A=A-1  X
1056 1740           356 BC EX  W
1057 1741          1733 GOTO   YTOX60 (1734)
1058 1742 LN420    1616 A SR   W
1059 1743 LN400       1 GOSUB  LNAP
1059 1744             0
1060 1745           156 AB EX  W
1061 1746           534 PT=    6
1062 1747          1033 GOTO   LN431  (1652)
1063 1750 PMUL1     456 A=A+B  W
1064 1751 PMUL     1142 C=C-1  PT
1065 1752          1763 GONC   PMUL1  (1750)
1066 1753           102 C=0    PT
1067 1754          1046 C=C+1  X
1068 1755          1734 INC PT
1069 1756          1740 RTN
1070 1757 LN580     214 ?S5=1
1071 1760          1640 RTN NC
1072 1761           116 C=0    W
1073 1762           730 MC EX
1074 1763             1 GOSUB  LNC10
1074 1764             0
1075 1765           356 BC EX  W
1076 1766             1 GOLONG DV2-13
1076 1767             2
1077 1770 10TOX      16 A=0    W
1078 1771             1 GSBLNG LNC10
1078 1772             0
1079 1773           260 C=N
1080 1774             1 GSBLNG MP1-10
1080 1775             0
1081 1776          1353 GOTO   YTOX50 (1733)
1082                    FILLTO END
     1777          0000 NOP
1083                    END

ERRORS :       0
```

SYMBOL TABLE

1/X10	213	-					
1/X13	216	-					
10TOX	1770	-					
AD1-10	11	-	6				
AD2-10	7	-					
AD2-13	14	-					
ADD10	20	-	24				
ADD30	34	-	41				
ADD40	60	-					
ADD45	42	-					
ADD50	72	-	102	63	57		
ADD55	51	-	45				
ADD60	104	-	73	33	27		
ADD65	55	-	50	35			
ADD90	36	-					
ADDONE	0	-					
DIV100	240	-					
DIV110	245	-	243				
DIV120	257	-	252				
DIV130	262	-	264				
DIV140	263	-	271	261			
DIV15	251	-					
DTOR	601	-					
DV1-10	232	-					
DV2-10	230	-					
DV2-13	235	-	227				
ERR0	303	-	357	355	353	237	
ERR0*	1441	-	1514	1512	1501	1476	1444
EXP10	1012	-					
EXP110	1021	-	1053	1017			
EXP120	1050	-	1031				
EXP13	1015	-					
EXP130	1033	-	1040				
EXP200	1044	-	1026				
EXP210	1054	-	1056				
EXP220	1055	-	1100	1047			
EXP230	1074	-	1062				
EXP240	1072	-	1065				
EXP300	1101	-	1070				
EXP400	1041	-	1140				
EXP410	1126	-	1130				
EXP420	1127	-	1043				
EXP430	1137	-	1073				
EXP500	1141	-					
EXP510	1142	-	1133				
EXP520	1165	-	1157				
EXP530	1204	-	1164				
EXP540	1203	-	1205				
EXP550	1153	-	1170				
EXP560	1156	-	1211				
EXP570	1150	-	1143				
EXP600	1237	-	1154				
EXP700	1112	-	1110				
EXP710	1114	-	1202				
EXP720	1120	-	1115				
EXP730	1124	-	1121				

```
EXP740   1247   -  1244
EXP750   1253   -  1250
EXSCR     452   -
HMS110    674   -   702
HMS120    677   -
HMS130    701   -   676
HMS140    703   -   673
HMS150    715   -   711
HMS160    721   -   714
HMS170    726   -   744
HMSDV     745   -
HMSM20    763   -   766  755
HMSMP     747   -
HRS100    730   -   706
HRS120    737   -   735
INT30     505   -   502
INTFRC    473   -
LD90      625   -
LN1+X2   1560   -  1572
LN1+X3   1606   -  1574
LN1+X6   1600   -  1607 1557
LN1+X7   1614   -  1605
LN1+X8   1610   -  1615
LN10     1505   -
LN13     1510   -  1562 1472
LN140    1525   -  1522
LN200    1547   -  1553
LN210    1554   -  1550
LN220    1540   -  1520
LN300    1534   -  1633 1616
LN310    1533   -  1625
LN320    1617   -  1621
LN330    1620   -  1537
LN400    1743   -  1710
LN410    1707   -  1611
LN420    1742   -  1646
LN430    1651   -
LN431    1652   -  1747
LN460    1650   -  1661
LN500    1667   -
LN520    1701   -  1706
LN530    1713   -  1704 1657
LN540    1711   -  1714
LN550    1716   -  1712
LN560    1723   -  1720
LN570    1700   -  1672
LN580    1757   -  1726
LNAP     1212   -
LNAP1    1222   -  1231
LNAP2    1230   -  1224
LNC10    1256   -
LNC10*   1255   -
LNC20    1275   -
LNC30    1321   -  1277
LNC40    1340   -  1304
LNC50    1355   -  1306
LNC60    1371   -  1310
LNC70    1403   -  1312
LNC80    1413   -  1314
LNCEND   1335   -  1420 1412 1402 1370 1354 1320 1274
```

```
LNSUB     771   -
LNSUB-    770   -
LNSUB1    775   -  1004
LNSUB2   1003   -   777
MOD1      543   -   541
MOD10     534   -
MOD2      550   -   544
MOD3      557   -   564  560
MOD4      571   -   547
MOD5      545   -   536
MP1-10    117   -
MP2-10    115   -
MP2-13    122   -
MPY110    131   -   127
MPY120    134   -   143
MPY130    137   -   141
MPY140    140   -   136
MPY150    145   -   114
MPY160    150   -
NRM10     160   -   207
NRM11     161   -   205
NRM12     162   -
NRM13     204   -
NRM20     202   -   167  165
NRM30     173   -   203
NRM40     201   -
PI/2      632   -
PMUL     1751   -
PMUL1    1750   -  1752
RCSCR     464   -
RCSCR*    462   -
RTOD      614   -
SHF10     155   -
SHF20     206   -   212  157
SHF40     154   -   151
SINFR     507   -
SINFR1    522   -   531
SINFR2    532   -   523
SINFRA    512   -
SQR10     276   -
SQR100    347   -   335
SQR13     301   -
SQR20     305   -   302
SQR30     322   -   320
SQR50     327   -   325
SQR60     336   -   340
SQR70     337   -   350
STSCR     442   -
STSCR*    440   -
STSCR1    450   -   461
SUBON1      4   -     1
SUBONE      2   -
TRC10     641   -
X/Y13     223   -
XFT100    354   -
XFT110    361   -   352
XFT120    351   -   367
XFT130    375   -   372
XFT140    402   -   427  425
XFT150    406   -   403
```

```
XFT160   412   -   413
XFT170   414   -   410
XFT180   421   -   422
XFT190   423   -   415
XLN1+X  1563   -
XTOHRS   662   -
XY^X    1421   -
YTOX50  1733   -  1776
YTOX60  1734   -  1741
YX11    1446   -  1440
YX12    1443   -  1450
YX13    1463   -  1461  1452  1434
YX31    1470   -
YXTEN   1465   -
```

ENTRY TABLE

1/X10	213	-
1/X13	216	-
10TOX	1770	-
AD1-10	11	-
AD2-10	7	-
AD2-13	14	-
ADDONE	0	-
DIV110	245	-
DIV120	257	-
DIV15	251	-
DTOR	601	-
DV1-10	232	-
DV2-10	230	-
DV2-13	235	-
ERR0	303	-
EXP10	1012	-
EXP13	1015	-
EXP400	1041	-
EXP500	1141	-
EXP710	1114	-
EXP720	1120	-
EXSCR	452	-
HMSDV	745	-
HMSMP	747	-
INTFRC	473	-
LD90	625	-
LN10	1505	-
LN560	1723	-
LNAP	1212	-
LNC10	1256	-
LNC10*	1255	-
LNC20	1275	-
LNSUB	771	-
LNSUB-	770	-
MOD10	534	-
MP1-10	117	-
MP2-10	115	-
MP2-13	122	-
MPY150	145	-
NRM10	160	-
NRM11	161	-
NRM12	162	-
NRM13	204	-
PI/2	632	-
PMUL	1751	-
RCSCR	464	-
RCSCR*	462	-
RTOD	614	-
SHF10	155	-
SHF40	154	-
SINFR	507	-
SINFRA	512	-
SQR10	276	-
SQR13	301	-
STSCR	442	-
STSCR*	440	-

SUBONE	2	-
TRC10	641	-
X/Y13	223	-
XFT100	354	-
XLN1+X	1563	-
XTOHRS	662	-
XY^X	1421	-

EXTERNAL REFERENCES

1/X13	1200		
1/X13	1201		
AD2-10	577		
AD2-10	600		
ADDONE	1251	1560	
ADDONE	1252	1561	
CHK#S	1427		
CHK#S	1430		
DIV110	1235		
DIV110	1236		
DIV15	1010	1555	
DIV15	1011	1556	
DV1-10	612		
DV1-10	613		
DV2-13	623	1766	
DV2-13	624	1767	
ERR0	1441		
ERR0	1442		
ERRDE	303		
ERRDE	304		
EXP13	1735		
EXP13	1736		
EXP500	1035		
EXP500	1036		
EXP720	1253		
EXP720	1254		
HMSDV	731	737	
HMSDV	732	740	
HMSMP	712	716	722
HMSMP	713	717	723
LD90	610	615	
LD90	611	616	
LN560	1545		
LN560	1546		
LNAP	1144	1743	
LNAP	1145	1744	
LNC10	1044	1763	1771
LNC10	1045	1764	1772
LNC10*	1667		
LNC10*	1670		
LNC20	1041	1652	
LNC20	1042	1653	
LNSUB	1576		
LNSUB	1577		
LNSUB-	1245		
LNSUB-	1246		
MP1-10	606	1774	
MP1-10	607	1775	
MP2-10	617		
MP2-10	620		
MP2-13	1731		
MP2-13	1732		
MPY150	726		
MPY150	727		
NRM10	274		
NRM10	275		

```
NRM12     344    505
NRM12     345    506
NRM13    1124   1503
NRM13    1125   1504
PI/2      602    621
PI/2      603    622
PMUL     1654   1701
PMUL     1655   1702
RCSCR    1473   1727
RCSCR    1474   1730
SHF10     476    567   1723
SHF10     477    570   1724
SINFR     473
SINFR     474
STSCR    1424
STSCR    1425
SUBONE   1116
SUBONE   1117
TRC10     634
TRC10     635

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

     2                     FILE   CN7B
* ROM ADDRESSES @16000-17777
     4                     ENTRY  GTACOD
     5                     ENTRY  TOGSHF
     6                     ENTRY  TGSHF1
************************************************
* NUT MESSAGE TABLE & MESSAGE-ROUTINE          *
************************************************
    10                     ENTRY  MSG
    11                     ENTRY  MSGA
    12                     ENTRY  MSGE
    13                     ENTRY  MSGX
    14                     ENTRY  MSGAD
    15                     ENTRY  MSGDE
    16                     ENTRY  MSGML
    17                     ENTRY  MSGNE
    18                     ENTRY  MSGNL
    19                     ENTRY  MSGNO
    20                     ENTRY  MSGOF
    21                     ENTRY  MSGPR
    22                     ENTRY  MSGRAM
    23                     ENTRY  MSGROM
    24                     ENTRY  MSGTA
    25                     ENTRY  MSGYES
    26                     ENTRY  MSGWR
*
    28                     FILLTO:@2            PUT SPARE AT BEGINNING
           0         0000 NOP
           1         0000 NOP
           2         0000 NOP
*
* PATCH9 - POST-RELEASE FIX TO:SIGMA+ AND SIGMA- TO GET OLD X
* PRESERVED IN LASTX.
```

```
*
    33                      ENTRY  PATCH9
    34     3 PATCH9  260 C=N                    GET NEW X
    35     4            1 GOLONG XCLX1          GO UPDATE X
    35     5            2
*
* PATCH6 - POST-RELEASE FIX TO CHKADR TO PREVENT WRAPAROUND WHEN
* PHYSICAL REGISTER ADDRESS CARRIES INTO THE 10TH OR 11TH BITS.
* WITH THIS PATCH, CHKADR WILL ACCEPT PHYSICAL REGISTER ADDRESSES
* UP THRU 511 ONLY (9 BITS ONLY).
*
    42                      ENTRY  PATCH6
    43     6 PATCH6 1110 S9=    1              REMEMBER ERROR EXIT TO ERRNE
    44     7           26 A=0    XS
    45    10          566 A=A+1  XS
    46    11         1426 ? A<C  XS             511<REG ADDRESS?
    47    12            1 GOLC   ERRNE          YES - NO SUCH REG
    47    13            3
    48    14         1160 DADD=C                ADDRESS THE REGISTER
    49    15            1 GOLONG P6RTN
    49    16            2
*
* MESSAGE TABLE
*
    53    17          401 CON    @401           A
    54    20           14 CON    @14            L
    55    21           20 CON    @20            P
    56    22           10 CON    @10            H
    57    23            1 CON    @01            A
    58    24           40 CON    @40
    59    25            4 CON    @04            D
    60    26            1 CON    @01            A
    61    27           24 CON    @24            T
    62    30 MSGAD      1 CON    @01            A
    63    31          404 CON    @404           D
    64    32            1 CON    @01            A
    65    33           24 CON    @24            T
    66    34            1 CON    @01            A
    67    35           40 CON    @40
    68    36            5 CON    @05            E
    69    37           22 CON    @22            R
    70    40           22 CON    @22            R
    71    41           17 CON    @17            O
    72    42 MSGDE     22 CON    @22            R
    73    43          415 CON    @415           M
    74    44            5 CON    @05            E
    75    45           15 CON    @15            M
    76    46           17 CON    @17            O
    77    47           22 CON    @22            R
    78    50           31 CON    @31            Y
    79    51           40 CON    @40
    80    52           14 CON    @14            L
    81    53           17 CON    @17            O
    82    54           23 CON    @23            S
    83    55 MSGML     24 CON    @24            T
    84    56          416 CON    @416           N
    85    57           17 CON    @17            O
    86    60           16 CON    @16            N
    87    61            5 CON    @05            E
    88    62           30 CON    @30            X
```

```
  89   63           11 CON    @11           I
  90   64           23 CON    @23           S
  91   65           24 CON    @24           T
  92   66            5 CON    @05           E
  93   67           16 CON    @16           N
  94   70 MSGNE     24 CON    @24           T
  95   71          416 CON    @416          N
  96   72           25 CON    @25           U
  97   73           14 CON    @14           L
  98   74 MSGNL     14 CON    @14           L
  99   75          420 CON    @420          P
 100   76           22 CON    @22           R
 101   77           11 CON    @11           I
 102  100           26 CON    @26           V
 103  101            1 CON    @01           A
 104  102           24 CON    @24           T
 105  103 MSGPR      5 CON    @05           E
 106  104          417 CON    @417          O
 107  105           25 CON    @25           U
 108  106           24 CON    @24           T
 109  107           40 CON    @40
 110  110           17 CON    @17           O
 111  111            6 CON    @06           F
 112  112           40 CON    @40
 113  113           22 CON    @22           R
 114  114            1 CON    @01           A
 115  115           16 CON    @16           N
 116  116            7 CON    @07           G
 117  117 MSGOF      5 CON    @05           E
 118  120          420 CON    @420          P
 119  121            1 CON    @01           A
 120  122            3 CON    @03           C
 121  123           13 CON    @13           K
 122  124           11 CON    @11           I
 123  125           16 CON    @16           N
 124  126 MSGWR      7 CON    @07           G
 125  127          424 CON    @424          T
 126  130           22 CON    @22           R
 127  131           31 CON    @31           Y
 128  132           40 CON    @40
 129  133            1 CON    @01           A
 130  134            7 CON    @07           G
 131  135            1 CON    @01           A
 132  136           11 CON    @11           I
 133  137 MSGTA     16 CON    @16           N
 134  140          431 CON    @431          Y
 135  141            5 CON    @5            E
 136  142 MSGYES    23 CON    @23           S
 137  143          416 CON    @416          N
 138  144 MSGNO     17 CON    @17           O
 139  145          422 CON    @422          R
 140  146            1 CON    @01           A
 141  147 MSGRAM    15 CON    @15           M
 142  150          422 CON    @422          R
 143  151           17 CON    @17           O
 144  152 MSGROM    15 CON    @15           M
*
* MSG - SEND A MESSAGE TO LCD DISPLAY
* CALLING MSG WITH S8 SET, MSGFLAG
* WILL BE SET SO THE DISPLAY WON'T BE REFRESHED BY DISPLAY REFRESH
```

```
* LOGIC. OTHERWISE, THE DISPLAY WILL BE REFRESHED.
* CALLING SEQUENCE:
*     GOSUB  MSGA
*     XDEF   <MSGXXX>
* MSG - SET S8 AUTOMATICALLY, THEN DROP TO MSGA
* MSGX -   PLUG-IN ROM CAN CALL MGSX TO DISPLAY MESSAGE IN ROM.
*         IF S8= 1,  GOSUB PRT6, BLINK LCD, SET MESSAGE FLAG
*         IF S8= 0,  DON'T PRINT OR SET MESSAGE FLAG
*     IN: C[6:3]= ADDRESS OF FIRST CHARACTER OF MESSAGE
*    OUT: IF S8= 1: SST 0 UP, MSG FLAG SET, CHIP 0 ENABLED, C= REG 14
*         IF S8= 0: CHIP 0 ENABLED
*   USES: IF S8= 1: A,C,G,N, ST[7:0], ACTIVE PT, 2 ADDITIONAL SUB LEVELS
*         IF S8= 0: A,C, ACTIVE PT,  1 ADDITIONAL SUB LEVEL
*  ASSUME:  HEXMODE
*
* MESSAGE TABLE FORMAT:
* EVERY CHAR IN THE MESSAGE COST A 10 BITS WORD TO STORE IT.
* ENTRY OF EACH MESSAGE POINTING LAST CHAR OF THE MESSAGE. THE
* MSG ROUTINE WORKS BACKWARD, IT PICK UP LAST CHAR FIRST AND SHIFT
* IT FROM RIGHT END TO THE DISPLAY, THEN PICK UP NEXT LAST ONE UNTIL
* DONE WITH THE 1ST CHAR WHICH HAS BIT 8 SET.
* CHAR IN THE MESSAGE TABLE IS IN LCD FORM.
*
  172  153 MSG      410 S8=     1
  173  154 MSGA     660 C=STK                 !!! DOESN'T WORK IN DEC MODE !!!!!!
  174  155         1140 SETHEX
  175  156         1460 CXISA
  176  157         1072 C=C+1   M
  177  160          560 STK=C                POINT TO P+2
  178  161 MSGE     674 RCR     11
  179  162          534 PT=     6            POINT TO MSG ENTRY
  180  163          120 LC      1            IN QUAR 7
  181  164         1420 LC      12
  182  165 MSGX     416 A=C     W
  183  166            1 GOSUB   CLLCDE
  183  167            0
  184  170          256 AC EX   W
  185  171 MSG100  1460 CXISA                LOAD A CHAR
  186  172         1172 C=C-1   M            POINT TO NEXT CHAR
  187  173          406 A=C     X
  188  174          126 C=0     XS
  189  175         1650 SRSABC
  190  176         1526 ? A#0   XS           IS THIS THE LAST CHAR ?
  191  177         1723 GONC    MSG100 ( 171) NO
  192
  193                 ENTRY   MSG105         CALLED FROM TIMER ROM
  194  200 MSG105     1 GOSUB   ENCP00       ENABLE CHIP 0
  194  201            0
  195  202          414 ?S8=1
  196  203         1640 RTN NC
  197  204         1615 CON     @1615
  198  205          674 CON     @674          GOSUB PRT6
* TO CONSERVE SUBROUTINE LEVELS, THE PRINTER POPS ITS RETURN OFF
* THE STACK AND DOES A GOLONG BACK TO MSG110
  201                 ENTRY   MSG110         FOR THE PRINTER
  202       MSG110
  203  206            1 GOLONG MSGDLY        DELAY FOR VIEWING MSG
  203  207            2
  204                                        AND SET MSGFLG
* STATUS SET 0 IS UP FROM MSGDLY
```

```
207                      ENTRY  SIGMA
208                      ENTRY  STATCK
209                      ENTRY  CHSA
210                      ENTRY  BRT140
211                      ENTRY  BRT200
212                      ENTRY  CHSA1
213                      ENTRY  BRT160
214                      ENTRY  BRT290
215                      ENTRY  TRCS10
216                      ENTRY  TOREC
217                      ENTRY  ADD1
218                      ENTRY  ADD2
219                      ENTRY  TRG240
220  210 SIGMA     1 GOSUB  STATCK
220  211            0
221  212          270 C=REGN 2
222  213 SIGMA1   360 CN EX
223  214          260 C=N
224  215          416 A=C    W
225  216          114 ?S4=1
226  217           43 GONC   SIGMA2 ( 223)
227  220            1 GOSUB  GETX
227  221            0
228  222           33 GOTO   SIGMA3 ( 225)
229  223 SIGMA2     1 GOSUB  GETY
229  224            0
230  225 SIGMA3     1 GOSUB  CHSA
230  226            0
231  227            1 GOSUB  ADD2
231  230            0
232  231          260 C=N
233  232          416 A=C
234  233            1 GSBLGX MP2-10
234  234            0
235  235            1 GOSUB  CHSA
235  236            0
236  237          114 ?S4=1
237  240           43 GONC   SIGMA4 ( 244)
238  241            1 GOSUB  GETXSQ
238  242            0
239  243           33 GOTO   SIGMA5 ( 246)
240  244 SIGMA4     1 GOSUB  GETYSQ
240  245            0
241  246 SIGMA5     1 GOSUB  ADD1
241  247            0
242  250          106 C=0    X
243  251         1160 DADD=C
244  252          370 C=REGN 3
245  253          114 ?S4=1
246  254           37 GOC    SIGMA6 ( 257)
247  255          110 S4=    1
248  256         1353 GOTO   SIGMA1 ( 213)
249  257 SIGMA6   416 A=C    W
250  260          270 C=REGN 2
251  261            1 GSBLGX MP2-10
251  262            0
252  263            1 GOSUB  CHSA
252  264            0
253  265            1 GOSUB  GETXY
```

```
   253  266            0
   254  267            1 GOSUB  ADD1
   254  270            0
   255  271           16 A=0    W
   256  272          542 A=A+1  PT
   257  273            1 GSUBNC CHSA
   257  274            0
   258  275            1 GOSUB  GETN
   258  276            0
   259  277            1 GOSUB  ADD2
   259  300            0
   260  301          360 NC EX
   261  302          116 C=0    W
   262  303         1160 DADD=C
   263  304          370 C=REGN 3              GET OLD X
   264  305          450 REGN=C 4              UPDATE LASTX
   265  306            1 GOLONG PATCH9
   265  307            2
*********************************************************
*THIS SUBROUTINE CHECKS ALL STAT REGISTERS FOR
*ALPHA DATA. IT STARTS AT THE HIGHEST ADDRESS
*AND WORKS DOWN THROUGH THE OTHER FIVE REGISTERS.
*********************************************************
   271  310 STATCK     1 GOSUB  SUMCHK           CX=ADR N B=N
   271  311            0
   272  312          534 PT=    6
   273  313          356 BC EX
   274  314 DOCHK      1 GOSUB  CHK#S            IS THIS NUMBER?
   274  315            0
   275  316         1140 SETHEX                  YES
   276  317          356 BC EX                  GET ADR
   277  320         1146 C=C-1  X
   278  321         1160 DADD=C                  ADR REGISTER
   279  322          356 BC EX                  SAVE ADR
   280  323           70 C=DATA                 GET NXT REG
   281  324         1724 DEC PT                  COUNT DOWN
   282  325         1624 ? PT=  0
   283  326         1663 GONC   DOCHK  ( 314) NO
   284  327          116 C=0
   285  330         1160 DADD=C
   286  331          423 GOTO   GET1   ( 373)
*********************************************************
   288  332 CHSA     214 ?S5=1
   289  333         1640 RTN NC
   290  334 CHSA1    276 AC EX  S
   291  335         1276 C=-C-1 S
   292  336          276 AC EX  S
   293  337         1740 RTN
   294  340 ADD1       1 GSBLGX AD1-10
   294  341            0
   295  342           33 GOTO   STOVF  ( 345)
   296  343 ADD2       1 GSBLGX AD2-10
   296  344            0
   297  345 STOVF      1 GSBLGX OVFL10
   297  346            0
   298  347         1360 DATA=C
   299  350         1534 PT=    12
   300  351         1740 RTN
   301                  ENTRY  GETN
   302                  ENTRY  GETX
```

```
303                      ENTRY  GETXSQ
304                      ENTRY  GETY
305                      ENTRY  GETYSQ
306                      ENTRY  GETXY
307                      ENTRY  XBAR
308  352 GETN    1724 DEC PT
309  353 GETXY   1724 DEC PT
310  354 GETYSQ  1724 DEC PT
311  355 GETY    1724 DEC PT
312  356 GETXSQ  1724 DEC PT
313  357 GETX    1140 SETHEX
314  360          116 C=0
315  361         1160 DADD=C
316  362         1520 C=REGN 13
317  363          674 RCR    11
318  364 GETADD  1046 C=C+1  X
319  365         1734 INC PT
320  366         1324 ? PT=  13
321  367         1753 GONC   GETADD ( 364)
322  370         1146 C=C-1  X
323  371         1160 DADD=C
324  372           70 C=DATA
325  373 GET1    1240 SETDEC
326  374         1534 PT=    12
327  375         1740 RTN
328  376 XBAR       1 GOSUB  STATCK
328  377            0
329  400            1 GOSUB  GETY
329  401            0
330  402            1 GOSUB  XBAR*
330  403            0
331  404          360 CN EX
332  405            1 GOSUB  GETX
332  406            0
333  407 XBAR*    416 A=C    W
334  410            1 GOSUB  GETN
334  411            0
335  412          356 BC EX  W
336  413          116 C=0    W
337  414         1160 DADD=C
338  415          356 BC EX  W
339  416            1 GOLNGX DV2-10
339  417            2
340                   ENTRY  XBAR*
341                   ENTRY  SD
342  420 SD       204 S5=    0
343  421            1 GOSUB  STATCK
343  422            0
344  423            1 GOSUB  GETYSQ
344  424            0
345  425 STDEV1   416 A=C    W
346  426            1 GOSUB  GETN
346  427            0
347  430            1 GSBLGX MP2-10
347  431            0
348  432            1 GSBLGX STSCR*
348  433            0
349  434          214 ?S5=1
350  435           47 GOC    STDEV4 ( 441)
351  436            1 GOSUB  GETY
```

```
351  437            0
352  440           33 GOTO   STDEV5 ( 443)
353  441 STDEV4     1 GOSUB  GETX
353  442            0
354  443 STDEV5   416 A=C
355  444            1 GSBLGX MP2-10
355  445            0
356  446         1276 C=-C-1 S
357  447          276 AC EX  S
358  450            1 GSBLGX RCSCR*
358  451            0
359  452            1 GSBLGX AD2-13
359  453            0
360  454            1 GOSUB  GETN
360  455            0
361  456            1 GSBLGX DV1-10
361  457            0
362  460            1 GSBLGX STSCR*
362  461            0
363  462            1 GOSUB  GETN
363  463            0
364  464           56 B=0    W
365  465          372 BC EX  M
366  466          416 A=C    W
367  467            1 GSBLGX SUBONE
367  470            0
368  471            1 GSBLGX RCSCR*
368  472            0
369  473            1 GSBLGX X/Y13
369  474            0
370  475         1376 ? C#0  S
371  476            1 GOLC   ERROF
371  477            3
372  500            1 GSBLGX SQR13
372  501            0
373  502          214 ?S5=1
374  503         1540 RTN C
375  504          360 CN EX
376  505          210 S5=    1
377  506            1 GOSUB  GETRSQ
377  507            0
378  510         1153 GOTO   STDEV1 ( 425)
379                  ENTRY  BRT100
380                  ENTRY  TOPOL
381                  ENTRY  TRC30
382                  ENTRY  BRTS10
383                  ENTRY  TRG430
384                  ENTRY  TRG100
385  511 TOPOL    260 C=N
386  512         1372 ? C#0  M
387  513          463 GONC   TOPOL2 ( 561)
388  514         1376 ? C#0  S
389  515           43 GONC   TOPOL1 ( 521)
390  516         1210 S7=    1
391  517         1610 S0=    1
392  520          136 C=0    S
393  521 TOPOL1   360 NC EX
394  522          416 A=C    W
395  523            1 GOSUB  MP2-10        CALC X^2
395  524            0
```

```
396  525            1 GOSUB  STSCR
396  526            0
397  527          270 C=REGN 2
398  530          416 A=C    W
399  531            1 GOSUB  MP2-10          CALC Y^2
399  532            0
400  533            1 GOSUB  RCSCR
400  534            0
401  535            1 GOSUB  AD2-13          CALC X^2+Y^2
401  536            0
402  537            1 GOSUB  SQR13           CALC SQR(X^2+Y^2)
402  540            0
403  541          360 NC EX
404  542          416 A=C    W
405  543          270 C=REGN 2
406  544          256 AC EX  W
407  545            1 GOSUB  DV2-10          CALC Y/ABS(X)
407  546            0
408  547         1372 ? C#0  M
409  550          337 GOC    BRT110 ( 603)
410  551           16 A=0    W
411  552          313 GOTO   BRT110 ( 603)
412  553 BRTS10  1614 ?S0=1
413  554           37 GOC    BRTS20 ( 557)
414  555         1610 S0=    1
415  556         1740 RTN
416  557 BRTS20  1604 S0=    0
417  560         1740 RTN
418  561 TOPOL2   256 AC EX  W
419  562         1210 S7=    1
420  563         1376 ? C#0  S
421  564           23 GONC   TOPOL4 ( 566)
422  565          510 S6=    1
423  566 TOPOL4   136 C=0    S
424  567          360 NC EX
425  570          260 C=N
426  571         1372 ? C#0  M
427  572         1640 RTN NC
428  573 TOPOL3    16 A=0    W
429  574          753 GOTO   BRT301 ( 671)
430  575 BRT120     1 GOSUB  BRTS10
430  576            0
431  577         1743 GOTO   TOPOL3 ( 573)
432  600 BRT100    56 B=0    W
433  601          416 A=C    W
434  602          172 AB EX  M
435  603 BRT110  1376 ? C#0  S
436  604          113 GONC   BRT130 ( 615)
437  605          510 S6=    1
438  606         1014 ?S2=1
439  607           63 GONC   BRT130 ( 615)
440  610         1614 ?S0=1
441  611           43 GONC   BRT130 ( 615)
442  612         1604 S0=    0
443  613         1210 S7=    1
444  614          504 S6=    0
445  615 BRT130  1534 PT=    12
446  616          246 AC EX  X
447  617          406 A=C    X
448  620          746 C=C+C  X
```

```
449  621           1 GOLC   BRT140
449  622           3
450  623 BRT150 1506 ? A#0  X
451  624         217 GOC    BRT170 ( 645)
452  625         316 C=B    W
453  626        1316 ? B#0  W
454  627        1443 GONC   TOPOL3 ( 573)
455  630        1534 PT=    12
456  631        1142 C=C-1  PT
457  632        1356 ? C#0  W
458  633         127 GOC    BRT170 ( 645)
459  634        1414 ?S1=1
460  635        1407 GOC    BRT120 ( 575)
461  636           1 GSBLGX TRC10
461  637           0
462  640          16 A=0    W
463  641         646 A=A-1  X
464  642         256 AC EX  W
465  643           1 GOLONG BRT200
465  644           2
466  645 BRT170 1414 ?S1=1
467  646           1 GOLCX  ERR0
467  647           3
468  650 BRT160    1 GSBLGX 1/X13
468  651           0
469  652           1 GOSUB  BRTS10
469  653           0
470  654 BRT290  156 AB EX  W
471  655         316 C=B    W
472  656        1534 PT=    12
473  657         132 C=0    M
474  660         136 C=0    S
475  661 BRT300 1046 C=C+1  X
476  662        1346 ? C#0  X
477  663         103 GONC   BRT310 ( 673)
478  664        1076 C=C+1  S
479  665        1724 DEC PT
480  666         524 ? PT=  6
481  667        1723 GONC   BRT300 ( 661)
482  670         356 BC EX  W
483  671 BRT301    1 GOLONG BRT200
483  672           2
484  673 BRT310  730 MC EX
485  674         116 C=0    W
486  675        1076 C=C+1  S
487  676        1716 C SR   W
488  677         153 GOTO   BRT340 ( 714)
489  700 BRT320  256 AC EX  W
490  701         730 MC EX
491  702        1042 C=C+1  PT
492  703         436 A=C    S
493  704         730 MC EX
494  705 BRT330 1656 B SR   W
495  706        1656 B SR   W
496  707         676 A=A-1  S
497  710        1753 GONC   BRT330 ( 705)
498  711          36 A=0    S
499  712         456 A=A+B  W
500  713         256 AC EX  W
501  714 BRT340  216 B=A    W
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502  715          716 A=A-C   W
503  716         1623 GONC    BRT320 ( 700)
504  717          730 MC EX
505  720         1076 C=C+1   S
506  721          730 MC EX
507  722          156 AB EX   W
508  723         1756 A SL    W
509  724         1724 DEC PT
510  725          524 ? PT=   6
511  726         1663 GONC    BRT340 ( 714)
512  727          356 BC EX   W
513  730            1 GSBLGX DIV120
513  731            0
514  732          156 AB EX   W
515  733          730 MC EX
516  734          106 C=0     X
517  735         1234 PT=     7
518  736 BRT350   356 BC EX   W
519  737            1 GOSUB   TRC30
519  740            0
520  741          356 BC EX   W
521  742           23 GOTO    BRT370 ( 744)
522  743 BRT360   456 A=A+B   W
523  744 BRT370  1142 C=C-1   PT
524  745         1763 GONC    BRT360 ( 743)
525  746         1616 A SR    W
526  747          102 C=0     PT
527  750         1372 ? C#0   M
528  751          433 GONC    BRT190 (1014)
529  752         1734 INC PT
530  753         1633 GOTO    BRT350 ( 736)
531  754 BRT140  1414 ?S1=1
532  755          343 GONC    BRT141 (1011)
533  756            1 GSBLGX STSCR
533  757            0
534  760            1 GSBLGX ADDONE
534  761            0
535  762            1 GSBLGX .EXSCR
535  763            0
536  764            1 GSBLGX SUBONE
536  765            0
537  766            1 GSBLGX .RCSCR
537  767            0
538  770            1 GSBLGX MP2-13
538  771            0
539  772           36 A=0     S
540  773            1 GSBLGX SQR13
540  774            0
541  775          260 C=N
542  776          136 C=0     S
543  777          730 MC EX
544 1000          630 C=M
545 1001          106 C=0     X
546 1002            1 GSBLGX X/Y13
546 1003            0
547 1004          246 AC EX   X
548 1005          406 A=C     X
549 1006          746 C=C+C   X
550 1007            1 GOLNC   BRT160
550 1010            2
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551 1011 BRT141     1 GOLONG BRT290
551 1012             2
552 1013 BRT180  1734 INC PT
553 1014 BRT190  1146 C=C-1   X
554 1015         1524 ? PT=   12
555 1016         1753 GONC    BRT180 (1013)
556 1017 BRT200   136 C=0     S
557 1020            1 GSBLGX SHF10
557 1021            0
558 1022         1614 ?S0=1
559 1023           73 GONC    BRT220 (1032)
560 1024         1276 C=-C-1  S
561 1025          276 AC EX   S
562 1026            1 GSBLGX PI/2
562 1027            0
563 1030            1 GSBLGX AD2-13
563 1031            0
564 1032 BRT220  1214 ?S7=1
565 1033           53 GONC    BRT240 (1040)
566 1034            1 GSBLGX PI/2
566 1035            0
567 1036            1 GSBLGX AD2-13
567 1037            0
568 1040 BRT240   114 ?S4=1
569 1041          207 GOC     BRT250 (1061)
570 1042            1 GSBLGX PI/2
570 1043            0
571 1044          546 A=A+1   X
572 1045          546 A=A+1   X
573 1046            0 NOP
574 1047            1 GSBLGX DV2-13
574 1050            0
575 1051          214 ?S5=1
576 1052           77 GOC     BRT250 (1061)
577 1053          116 C=0     W
578 1054         1534 PT=     12
579 1055         1146 C=C-1   X
580 1056         1120 LC      9
581 1057            1 GSBLGX MP1-10
581 1060            0
582 1061 BRT250   514 ?S6=1
583 1062           23 GONC    BRT260 (1064)
584 1063         1276 C=-C-1  S
585 1064 BRT260  1014 ?S2=1
586 1065         1540 RTN C
587 1066          360 NC EX
588 1067         1740 RTN
589 1070 TRC30    116 C=0     W
590 1071         1156 C=C-1   W
591 1072          136 C=0     S
592 1073         1524 ? PT=   12
593 1074          157 GOC     TRC90  (1111)
594 1075          624 ? PT=   11
595 1076          357 GOC     TRC50  (1133)
596 1077          324 ? PT=   10
597 1100          447 GOC     TRC60  (1144)
598 1101         1124 ? PT=   9
599 1102          517 GOC     TRC70  (1153)
600 1103          424 ? PT=   8
601 1104          547 GOC     TRC80  (1160)
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```
602 1105          1634 PT=     0
603 1106 TRC35     720 LC      7
604 1107 TRC40    1234 PT=     7
605 1110          1740 RTN
606 1111 TRC90     334 PT=     10
607 1112           620 LC      6
608 1113           620 LC      6
609 1114          1020 LC      8
610 1115           620 LC      6
611 1116           520 LC      5
612 1117           220 LC      2
613 1120           420 LC      4
614 1121          1120 LC      9
615 1122           120 LC      1
616 1123           120 LC      1
617 1124           620 LC      6
618 1125 TRC91    1534 PT=     12
619 1126          1740 RTN
620 1127 TRCS10    620 LC      6
621 1130          1624 ? PT=   0
622 1131          1763 GONC    TRCS10 (1127)
623 1132          1543 GOTO    TRC35  (1106)
624 1133 TRC50     434 PT=     8
625 1134             1 GOSUB   TRCS10
625 1135             0
626 1136          1634 PT=     0
627 1137           520 LC      5
628 1140           134 PT=     4
629 1141          1020 LC      8
630 1142           634 PT=     11
631 1143          1740 RTN
632 1144 TRC60     534 PT=     6
633 1145             1 GOSUB   TRCS10
633 1146             0
634 1147          1634 PT=     0
635 1150          1120 LC      9
636 1151           334 PT=     10
637 1152          1740 RTN
638 1153 TRC70     134 PT=     4
639 1154             1 GOSUB   TRCS10
639 1155             0
640 1156          1134 PT=     9
641 1157          1740 RTN
642 1160 TRC80    1034 PT=     2
643 1161             1 GOSUB   TRCS10
643 1162             0
644 1163           434 PT=     8
645 1164          1740 RTN
646 1165 TOREC    1010 S2=     1
647 1166          1410 S1=     1
648 1167           256 AC EX   W
649 1170 TRG100     16 A=0     W
650 1171            56 B=0     W
651 1172           272 AC EX   M
652 1173          1376 ? C#0   S
653 1174           103 GONC    TRG130 (1204)
654 1175          1210 S7=     1
655 1176          1414 ?S1=1
656 1177            33 GONC    TRG110 (1202)
657 1200          1614 ?S0=1
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658 1201           23 GONC   TRG120 (1203)
659 1202 TRG110   510 S6=    1
660 1203 TRG120   136 C=0    S
661 1204 TRG130   356 BC EX  W
662 1205          114 ?S4=1
663 1206            1 GOLC   TRG240
663 1207            3
664 1210          214 ?S5=1
665 1211           53 GONC   TRG135 (1216)
666 1212          256 AC EX  W
667 1213          416 A=C    W
668 1214         1716 C SR   W
669 1215          716 A=A-C  W
670 1216 TRG135   116 C=0    W
671 1217         1534 PT=    12
672 1220          420 LC     4
673 1221          520 LC     5
674 1222          356 BC EX  W
675 1223         1146 C=C-1  X
676 1224         1366 ? C#0  XS
677 1225           57 GOC    TRG140 (1232)
678 1226         1146 C=C-1  X
679 1227           33 GONC   TRG140 (1232)
680 1230         1046 C=C+1  X
681 1231         1616 A SR   W
682 1232 TRG140   356 BC EX  W
683 1233 TRG150   730 MC EX
684 1234          630 C=M
685 1235          756 C=C+C  W
686 1236          756 C=C+C  W
687 1237          756 C=C+C  W
688 1240         1716 C SR   W
689 1241          356 BC EX  W
690 1242         1366 ? C#0  XS
691 1243          237 GOC    TRG180 (1266)
692 1244 TRG155   616 A=A-B  W
693 1245         1773 GONC   TRG155 (1244)
694 1246          456 A=A+B  W
695 1247         1756 A SL   W
696 1250         1146 C=C-1  X
697 1251         1733 GONC   TRG155 (1244)
698 1252          116 C=0    W
699 1253          356 BC EX  W
700 1254          630 C=M
701 1255          756 C=C+C  W
702 1256          114 ?S4=1
703 1257           33 GONC   TRG160 (1262)
704 1260         1616 A SR   W
705 1261         1716 C SR   W
706 1262 TRG160   356 BC EX  W
707 1263 TRG170   616 A=A-B  W
708 1264          133 GONC   TRG190 (1277)
709 1265          456 A=A+B  W
710 1266 TRG180   356 BC EX  W
711 1267          630 C=M
712 1270          356 BC EX  W
713 1271          114 ?S4=1
714 1272          413 GONC   TRG270 (1333)
715 1273         1346 ? C#0  X
716 1274          367 GOC    TRG260 (1332)
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717 1275          1756 A SL    W
718 1276           353 GOTO    TRG270 (1333)
719 1277 TRG190  1614 ?S0=1
720 1300           107 GOC     TRG220 (1310)
721 1301          1610 S0=     1
722 1302 TRG200   514 ?S6=1
723 1303            37 GOC     TRG210 (1306)
724 1304           510 S6=     1
725 1305          1563 GOTO    TRG170 (1263)
726 1306 TRG210   504 S6=     0
727 1307          1543 GOTO    TRG170 (1263)
728 1310 TRG220  1604 S0=     0
729 1311          1414 ?S1=1
730 1312          1703 GONC    TRG200 (1302)
731 1313          1214 ?S7=1
732 1314            33 GONC    TRG230 (1317)
733 1315          1204 S7=     0
734 1316          1453 GOTO    TRG170 (1263)
735 1317 TRG230  1210 S7=     1
736 1320          1433 GOTO    TRG170 (1263)
737 1321 TRG240     1 GSBLGX TRC10
737 1322            0
738 1323          1103 GOTO    TRG150 (1233)
739 1324 TRG250   156 AB EX   W
740 1325           616 A=A-B   W
741 1326             0 NOP
742 1327             1 GOSUB   BRTS10
742 1330             0
743 1331            73 GOTO    TRG280 (1340)
744 1332 TRG260  1046 C=C+1   X
745 1333 TRG270  1366 ? C#0   XS
746 1334            47 GOC     TRG280 (1340)
747 1335           616 A=A-B   W
748 1336          1663 GONC    TRG250 (1324)
749 1337           456 A=A+B   W
750 1340 TRG280  1146 C=C-1   X
751 1341             0 NOP
752 1342             1 GSBLGX SHF10
752 1343             0
753 1344           114 ?S4=1
754 1345           137 GOC     TRG300 (1360)
755 1346           630 C=M
756 1347           756 C=C+C   W
757 1350          1146 C=C-1   X
758 1351             0 NOP
759 1352             1 GSBLGX DV1-10
759 1353             0
760 1354             1 GSBLGX PI/2
760 1355             0
761 1356             1 GSBLGX MP2-13
761 1357             0
762 1360 TRG300   730 MC EX
763 1361           256 AC EX   W
764 1362           416 A=C     W
765 1363          1046 C=C+1   X
766 1364            73 GONC    TRG310 (1373)
767 1365           156 AB EX   W
768 1366          1756 A SL    W
769 1367            73 GOTO    TRG330 (1376)
770 1370 TRG305  1724 DEC PT
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771 1371          524 ? PT=  6
772 1372          667 GOC    TRG315 (1460)
773 1373 TRG310  1046 C=C+1  X
774 1374         1743 GONC   TRG305 (1370)
775 1375          156 AB EX  W
776 1376 TRG330   116 C=0    W
777 1377 TRG340   356 BC EX  W
778 1400            1 GOSUB  TRC30
778 1401            0
779 1402          356 BC EX  W
780 1403           23 GOTO   TRG800 (1405)
781 1404 TRG810  1076 C=C+1  S
782 1405 TRG800   616 A=A-B  W
783 1406         1763 GONC   TRG810 (1404)
784 1407          456 A=A+B  W
785 1410         1724 DEC PT
786 1411         1716 C SR   W
787 1412         1756 A SL   W
788 1413          524 ? PT=  6
789 1414         1633 GONC   TRG340 (1377)
790 1415          730 MC EX
791 1416         1616 A SR   W
792 1417         1616 A SR   W
793 1420          116 C=0    W
794 1421         1534 PT=    12
795 1422          120 LC     1
796 1423          730 MC EX
797 1424         1634 PT=    0
798 1425          620 LC     6
799 1426          620 LC     6
800 1427          133 GOTO   TRG370 (1442)
801 1430 TRG350  1612 A SR   WPT
802 1431         1612 A SR   WPT
803 1432 TRG360   676 A=A-1  S
804 1433         1753 GONC   TRG350 (1430)
805 1434           36 A=0    S
806 1435          730 MC EX
807 1436          256 AC EX  W
808 1437         1116 C=A-C  W
809 1440          456 A=A+B  W
810 1441          730 MC EX
811 1442 TRG370   216 B=A    W
812 1443          436 A=C    S
813 1444         1142 C=C-1  PT
814 1445         1653 GONC   TRG360 (1432)
815 1446          256 AC EX  W
816 1447         1772 A SL   M
817 1450          256 AC EX  W
818 1451         1372 ? C#0  M
819 1452          413 GONC   TRG400 (1513)
820 1453         1176 C=C-1  S
821 1454         1146 C=C-1  X
822 1455           36 A=0    S
823 1456         1616 A SR   W
824 1457         1633 GOTO   TRG370 (1442)
825 1460 TRG315   630 C=M
826 1461         1014 ?S2=1
827 1462          517 GOC    TRG430 (1533)
828 1463         1614 ?S0=1
829 1464          473 GONC   TRG430 (1533)
```

```
830 1465           1 GSBLGX 1/X13
830 1466           0
831 1467         443 GOTO   TRG430 (1533)
832 1470 TOREC1  260 C=N
833 1471         730 MC EX
834 1472         630 C=M
835 1473         106 C=0    X
836 1474           1 GSBLGX X/Y13
836 1475           0
837 1476         360 MC EX
838 1477           1 GSBLGX RCSCR
838 1500           0
839 1501           1 GSBLGX MP2-13
839 1502           0
840 1503        1614 ?S0=1
841 1504          23 GONC   TOREC2 (1506)
842 1505         360 MC EX
843 1506 TOREC2 1214 ?S7=1
844 1507          23 GONC   TOREC3 (1511)
845 1510        1276 C=-C-1 S
846 1511 TOREC3  360 MC EX
847 1512         413 GOTO   TRG500 (1553)
848 1513 TRG400  136 C=0    S
849 1514         730 MC EX
850 1515         256 AC EX  W
851 1516         630 C=M
852 1517         656 A=A-1  W
853 1520        1014 ?S2=1
854 1521          37 GOC    TRG415 (1524)
855 1522        1614 ?S0=1
856 1523          37 GOC    TRG420 (1526)
857 1524 TRG415 1206 C=-C   X
858 1525         156 AB EX  W
859 1526 TRG420 1332 ? B#0  M
860 1527         303 GONC   TRG440 (1557)
861 1530         730 MC EX
862 1531           1 GSBLGX DIV15
862 1532           0
863 1533 TRG430 1414 ?S1=1
864 1534         173 GONC   TRG500 (1553)
865 1535           1 GSBLGX STSCR
865 1536           0
866 1537           1 GSBLGX RCSCR
866 1540           0
867 1541           1 GSBLGX MP2-13
867 1542           0
868 1543           1 GSBLGX ADDONE
868 1544           0
869 1545           1 GSBLGX SQR13
869 1546           0
870 1547        1014 ?S2=1
871 1550        1207 GOC    TOREC1 (1470)
872 1551           1 GSBLGX 1/X13
872 1552           0
873 1553 TRG500  514 ?S6=1
874 1554        1640 RTN NC
875 1555        1276 C=-C-1 S
876 1556        1740 RTN
877 1557 TRG440  116 C=0    W
878 1560        1534 PT=    12
```

```
   879 1561          1152 C=C-1   WPT
   880 1562           126 C=0     XS
   881 1563           416 A=C     W
   882 1564           216 B=A     W
   883 1565          1414 ?S1=1
   884 1566          1640 RTN NC
   885 1567          1443 GOTO    TRG430 (1533)
   886 1570             0 NOP                    PRESERVE ENTRY POINT ADDRESSES
   887                    ENTRY   TODEC
   888                    ENTRY   TOOCT
*********************************************
*   IF S4=1, THEN DOING TO DECIMAL          *
*   IF S4=0, THEN DOING TO OCTAL            *
*********************************************
   893 1571 TOOCT       1 GSBLGX INTFRC
   893 1572             0
   894 1573          1372 ? C#0   M
   895 1574             1 GOLCX   ERR0
   895 1575             3
   896 1576           260 C=N
   897 1577           114 ?S4=1
   898 1600           637 GOC     TODEC  (1663)
   899 1601           416 A=C     W
   900 1602            36 A=0     S
   901 1603           116 C=0     W
   902 1604          1534 PT=     12
   903 1605          1146 C=C-1   X
   904 1606           320 LC      3
   905 1607             1 GSBLGX AD2-10
   905 1610             0
   906 1611           116 C=0     W
   907 1612           120 LC      1
   908 1613            20 LC      0
   909 1614           720 LC      7
   910 1615           320 LC      3
   911 1616           720 LC      7
   912 1617           420 LC      4
   913 1620           120 LC      1
   914 1621          1020 LC      8
   915 1622           220 LC      2
   916 1623           420 LC      4
   917 1624          1634 PT=     0
   918 1625          1120 LC      9
   919 1626             1 GSBLGX DV1-10
   919 1627             0
   920 1630          1366 ? C#0   XS
   921 1631             1 GOLNCX ERR0
   921 1632             2
   922 1633           340 SEL Q
   923 1634           434 PT=     8
   924 1635           240 SEL P
   925 1636          1634 PT=     0
   926 1637           156 AB EX   W
   927 1640            23 GOTO    TOOCT2 (1642)
   928 1641 TOOCT1  1616 A SR     W
   929 1642 TOOCT2  1046 C=C+1    X
   930 1643          1763 GONC    TOOCT1 (1641)
   931 1644           116 C=0     W
   932 1645           256 AC EX   W
   933 1646 TOOCT3    756 C=C+C   W
```

```
   934 1647           756 C=C+C  W
   935 1650           756 C=C+C  W
   936 1651          1756 A SL   W
   937 1652          1374 RCR    13
   938 1653           240 SEL P
   939 1654           242 AC EX  PT
   940 1655           340 SEL Q
   941 1656          1716 C SR   W
   942 1657          1724 DEC PT
   943 1660          1524 ? PT=  12
   944 1661          1653 GONC   TOOCT3 (1646)
   945 1662           423 GOTO   TODEC6 (1724)
   946 1663 TODEC    1634 PT=    0
   947 1664           102 C=0    PT
   948 1665          1346 ? C#0  X
   949 1666             1 GOLCX  ERR0
   949 1667             3
   950 1670           260 C=N
   951 1671 TODEC1   1042 C=C+1  PT
   952 1672            37 GOC    TODEC2 (1675)
   953 1673          1732 C SR   M
   954 1674          1753 GOTO   TODEC1 (1671)
   955 1675 TODEC2    256 AC EX  W
   956 1676           642 A=A-1  PT
   957 1677           116 C=0    W
   958 1700            56 B=0    W
   959 1701          1534 PT=    12
   960 1702          1020 LC     8
   961 1703          1534 PT=    12
   962 1704           356 BC EX  W
   963 1705 TODEC7   1442 ? A<B  PT
   964 1706            47 GOC    TODEC4 (1712)
   965 1707             1 GOLONG ERR0
   965 1710             2
   966 1711 TODEC3   1056 C=C+1  W
   967 1712 TODEC4    642 A=A-1  PT
   968 1713          1763 GONC   TODEC3 (1711)
   969 1714           646 A=A-1  X
   970 1715            67 GOC    TODEC5 (1723)
   971 1716           756 C=C+C  W
   972 1717           756 C=C+C  W
   973 1720           756 C=C+C  W
   974 1721          1772 A SL   M
   975 1722          1633 GOTO   TODEC7 (1705)
   976 1723 TODEC5    256 AC EX  W
   977 1724 TODEC6    260 C=N
   978 1725           112 C=0    WPT
   979 1726          1434 PT=    1
   980 1727           120 LC     1
   981 1730           220 LC     2
   982 1731             1 GOLNGX SHF10
   982 1732             2
*
* GTACOD - GET ALPHACODE[KEYCODE]
* GETS THE ALPHAMODE DEFAULT FUNCTION TABLE ENTRY FOR THE
* CURRENT KEY.  USED BY NAMEA AND STK SECTIONS OF PARSE.
* ENTRY CONDITIONS: CHIP 0 ON, LOGICAL KEYCODE IN N[2:1]
* USES A.X & C.
* RETURNS ALPHACODE[KEYCODE] IN C.X
*
```

```
 991 1733 GTACOD  260 C=N
 992 1734          406 A=C     X
 993 1735          116 C=0
 994 1736          460 LDI
 995 1737          525 CON     @525          HI550\16=@525
 996 1740         1574 RCR     12
 997 1741         1006 C=A+C   X
 998 1742         1574 RCR     12
 999 1743         1460 CXISA
1000 1744         1740 RTN
1001
1002
1003
*
* TOGSHF - TOGGLE SHIFT FLAG
*
* USES C AND 1 SUBROUTINE LEVEL.  LEAVES CHIP 0 ENABLED.
*
* TGSHF1 - SAME AS TOGSHF EXCEPT REQUIRES CHIP 0 ENABLED ON ENTRY.
*
1011 1745 TOGSHF     1 GOSUB   ENCP00
1011 1746            0
1012 1747 TGSHF1  1670 C=REGN  14
1013 1750         1074 RCR     2
1014 1751         1730 CST EX                 PUT UP SS 1
1015 1752         1614 ?S0=1                  SHIFT?
1016 1753           37 GOC     TOG10  (1756) YES
1017 1754         1610 S0=     1              NO. SET SHIFT.
1018 1755           23 GOTO    TOG20  (1757)
1019 1756 TOG10   1604 S0=     0              CLEAR SHIFT
1020 1757 TOG20   1730 CST EX
1021 1760         1574 RCR     12
1022 1761         1650 REGN=C  14
1023 1762         1740 RTN
1024                   ENTRY   APND-
1025                   ENTRY   APND10
1026                   ENTRY   APNDDG
1027 1763 APND-    460 LDI
1028 1764           55 CON     @55
1029 1765 APND10  1634 PT=     0
1030 1766 APND15   130 G=C
1031 1767          240 SEL P
1032 1770            1 GOLONG APNDNW
1032 1771            2
1033 1772 APNDDG   630 C=M
1034 1773         1734 INC PT
1035 1774          320 LC      3
1036 1775         1713 GOTO    APND15 (1766)
1037
1038
* RESERVE 2 WORDS AT THE END OF CN7 FOR CHIP 1 CHECKSUM AND
* TRAILER.
1041                   FILLTO @1775
1042 1776 REVLV1     6 CON     6              REV LEVEL= F
1043 1777 CKSUM1     0 CON     @0000
1044                   END

ERRORS :       0
```

SYMBOL TABLE

ADD1	340	-			
ADD2	343	-			
APND-	1763	-			
APND10	1765	-			
APND15	1766	-	1775		
APNDDG	1772	-			
BRT100	600	-			
BRT110	603	-	552	550	
BRT120	575	-	635		
BRT130	615	-	611	607	604
BRT140	754	-			
BRT141	1011	-	755		
BRT150	623	-			
BRT160	650	-			
BRT170	645	-	633	624	
BRT180	1013	-	1016		
BRT190	1014	-	751		
BRT200	1017	-			
BRT220	1032	-	1023		
BRT240	1040	-	1033		
BRT250	1061	-	1052	1041	
BRT260	1064	-	1062		
BRT290	654	-			
BRT300	661	-	667		
BRT301	671	-	574		
BRT310	673	-	663		
BRT320	700	-	716		
BRT330	705	-	710		
BRT340	714	-	726	677	
BRT350	736	-	753		
BRT360	743	-	745		
BRT370	744	-	742		
BRTS10	553	-			
BRTS20	557	-	554		
CHSA	332	-			
CHSA1	334	-			
CKSUM1	1777	-			
DOCHK	314	-	326		
GET1	373	-	331		
GETADD	364	-	367		
GETN	352	-			
GETX	357	-			
GETXSQ	356	-			
GETXY	353	-			
GETY	355	-			
GETYSQ	354	-			
GTACOD	1733	-			
MSG	153	-			
MSG100	171	-	177		
MSG105	200	-			
MSG110	206	-			
MSGA	154	-			
MSGAD	30	-			
MSGDE	42	-			
MSGE	161	-			
MSGML	55	-			

```
MSGNE     70   -
MSGNL     74   -
MSGNO    144   -
MSGOF    117   -
MSGPR    103   -
MSGRAM   147   -
MSGROM   152   -
MSGTA    137   -
MSGWR    126   -
MSGX     165   -
MSGYES   142   -
PATCH6     6   -
PATCH9     3   -
REVLV1  1776   -
SD       420   -
SIGMA    210   -
SIGMA1   213   -   256
SIGMA2   223   -   217
SIGMA3   225   -   222
SIGMA4   244   -   240
SIGMA5   246   -   243
SIGMA6   257   -   254
STATCK   310   -
STDEV1   425   -   510
STDEV4   441   -   435
STDEV5   443   -   440
STOVF    345   -   342
TGSHF1  1747   -
TODEC   1663   -  1600
TODEC1  1671   -  1674
TODEC2  1675   -  1672
TODEC3  1711   -  1713
TODEC4  1712   -  1706
TODEC5  1723   -  1715
TODEC6  1724   -  1662
TODEC7  1705   -  1722
TOG10   1756   -  1753
TOG20   1757   -  1755
TOGSHF  1745   -
TOOCT   1571   -
TOOCT1  1641   -  1643
TOOCT2  1642   -  1640
TOOCT3  1646   -  1661
TOPOL    511   -
TOPOL1   521   -   515
TOPOL2   561   -   513
TOPOL3   573   -   627  577
TOPOL4   566   -   564
TOREC   1165   -
TOREC1  1470   -  1550
TOREC2  1506   -  1504
TOREC3  1511   -  1507
TRC30   1070   -
TRC35   1106   -  1132
TRC40   1107   -
TRC50   1133   -  1076
TRC60   1144   -  1100
TRC70   1153   -  1102
TRC80   1160   -  1104
TRC90   1111   -  1074
```

```
TRC91    1125   -
TRCS10   1127   -  1131
TRG100   1170   -
TRG110   1202   -  1177
TRG120   1203   -  1201
TRG130   1204   -  1174
TRG135   1216   -  1211
TRG140   1232   -  1227 1225
TRG150   1233   -  1323
TRG155   1244   -  1251 1245
TRG160   1262   -  1257
TRG170   1263   -  1320 1316 1307 1305
TRG180   1266   -  1243
TRG190   1277   -  1264
TRG200   1302   -  1312
TRG210   1306   -  1303
TRG220   1310   -  1300
TRG230   1317   -  1314
TRG240   1321   -
TRG250   1324   -  1336
TRG260   1332   -  1274
TRG270   1333   -  1276 1272
TRG280   1340   -  1334 1331
TRG300   1360   -  1345
TRG305   1370   -  1374
TRG310   1373   -  1364
TRG315   1460   -  1372
TRG330   1376   -  1367
TRG340   1377   -  1414
TRG350   1430   -  1433
TRG360   1432   -  1445
TRG370   1442   -  1457 1427
TRG400   1513   -  1452
TRG415   1524   -  1521
TRG420   1526   -  1523
TRG430   1533   -  1567 1467 1464 1462
TRG440   1557   -  1527
TRG500   1553   -  1534 1512
TRG800   1405   -  1403
TRG810   1404   -  1406
XBAR      376   -
XBAR*     407   -
```

ENTRY TABLE

ADD1	340	-
ADD2	343	-
APND-	1763	-
APND10	1765	-
APNDDG	1772	-
BRT100	600	-
BRT140	754	-
BRT160	650	-
BRT200	1017	-
BRT290	654	-
BRTS10	553	-
CHSA	332	-
CHSA1	334	-
GETN	352	-
GETX	357	-
GETXSQ	356	-
GETXY	353	-
GETY	355	-
GETYSQ	354	-
GTACOD	1733	-
MSG	153	-
MSG105	200	-
MSG110	206	-
MSGA	154	-
MSGAD	30	-
MSGDE	42	-
MSGE	161	-
MSGML	55	-
MSGNE	70	-
MSGNL	74	-
MSGNO	144	-
MSGOF	117	-
MSGPR	103	-
MSGRAM	147	-
MSGROM	152	-
MSGTA	137	-
MSGWR	126	-
MSGX	165	-
MSGYES	142	-
PATCH6	6	-
PATCH9	3	-
SD	420	-
SIGMA	210	-
STATCK	310	-
TGSHF1	1747	-
TODEC	1663	-
TOGSHF	1745	-
TOOCT	1571	-
TOPOL	511	-
TOREC	1165	-
TRC30	1070	-
TRCS10	1127	-
TRG100	1170	-
TRG240	1321	-
TRG430	1533	-
XBAR	376	-

```
XBAR*     407    -
```

EXTERNAL REFERENCES

1/X13	650	1465	1551		
1/X13	651	1466	1552		
AD1-10	340				
AD1-10	341				
AD2-10	343	1607			
AD2-10	344	1610			
AD2-13	452	535	1030	1036	
AD2-13	453	536	1031	1037	
ADD1	246	267			
ADD1	247	270			
ADD2	227	277			
ADD2	230	300			
ADDONE	760	1543			
ADDONE	761	1544			
APNDNW	1770				
APNDNW	1771				
BRT140	621				
BRT140	622				
BRT160	1007				
BRT160	1010				
BRT200	643	671			
BRT200	644	672			
BRT290	1011				
BRT290	1012				
BRTS10	575	652	1327		
BRTS10	576	653	1330		
CHK#S	314				
CHK#S	315				
CHSA	225	235	263	273	
CHSA	226	236	264	274	
CLLCDE	166				
CLLCDE	167				
DIV120	730				
DIV120	731				
DIV15	1531				
DIV15	1532				
DV1-10	456	1352	1626		
DV1-10	457	1353	1627		
DV2-10	416	545			
DV2-10	417	546			
DV2-13	1047				
DV2-13	1050				
ENCP00	200	1745			
ENCP00	201	1746			
ERR0	646	1574	1631	1666	1707
ERR0	647	1575	1632	1667	1710
ERRNE	12				
ERRNE	13				
ERROF	476				
ERROF	477				
EXSCR	762				
EXSCR	763				
GETN	275	410	426	454	462
GETN	276	411	427	455	463
GETX	220	405	441		
GETX	221	406	442		

```
GETXSQ   241   506
GETXSQ   242   507
GETXY    265
GETXY    266
GETY     223   400   436
GETY     224   401   437
GETYSQ   244   423
GETYSQ   245   424
INTFRC  1571
INTFRC  1572
MP1-10  1057
MP1-10  1060
MP2-10   233   261   430   444   523   531
MP2-10   234   262   431   445   524   532
MP2-13   770  1356  1501  1541
MP2-13   771  1357  1502  1542
MSGDLY   206
MSGDLY   207
OVFL10   345
OVFL10   346
P6RTN     15
P6RTN     16
PATCH9   306
PATCH9   307
PI/2    1026  1034  1042  1354
PI/2    1027  1035  1043  1355
RCSCR    533   766  1477  1537
RCSCR    534   767  1500  1540
RCSCR*   450   471
RCSCR*   451   472
SHF10   1020  1342  1731
SHF10   1021  1343  1732
SQR13    500   537   773  1545
SQR13    501   540   774  1546
STATCK   210   376   421
STATCK   211   377   422
STSCR    525   756  1535
STSCR    526   757  1536
STSCR*   432   460
STSCR*   433   461
SUBONE   467   764
SUBONE   470   765
SUMCHK   310
SUMCHK   311
TRC10    636  1321
TRC10    637  1322
TRC30    737  1400
TRC30    740  1401
TRCS10  1134  1145  1154  1161
TRCS10  1135  1146  1155  1162
TRG240  1206
TRG240  1207
X/Y13    473  1002  1474
X/Y13    474  1003  1475
XBAR*    402
XBAR*    403
XCLX1      4
XCLX1      5

End of VASM assembly
```

```
* HP41C MAINFRAME MICROCODE ADDRESSES @20000-21777
*
     4                    FILE   CN8B
     5                    ENTRY  GSUBS1
     6                    ENTRY  XBST
     7                    ENTRY  XSST
     8                    ENTRY  XDELET
     9                    ENTRY  CLRPGM
    10                    ENTRY  UPLINK
    11                    ENTRY  GTLINK
    12                    ENTRY  GENLNK
    13                    ENTRY  GTLNKA
    14                    ENTRY  INSSUB
    15                    ENTRY  DELNNN
    16                    ENTRY  DELLIN
    17                    ENTRY  PTLINK
    18                    ENTRY  PTLNKA
    19                    ENTRY  PTLNKB
    20                    ENTRY  PTBYTA
    21                    ENTRY  PTBYTP
    22                    ENTRY  PUTPC
    23                    ENTRY  PUTPCF
    24                    ENTRY  PUTPCX
    25                    ENTRY  PUTPCA
    26                    ENTRY  SKPDEL
    27
    28
    29
    30
    31                    ENTRY  CLRREG
    32                    ENTRY  ERR110
    33                    ENTRY  ERROR
    34                    ENTRY  ERR120
    35                    ENTRY  GTFEN1
    36                    ENTRY  GTFEND
    37                    ENTRY  MOVREG
    38                    ENTRY  PACKE
    39                    ENTRY  PACKN
    40                    ENTRY  PAK200
    41                    ENTRY  PAKEND
    42                    ENTRY  PAKSPC
    43                    ENTRY  PKIOAS
    44                    ENTRY  XCOPY
    45                    ENTRY  XPACK
*
* PACK - PACK MEMORY INCLUDING I/O AREA AND KEY ASSIGNMENT AREA
*
* PACKN - NORMAL PACKING SUBROUTINE
* PACKE - FATAL PACKING, AFTER PACKING WOULD SAY "TRY AGAIN"
*         EXITS TO ERROR INSTEAD OF RETURNING
* XPACK - SET PUSHFLAG THEN NORMAL PACKING
*
* USED A,B,C,M,N,G STATUS 0-9, THREE LEVEL SUB.
* DURING PACKING USED M,N AS COUNTER :
* M(3:0) - NEXT PACKED BYTE ADDR
```

```
* M(7:4) - LAST PACKED END OR ALBL ADDR
* N(3:0) - LAST PICKING UP BYTE ADDR
*
* EXITS VIA DECOMPILE ENTRIES DCPL00 OR DCPERT.
* EVENTUALLY RETURNS (EXCEPT PACKE) WITH CHIP 0 ENABLED AND
* STATUS SET 0 UP.
*
   64       XPACK
   65     0 PACKN   1104 S9=     0                NORMAL PACKING ENTRY
   66     1           23 GOTO    PACK    (   3)
   67     2 PACKE   1110 S9=     1                FATAL PACKING ENTRY
   68     3 PACK       1 GOSUB   MSG              SAY "PACKING"
   68     4            0
   69     5            0 XDEF    MSGWR
   70     6            1 GOSUB   RSTMS0           ENABLE CHIP 0 AND CLR MSGFLG
   70     7            0
   71    10            1 GOSUB   PKIOAS           PACK IO BUFFER AREA
   71    11            0
   72    12          116 C=0     W
   73    13          530 M=C                      INDICATE START FROM CHAIN END
   74    14          104 S4=     0
   75    15         1210 S7=     1
   76    16            1 GOSUB   GTFEND           GET FINAL END
   76    17            0
   77    20            1 GOSUB   STBT31           RESET PACK BIT
   77    21            0
   78    22         1360 DATA=C
   79    23          263 GOTO    PAK108  (  51)
   80    24 PAK100     1 GOSUB   UPLINK
   80    25            0
   81    26          212 B=A     WPT
   82    27         1076 C=C+1   S                IS THIS AN "END" ?
   83    30           43 GONC    PAK105  (  34) YES
   84    31 PAK102 1346 ? C#0    X                REACH CHAIN END ?
   85    32         1727 GOC     PAK100  (  24) NOT YET
   86    33          253 GOTO    PAK110  (  60)
   87    34 PAK105   252 C=A     WPT              SAVE 1ST BYTE ADDR OF END IN N
   87    35          412
   88    36          160 N=C
   89    37            1 GOSUB   INCAD2           BY PASS THE LINK
   89    40            0
   90    41         1176 C=C-1   S
   91    42         1574 RCR     12               C(0:1) _ THIRD BYTE
   92    43            1 GOSUB   STBT30           RESET THE PACK BIT
   92    44            0
   93    45            1 GOSUB   PTBYTA
   93    46            0
   94    47          260 C=N                      GET ADDR OF END
   95    50          252 AC EX   WPT
   96    51 PAK108     1 GOSUB   GTLINK
   96    52            0
   97    53         1563 GOTO    PAK102  (  31)
   98    54 PAK120     1 GOSUB   FSTIN            GET TOP MEM ADDR -1
   98    55            0
   99    56          116 C=0     W                PACKING START FROM TOP
  100    57          133 GOTO    PAK115  (  72)
  101    60 PAK110   414 ?S8=1                    DOES 1ST PGM NEEDS PACKING ?
  102    61         1737 GOC     PAK120  (  54) YES
  103    62          630 C=M
  104    63         1352 ? C#0   WPT              ANY PGM NEEDS PACKING ?
```

```
  105   64           1 GOLNC  DCPLRT         NONE OF THE PGM NEEDS PACKING
  105   65           2
  106                                         EXIT VIA DCPLRT IN DECOMPILE
  107   66         412 A=C    WPT            A(3:0) _ STARTING ADDR
  108   67         374 RCR    10             C(7:4) _ STARTING ADDR
  109   70           1 GOSUB  INCAD2         POINT TO THIRD BYTE OF END
  109   71           0
  110   72 PAK115    1 GOSUB  INCADA         POINT TO NEXT PACKING ADDR
  110   73           0
  111   74         252 C=A    WPT
  111   75         412
  112   76         530 M=C                    SET THE TWO ADDRS IN M
  113   77           1 GOSUB  DECADA         BACKUP ONE BYTE
  113  100           0
  114  101         212 B=A    WPT
* DECIDE WHETHER WE NEED TO ADJUST THE PC WHILE PACKING
  116  102           1 GOSUB  GETPC
  116  103           0
  117  104         314 ?S10=1                 ARE WE IN ROM ?
  118  105         127 GOC    PAK117 ( 117) YES, DON'T TOUCH PC AT ALL
  119  106         630 C=M                    C_ADDR TO START PACKING
  120  107        1406 ? A<C  X              PC<START ADDR?
  121  110         107 GOC    PAK118 ( 120) YES. NEED TO ADJUST PC
  122  111        1546 ? A#C  X              PC>START ADDR?
  123  112          57 GOC    PAK117 ( 117) YES. DON'T TOUCH PC
  124  113        1402 ? A<C  PT             PC<START ADDR?
  125  114          47 GOC    PAK118 ( 120) YES. NEED TO ADJUST PC
  126  115        1542 ? A#C  PT             PC>START ADDR?
  127  116          23 GONC   PAK118 ( 120) NO. MUST ADJUST PC
  128  117 PAK117   12 A=0    WPT            LEAVE THE PGMPC ALONE
  129  120 PAK118  256 AC EX
  130  121         374 RCR    10             C(7:4) _ OLD PC
  131  122         312 C=B    WPT
  132  123         160 N=C
  133  124 PAK130  404 S8=    0              REMEMBER LAST LINE NOT A D.E.
*
  135  125 PAK200  260 C=N                    C(3:0) _ STARTING PICK UP ADDR
  136  126         412 A=C    WPT
  137  127 PAK210  212 B=A    WPT
  138  130         260 C=N
  139  131         312 C=B    WPT
  140  132         160 N=C
  141  133           1 GOSUB  NXBYTA         PICK UP NEXT BYTE
  141  134           0
  142  135        1574 RCR    12             CHECK IF IT IS A NULL ?
  143  136        1342 ? C#0  PT
  144  137          37 GOC    PAK220 ( 142) NOT A NULL
  145  140        1366 ? C#0  XS
  146  141        1663 GONC   PAK210 ( 127) SKIP A NULL
  147  142 PAK220 1142 C=C-1  PT             IS IT A ROW 0 FC ?
  148  143         277 GOC    PAK250 ( 172) YES
  149  144        1142 C=C-1  PT             IS IT A RWO 1 FC ?
  150  145         253 GONC   PAK250 ( 172) NO
  151  146         766 C=C+C  XS             IS COLUMN # <= 7 ?
  152  147          53 GONC   PAK230 ( 154) YES IT IS A D.E.
  153  150         766 C=C+C  XS             IS COLUMN # <= 11 ?
  154  151          33 GONC   PAK230 ( 154) YES, IT IS A D.E.
  155  152        1366 ? C#0  XS             IS IT A CHS ?
  156  153         177 GOC    PAK250 ( 172) NO
  157  154 PAK230  414 ?S8=1                 PREVIOUS LINE A D.E. ?
```

```
158  155          133 GONC   PAK240 ( 170) NO
159  156          630 C=M                  LOAD NEXT PACKED ADDR
160  157          412 A=C    WPT
161  160          106 C=0    X
162  161            1 GOSUB  PTBYTA         STORE A NULL BETWEEN D.E.
162  162            0
163  163            1 GOSUB  INCADA         POINT TO NEXT PACKED ADDR
163  164            0
164  165          630 C=M
165  166          252 AC EX  WPT
166  167          530 M=C
167  170 PAK240   410 S8=    1              REMEMBER THIS LINE IS D.E.
168  171           23 GOTO   PAK260 ( 173)
169  172 PAK250   404 S8=    0              REMEMBER THIS LINE NOT A D.E.
170  173 PAK260   260 C=N
171  174          412 A=C    WPT            A(3:0) _ POSSIBLE NEW PC
172  175          174 RCR    4              C(3:0) _ OLD PC
173  176         1406 ? A<C  X              PASS OLD PC ALREADY?
174  177          417 GOC    PAK280 ( 240) YES, SET NEW PC
175  200         1546 ? A#C  X              SAME REG ?
176  201           57 GOC    PAK265 ( 206) NO, NOT CLOSE TO PC YET
177  202         1402 ? A<C  PT             PASS PC BYTE ?
178  203          357 GOC    PAK280 ( 240) YES, SET NEW PC
179  204         1542 ? A#C  PT             SAME BYTE ?
180  205          333 GONC   PAK280 ( 240) YES, SET NEW PC
181  206 PAK265     1 GOSUB  NXLDEL         GET NEXT LINE
181  207            0
182  210          260 C=N                  C(3:0) _ LAST PICK UP ADDR
183  211          252 AC EX  WPT            C(3:0) _ END PICK UP ADDR
184  212          160 N=C                  N(3:0) _ END PICK UP ADDR
185  213 PAK270     1 GOSUB  NXBYTA         PICK UP NEXT BYTE
185  214            0
186  215          352 BC EX  WPT            SAVE THE BYTE IN B
187  216          630 C=M                  C(3:0) _ NEXT PACKED ADDR
188  217         1160 DADD=C
189  220         1434 PT=    1
190  221            1 GOSUB  PTBYTP         PACK ONE BYTE
190  222            0
191  223          630 C=M
192  224         1142 C=C-1  PT
193  225           43 GONC   PAK275 ( 231)
194  226         1142 C=C-1  PT
195  227         1142 C=C-1  PT
196  230         1156 C=C-1
197  231 PAK275  1142 C=C-1  PT
198  232          530 M=C
199  233          260 C=N                  C(3:0) _ END PICKING ADDR
200  234         1552 ? A#C  WPT            PICKED UP LAST BYTE ALREADY ?
201  235         1567 GOC    PAK270 ( 213) NO
202  236            1 GOLONG PAK200
202  237            2
203  240 PAK280   106 C=0    X
204  241          374 RCR    10
205  242          160 N=C                  SET OLD PC TO VERY SMALL
206  243          212 B=A    WPT
207  244          630 C=M
208  245          412 A=C    WPT            GET NEXT PACKING ADDR
209  246            1 GOSUB  DECADA
209  247            0
210  250            1 GOSUB  PUTPCX         SET NEW PC
```

```
   210  251           0
   211  252         152 AB EX  WPT
   212  253        1333 GOTO   PAK265 ( 206)
*
* PAKEND - THIS IS FINAL PART OF THE PACK ROUTINE. WHEN THE
*   PACKING REACHED THE FINAL END, IT WOULD BRANCH TO HERE TO
*   GENERATE A NEW FINAL END INSTEAD OF PACKING IT. THE REASON
*   IS THAT THE FINAL END HAS TO BE RIGHT JUSTIFIED IN THE REG.
*
   219  254 PAKEND   40 SPOPND
   220  255         260 C=N                    LOAD THE .END. ADDR
   221  256        1160 DADD=C
   222  257          70 C=DATA                 LOAD THE .END.
   223  260        1634 PT=    0
   224  261         130 G=C                    SAVE LAST BYTE OF .END. IN G
   225  262         630 C=M                    GET ADDR OF LAST PACKED REG
   226  263        1160 DADD=C                   CHECK IF ENOUGH ROOM IN THIS
   227  264         416 A=C                      REG. FOR A THREE BYTE'S .END.
   228  265          70 C=DATA
   229  266         216 B=A                    SAVE THE ADDR IN B
   230  267        1616 A SR                   A.XS _ LAST BYTE'S POSITION
   231  270        1434 PT=    1               CLEAR UNUSED BYTE AT TAIL
   232  271 PKEND1  666 A=A-1  XS              THIS BYTE USED ?
   233  272          77 GOC    PKEND2 ( 301) YES
   234  273         666 A=A-1  XS
   235  274        1734 INC PT                 POINT TO NEXT HIGHER BYTE
   236  275        1734 INC PT
   237  276        1733 GOTO   PKEND1 ( 271)
   238  277 PKEND4  402 A=C    PT              PUT .END. IN LAST PACKED REG
   239  300         173 GOTO   PKEND3 ( 317)  -
   240  301 PKEND2  112 C=0    WPT             CLEAR UNUSED BYTES
   241  302        1360 DATA=C                 PUT LAST REG BACK
   242  303          34 PT=    3               CHECK HOW MANY BYTES UNUSED
   243  304         152 AB EX  WPT             GET LAST BYTE'S ADDR
   244  305         420 LC     4               AT LEAST NEED 3 UNUSED BYTES
   245  306          34 PT=    3
   246  307        1402 ? A<C  PT              CHECK LAST BYTE POSITION
   247  310        1673 GONC   PKEND4 ( 277) THERE IS ENOUGH ROOM THERE
   248  311         246 AC EX  X               NOT ENOUGH ROOM IN LAST REG
   249  312        1146 C=C-1  X                 FOR A .END., WE HAVE TO PUT IT
   250  313        1160 DADD=C                   TO NEXT REG.
   251  314         412 A=C    WPT             SAVE NEW .END. ADDR IN A
   252  315         116 C=0    W               CLEARN NEXT REG FIRST
   253  316        1360 DATA=C
   254  317 PKEND3  630 C=M                    LET GENLNK PUT THE LINK IN
   255  320         174 RCR    4               C[3:0] _ PREV. END/ALBL ADDR
   256  321         252 AC EX  WPT             C[3:0] _ NEW .END. ADDR
   257  322           1 GOSUB  GENLNK
   257  323           0
   258  324 PKEND5 1160 DADD=C                 PUT LAST BYTE OF .END. IN PLACE
   259  325          70 C=DATA
   260  326        1634 PT=    0
   261  327         230 C=G
   262  330        1360 DATA=C
*
* NOW CLEAR ALL REG'S BETWEEN NEW .END. AND OLD .END.
*
   266  331         106 C=0    X
   267  332        1160 DADD=C                 ENABLE CHIP 0
   268  333        1570 C=REGN 13              C.X _ OLD CHAIN HEAD
```

```
   269  334          246 AC EX  X              C.X _ NEW CHAIN HEAD
   270  335         1550 REGN=C 13
   271  336           56 B=0    W
   272  337 PKEND6  1546 ? A#C  X              ALL DONE ?
   273  340            1 GOLNC  DCPL00         YES - DECOMPILE AND EXIT
   273  341            2
   274  342         1146 C=C-1  X
   275  343         1160 DADD=C
   276  344          356 BC EX  W
   277  345         1360 DATA=C
   278  346          356 BC EX  W
   279  347         1703 GOTO   PKEND6 ( 337)
*
* GTFEND - LOAD FINAL END
*
   283  350 GTFEND  106 C=0    X
   284  351         1160 DADD=C
   285  352         1570 C=REGN 13             LOAD CHAIN HEAD
   286  353 GTFEN1   34 PT=    3
   287  354          420 LC     4
   288  355         1160 DADD=C
   289  356           34 PT=    3
   290  357          412 A=C    WPT
   291  360           70 C=DATA
   292  361         1740 RTN
*
* PAKSPC
*
* SPECIAL PACK LOGIC - A SUBBRANCH FROM NEXT LINE ROUTINE
* PACK CALLS NXLDEL TO FIGURE OUT HOW MANY BYTES IN NEXT LINE,
* BUT NXLDEL WOULD SEND IT BACK TO HERE IF IT ENCOUNTER AN
* ALBL OR AN END. THE SPECIAL PACK LOGIC HERE WILL GENERATE A
* NEW LINK FOR EACH ALBL OR END, BUT NOT FOR THE FINAL END. IT
* WILL BRANCH AGAIN TO PAKEND, LET HIM TO TAKE CARE OF THE
* FINAL END.
*
   304  362 PAKSPC    1 GOSUB  GTLINK
   304  363           0
   305  364         1076 C=C+1  S              IS IT AN END
   306  365           67 GOC    PKSPC1 ( 373) NO, IS AN ALBL
   307  366          776 C=C+C  S              CHECK FOR FINAL END
   308  367          776 C=C+C  S
   309  370          776 C=C+C  S
   310  371            1 GOLC   PAKEND         IS A FINAL END
   310  372            3
   311  373 PKSPC1  630 C=M                    C(3:0) _ NEXT PACKING ADDR
   312  374          412 A=C    WPT
   313  375          174 RCR    4              C(3:0) _ PREVIOUS END OR ALBL ADDR
   314  376          252 AC EX  WPT
   315  377            1 GOSUB  GENLNK
   315  400            0
   316  401          374 RCR    10
   317  402            1 GOSUB  INCAD2
   317  403            0
   318  404          252 AC EX  WPT
   319  405          530 M=C
   320  406 PKSPC3  260 C=N
   321  407          412 A=C    WPT
   322  410            1 GOSUB  INCAD2
   322  411            0
```

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   323  412          252 C=A     WPT
   323  413          412
   324  414          160 N=C
   325  415            1 GOSUB   NXBYTA
   325  416            0
   326  417         1574 RCR     12
   327  420         1042 C=C+1   PT
   328  421            1 GOLC    NXLTX
   328  422            3
   329  423         1740 RTN
*
* PKIOAS - PACK I/O BUFFER AREA & KEY ASSIGNMENT AREA AT BOTTOM
*          OF PROGRAM MEMORY.
* ASSUME CHIP 0 ENABLE
* USED A,B,C,M,N. RETURN WITH CHIP 0 DISABLE
* 2 SUB LEVELS DEEP
*
* FOR FLOWCHART OF PKIOAS, SEE DRC'S LAB NOTEBOOK #00004 P.26
*
   339  424 PKIOAS 1570 C=REGN 13            LOAD CHAIN HEAD
   340  425          346 BC EX  X             SAVE CHAIN HEAD IN B.X
   341  426          116 C=0    W
   342  427          460 LDI
   343  430          300 CON2   12     0      ADDR OF CHIP 12 REG.0
   344  431          530 M=C                  M(2:0) _ CURRENT STACK ADDR
   345  432          160 N=C                  N(2:0) _ CURRENT CHECKING ADDR
   346  433          203 GOTO   PKASN3 ( 453)
   347  434 PKM10  1160 DADD=C                ENABLE CHECKING REG.
   348  435           70 C=DATA               LOAD THE CHECKING REG.
   349  436         1076 C=C+1   S             IS A KEY ASSIGNMENT REG. ?
   350  437          223 GONC   PKIO10 ( 461) NO, TRY TO PACK I/O AREA
   351  440         1434 PT=    1
   352  441         1352 ? C#0  WPT           KEYCODE IN REG.[1:0] ?
   353  442           47 GOC    PKASN1 ( 446) YES
   354  443          574 RCR    6
   355  444         1352 ? C#0  WPT           KEYCODE IN REG.[6:7] ?
   356  445           43 GONC   PKASN2 ( 451) NO, PACK THIS REG.
   357  446 PKASN1    1 GOSUB   MOVREG
   357  447            0
   358  450           33 GOTO   PKASN3 ( 453)
   359  451 PKASN2    1 GOSUB   CLRREG
   359  452            0
   360  453 PKASN3   306 C=B     X             LOAD CHAIN HEAD
   361  454          406 A=C     X
   362  455          260 C=N
   363  456         1546 ? A#C   X             REACHED CHAIN HEAD ?
   364  457         1557 GOC     PKM10  ( 434) NOT YET
   365  460         1740 RTN
* NOTE THERE IS AT LEAST ONE STATE TO BE HAD BY MOVING THE LOGIC
* AT PKASN3 AHEAD OF PKM10.  THE USE OF B.M INSTEAD OF N11:10 TO
* STORE THE BUFFER LENGTH IN THE PKIO15 PATH MIGHT RESULT IN
* SAVING ANOTHER STATE OR TWO.
*
   371  461 PKIO10 1176 C=C-1   S             RESTORE THE REG.
   372  462         1356 ? C#0   W             REACHED EMPTY AREA ?
   373  463         1640 RTN NC                YES WE ARE DONE
   374  464          376 BC EX   S             CHECK I O BUFFER
   375  465          334 PT=     10
   376  466          130 G=C                      G _ BUFFER LENGTH
   377  467          260 C=N
```

```
   378  470          230 C=G                    N(11:10) _ BUFFER LENGTH
   379  471          160 N=C
   380  472         1434 PT=     1
   381  473 PKI020   260 C=N
   382  474          374 RCR     10             C.[1:0] _ BUFFER LENGTH
   383  475         1152 C=C-1   WPT            DONE WITH THIS BUFFER ?
   384  476         1557 GOC     PKASN3 ( 453) YES
   385  477          174 RCR     4
   386  500          160 N=C                    PUT THE UPDATED LENGTH BACK
   387  501            1 GOSUB   CLRREG
   387  502            0
   388  503         1336 ? B#0   S              IS THIS BUFFER BEING USED?
   389  504            1 GSUBC   PUTREG         YES. PUT REG BACK.
   389  505            1
   390  506         1653 GOTO    PKI020 ( 473)
   391                   FILLTO:@524            PRESERVE ENTRY TABLE
        507         0000 NOP
        510         0000 NOP
        511         0000 NOP
        512         0000 NOP
        513         0000 NOP
        514         0000 NOP
        515         0000 NOP
        516         0000 NOP
        517         0000 NOP
        520         0000 NOP
        521         0000 NOP
        522         0000 NOP
        523         0000 NOP
        524         0000 NOP
*
* CLRREG - CLEAR AN UNUSED REG. IN PROGRAM MEMORY
*  THIS ROUTINE CALLED BY PKIOAS WHEN CLEAR AN UNUSED REG
*  IN I/O OR KEY ASSIGNMENT AREA.
* N[3:0] = CURRENT CHECKING REG'S ADDR ( THE REG TO BE CLEARED)
*
   398  525 CLRREG   260 C=N                    C.X _ CURRENT CHECKING ADDR
   399  526         1160 DADD=C
   400  527         1056 C=C+1                 POINT TO NEXT CHECKING REG.
   401  530          160 N=C
   402  531           70 C=DATA
   403  532           16 A=0
   404  533           73 GOTO    MOVR10 ( 542)
*
* MOVREG - MOVE A REG. TO OTHER ADDR
*  THIS ROUTINE CALLED BY PKIOAS FOR PACKING THOSE UNUSED REG
* N[3:0] = ADDR OF THE REG TO BE MOVED
* M[3:0] = DESTINATION ADDR
   410
* PUTREG - PUT A REGISTER BACK TO THE DESTINATION ADDRESS, AND
* INCREMENT THE DESTINATION ADDRESS.
* USES: A,C
* IN: A = REG TO BE PUT BACK
*     M.X = DESTINATION ADDRESS
* OUT: (A) IS STORED TO DATA REG (M.X)
*     DADD = M.X
*     M.X IS INCREMENTED BY 1.
*     A IS CLOBBERED.
* ASSUMES: HEXMODE, NO PERIPHERAL ENABLED.
*
```

```
   422  534 MOVREG    1 GOSUB  CLRREG         CLEAR THE CHECKING REG FIRST
   422  535            0
   423                 ENTRY  PUTREG
   424  536 PUTREG  630 C=M
   425  537         1160 DADD=C                ENABLE THE DESTINATION REG.
   426  540         1056 C=C+1                 POINT TO NEXT DESTINATION REG
   427  541          530 M=C
   428  542 MOVR10   256 AC EX  W
   429  543         1360 DATA=C
   430  544         1740 RTN
*
* COPY - COPY A PROGRAM FROM ROM TO RAM
* ALPHA STRING IS IN REG.9 RIGHT JUSTIFIED. THE ROUTINE WILL
* SEARCH THE STRING IN ROM AND START COPYING FROM TOP OF
* THAT PROGRAM. IF REG.9 HAS NULL STRING AND IN ROM MODE, COPY
* THE CURRENT PGM.
* USED A,B,C CALL ASRCH, MEMLFT.
* NORMAL RETURN TO NFRKB. IF NOT ENOUGH MEM TO STORE THE PGM,
* DO NOTHING, SIMPLY GOTO PACK THE MEM AND SAY TRY AGAIN.
* DURING THE COPYING:
* C[6:3] HAS ROM ADDR. B[5:3] HAS RAM ADDR. B[2:0] HAS THE
* REMAINING # OF REG.'S TO BE COPIED.
   443  545 XCOPY  1170 C=REGN 9              GET ALPHA STRING
   444  546          530 M=C
   445  547         1356 ? C#0  W              NULLSTRING ?
   446  550          213 GONC   CPY120 ( 571) YES, START FROM PGM HEAD
   447  551            1 GOSUB  ASRCH          DO THE ALPHA SEARCH
   447  552            0
   448  553         1356 ? C#0  W              FIND IT ?
   449  554 CPYNE      1 GOLNC  ERRNE
   449  555            2
   450  556 CPY100 1114 ?S9=1                  USER CODE ?
   451  557         1757 GOC    CPYNE  ( 554) NO, MICRO CODE
   452  560         1014 ?S2=1                 ROM ?
   453  561           47 GOC    CPY110 ( 565) YES
   454                 ENTRY  ERRRAM
   455  562 ERRRAM     1 GOSUB  ERROR
   455  563            0
   456  564            0 XDEF   MSGRAM         SAY RAM
   457  565 CPY110    34 PT=    3              GET THE PRM HEAD
   458  566            1 GOSUB  ROMH05
   458  567            0
   459  570           53 GOTO   CPY130 ( 575)
   460  571 CPY120  314 ?S10=1                 ARE WE IN ROM ?
   461  572         1703 GONC   ERRRAM ( 562) NO, WE ARE IN RAM
   462  573            1 GOSUB  ROMHED         GET PGM HEAD
   462  574            0
*
   464  575 CPY130  256 AC EX  W
   465  576          674 RCR    11             C.M _ PGM HEAD ADDR
   466  577         1460 CXISA                 GET HEADED WORD
   467  600         1166 C=C-1  XS             CHECK PRIVATE
   468  601         1166 C=C-1  XS
   469  602         1166 C=C-1  XS
   470  603           47 GOC    CPY140 ( 607) NOT PRIVATE
   471                 ENTRY  ERRPR
   472  604 ERRPR      1 GOSUB  ERROR
   472  605            0
   473  606            0 XDEF   MSGPR
   474  607 CPY140 1172 C=C-1  M              POINT TO P-1
```

```
475  610          372 BC EX  M              SAVE ADDR IN B.M
476  611            1 GOSUB  MEMLFT         HOW MANY REG LEFT ?
476  612            0
477  613          406 A=C    X              A.X_ # OF REG LEFT IN MEM
478  614          332 C=B    M              SEE HOW MANY REG REQUIRED
479  615          432 A=C    M
480  616         1460 CXISA                 LOAD # OF REG REQUIRED
481  617         1406 ? A<C  X              ENOUGH ROOM FOR THIS PRM ?
482  620            1 GOLC   PACKE          NO, TRY TO PACK MEM
482  621            3
483  622         1146 C=C-1  X
484  623          346 BC EX  X              SAVE # OF REG IN B.X
485  624          106 C=0    X
486  625         1160 DADD=C
487  626         1570 C=REGN 13             LOAD CHAIN HEAD
488  627         1160 DADD=C
489  630         1146 C=C-1  X              POINT TO STARTING RAM ADDR
490  631          674 RCR    11
491  632          372 BC EX  M              SAVE RAM ADDR IN B.M
492  633           70 C=DATA                LOAD FINAL END
493  634         1730 CST EX
494  635          204 S5=    0              MAKE IT BECOME LOCAT END
495  636         1730 CST EX
496  637         1360 DATA=C
497  640          272 AC EX  M              GET ROM ADDR
498  641         1072 C=C+1  M              POINT TO HEADER WORD
499  642         1460 CXISA                 LOAD # OF BYTES IN 1ST REG
500  643         1434 PT=    1
501  644         1142 C=C-1  PT
502  645          402 A=C    PT             MOVE COUNTER TO C.S
503  646         1574 RCR    12
504  647          242 AC EX  PT
505  650         1074 RCR    2
506  651 CPY145   16 A=0     W               PACK 7 ROM WORDS TO 1 REG
507  652 CPY150 1072 C=C+1   M
508  653         1460 CXISA                 LOAD A BYTE
509  654          412 A=C    WPT
510  655         1176 C=C-1  S
511  656           47 GOC    CPY160 ( 662) DONE WITH ONE REG.
512  657         1756 A SL   W
513  660         1756 A SL   W
514  661         1713 GOTO   CPY150 ( 652)
515  662 CPY160   356 BC EX  W
516  663           74 RCR    3              C.X _ RAM ADDR
517  664         1160 DADD=C
518  665         1146 C=C-1  X
519  666          356 BC EX  W
520  667          256 AC EX  W
521  670         1360 DATA=C
522  671          356 BC EX  W
523  672          674 RCR    11             C.X _ # OF REG REMAINED
524  673         1146 C=C-1  X
525  674           77 GOC    CPY170 ( 703) ALL DONE
526  675          356 BC EX  W
527  676          256 AC EX  W
528  677         1334 PT=    13
529  700          620 LC     6
530  701         1434 PT=    1
531  702         1473 GOTO   CPY145 ( 651)
*
```

```
   533  703 CPY170    74 RCR    3
   534  704        1046 C=C+1   X
   535  705         406 A=C     X              A.X _ NEW CHAIN HEAD ADDR
   536  706         106 C=0     X
   537  707        1160 DADD=C
   538  710        1570 C=REGN 13
   539  711         246 AC EX   X
   540  712        1550 REGN=C 13              PUT NEW CHAINHEAD AWAY
   541  713          34 PT=    3
   542  714           2 A=0     PT             SET PC TO BYTE 0
   543                                         OF OLD CHAINHEAD REGISTER
   544  715         304 S10=    0              CLEAR ROMFLAG
   545  716           1 GOSUB   PUTPCX
   545  717           0
   546  720           1 GOSUB   DECMPL         DECOMPILE
   546  721           0
   547  722 NFRKBX    1 GOLONG  NFRKB
   547  723           2
   548                   ENTRY   TRGSET
   549  724 TRGSET 1670 C=REGN 14
   550  725         106 C=0     X
   551  726        1074 RCR     2
   552  727        1530 ST=C
   553  730         504 S6=     0
   554  731        1204 S7=     0
   555  732         260 C=N
   556  733        1740 RTN
*
*
* PATCH1 - POST-RELEASE FIX TO DECAD & DECADA 9/21/78
* DECAD IS IN QUAD 10.
*
   562                   ENTRY   PATCH1
   563  734 PATCH1   542 A=A+1   PT
   564  735           1 GOLNC   INCADA
   564  736           2
   565  737         556 A=A+1
   566  740        1740 RTN
*
* PATCH2 - POST-RELEASE FIX TO CLRPGM FOUND LATER IN QUAD 8.
* THIS PATCH ALLOWS CLEARING OF PRIVATE PROGRAMS AT THE END OF
* PROGRAM MEMORY.
* THE S10=0 IS ANOTHER FIX TO ALLOW CLEARING OF RAM PROGRAMS
* WHEN THE PROGRAM COUNTER IS POINTING TO ROM.
*
   574                   ENTRY   PATCH2
   575  741 PATCH2   304 S10=    0              CLEAR ROM FLAG
   576  742           1 GOSUB   FIXEND         GET THE 3RD BYTE OF THE CURRENT END
   576  743           0
   577  744         312 C=B     WPT
   578  745        1730 CST EX                 TURN OFF THE PRIVATE BIT.
   579  746         504 S6=     0
   580  747        1730 CST EX
   581  750           1 GOSUB   PTBYTM         PUT THE 3RD BYTE BACK
   581  751           0
   582  752         474 RCR     8              SET UP FOR CPGMHD
   583  753         412 A=C     WPT
   584  754           1 GOLONG  CPGMHD         GO TO THE TOP OF THE PROGRAM AND RE
   584  755           2
*
```

```
* PATCH3 - POST-RELEASE FIX TO INSSUB FOUND AT THE END OF QUAD 8
* THIS FIX PREVENTS DATA ENTRY INTO PRIVATE PROGRAMS.
*
   589                    ENTRY  PATCH3
   590  756 PATCH3  314 ?S10=1                IS THIS A ROM PROGRAM?
   591  757         1640 RTN NC               NO, CONTINUE
   592  760            1 GOSUB  ERROR         YES, ERROR OUT
   592  761            0
   593  762            0 XDEF   MSGROM
*
* PATCH5 - POST-RELEASE FIX TO DEL NNN TO MAKE IT WORK WHEN LINE#=000
*
   597                    ENTRY  PATCH5
   598  763 PATCH5 1146 C=C-1  X              DEC LINE# & TEST FOR 000
   599  764         1640 RTN NC               NOT ZERO - OK
   600  765          214 ?S5=1                IS THIS BACKARROW?
   601  766         1347 GOC    NFRKBX (722)  YES. DO NOTHING.
   602  767          106 C=0    X             MUST BE DEL NNN.
   603                                        PUT LINE# BACK TO 000
   604  770         1740 RTN
   605                    FILLTO @777
        771         0000 NOP
        772         0000 NOP
        773         0000 NOP
        774         0000 NOP
        775         0000 NOP
        776         0000 NOP
        777         0000 NOP
*
* UPLINK JUMP TABLE HERE
*
   609 1000 TABUPL   70 C=DATA                GET THE FIRST BYTE
   610 1001         553 GOTO   UPLB0  (1056) SPECIAL CASE
   611 1002          70 C=DATA
   612 1003         443 GOTO   UPLB1  (1047) ANOTHER SPECIAL CASE
   613 1004          70 C=DATA
   614 1005         403 GOTO   UPLB2  (1045)
   615 1006          70 C=DATA
   616 1007         343 GOTO   UPLB3  (1043)
   617 1010          70 C=DATA
   618 1011         303 GOTO   UPLB4  (1041)
   619 1012          70 C=DATA
   620 1013         243 GOTO   UPLB5  (1037)
   621 1014 UPLB6    70 C=DATA
   622 1015 GBA5    374 RCR    10             ROTATE LINK INTO PLACE
   623 1016        1740 RTN
   624                    FILLTO @1017
       1017        0000 NOP
* GET BYTE JUMP TABLE HERE
   626 1020 TBLGBA   70 C=DATA                7 ENTRY POINTS(0,2,4,...,12)
   627 1021        1740 RTN
   628 1022          70 C=DATA
   629 1023         223 GOTO   GBA1   (1045)
   630 1024          70 C=DATA
   631 1025         163 GOTO   GBA2   (1043)
   632 1026          70 C=DATA
   633 1027         123 GOTO   GBA3   (1041)
   634 1030          70 C=DATA
   635 1031          63 GOTO   GBA4   (1037)
   636 1032          70 C=DATA
```

```
   637 1033          1623 GOTO   GBA5   (1015)
   638 1034 GBA6       70 C=DATA
   639 1035 GBA6A    1574 RCR    12
   640 1036          1740 RTN
   641       UPLB5
   642 1037 GBA4      474 RCR    8
   643 1040          1740 RTN
   644       UPLB4
   645 1041 GBA3      574 RCR    6
   646 1042          1740 RTN
   647       UPLB3
   648 1043 GBA2      174 RCR    4
   649 1044          1740 RTN
   650       UPLB2
   651 1045 GBA1     1074 RCR    2
   652 1046          1740 RTN
   653 1047 UPLB1     206 B=A    X             RETRIEVE REGISTER #
   654 1050           352 BC EX  WPT           SAVE LINK (4 DIG), GET ADDRESS IN C
   655 1051          1146 C=C-1  X
   656 1052          1160 DADD=C
   657 1053            70 C=DATA               GET THE THIRD BYTE
   658 1054           312 C=B    WPT
   659 1055          1740 RTN
   660 1056 UPLB0     206 B=A    X             RETRIEVE THE REGISTER #
   661 1057           346 BC EX  X             SAVE 2 DIGITS OF LINK, GET ADD IN C
   662 1060          1146 C=C-1  X
   663 1061          1160 DADD=C
   664 1062            70 C=DATA               GET 2ND AND 3RD BYTES
   665 1063           306 C=B    X
   666 1064          1513 GOTO   GBA6A  (1035) PUT ALL 3 BYTES IN PLACE
* UPLINK - MOVE UP ONE LINK OF THE LABEL CHAIN
* GIVEN AN ADDRESS OF THE FIRST BYTE OF A LINK IN A[0-3] IN
*- MM FORMAT, AND THE LINK AT THAT ADDRESS IN C[0-2], RETURNS
*- THE ADDRESS OF THE NEXT LINK IN A AND THE NEXT LINK IN C IN
*- THE SAME FORMAT AS INPUT. IN ADDITION, THE BYTE FOLLOWING THE
*- NEXT LINK IS FOUND IN C[12-13].
* EXPECTS AND RETURNS PT=3
* USES A[0-3],B[0-3],AND C.
* LEAVES DADD#0.
*
* GTLINK - GET A LINK. GIVEN THE ADDRESS OF A LINK IN A[0-3]
*- RETURNS THE LINK IN THE SAME FORM AS UPLINK.
*
* GTLNKA - SAME AS GTLINK, BUT EXPECT ADDRESS IN C[0-3]
*
   682 1065 UPLINK    102 C=0    PT            CREATE THE NEW ADDRESS
   683 1066           752 C=C+C  WPT           EXPAND THE LINK
   684 1067           752 C=C+C  WPT
   685 1070           752 C=C+C  WPT
   686 1071          1042 C=C+1  PT            ADD 2 TO BYTE NUMBER WHEN DOUBLED
   687 1072           742 C=C+C  PT            PREPARE FOR BASE 14 ADD
   688 1073           746 C=C+C  X
   689 1074            37 GOC    ULINK1 (1077)
   690 1075          1706 C SR   X
   691 1076            33 GOTO   ULINK2 (1101)
   692 1077 ULINK1   1706 C SR   X
   693 1100          1066 C=C+1  XS
   694 1101 ULINK2   1012 C=A+C  WPT           FORM NEW ADDRESS
   695 1102            33 GONC   ULINK3 (1105)
   696 1103          1046 C=C+1  X
```

```
   697                    LEGAL
   698 1104          33 GOTO   GTLNKA (1107) ADDRESS READY
   699 1105 ULINK3 1142 C=C-1  PT
   700 1106        1142 C=C-1  PT              THE ADDRESS IS READY
   701 1107 GTLNKA  412 A=C    WPT             SAVE THE ADDRESS
   702 1110        1160 DADD=C                 SELECT THE CORRECT REGISTER
   703 1111         174 RCR    4               PREPARE FOR 7 WAY TABLE
   704 1112         460 LDI
* TABLE JUMP
   706 1113        1040 CON    @1040           UPLINK TABLE ADDRESS
   707 1114         374 RCR    10
   708 1115         740 GOTOC                  GO GET LINK
* GTLINK HERE
   710 1116 GTLINK  252 AC EX  WPT             PUT ADDRESS IN PLACE
   711 1117        1703 GOTO   GTLNKA (1107)  GO GET LINK
*
* XBST - EXECUTE BACKSTEP
* MAINLINE CODE TO EXECUTE BACKSTEP FUNCTION
* ASSUMES STATUS SET 0 UP, PRGM MODE BIT USED
* USES 3 SUB LEVELS.
*
   718 1120 XBST    574 RCR    6               CATALOG SET
   719 1121        1730 CST EX
   720 1122        1414 ?S1=1
   721 1123           1 GOLC   BSTCAT
   721 1124           3
   722 1125           1 GOSUB  SSTBST
   722 1126           0
   723 1127           1 GOSUB  BSTEP           BACK UP ONE LINE
   723 1130           0
   724 1131 XBST1     1 GOSUB  DFRST9          DISPLAY STEP NUMBER UNTIL KEY UP
   724 1132           0
   725 1133          14 ?S3=1                  PROG MODE?
   726 1134           1 GOLC   DRSY25          YES, DON'T PUT UP NEW DISPLAY
   726 1135           3
   727 1136           1 GOLONG NFRKB1          DONE!
   727 1137           2
*
* XSST - EXECUTE SINGLE STEP
* ASSUMES STATUS SET 0 UP. PRGM MODE BIT USED.
*
   732 1140 XSST    574 RCR    6               CATALOG MODE
   733 1141        1730 CST EX
   734 1142        1414 ?S1=1
   735 1143           1 GOLC   SSTCAT
   735 1144           3
   736 1145           1 GOSUB  SSTBST
   736 1146           0
   737 1147           1 GOSUB  GETPC
   737 1150           0
   738 1151        1770 C=REGN 15              ALSO GET THE LINE NUMBER
   739 1152          14 ?S3=1                  PRGM MODE?
   740 1153         203 GONC   XSSTR  (1173)   NO, RUN MODE
   741 1154        1346 ? C#0  X               IF THE LINE NUMBER #0
   742 1155           1 GSUBC  NXLSST          GO TO THE NEXT LINE
   742 1156           1
   743 1157           1 GOSUB  GETLIN          FIX THE LINE NUMBER
   743 1160           0
   744 1161         514 ?S6=1                  TOP OF PROG?
   745 1162          23 GONC   *+2    (1164)   NO, DO A SIMPLE INCREMENT
```

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   746 1163          106 C=0     X              YES, SET LINE # TO 1
   747 1164         1046 C=C+1   X
   748 1165           23 GONC    *+2    (1167) IF NOT VALID, LEAVE ALONE
   749 1166         1146 C=C-1   X
   750 1167         1750 REGN=C 15
   751 1170            1 GOSUB   PUTPC          FIX UP PC
   751 1171            0
   752 1172         1373 GOTO    XBST1  (1131) DONE!
* RUN MODE SINGLE STEP
   754 1173 XSSTR   1346 ? C#0   X              LINE 0?
   755 1174           37 GOC     XSSTR1 (1177) NO,DO NOTHING
   756 1175         1046 C=C+1   X              YES, MOVE TO LINE 1
   757 1176         1750 REGN=C 15
   758 1177 XSSTR1     1 GOSUB   DFKBCK         DISPLAY LINE NUMBER
   758 1200            0
   759 1201         1114 ?S9=1                  KEYBD RESET YET?
   760 1202            1 GSUBNC NULTST          NO
   760 1203            0
   761 1204            1 GOSUB   GETLIN         INCREMENT THE LINE NUMBER
   761 1205            0
   762 1206         1046 C=C+1   X
   763 1207         1750 REGN=C 15
   764 1210            1 GOSUB   SETSST         SET SST BIT
   764 1211            0
   765 1212            1 GOLONG  RUNNK          GO DO 1 INSTRUCTION
   765 1213            2
*
* CLRPGM - CLEAR PROGRAM
* THIS ROUTINE CLEARS THE PROGRAM WHOSE NAME IS FOUND IN REG 9.
* IF REG 9 = NULL, THEN CLEAR THE PROGRAM WHERE THE PC IS
*- CURRENTLY POINTING
* USES A, B[0-3],C,M,N,PT,S[0-7,9],4 SUB LEVELS.
*
* SEE DRC'S LAB NOTEBOOK #10422X P.106 FOR FLOWCHART OF CLRPGM
*
   775 1214 CLRPGM 1170 C=REGN 9               RETRIEVE THE NAME
   776 1215          530 M=C                    SAVE FOR ASRCH
   777 1216         1356 ? C#0                  LABEL PRESENT?
   778 1217          207 GOC     CLRP1  (1237) YES, GO FIND IT
   779 1220          314 ?S10=1                  ROM FLAG?
   780 1221          437 GOC     XCLPX1 (1264) YES, DO NOTHING
   781 1222            1 GOSUB   GETPC          NULL STRING HERE,GET CURRENT
   781 1223            0
   782 1224 CLRP2      1 GOSUB   FLINK          FIND THE END OF THE PROGRAM
   782 1225            0
   783 1226            1 GOSUB   PATCH2         THIS PATCH CLEARS THE PRIVATE
   783 1227            0
   784 1230            1 GOSUB   PUTPCL         STORE IN PC & GET LINE #
   784 1231            0
   785 1232          210 S5=     1              DELETE THE PROGRAM END
   786 1233          116 C=0                    SET # LINES TO DELETE = FFF
   787 1234         1146 C=C-1   X
   788 1235         1110 S9=     1              SET UP FOR PACK
   789 1236          413 GOTO    CLRP3  (1277) GO DELETE THE PROGRAM
   790 1237 CLRP1      1 GOSUB   ASRCH          GO DO ALPHA SEARCH
   790 1240            0
   791 1241           34 PT=     3
   792 1242         1356 ? C#0                  SUCCESS?
   793 1243           33 GONC    CLPERR (1246) NO, ERROR EXIT
   794 1244         1014 ?S2=1                  LABEL FOUND IN ROM?
```

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   795 1245         1573 GONC   CLRP2  (1224) NO, FOUND IN RAM.
   796 1246 CLPERR     1 GOLONG ERRNE          ERROR EXIT
   796 1247            2
*
* DELNNN - DELETE NNN INSTRUCTIONS
* THIS ROUTINE DELETES NNN LINES OF PROGRAM STARTING WITH
*- THE ONE POINTED TO BY THE PC.
* THE NNN ARGUMENT IS FOUND IN A[X].
* DELNNN WILL NOT DELETE A PROGRAM END STATEMENT.
* IN ALL OTHER WAYS THIS FUNCTION IS LIKE XDELET FOUND BELOW.
*
*
* XDELET - EXECUTE DELETE LINE
* DELETES 1 LINE FROM PROGRAM MEMORY STARTING WITH
*- THE BYTE POINTED TO BY THE PC +1. THE PC IS SET
*- TO PROPERLY POINT TO THE PRECEEDING LINE.
* UPDATES LINKS IF A CHAIN ELEMENT IS DELETED.
* ALSO SETS PACK AND DECOMPILE BITS OF THE
*- FOLLOWING END.
* S6 SET TO 1 WHEN AN END IS DELETED
* NOTE, WILL NOT DELETE THE FINAL END!
* USES A,B,C,M,N,S[0-9],PT
*
* SEE DRC'S LAB NOTEBOOK #10422X P.107 FOR FLOWCHART OF DELNNN AND
*     XDELET.
*
   820 1250 DELNNN   256 AC EX                 STORE # TO DELETE -1 IN N
   821 1251         1146 C=C-1  X
   822 1252          617 GOC    XDELEX (1333) ZERO TO DELETE, DO NOTHING.
   823 1253          204 S5=    0             DON'T DELETE AN END.
   824 1254           14 ?S3=1                 PRGM MODE?
   825 1255          563 GONC   XDELEX (1333) NO, DON'T DO IT.
   826 1256           33 GOTO   XDELA  (1261) GO DELETE.
   827 1257 XDELET  210 S5=     1             DELETE ENDS.
   828 1260          116 C=0                  DELETE 1 LINE
   829 1261 XDELA   160 N=C                  STORE # OF LINES TO DELETE -1
   830 1262         1514 ?S12=1               PRIVATE?
   831 1263          507 GOC    XDELEX (1333) YES - DO NOTHING
   832 1264 XCLPX1  314 ?S10=1                ROM FLAG?
   833 1265            1 GOLC   INSSUB        YES, DO NOTHING. DISPLAY [ROM].
   833 1266            3
   834 1267            1 GOSUB  GETPC         GET STARTING ADDRESS OF DELETE
   834 1270            0
   835 1271         1770 C=REGN 15            DECREMENT LINE NUMBER IF NON ZERO
   836 1272            1 GOSUB  PATCH5
   836 1273            0
   837 1274         1750 REGN=C 15
   838 1275         1104 S9=    0             CLEAR PACK FLAG
   839 1276          260 C=N
   840 1277 CLRP3   504 S6=     0             CLEAR END FLAG
   841 1300 XDELM1  160 N=C                  STORE # OF LINES LEFT TO DELETE -1
   842 1301            1 GOSUB  DELLIN        DELETE 1 LINE
   842 1302            0
   843 1303          514 ?S6=1                TRAVERSED AN END?
   844 1304           47 GOC    XDELM2 (1310) YES. QUIT.
   845 1305          260 C=N                  C[X]-1 = # LEFT TO DELETE
   846 1306         1146 C=C-1  X             DONE?
   847 1307         1713 GONC   XDELM1 (1300) NO, GO AROUND AGAIN
   848 1310 XDELM2     1 GOSUB  FLINKP        FIND THE CURRENT END
   848 1311            0
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   849 1312          174 RCR    4              SAVE PREVIOUS LINK ADDRESS IN C[3-6]
   850 1313          252 AC EX  WPT
   851 1314          374 RCR    10             PUT DECOMPILE BITS IN END
   852 1315            1 GOSUB  FIXEND
   852 1316            0
   853 1317          174 RCR    4              PUT A[0-3]  BACK
   854 1320          412 A=C    WPT
   855 1321         1114 ?S9=1                  GO PACK?
   856 1322            1 GOLC   GTO.5          YES.
   856 1323            3
   857 1324            1 GOSUB  GETLIN         BACK STEP IF NEW LINE NUM. # 0.
   857 1325            0
   858 1326         1346 ? C#0  X              BACK STEP?
   859 1327           43 GONC   XDELEX (1333) NO, LINE 0.
   860 1330          630 C=M                  RETRIEVE THE CURRENT ADDRESS
   861 1331            1 GOSUB  BSTEPA         BACK STEP.
   861 1332            0
   862 1333 XDELEX     1 GOLONG NFRKB          ALL DONE!
   862 1334            2
*
* SSTBST - LOGIC COMMON TO SST AND BST
*
   866                   ENTRY  SSTBST
   867 1335 SSTBST 1505 CON    @1505          GOSUB PRT15
   868 1336         674 CON    @674
   869                   ENTRY  PR15RT         FOR THE PRINTER
   870       PR15RT
   871 1337            1 GOSUB  RSTSEQ         CLEAR 6 FLAGS
   871 1340            0
   872 1341            1 GOSUB  ANNOUT         UPDATE ANNUNCIATORS
   872 1342            0
   873 1343            1 GOSUB  LINNUM         RECONSTRUCT PRIVACY FLAG
   873 1344            0
   874 1345         1514 ?S12=1                 PRIVACY?
   875 1346         1657 GOC    XDELEX (1333) YES. GOLONG NFRKB
   876 1347         1740 RTN
   877
* ERROR - ERROR EXIT
* CALLING SEQUENCE:
*   GOSUB ERROR
*   XDEF  <MSGXXX>
* ERROR ROUTINE PERFORMS :
* 1. IF ERROR FLAG ALREADY SET, RESET IT, RTN TO NFRKB
* 2. UNCONDITIONAL RESET DATAENTRY FLAG, AND OTHERS
* 3. DISPLAY ERROR MESSAGE
* 4. IF PROGRAM RUNNING, STOP-RUNNING AND DO A BACK STEP
* 5. ALWAYS RETURN TO NFRKB, WON'T RETURN TO CALLING PROGRAM
*
*
* ERR110 - ERROR EXIT SIMPLY DECIDE TO DO A BACK STEP OR NOT BEFORE
*          RETURNNING TO NFR. REQUIRED STATUS SET 0 LOADING.
*
   893                   ENTRY  ERRSUB
   894 1350 ERRSUB     1 GOSUB  RSTMS0         ENABLE CHIP 0 AND
   894 1351            0
   895                                         CLEAR DATAENTRY FLAG
   896 1352          410 S8=    1              TELL MSG TO SET MSGFLAG
   897 1353         1140 SETHEX
   898 1354         1274 RCR    7
   899 1355         1530 ST=C
```

```
   900 1356          1014 ?S2=1                    ERROR FLAG ?
   901 1357          1640 RTN NC                   NO
   902 1360          1004 S2=     0                RESET ERROR FLAG
   903 1361          1630 C=ST
   904 1362          1274 RCR     7
   905 1363          1650 REGN=C  14
   906 1364 ERRTN    1473 GOTO    XDELEX (1333)
*
   908 1365 ERROR       1 GOSUB   ERRSUB
   908 1366             0
   909 1367           660 C=STK
   910 1370          1460 CXISA
   911 1371             1 GOSUB   MSGE
   911 1372             0
   912 1373 ERR110   1314 ?S13=1                   RUNNING ?
   913 1374            37 GOC     ERR120 (1377)  YES
   914 1375           114 ?S4=1                    SST ?
   915 1376            33 GONC    ERR130 (1401)  NO
   916 1377 ERR120      1 GOSUB   BSTEP
   916 1400             0
   917      ERR130
   918 1401             1 GOSUB   STOPS          CLEAR PAUSEFLAG & RUNNING
   918 1402             0
   919 1403             1 GOSUB   LINNUM         GUARANTEE VALID LINE NUMBER
   919 1404             0
   920                                           FOR PARSE IN PRGM MODE
   921 1405          1573 GOTO    ERRTN  (1364)
*
*
* DELLIN - DELETE LINE FROM PROGRAM MEMORY
* THIS ROUTINE DELETES A LINE OF CODE STARTING WITH THE
*- NEXT BYTE AFTER THE ONE SPECIFIED BY A[0-3] IN MM FORMAT.
* WILL NOT DELETE THE FINAL END.
* RETURNS S6=1 IF END DELETED.
* IF A CHAIN ELEMENT IS DELETED, THE PREVIOUS LINK IS UPDATED
*- TO INCLUDE THE DELETED LINK.
* USES A[0-3],B,C,M,3 SUBROUTINE LEVELS
*
* NOTE !!! THIS ROUTINE CANNOT BE CALLED FROM A SUBROUTINE
*
   935 1406 DELLIN    252 AC EX  WPT             SAVE STARTING ADDRESS
   936 1407           412 A=C    WPT
   937 1410           530 M=C
   938 1411           110 S4=    1
   939 1412          1210 S7=    1
   940 1413             1 GOSUB  NXLDEL          FIND THE ENDING ADDRESS
   940 1414             0
   941 1415           630 C=M                     RETRIEVE THE STARTING ADDRESS
   942 1416           252 AC EX  WPT             AND SAVE THE ENDING ADDRESS
   943 1417           530 M=C
   944 1420            63 GOTO   DELLN1 (1426)   ZERO OUT APPROPRIATE BYTES
   945 1421 DELLN2    116 C=0                     ZERO 1 BYTE
   946 1422             1 GOSUB  INCADA          MOVE THERE
   946 1423             0
   947 1424             1 GOSUB  PTBYTA          PUT ZERO'S IN
   947 1425             0
   948 1426 DELLN1    630 C=M                     RETRIEVE THE ENDING ADDRESS
   949 1427          1552 ? A#C  WPT             DONE?
   950 1430          1717 GOC    DELLN2 (1421)   NO, DELETE SOME MORE
   951 1431          1740 RTN                    ALL DONE
```

```
*
* PTLINK - PUT LINK
* PUTS C[0-3] INTO PROGRAM MEMORY AT THE ADDRESS POINTED TO
*- A[0-3] IN MM FORMAT.
* PT=3 EXPECTED AND RETURNED
* USES B[0-3]
* THIS ROUTINE MIXED IN WITH PTBYTA
*
   961 1432 PTLINK  252 AC EX   WPT          SAVE BYTES TO STORE
   962 1433 PTLNKA  212 B=A     WPT          IN B
   963 1434        1160 DADD=C               WAKE UP THE RIGHT REGISTER
   964 1435         412 A=C     WPT          RESTORE A
   965 1436         174 RCR     4            PREPARE FOR BRANCH TABLE (7)
   966 1437         460 LDI
* TABLE JUMP
   968 1440        1203 CON     @1203         PUT LINK TABLE ADDRESS
   969 1441 PTLNKB  374 RCR     10           PUT ADDRESS IN-POSITION
   970 1442         740 GOTOC                 7 WAY BRANCH
*
* PTBYTA - PUT BYTE
* PUT THE BYTE IN C[0-1] INTO RAM AT THE ADDRESS
*- POINTED TO BY A[0-3] IN MM FORMAT.
* PT=3 OUT.
* USES B[0-1]
*
   978 1443 PTBYTA  256 AC EX                SAVE BYTE TO STORE IN B
   979 1444        1434 PT=     1            SET UP FOR 1 BYTE STORE
   980 1445         212 B=A     WPT          SAVE BYTE
   981 1446        1160 DADD=C               WAKE UP THE RIGHT REG.
   982 1447         416 A=C                  RESTORE A
   983 1450 PTBYTP  174 RCR     4            PREPARE FOR TABLE JUMP
   984 1451         460 LDI
* TABLE JUMP
   986 1452        1200 CON     @1200         PUT BYTE TABLE ADDRESS
   987 1453        1663 GOTO    PTLNKB (1441)
*
* PUTPC - PUT AWAY THE PROGRAM COUNTER
* PLACES A[0-3] IN MM FORMAT INTO THE PC AFTER CONVERTING
*- TO PC FORMAT BY SHIFTING A[3] RIGHT 1 BIT IF S10=0
* PT=3 ASSUMED AND RETURNED
*
* PUTPCF - SAME AS PUTPC, BUT SETS LINE# TO FFF
*
* PUTPCX - SAME AS PUTPCF EXCEPT IF RUNNING LINE# NOT SET TO FFF
*
* PUTPCD - SAME AS PUTPC EXCEPT CALLS DECAD BEFORE GOING TO PUTPC
* CONSEQUENTLY USES 1 SUBROUTINE LEVEL
*
  1001                    ENTRY  PUTPCD
  1002 1454 PUTPCD     1 GOSUB  DECAD
  1002 1455            0
  1003 1456          113 GOTO   PUTPC  (1467)
*
  1005 1457 PUTPCX 1314 ?S13=1              RUNNING?
  1006 1460          77 GOC    PUTPC  (1467) YES, DON'T SET LINE# TO FFF
  1007 1461 PUTPCF  116 C=0                 SET LINE# TO FFF
  1008 1462        1160 DADD=C
  1009 1463        1770 C=REGN 15
  1010 1464         106 C=0    X
```

```
1011 1465         1146 C=C-1  X
1012 1466         1750 REGN=C 15
1013 1467 PUTPC    106 C=0    X
1014 1470         1160 DADD=C
1015 1471 PUTPCA  1470 C=REGN 12            GET PC
1016 1472          252 AC EX  WPT
1017 1473          412 A=C    WPT           NEW PC IN PLACE
1018 1474          314 ?S10=1               ROM ADDRESS?
1019 1475          127 GOC    PUTPC3 (1507) YES,NO SHIFT
1020 1476          742 C=C+C  PT            SHIFT 1 BIT RIGHT
1021 1477           23 GONC   PUTPC1 (1501)
1022 1500         1042 C=C+1  PT
1023 1501 PUTPC1   742 C=C+C  PT
1024 1502           23 GONC   PUTPC2 (1504)
1025 1503         1042 C=C+1  PT
1026 1504 PUTPC2   742 C=C+C  PT
1027 1505           23 GONC   PUTPC3 (1507)
1028 1506         1042 C=C+1  PT
1029 1507 PUTPC3  1450 REGN=C 12            PUT PC BACK
1030 1510         1740 RTN
* SPECIAL DELETE AND PACK LOGIC HERE
1032 1511 SKPDEL   114 ?S4=1               DELETE LOGIC?
1033 1512            1 GOLNC  PAKSPC       PACK LOGIC GOES HERE
1033 1513            2
1034 1514 SKPDL      1 GOSUB  INCADA       MOVE INSIDE LINK
1034 1515            0
1035 1516            1 GOSUB  FLINKA       FIND VARIOUS LINKS
1035 1517            0
1036 1520          252 AC EX  WPT
1037 1521          412 A=C    WPT           RESTORE ADDRESS BEFORE LINK
1038 1522            1 GOSUB  DECADA
1038 1523            0
1039 1524          252 AC EX  WPT
1040 1525          530 M=C                  SAVE CURRENT AND PREVIOUS LINK ADDRESS
1041 1526            1 GOSUB  GTLINK       GET THE CURRENT LINK
1041 1527            0
1042 1530         1076 C=C+1  S             END?
1043 1531          137 GOC    SKPD7  (1544) NO, ALPHA LABEL.
1044 1532          510 S6=    1             END, REMEMBER IT.
1045 1533          214 ?S5=1                TRAVERSE THE END? (DELET)
1046 1534           63 GONC   SKPD4  (1542) NO, (DEL NNN)
1047 1535         1176 C=C-1  S             FINAL END?
1048 1536          776 C=C+C  S
1049 1537          776 C=C+C  S
1050 1540          776 C=C+C  S
1051 1541          343 GONC   SKPD1  (1575) NO, TRAVERSE THE END
1052 1542 SKPD4    660 C=STK                THIS IS A SPECIAL CASE EXIT OUT
1053 1543         1740 RTN                  OF DELLIN!!! WATCH OUT!!!
1054 1544 SKPD7    630 C=M                  SAVE M IN B
1055 1545          356 BC EX
1056 1546            1 GOSUB  INCAD2       CHECK BYTE AFTER TEXT CHAR.
1056 1547            0
1057 1550            1 GOSUB  NXBYTA       GET KEYCODE
1057 1551            0
1058 1552         1434 PT=    1
1059 1553         1152 C=C-1  WPT           SUBTRACT 1
1060 1554          117 GOC    SKPD6  (1565) DO NOTHING IF 0 KEYCODE
1061 1555          406 A=C    X              POSITION FOR BITMAP SUBS.
1062 1556         1746 A SL   X
1063 1557          116 C=0
```

```
1064 1560          1160 DADD=C
1065 1561             1 GOSUB  TBITMP          CLEAR BIT
1065 1562             0
1066 1563             1 GOSUB  SRBMAP
1066 1564             0
1067 1565 SKPD6     316 C=B                    RESTORE B TO M
1068 1566           530 M=C
1069 1567            34 PT=    3
1070 1570           412 A=C    WPT
1071 1571             1 GOSUB  INCADA          GET ADDRESS OF LINK IN A[0-3]
1071 1572             0
1072 1573             1 GOSUB  GTLINK          GET THE LINK
1072 1574             0
1073 1575 SKPD1     374 RCR    10             SAVE THE CURRENT LINK
1074 1576           356 BC EX                 FIX PREVIOUS LINK
1075 1577           630 C=M                   GET ADDRESS OF PREVIOUS LINK
1076 1600           174 RCR    4              POSITION FOR GTLINK
1077 1601             1 GOSUB  GTLNKA         GET IT
1077 1602             0
1078 1603           356 BC EX                 PLACE THE FIRST LINK IN A[0-3]
1079 1604           174 RCR    4
1080 1605           356 BC EX
1081 1606           152 AB EX  WPT
1082 1607          1506 ? A#0  X              END OF CHAIN SPECIAL CASE
1083 1610            27 GOC    *+2    (1612) NOT HERE
1084 1611           106 C=0    X              PUT END OF CHAIN 1 LINK DOWN
1085 1612          1066 C=C+1  XS             BASE 14 ADD
1086 1613          1066 C=C+1  XS
1087 1614          1006 C=A+C  X              CREATE NEW LONGER LINK
1088 1615            47 GOC    SKPD2  (1621)
1089 1616          1166 C=C-1  XS
1090 1617          1166 C=C-1  XS
1091 1620            23 GONC   SKPD3  (1622)
1092 1621 SKPD2    1046 C=C+1  X              NEW LINK READY
1093 1622 SKPD3     152 AB EX  WPT            PUT THE NEW LINK BACK
1094 1623             1 GOSUB  PTLINK
1094 1624             0
1095 1625           630 C=M
1096 1626           412 A=C    WPT            GET ADDRESS OF BYTE BEFORE LINK
1097 1627          1204 S7=    0              TRAVERSE THE LINK THIS TIME
1098 1630             1 GOLONG .NXLDEL        AROUND WE GO AGAIN.
1098 1631             2
1099
*
* GENLNK - GENERATE LINK
* GIVEN 2 ADDRESSES IN A[0-3](LARGER) AND C[0-3](SMALLER),
*- CREATES THE NECESSARY LINK TO GO UP THE CHAIN FROM C TO A.
*- THIS LINK IS STORED IN THE C ADDRESS IN MEMORY.
* ASSUMES AND RETURNES PT=3.
* USES A[0-3];B[0-3],M, AND 1 SUB LEVEL. C SAVED.
* FOR THE SPECIAL CASE OF A=0[0-3], 0 IS STORED AS THE LINK.
*
1109 1632 GENLNK    530 M=C
1110 1633          1512 ? A#0  WPT            TOP OF CHAIN?
1111 1634            27 GOC    *+2    (1636) NO
1112 1635           112 C=0    WPT            YES, CREATE A ZERO LINK.
1113 1636          1112 C=A-C  WPT            CREATE LINK
1114 1637            43 GONC   GENLK1 (1643)
1115 1640          1146 C=C-1  X              FIX UP ADDRESS
1116 1641          1142 C=C-1  PT
```

```
 1117 1642          1142 C=C-1  PT              IN THE BORROW CASE
 1118 1643 GENLK1    746 C=C+C  X               MAKE COMPACT LINK
 1119 1644           746 C=C+C  X
 1120 1645           746 C=C+C  X
 1121 1646           746 C=C+C  X
 1122 1647            23 GONC   *+2     (1651)
 1123 1650          1042 C=C+1  PT
 1124 1651          1712 C SR   WPT
 1125 1652          1420 LC     12              CREATE LINK CHAR.
 1126 1653            34 PT=    3               PUT POINTER BACK
 1127 1654           412 A=C    WPT             STORE LINK
 1128 1655           630 C=M
 1129 1656             1 GOSUB  PTLNKA
 1129 1657             0
 1130 1660           630 C=M                    FIX UP
 1131 1661          1740 RTN                    DONE
*
* INSSUB - INSERT SUBROUTINE
* THIS SUBROUTINE SETS UP THE CALCULATOR FOR AN INSERT.
* IF THE LINE NUMBER # 0 OR THE CURRENT LINE # END, THEN
*- THE PC IN ADVANCED PAST THE CURENT LINE, S9 IS SET TO 1,
*- AND THE LINE # IS INCREMENTED BY 1.
* C[13-10] IS SAVED IN A[13-10].
* USES A[0-3],B[0-3],C,S[0-7,9].
*
 1141 1662 INSSUB      1 GOSUB  PATCH3           THIS PATCH CHECKS PRIVACY FOR DATA E
 1141 1663             0
 1142 1664          1514 ?S12=1                  IS THIS A PRIVATE PROGRAM?
 1143 1665             1 GOLC   ERRPR            YES, SAY PRIVATE.
 1143 1666             3
 1144 1667 INSUBA    256 AC EX                   SAVE C IN A
 1145 1670             1 GOSUB  GETPC
 1145 1671             0
 1146 1672          1104 S9=    0                DISABLE BACKSTEP IN INBYT ERROR
 1147 1673          1720 C=REGN 15               GET LINE NUMBER
 1148 1674          1346 ? C#0  X                NON ZERO LINE NUMBER?
 1149 1675            63 GONC   INSUB1 (1703)    NO, DON'T SKPLIN, BUT INC LINNUM.
 1150 1676             1 GOSUB  SKPLIN           SKIP A LINE
 1150 1677             0
 1151 1700           514 ?S6=1                   HIT AN END?
 1152 1701            67 GOC    INSUB2 (1707)    YES, DON'T INCREMENT LINNUM.
 1153 1702          1110 S9=    1                ENABLE BACKSTEP ON ERROR.
 1154 1703 INSUB1      1 GOSUB  GETLIN           INCREMENT LINE NUMBER
 1154 1704             0
 1155 1705          1046 C=C+1  X
 1156 1706          1750 REGN=C 15               STORE AWAY AGAIN
 1157 1707 INSUB2      1 GOLONG PUTPC            PUT ADDRESS AWAY AND RETURN
 1157 1710             2
 1158
 1159
 1160
 1161
 1162
 1163
 1164
*
* GOSUB0,GOSUB1,GOSUB2,GOSUB3 - GOSUB LONG WITHIN A 4K ROM TO AN
*- ADDRESS WITHIN A SPECIFIED 1K ROM.
* THESE ROUTINES ARE THE SAME AS GOSUB EXCEPT INSTEAD OF ASSUMING THAT
*- THE DESTINATION ADDRESS IS WITHIN THE CURRENT 1024 WORD ROM, THE
```

```
*- DESTINATION ROM IS SPECIFIED BY THE CALL. I.E. TO GOSUB TO A
*- SUBROUTINE IN ROM1 OF A 4 ROM CHIP, ONE WOULD USE:
*    GOSUB  GOSUB1
*    XDEF   <NAME>
*
* WARNING!!! IF YOU SPECIFY THE WRONG ROM, THE CALL WILL GO TO THE
*- ADDRESS YOU SPECIFY RATHER THAN THE CORRECT ONE.  THIS IS A PAINFUL
*- ERROR TO FIND SINCE IT RESULTS IN JUMPS TO THE MIDDLE OF NOWHERE.
*
* USES C PLUS 1 ADDITIONAL SUBROUTINE LEVEL TEMPORARILY.
*
* GOL0,GOL1,GOL2,GOL3 - GOLONG TO ANYWHERE IN A 4K ROM.
* SAME AS GOLONG EXCEPT DESTINATION 1K ROM SPECIFIED AS IN GOSUB[0-3]
* USES C PLUS 1 SUBROUTINE LEVEL TEMPORARILY.
*
* INTERNAL SUBROUTINE FOR GOSUB[0-3] AND GOL[0-3]
*
 1187                    ENTRY  GOL0
 1188                    ENTRY  GOSUB0
 1189                    ENTRY  GOL1
 1190                    ENTRY  GOSUB1
 1191                    ENTRY  GOL2
 1192                    ENTRY  GOSUB2
 1193                    ENTRY  GOL3
 1194                    ENTRY  GOSUB3
 1195 1711 GSUBS1 1460 CXISA                 GET 10 LSB OF ADDRESS PLUS 00
 1196 1712        1732 C SR   M              PREPARE TO CONCATINATE 12 BITS TO
 1197 1713        1732 C SR   M              TOP 4 BITS OF GOSUB ADDRESS
 1198 1714        1732 C SR   M
 1199 1715         756 C=C+C                 ALIGN SO THAT A MANTISSA INCREMENT
 1200 1716         756 C=C+C                 WILL CHANGE BIT 10 OF THE FINAL ADDRE
 1201 1717        1740 RTN
 1202 1720 GOL0    660 C=STK                 GET CALLING ADDRESS
 1203 1721          53 GOTO   GSB0A  (1726) GO TO IT (IN ROM 0)
 1204 1722 GOSUB0  660 C=STK                 GET CALLING ADDRESS
 1205 1723        1072 C=C+1  M              INCREMENT PAST ARGUMENT
 1206 1724         560 STK=C                 PUT BACK FOR SUBROUTINE RETURN
 1207 1725        1172 C=C-1  M              DECREMENT TO GET ARGUMENT
 1208                    LEGAL
 1209 1726 GSB0A     1 GOSUB  GSUBS1         PREPARE ADDRESS
 1209 1727           0
 1210 1730         363 GOTO   GSBQ0  (1766) FINISH UP
 1211 1731 GOL1    660 C=STK
 1212 1732          53 GOTO   GSB1A  (1737)
 1213 1733 GOSUB1  660 C=STK
 1214 1734        1072 C=C+1  M
 1215 1735         560 STK=C
 1216 1736        1172 C=C-1  M
 1217                    LEGAL
 1218 1737 GSB1A     1 GOSUB  GSUBS1
 1218 1740           0
 1219 1741         243 GOTO   GSBQ1  (1765)
 1220 1742 GOL2    660 C=STK
 1221 1743          53 GOTO   GSB2A  (1750)
 1222 1744 GOSUB2  660 C=STK
 1223 1745        1072 C=C+1  M
 1224 1746         560 STK=C
 1225 1747        1172 C=C-1  M
 1226                    LEGAL
 1227 1750 GSB2A     1 GOSUB  GSUBS1
```

```
1227 1751            0
1228 1752          123 GOTO   GSBQ2  (1764)
1229 1753 GOL3     660 C=STK
1230 1754           53 GOTO   GSB3A  (1761)
1231 1755 GOSUB3   660 C=STK
1232 1756         1072 C=C+1  M
1233 1757          560 STK=C
1234 1760         1172 C=C-1  M
1235                   LEGAL
1236 1761 GSB3A      1 GOSUB  GSUBS1
1236 1762            0
1237 1763 GSBQ3    1072 C=C+1  M              SELECT ROM 3 OF CHIP
1238 1764 GSBQ2    1072 C=C+1  M              SELECT ROM 2 OF CHIP
1239 1765 GSBQ1    1072 C=C+1  M              SELECT ROM 1 OF CHIP
1240 1766 GSBQ0    1574 RCR    12             MOVE ADDRESS ALMOST INTO PLACE
1241 1767           756 C=C+C                 ALIGN DESTINATION ADDRESS ON
1242 1770           756 C=C+C                 DIGIT BOUNDARIES.
1243 1771           740 GOTOC                 GO!
*
* GSB000,GSB256,GSB512,GSB768 - FAST ABSOLUTE GOSUB
* THESE FOUR ENTRY POINTS TO THE SAME ROUTINE PROVIDE A MEANS
*- FOR FAST 2 WORD GOSUBS IN PORT ADDRESSED MICROCODED PLUG-IN
*- ROMS. THE SUBROUTINE CALLED MUST HAVE ITS FIRST WORD LOCATED
*- ON A LOCAL 256(DEC) BOUNDARY AND THE GOSUBS REFERENCING THE
*- SUBROUTINE MUST BE LOCATED WITHIN THAT 256 WORD BLOCK.
* I.E. A SUBROUTINE COULD BE LOCATED STARTING AT LOCATION 512
*- (1000 OCT) IN SOME ROM AND BE CALLED WITH A SINGLE 2 WORD
*- GOSUB [ GOSUB GSB256 ] AMYWHERE BETWEEN LOCATIONS 512 AND 767.
*
* BEWARE!!! - THIS ROUTINE IS DUMB. IF YOU CALL GSB256 FROM LOCATION
*- 700 IT WILL NOT GO TO 256 BUT TO 512 AS THE LABELS ARE FOR
*- PROGRAMMING CONVENIENCE ONLY. BE CAREFUL WHEN YOU USE THESE ROUTINES.
*
* USES ONLY C[2-6] PLUS 1 SUBROUTINE LEVEL TEMPORARILY.
*
1261                   ENTRY  GSB000
1262                   ENTRY  GSB256
1263                   ENTRY  GSB512
1264                   ENTRY  GSB768
1265       GSB000
1266       GSB256
1267       GSB512
1268 1772 GSB768   660 C=STK                 GET THE ADDRESS
1269 1773          560 STK=C                 RESTORE THE RETURN ADDRESS
1270 1774         1074 RCR    2              ZERO THE LAST 8 BITS
1271 1775          106 C=0    X
1272 1776         1574 RCR    12             RESTORE ADDRESS TO GOTOC SPOT
1273 1777          740 GOTOC                 GO DO IT
1274
1275
1276
1277
1278                   UNLIST
1281                   END

ERRORS :       0
```

SYMBOL TABLE

CLPERR	1246	-	1243
CLRP1	1237	-	1217
CLRP2	1224	-	1245
CLRP3	1277	-	1236
CLRPGM	1214	-	
CLRREG	525	-	
CPY100	556	-	
CPY110	565	-	561
CPY120	571	-	558
CPY130	575	-	570
CPY140	607	-	603
CPY145	651	-	702
CPY150	652	-	661
CPY160	662	-	656
CPY170	703	-	674
CPYNE	554	-	557
DELLIN	1406	-	
DELLN1	1426	-	1420
DELLN2	1421	-	1430
DELNNN	1250	-	
ERR110	1373	-	
ERR120	1377	-	1374
ERR130	1401	-	1376
ERROR	1365	-	
ERRPR	604	-	
ERRRAM	562	-	572
ERRSUB	1350	-	
ERRTN	1364	-	1405
GBA1	1045	-	1023
GBA2	1043	-	1025
GBA3	1041	-	1027
GBA4	1037	-	1031
GBA5	1015	-	1033
GBA6	1034	-	
GBA6A	1035	-	1064
GENLK1	1643	-	1637
GENLNK	1632	-	
GOL0	1720	-	
GOL1	1731	-	
GOL2	1742	-	
GOL3	1753	-	
GOSUB0	1722	-	
GOSUB1	1733	-	
GOSUB2	1744	-	
GOSUB3	1755	-	
GSB000	1772	-	
GSB0A	1726	-	1721
GSB1A	1737	-	1732
GSB256	1772	-	
GSB2A	1750	-	1743
GSB3A	1761	-	1754
GSB512	1772	-	
GSB768	1772	-	
GSBQ0	1766	-	1730
GSBQ1	1765	-	1741
GSBQ2	1764	-	1752

GSBQ3	1763	-			
GSUBS1	1711	-			
GTFEN1	353	-			
GTFEND	350	-			
GTLINK	1116	-			
GTLNKA	1107	-	1117	1104	
INSSUB	1662	-			
INSUB1	1703	-	1675		
INSUB2	1707	-	1701		
INSUBA	1667	-			
MOVR10	542	-	533		
MOVREG	534	-			
NFRKBX	722	-	766		
PACK	3	-	1		
PACKE	2	-			
PACKN	0	-			
PAK100	24	-	32		
PAK102	31	-	53		
PAK105	34	-	30		
PAK108	51	-	23		
PAK110	60	-	33		
PAK115	72	-	57		
PAK117	117	-	112	105	
PAK118	120	-	116	114	110
PAK120	54	-	61		
PAK130	124	-			
PAK200	125	-			
PAK210	127	-	141		
PAK220	142	-	137		
PAK230	154	-	151	147	
PAK240	170	-	155		
PAK250	172	-	153	145	143
PAK260	173	-	171		
PAK265	206	-	253	201	
PAK270	213	-	235		
PAK275	231	-	225		
PAK280	240	-	205	203	177
PAKEND	254	-			
PAKSPC	362	-			
PATCH1	734	-			
PATCH2	741	-			
PATCH3	756	-			
PATCH5	763	-			
PKASN1	446	-	442		
PKASN2	451	-	445		
PKASN3	453	-	476	450	433
PKEND1	271	-	276		
PKEND2	301	-	272		
PKEND3	317	-	300		
PKEND4	277	-	310		
PKEND5	324	-			
PKEND6	337	-	347		
PKIO10	461	-	437		
PKIO20	473	-	506		
PKIOAS	424	-			
PKM10	434	-	457		
PKSPC1	373	-	365		
PKSPC3	406	-			
PR15RT	1337	-			
PTBYTA	1443	-			

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PTBYTP  1450  -
PTLINK  1432  -
PTLNKA  1433  -
PTLNKB  1441  -  1453
PUTPC   1467  -  1460 1456
PUTPC1  1501  -  1477
PUTPC2  1504  -  1502
PUTPC3  1507  -  1505 1475
PUTPCA  1471  -
PUTPCD  1454  -
PUTPCF  1461  -
PUTPCX  1457  -
PUTREG   536  -
SKPD1   1575  -  1541
SKPD2   1621  -  1615
SKPD3   1622  -  1620
SKPD4   1542  -  1534
SKPD6   1565  -  1554
SKPD7   1544  -  1531
SKPDEL  1511  -
SKPDL   1514  -
SSTBST  1335  -
TABUPL  1000  -
TBLGBA  1020  -
TRGSET   724  -
ULINK1  1077  -  1074
ULINK2  1101  -  1076
ULINK3  1105  -  1102
UPLB0   1056  -  1001
UPLB1   1047  -  1003
UPLB2   1045  -  1005
UPLB3   1043  -  1007
UPLB4   1041  -  1011
UPLB5   1037  -  1013
UPLB6   1014  -
UPLINK  1065  -
XBST    1120  -
XBST1   1131  -  1172
XCLPX1  1264  -  1221
XCOPY    545  -
XDELA   1261  -  1256
XDELET  1257  -
XDELEX  1333  -  1364 1346 1327 1263 1255 1252
XDELM1  1300  -  1307
XDELM2  1310  -  1304
XPACK      0  -
XSST    1140  -
XSSTR   1173  -  1153
XSSTR1  1177  -  1174
```

ENTRY TABLE

CLRPGM	1214	-
CLRREG	525	-
DELLIN	1406	-
DELNNN	1250	-
ERR110	1373	-
ERR120	1377	-
ERROR	1365	-
ERRPR	604	-
ERRRAM	562	-
ERRSUB	1350	-
GENLNK	1632	-
GOL0	1720	-
GOL1	1731	-
GOL2	1742	-
GOL3	1753	-
GOSUB0	1722	-
GOSUB1	1733	-
GOSUB2	1744	-
GOSUB3	1755	-
GSB000	1772	-
GSB256	1772	-
GSB512	1772	-
GSB768	1772	-
GSUBS1	1711	-
GTFEN1	353	-
GTFEND	350	-
GTLINK	1116	-
GTLNKA	1107	-
INSSUB	1662	-
MOVREG	534	-
PACKE	2	-
PACKN	0	-
PAK200	125	-
PAKEND	254	-
PAKSPC	362	-
PATCH1	734	-
PATCH2	741	-
PATCH3	756	-
PATCH5	763	-
PKIOAS	424	-
PR1SRT	1337	-
PTBYTA	1443	-
PTBYTP	1450	-
PTLINK	1432	-
PTLNKA	1433	-
PTLNKB	1441	-
PUTPC	1467	-
PUTPCA	1471	-
PUTPCD	1454	-
PUTPCF	1461	-
PUTPCX	1457	-
PUTREG	536	-
SKPDEL	1511	-
SSTBST	1335	-
TRGSET	724	-
UPLINK	1065	-

XBST	1120	-
XCOPY	545	-
XDELET	1257	-
XPACK	0	-
XSST	1140	-

EXTERNAL REFERENCES

ANNOUT	1341				
ANNOUT	1342				
ASRCH	551	1237			
ASRCH	552	1240			
BSTCAT	1123				
BSTCAT	1124				
BSTEP	1127	1377			
BSTEP	1130	1400			
BSTEPA	1331				
BSTEPA	1332				
CLRREG	451	501	534		
CLRREG	452	502	535		
CPGMHD	754				
CPGMHD	755				
DCPL00	340				
DCPL00	341				
DCPLRT	64				
DCPLRT	65				
DECAD	1454				
DECAD	1455				
DECADA	77	246	1522		
DECADA	100	247	1523		
DECMPL	720				
DECMPL	721				
DELLIN	1301				
DELLIN	1302				
DFKBCK	1177				
DFKBCK	1200				
DFRST9	1131				
DFRST9	1132				
DRSY25	1134				
DRSY25	1135				
ERRNE	554	1246			
ERRNE	555	1247			
ERROR	562	604	760		
ERROR	563	605	761		
ERRPR	1665				
ERRPR	1666				
ERRSUB	1365				
ERRSUB	1366				
FIXEND	742	1315			
FIXEND	743	1316			
FLINK	1224				
FLINK	1225				
FLINKA	1516				
FLINKA	1517				
FLINKP	1310				
FLINKP	1311				
FSTIN	54				
FSTIN	55				
GENLNK	322	377			
GENLNK	323	400			
GETLIN	1157	1204	1324	1703	
GETLIN	1160	1205	1325	1704	
GETPC	102	1147	1222	1267	1670
GETPC	103	1150	1223	1270	1671

```
GSUBS1  1726  1737  1750  1761
GSUBS1  1727  1740  1751  1762
GTFEND    16
GTFEND    17
GTLINK    51   362  1526  1573
GTLINK    52   363  1527  1574
GTLNKA  1601
GTLNKA  1602
GTO.5   1322
GTO.5   1323
INCAD2    37    70   402   410  1546
INCAD2    40    71   403   411  1547
INCADA    72   163   735  1422  1514  1571
INCADA    73   164   736  1423  1515  1572
INSSUB  1265
INSSUB  1266
LINNUM  1343  1403
LINNUM  1344  1404
MEMLFT   611
MEMLFT   612
MOVREG   446
MOVREG   447
MSG        3
MSG        4
MSGE    1371
MSGE    1372
MSGPR    606
MSGRAM   564
MSGROM   762
MSGWR      5
NFRKB    722  1333
NFRKB    723  1334
NFRKB1  1136
NFRKB1  1137
NULTST  1202
NULTST  1203
NXBYTA    133   213   415  1550
NXBYTA    134   214   416  1551
NXLDEL    206  1413  1630
NXLDEL    207  1414  1631
NXLSST  1155
NXLSST  1156
NXLTX     421
NXLTX     422
PACKE     620
PACKE     621
PAK200    236
PAK200    237
PAKEND    371
PAKEND    372
PAKSPC   1512
PAKSPC   1513
PATCH2   1226
PATCH2   1227
PATCH3   1662
PATCH3   1663
PATCH5   1272
PATCH5   1273
PKIOAS     10
PKIOAS     11
```

```
PTBYTA    45   161  1424
PTBYTA    46   162  1425
PTBYTM   750
PTBYTM   751
PTBYTP   221
PTBYTP   222
PTLINK  1623
PTLINK  1624
PTLNKA  1656
PTLNKA  1657
PUTPC   1170  1707
PUTPC   1171  1710
PUTPCL  1230
PUTPCL  1231
PUTPCX   250   716
PUTPCX   251   717
PUTREG   504
PUTREG   505
ROMH05   566
ROMH05   567
ROMHED   573
ROMHED   574
RSTMS0     6  1350
RSTMS0     7  1351
RSTSEQ  1337
RSTSEQ  1340
RUNNK   1212
RUNNK   1213
SETSST  1210
SETSST  1211
SKPLIN  1676
SKPLIN  1677
SRBMAP  1563
SRBMAP  1564
SSTBST  1125  1145
SSTBST  1126  1146
SSTCAT  1143
SSTCAT  1144
STBT30    43
STBT30    44
STBT31    20
STBT31    21
STOPS   1401
STOPS   1402
TBITMP  1561
TBITMP  1562
UPLINK    24
UPLINK    25

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @22000-23777
*
     4                    FILE   CN9B
     5                    ENTRY  SAR021
     6                    ENTRY  SAR022
```

```
 8                    ENTRY  SERR
 9                    ENTRY  SEARCH
10                    ENTRY  ASRCH
11                    ENTRY  SNRCH
12                    ENTRY  DOSRCH
13                    ENTRY  XGNN10
14                    ENTRY  XGNN12
15                    ENTRY  XEQC01
16                    ENTRY  GTSRCH
17                    ENTRY  SNR12
18                    ENTRY  SNR10
19                    ENTRY  SGTO19
20                    ENTRY  SAROM
21                    ENTRY  XRTN
22                    ENTRY  RTN30
23                    ENTRY  XGI
24                    ENTRY  ROW0
25                    ENTRY  ROW11
26                    ENTRY  ROW12
27                    ENTRY  XXEQ
28                    ENTRY  XGTO
29
30
31
32
33     0 SNROM    146 AB EX  X              A[1:0]_LBL
34     1          674 RCR    11             SET ADDR TO NXT WORD
35     2 SNR09   1434 PT=    1              -
36     3 SNR010  1072 C=C+1  M              -
37     4 SNR012  1460 CXISA                 GET ROM WORD
38     5         1166 C=C-1  XS             1ST BYTE?
39     6         1366 ? C#0  XS             1ST BYTE?
40     7         1747 GOC    SNR010 (   3) NOPE
41    10         1342 ? C#0  PT             ROW0?
42    11           77 GOC    SNR020 (  20) NOPE
43    12         1352 ? C#0  WPT            NULL?
44    13         1703 GONC   SNR010 (   3) YES
45    14         1146 C=C-1  X              LBL_LBL-1
46    15         1552 ? A#C  WPT            CORRECT SHORT LBL?
47    16         1657 GOC    SNR010 (   3) NOPE
48    17          403 GOTO   SNR040 (  57) RETURN
49
50    20 SNR020  1042 C=C+1  PT             ROW 12?
51    21         1042 C=C+1  PT             -
52    22         1042 C=C+1  PT             -
53    23         1042 C=C+1  PT             -
54    24         1573 GONC   SNR010 (   3) NOPE
55    25         1634 PT=    0              LONG LBL?
56    26         1042 C=C+1  PT             -
57    27          237 GOC    SNR030 (  52) YES
58    30         1042 C=C+1  PT             CHAIN?
59    31         1517 GOC    SNR09  (   2) NOPE
60    32         1072 C=C+1  M              GET 3RD BYTE
61    33         1072 C=C+1  M              -
62    34         1460 CXISA                 -
63    35         1434 PT=    1              ALBL?
64    36         1042 C=C+1  PT             -
65    37         1447 GOC    SNR010 (   3) YES
66    40          116 C=0                   -
```

```
    67   41          1114 ?S9=1                      2ND END?
    68   42           177 GOC     SNR050 (  61)
    69   43          1110 S9=     1                  1ST END FOUND
    70   44           216 B=A                        SAVE LBL
    71   45             1 GSBLNG:RONHED              GET BEGIN ADDR
    71   46             0
    72   47           156 AB EX                      PUT BACK LBL
    73   50           674 RCR     11                 -
    74   51          1313 GOTO    SNR09  (   2) CONTINUE SEARCH
    75
    76   52 SNR030  1072 C=C+1   M                  CORRECT LONG LBL?
    77   53          1460 CXISA                     -
    78   54          1546 ? A#C   X                 -
    79   55          1257 GOC     SNR09  (   2) NOPE
    80   56          1172 C=C-1   M                 POSITION ADDRESS
    81   57 SNR040  1172 C=C-1   M                 -
    82   60            74 RCR     3                 C[3:0]_ROM ADDRESS
    83   61 SNR050     34 PT=     3
    84   62          1740 RTN
    85
    86
    87
    88
    89
*  SEARCH - SEARCH FOR NUMERIC LABEL
*- SEARCH THE CURRENT PROGRAM FOR THE DESIGNATED
*- LONG OR SHORT NUMERIC LABEL. (SEARCH'S IN ROM
*- OR RAM)
*- IN:   A.X=NUMERIC LABEL (IF PC IS IN RAM, A[2] MAY BE NON-ZERO)
*-       PT= 3
*- OUT:  C=0 IMPLIES THE LABEL WAS NOT FOUND
*         OTHERWISE
*-       C[3:0]= LABEL ADDRESS (ADDRESS OF BYTE BEFORE LABEL)
*-       PT= 3
*-       CHIP 0 SELECTED
*- USES:  STATUS BITS 9,6,0, G, A[13:0], C[13:0],B[3:0]
*        S6=1 IMPLIES PROGRAM COUNTER IS AT THE FIRST BYTE
*            OF A THREE BYTE INSTRUCTION ON INPUT.  THIS
*            ONLY OCCURS WHEN EXECUTING LONG GTONN AND XEQNN
*            OUT OF PROGRAM MEMORY.
*        S6=0 IMPLIES PROGRAM COUNTER IS AT A STANDARD POSITION
*            (I.E. AT THE BYTE BEFORE THE FIRST BYTE OF A LINE).
*- USES:  2 SUBROUTINE LEVELS
   109
   110
   111
   112                 ENTRY  SEARC1
   113   63 SEARCH  504 S6=    0
   114   64 SEARC1 1104 S9=    0                  1ST END NOT FOUND
   115   65          206 B=A    X                  SAVE A
   116   66            1 GSBLNG:GETPC              GET ADDR
   116   67            0
   117   70          314 ?S10=1                     ROM?
   118   71         1077 GOC    SNROM  (   0) YES
   119   72          306 C=B    X                  G_LBL
   120   73          674 RCR    11                 -
   121   74          130 G=C                       -
   122   75          514 ?S6=1                     -
   123   76           33 GONC   SNR12  ( 101)
   124   77 SNR10     1 GSBLNG INCAD2
```

```
124  100            0
125  101 SNR12      1 GSBLNG NXBYTA          GET A BYTE
125  102            0
126  103         1574 RCR    12              SET PTR
127  104         1202 C=-C   PT              1 BYTE FC?
128  105          742 C=C+C  PT              -
129  106         1737 GOC    SNR12  ( 101) YES
130  107          742 C=C+C  PT              2 BYTE FC?
131  110          467 GOC    SNR70  ( 156) YES
132  111          742 C=C+C  PT              3 BYTE FC?
133  112         1657 GOC    SNR10  (  77) YES
134  113          742 C=C+C  PT              ROW 0?
135  114           43 GONC   SNR50  ( 120) YES
136  115            1 GSBLNG NXLTX           ITS A TEXT FC
136  116            0
137  117         1623 GOTO   SNR12  ( 101) -
138
139  120 SNR50   1366 ? C#0  XS              NULL?
140  121         1603 GONC   SNR12  ( 101) YES
141  122         1604 S0=    0              -
142  123         1166 C=C-1  XS              LBL_LBL-1
143  124         1074 RCR    2              -
144  125 SNR55    256 AC EX                 C[6:3]_RAM ADDRESS
145  126          674 RCR    11             -
146  127         1634 PT=    0              C[1:0]_LBL
147  130          230 C=G                   -
148  131          426 A=C    XS             -
149  132           34 PT=    3              -
150  133         1546 ? A#C  X              CORRECT LBL?
151  134          147 GOC    SNR60  ( 150) NOPE
152  135           74 RCR    3              YES, PNT AT PREV STEP
153  136          416 A=C                   -
154  137            1 GSBLNG DECADA         DEC RAM ADDR
154  140            0
155  141         1614 ?S0=1                 LNG LBL?
156  142            1 GSUBC  DECADA         YES, DEC RAM ADDR AGAIN
156  143            1
157  144          116 C=0                   RE-ENABLE CHIP 0
158  145         1160 DADD=C
159  146          252 AC EX  WPT            C[3:0]_LBL ADDR
160  147         1740 RTN                  RETURN FROM SEARCH
161
162  150 SNR60     74 RCR    3              A[3:0]_RAM ADDR
163  151          416 A=C                   -
164  152         1273 GOTO   SNR12  ( 101) -
165
166  153 SNR65      1 GSBLNG INCADA         INC RAM ADDR
166  154            0
167  155         1243 GOTO   SNR12  ( 101) -
168
169  156 SNR70   1342 ? C#0  PT              ROW 12?
170  157         1747 GOC    SNR65  ( 153) NOPE
171  160         1066 C=C+1  XS              LONG LBL?
172  161          307 GOC    SNR80  ( 211) YES
173  162         1066 C=C+1  XS              X<>?
174  163         1707 GOC    SNR65  ( 153) YES
175  164            1 GSBLNG GTLINK         C[13]_3RD BYT OF CHAIN
175  165            0
176  166         1076 C=C+1  S               ALBL?
177  167         1647 GOC    SNR65  ( 153) YES
```

```
   178  170          1114 ?S9=1                    2ND END?
   179  171            57 GOC     SNR72  ( 176) YES
   180  172             1 GOSUB   CPGMHD         GOTO PGM HEAD
   180  173             0
   181  174          1110 S9=     1               1ST END FOUND
   182  175          1043 GOTO    SNR12  ( 101)
   183       SNR72
* SEARCH GIVES UP HERE
   185  176           514 ?S6=1                    PGM CTR IN ODD PLACE?
   186  177            73 GONC    SNR73  ( 206) NO
   187  200             1 GOSUB   GETPC          YES
   187  201             0
   188  202             1 GOSUB   INCAD2         SET IT TO END OF 3 BYTE FC
   188  203             0
   189  204             1 GOSUB   PUTPC
   189  205             0
   190  206 SNR73     116 C=0                     NOT FOUND
   191  207          1160 DADD=C                  RE-ENABLE CHIP 0
   192  210          1740 RTN                     -
   193
   194  211 SNR80       1 GSBLNG NXBYTA          GET 2ND BYT OF LNG LBL
   194  212             0
   195  213          1610 S0=     1               LNG LBL
   196  214          1113 GOTO    SNR55  ( 125) CORRECT LNG LBL?
   197
   198
   199
   200
   201
   202                   ENTRY   XGA00
*
* XGA - XEQ/GTO ALPHA
*- PLACE THE PROGRAM COUNTER AT THE SPECIFIED ALPHA
*- STRING LABEL ADDRESS.  IN THE CASE OF A XEQ, THE
*- RETURN STACK IS PUSHED THROUGH A TRANSFER TO "XEQC"
*- IN:  S7= 1/0 IMPLIES XEQ/GTO FUNCTION
*-      S9= 1 IMPLIES AN ALPHA SEARCH HAS BEEN
*-            PREVIOUSLY PERFORMED
*-      M[3:0]=ADDRESS OR M=ALPHA STRING
*
   213  215 XGA00       1 GOSUB   SAVRC          SAVE RETURN ADDRESS
   213  216             0
   214  217           630 C=M                     C=ALBL OR ADDRESS
   215  220          1314 ?S13=1                  RUNNING?
   216  221           277 GOC     XGI52  ( 250) YES
   217  222           114 ?S4=1                   SST?
   218  223           257 GOC     XGI52  ( 250) YES
* MUST BE FROM KEYBOARD
   220  224          1114 ?S9=1                   ALREADY FOUND?
   221  225           233 GONC    XGI52  ( 250) NO. (GTO FROM KEYBOARD)
   222  226           313 GOTO    XGI54  ( 257) MUST BE XEQ OF USER LABEL
*
* XGI - XEQ/GTO INDIRECT
*- PLACE THE PROGRAM COUNTER AT THE NUMERIC OR
*- ALPHA LABEL FOUND IN THE SPECIFIED REGISTER.
*- IN THE CASE OF AN XEQ, THE SUBROUTINE RETURN
*- STACK IS PUSHED THROUGH A TRANSFER TO "XEQC".
*- IN:  STATUS= 2ND BYTE OF FUNCTION CODE
*-      STATUS BIT 7 = 0/1 IMPLIES GTO/XEQ FUNCTION
*- OUT: GTO- CHIP 0 SELECTED
```

```
*-      XEQ- PT= 3
*-           C[3:0]= LABEL ADDRESS
*-           CHIP 0 SELECTED
*- USES: A,B,C,N,M,G,STATUS BITS, STATUS BITS 8 & 9
*-       REG 9, REG 10 DIGITS 0,1
*- USES: 4 SUBROUTINE LEVELS
   238
   239
   240
   241
   242  227 XGI30   1534 PT=     12             TEST FOR NULL LBL
   243  230          102 C=0     PT             -
   244  231         1356 ? C#0                  -
   245  232          453 GONC    SERRXF ( 277) YES
   246  233          416 A=C                    FORMAT
   247  234          116 C=0                    -
   248  235         1160 DADD=C
   249  236         1434 PT=     1              -
   250  237 XGI40   1512 ? A#0   WPT            - (END OF STRING?)
   251  240           53 GONC    XGI50  ( 246) -  (YES)
   252  241          252 AC EX   WPT            -
   253  242         1574 RCR     12             -
   254  243         1616 A SR                   -
   255  244         1616 A SR                   -
   256  245         1723 GOTO    XGI40  ( 237) -
   257  246 XGI50   1074 RCR     2              -
   258  247          530 M=C                    -
   259  250 XGI52   1150 REGN=C 9
   260  251            1 GSBLNG ASRCH           SEARCH FOR ALPHA LBL
   260  252            0
   261  253         1356 ? C#0                  FOUND?
   262  254          233 GONC    SERRXF ( 277) NO
   263  255         1014 ?S2=1                  ROM?
   264  256           37 GOC     XGI55  ( 261) YES
   265  257 XGI54    304 S10=    0              NO.  MUST BE RAM
   266  260          223 GOTO    XGI60  ( 302)
   267  261 XGI55   1114 ?S9=1                  MICROCODE?
   268  262          173 GONC    XGI57  ( 301) NO, MUST BE USER LANG
   269  263          214 ?S5=1                  MAINFRAME?
   270  264          647 GOC     SERR   ( 350) YES, ERROR
   271  265          530 M=C                    SAVE ADDRESS IN M
   272  266         1270 C=REGN 10              RETRIEVE RTN ADDR
   273  267         1346 ? C#0   X              XEQ?
   274  270          603 GONC    SERR   ( 350) NO, AGTO ILLEGAL FOR
   275                                          MICROCODE
   276  271         1670 C=REGN 14              RESTORE SS0
   277  272         1530 ST=C
   278  273          630 C=M                    C[3:0]=XADR
   279  274          674 RCR     11             C[6:3]=XADR
   280  275         1460 CXISA                  GET WORD AT XADR
   281  276         1346 ? C#0   X              PROGRAMMABLE FCN?
   282  277 SERRXF   513 GONC    SERR   ( 350) NO, ERROR
   283  300          740 GOTOC
*
   285                  ENTRY   XGI57
* XROM ENTERS AT XGI57
* ON ENTRY, ADDRESS OF FIRST BYTE OF DESTINATION LABEL IS IN C[3:0],
* AND RETURN ADDRESS IS IN R10[3:0] ALREADY PACKED FOR PUSH ONTO
* SUBROUTINE STACK
   290  301 XGI57    310 S10=    1              ROM USER LANGUAGE
```

```
291  302 XGI60     34 PT=     3              -
292  303          412 A=C     WPT            -
293  304            1 GSBLNG  DECAD          -
293  305            0
294  306          243 GOTO    XGI07  ( 332) -
295
296  307 XGI        1 GOSUB   SAVRC          SAVE RETURN ADDRESSS
296  310            0
297  311         1204 S7=     0              CLEAR S7 FOR ADRFCH
298  312            1 GSBLNG  ADRFCH         C[13:0]_REG CONTENTS
298  313            0
299  314         1176 C=C-1   S
300  315         1376 ? C#0   S              VALID # LABEL?
301  316         1113 GONC    XGI30  ( 227) NOPE
302  317            1 GSBLNG.BCDBIN          CNVRT BCD TO BINARY
302  320            0
303  321          406 A=C     X              VALID LABEL?
304  322          460 LDI                    -
305  323          144 CON     100            -
306  324         1406 ? A<C   X              -
307  325          233 GONC    SERR   ( 350) NOPE, # TOO BIG
308  326            1 GSBLNG.DOSRC1          SEARCH FOR LBL
308  327            0
309  330 XGI05     34 PT=     3              -
310  331          412 A=C     WPT            A[3:0]_LBL ADDR
*
*  XGI07  -  ENTRY POINT TO DO XEQ [RAM ADDRESS]
*            ADDED FOR WAND 2/13/80 JAVB.
*    ON INPUT
*       CHIP 0 ENABLED
*       REG10 HAS PACKED RETURN ADDRESS (SEE SAVRTN)
*       A[3:0] HAS RAM ADDRESS
*       PT = 3
*    NEVER RETURNS TO CALLING PROGRAM
*
321                     ENTRY   XGI07
322  332 XGI07   1270 C=REGN 10             RETRIEVE RTN ADDR
323  333         1346 ? C#0   X              XEQ?
324  334          663 GONC    XGNN10 ( 422) NO. GTO
325  335          212 B=A     WPT            LBL ADDR TO B[3:0]
326  336          143 GOTO    XEQC01 ( 352)
327
328
329
330
331  337 GTSRCH   152 AB EX   WPT            A[1:0]_CORRESPONDING SHORT LBL
332  340         1606 A SR    X              -
333  341         1606 A SR    X              -
334  342          646 A=A-1   X              -
335                     ENTRY   DOSRC1
336  343 DOSRC1   504 S6=     0              PGM CTR IS IN A STD PLACE
337  344 DOSRCH     1 GSBLNG.SEARC1          SEARCH FOR NUMERIC LABEL
337  345            0
338  346         1356 ? C#0                  FOUND?
339  347         1540 RTN C                  YES
340  350 SERR       1 GOLONG.ERRNE          REPORT ERROR
340  351            2
341                                         "NON-EXISTENT"
342
343
```

```
   344
*  XEQC01 - XEQ COMMON LOGIC
*- IF IN KEYBOARD MODE, THE SUBROUTINE RETURN STACK
*- IS CLEARED, & THE PROGRAM IS SET TO RUNNING,
*- OTHERWISE THE SUBROUTINE STACK IS PUSHED AND THE
*- PROGRAM COUNTER IS SET TO THE DESIGNATED LABEL
*- ADDRESS
*- IN:  D[3:0]= LABEL ADDRESS
*-      PT= 3
*       REG 10 [3:0] = RETURN ADDRESS ALREADY PACKED
*- OUT: CHIP 0 SELECTED
*- USES: B[3:0], C[13:0], A[13:0]
*- USES: 1 SUBROUTINE LEVEL
*
* XEQ20 - SAME AS XEQC01 EXCEPT DOESN'T CHECK FOR KEYBOARD MODE
*
   360
   361
   362
   363  352 XEQC01   106 C=0     X              SELECT CHIP 0.
   364  353          1160 DADD=C                 -
   365  354          1314 ?S13=1                 RUNNING?
   366  355            57 GOC     XEQ20  ( 362) YES
   367  356          1670 C=REGN 14              SSTFLAG?
   368  357          1530 ST=C                   -
   369  360           114 ?S4=1                  -
   370  361           203 GONC    XEQ50  ( 401) NOPE
   371  362 XEQ20    1270 C=REGN 10              GET RETURN ADDRESS
   372  363           412 A=C     WPT            PUT RTN ADDR TO A[3:0]
   373  364          1470 C=REGN 12
   374  365           252 AC EX  WPT
   375  366           374 RCR     10             PUSH STACK
   376  367           416 A=C                    -
   377  370          1370 C=REGN 11              -
   378  371           374 RCR     10             -
   379  372           252 AC EX  WPT             -
   380  373          1350 REGN=C 11              -
   381  374           256 AC EX                  -
   382  375             1 GSBLNG.CLRSB3          FINISH PUSH
   382  376             0
   383  377           253 GOTO    XGNN12 ( 424)
   384
   385  400 XEQ49    352 BC EX  WPT             KEYBOARD PATH
   386  401 XEQ50      1 GSBLNG.CLRSB2          CLEAR RTN STACK
   386  402             0
   387  403             1 GOLONG.RUN
   387  404             2
   388
   389
   390
* XGNN - XEQ/GTO NUMERIC  (LONG FORM GTO)
*- PLACE THE PROGRAM COUNTER AT THE SPECIFIED NUMERIC
*- LABEL ADDRESS, COMPILING A DISPLACEMENT TO BE
*- STORED WITH THE FUNCTION UPON THE FIRST ENCOUNTER
*- OF THAT FUNCTION. (FOLLOWING A DECOMPILE)  IN THE
*- CASE OF AN XEQ, THE RETURN STACK IS PUSHED THROUGH
*- A TRANSFER TO "XEQC".
*- IN: S1= 0/1 IMPLIES GTO/XEQ FUNCTION
*-     S9=1 IMPLIES A NUMERIC SEARCH HAS BEEN
*-        PREVIOUSLY PERFORMED
```

```
*-      C[1:0]= NUMERIC LABEL
*- OUT: GTO- CHIP 0 SELECTED
*-       XEQ- C[3:0]= LABEL ADDRESS
*-            PT= 3
*-            CHIP 0 SELECTED
*- USES: STATUS BITS 0,1,6,8,9, A[13:0], B[13:0], C[13:0],
*-        M[13:0], G
*- USES: 4 SUBROUTINE LEVELS
   409
   410
   411
   412
   413   405 XGTO    1404 S1=     0               GTO NN
   414   406 XGNN    1314 ?S13=1                  RUNNING?
   415   407          177 GOC     XGNN02 ( 426) YES
   416   410          114 ?S4=1                    SSTFLAG?
   417   411          157 GOC     XGNN02 ( 426) YES
   418   412          406 A=C     X                A[1:0]_# LBL
   419   413          630 C=M
   420   414         1114 ?S9=1
   421   415            1 GSUBNC DOSRC1
   421   416            0
   422   417         1414 ?S1=1                    XEQ?
   423   420         1607 GOC     XEQ49   ( 400)
   424   421          412 A=C     WPT
   425   422 XGNN10     1 GSBLNG PUTPCX           -
   425   423            0
   426   424 XGNN12     1 GOLONG NFRPU            -
   426   425            2
   427   426 XGNN02   314 ?S10=1                   ROM?
   428   427          463 GONC    XGNN20 ( 475) NOPE
   429   430          412 A=C     WPT              -
   430   431            2 A=0     PT               -
   431   432         1470 C=REGN  12               NO, A[2:0]_FULL REL ADDR.
   432   433          674 RCR     11               -
   433   434         1072 C=C+1   M                -
   434   435         1460 CXISA                    -
   435   436          246 AC EX   X                -
   436   437          266 AC EX   XS               -
   437   440         1072 C=C+1   M                DETERMINE SIGN
   438   441         1460 CXISA                    -
   439   442         1374 RCR     13               -
   440   443          746 C=C+C   X                -
   441   444          107 GOC     XGNN15 ( 454) ADD.
   442   445         1470 C=REGN  12               PCMCTR_PCMCTR-REL ADDR.
   443   446          252 AC EX   WPT              -
   444   447          712 A=A-C   WPT              -
   445   450 XGNN05 1414 ?S1=1                     XEQ?
   446   451 XGNN06 1513 GONC    XGNN10 ( 422) NOPE
   447   452          212 B=A     WPT              B[3:0]_LBL ADDRESS
   448   453         1073 GOTO    XEQ20   ( 362)
   449
   450   454 XGNN15 1470 C=REGN  12               PCMCTR_PCMCTR+REL ADDR.
   451   455          512 A=A+C   WPT              -
   452                    LEGAL
   453   456         1723 GOTO    XGNN05 ( 450) -
*
   455
   456   457 XXEQ    1410 S1=     1               XEQ
   457   460          356 BC EX                   SAVE PC & 2ND BYTE IN B
```

```
458  461            1 GOSUB  GETPC          CALC RETURN ADDRESS
458  462            0
459  463            1 GOSUB  INCAD          INCREMENT OVER 2ND AND
459  464            0
460  465            1 GOSUB  INCAD           3RD BYTES OF XEQ NN
460  466            0
461  467          252 C=A    WPT             COPY ADDR TO C[3:0]
461  470          412
462  471            1 GOSUB  SAVR10          REQ ADDR IN BOTH A AND C
462  472            0
463                                          SAVES RTN ADDR IN R10
464  473          356 BC EX                  RESTORE C
465  474         1123 GOTO   XGNN   ( 406)
466
467
468  475 XGNN20   414 ?S8=1                  FULL REL ADDR?
469  476           73 GONC   XGNN25 ( 505) YES
470  477          352 BC EX  WPT             NO, C[2:0]_FULL REL ADDR
471  500            1 GSBLNG GETPCA          -
471  501            0
472  502            1 GSBLNG NXBYTA          -
472  503            0
473  504          326 C=B    XS              -
474  505 XGNN25 1346 ? C#0   X               COMPILE?
475  506          463 GONC   XGNN65 ( 554) YES
476  507          102 C=0    PT              UNPACK REL ADDR &
477  510          752 C=C+C  WPT             -   INC BYTE BY 2
478  511          752 C=C+C  WPT             -
479  512          752 C=C+C  WPT             -
480  513         1042 C=C+1  PT              -
481  514          742 C=C+C  PT              -
482  515          746 C=C+C  X               -
483  516          227 GOC    XGNN50 ( 540) -
484  517         1706 C SR   X               -
485  520 XGNN30   352 BC EX  WPT             B[3:0]_REL ADDR  (MM)
486  521            1 GSBLNG:GT3DBT          GET 3RD BYTE
486  522            0
487  523          730 MC EX                  M_ORG STATUS, C_PGMCTR
488  524          152 AB EX  WPT             A[3:0]_REL ADDR
489  525         1214 ?S7=1                  SUBTRACT?
490  526          203 GONC   XGNN60 ( 546) YES
491  527          506 A=A+C  X               -
492  530          502 A=A+C  PT              A[3:0]_LBL ADDR
493  531          123 GONC   XGNN55 ( 543) -
494  532          546 A=A+1  X               -
495  533 XGNN35   630 C=M                    RESTORE ORG STATUS
496  534         1530 ST=C                   -
497                   ENTRY  XGNN40
498  535 XGNN40   106 C=0    X               RE-ENABLE CHIP 0
499  536         1160 DADD=C
500  537         1113 GOTO   XGNN05 ( 450)
501
502  540 XGNN50 1706 C SR    X               -
503  541         1066 C=C+1  XS              -
504                   LEGAL
505  542         1563 GOTO   XGNN30 ( 520) -
506
507  543 XGNN55   642 A=A-1  PT              BYTE_BYTE-2
508  544          642 A=A-1  PT              -
509                   LEGAL
```

```
510  545          1663 GOTO   XGNN35 ( 533) -
511
512  546 XGNN60   252 AC EX  WPT            A[3:0]_PGMCTR-REL ADDR
513  547          1142 C=C-1  PT             -
514  550          1142 C=C-1  PT             -
515                    LEGAL
516  551             1 GSBLNG:CALDSP         CALCULATE DISPLACEMENT
516  552             0
517  553          1603 GOTO   XGNN35 ( 533) -
518
519
520  554 XGNN65   410 S8=     1              -
521  555             1 GSBLNG:GT3DBT         GET 3RD BYTE
521  556             0
522  557          1204 S7=     0              DECOMPILE DOESN'T CLEAR
523                                           BIT 7 OF THE THIRD BYTE
524  560          1730 CST EX                 -
525  561           406 A=C     X              -
526  562           510 S6=     1              PGM PTR IS AT 1ST BYTE
527                                           OF 3 BYTE FC "
528  563             1 GSBLNG:DOSRCH         SEARCH RAM FOR LBL
528  564             0
529  565           412 A=C     WPT            CALCULATE DISPLACEMENT
530  566           730 MC EX                  -  (M_LBL ADDRESS)
531  567          1546 ? A#C   X              -
532  570            47 GOC     XGNN70 ( 574) -
533  571          1402 ? A<C   PT             -
534  572            63 GONC    XGNN80 ( 600) -
535  573            33 GOTO    XGNN75 ( 576) -
536  574 XGNN70 1406 ? A<C   X              -
537  575            33 GONC    *+3    ( 600) -
538  576 XGNN75   404 S8=     0              -
539  577           252 AC EX   WPT            -
540  600 XGNN80 1106 C=A-C   X              -  (#REGS)
541  601          1102 C=A-C   PT             -  (#BYTES)
542  602            43 GONC    *+4    ( 606) -  (NO CARRY)
543  603          1146 C=C-1   X              -  (REG_REG-1)
544  604          1142 C=C-1   PT             -  (BYTE_BYTE-2)
545  605          1142 C=C-1   PT             -
546  606           746 C=C+C   X              PACK DISPLACEMENT
547  607           746 C=C+C   X              -
548  610           746 C=C+C   X              -
549  611           746 C=C+C   X              -
550  612            23 GONC    *+2    ( 614) -
551  613          1042 C=C+1   PT             -
552  614          1712 C SR    WPT            -
553  615           346 BC EX   X              REL ADDR_DISPLACEMENT
554  616             1 GSBLNG:GETPC          -
554  617             0
555  620             1 GSBLNG:GTBYTA         -
555  621             0
556  622          1574 RCR     12             -
557  623           306 C=B     X              -
558  624          1074 RCR     2              -
559  625           372 BC EX   M              -
560  626           376 BC EX   S              -
561  627             1 GSBLNG:PTBYTA         -
561  630             0
562  631             1 GSBLNG:INCADA         -
562  632             0
```

```
   563  633          316 C=B                     -
   564  634         1574 RCR     12              -
   565  635            1 GSBLNG :PTBYTA          -
   565  636            0
   566  637            1 GSBLNG :INXBYTA         SET BIT 0 OF LABEL BYTE
   566  640            0
   567  641         1730 CST EX                   -
   568  642         1204 S7=     0                -
   569  643          414 ?S8=1                    -
   570  644           23 GONC    *+2     ( 646) -
   571  645         1210 S7=     1                -
   572  646         1730 CST EX                   -
   573  647            1 GSBLNG :PTBYTA          -
   573  650            0
   574  651          630 C=M                      A[3:0]_LBL ADDRESS
   575  652          412 A=C     WPT              -
   576  653            1 GOLONG :XGNN40          -
   576  654            2
   577
* GT3DBT MOVED TO CN0
   579
   580
   581  655 ROW11      1 GSBLNG :INCGT2          GET 2ND BYTE
   581  656            0
   582  657         1526 ? A#0   XS               SHORT GTO?
   583  660         1640 RTN NC                  NOPE
   584  661          212 B=A     WPT              -
   585  662           26 A=0     XS               -
   586  663          314 ?S10=1                   ROM?
   587  664          303 GONC    SGTO25 ( 714) NOPE
   588  665         1506 ? A#0   X                NEED SEARCH?
   589  666          213 GONC    SGTO15 ( 707) YES
   590  667            2 A=0     PT               -
   591  670          246 AC EX   X                STATUS_BYTE2
   592  671         1530 ST=C                     -
   593  672         1214 ?S7=1                    SUBTRACT?
   594  673           73 GONC    SGTO10 ( 702) YES
   595  674         1204 S7=     0                PGMCTR_PGMCTR+ REL ADDR
   596  675         1630 C=ST                     -
   597  676          406 A=C     X                -
   598  677         1470 C=REGN  12               -
   599  700          512 A=A+C   WPT              -
   600                   LEGAL
   601  701          113 GOTO    SGTO20 ( 712) -
   602
   603  702 SGTO10   406 A=C     X                PGMCTR_PGMCTR-REL ADDR
   604  703         1470 C=REGN  12               -
   605  704          252 AC EX   WPT              -
   606  705          712 A=A-C   WPT              -
   607                   LEGAL
   608  706           43 GOTO    SGTO20 ( 712) -
   609
   610  707 SGTO15     1 GSBLNG :GTSRCH          SEARCH FOR NUMERIC SHORT LBL
   610  710            0
   611  711 SGTO19   412 A=C     WPT              PGMCTR_LBL ADDRESS
   612  712 SGTO20     1 GOLONG :XGNN10          -
   612  713            2
   613
   614
   615  714 SGTO25  1506 ? A#0   X                NEED COMPILE?
```

```
616  715          273 GONC   SGT040 ( 744) YES
617  716         1752 A SL   WPT            UNPACK REL ADDR(EXCEPT FOR +- BIT)
618  717         1752 A SL   WPT            -
619  720         1606 A SR   X              -
620  721         1606 A SR   X              -
621  722         1470 C=REGN 12             A[3:0]_PGMCTR
622  723          742 C=C+C  PT             -
623  724          252 AC EX  WPT            C[3:0]_REL ADDR
624  725          742 C=C+C  PT             ADD?
625  726           47 GOC    SGT030 ( 732) YES
626  727            1 GSBLNG CALDSP         CALCULATE DISPLACEMENT
626  730            0
627  731         1613 GOTO   SGT020 ( 712) -
628
629  732 SGT030   506 A=A+C  X              -
630  733         1042 C=C+1  PT             PGMCTR_PGMCTR+REL ADDR
631  734         1042 C=C+1  PT             -
632  735          502 A=A+C  PT             -
633  736           33 GONC   SGT035 ( 741) -
634  737          546 A=A+1  X              -
635                   LEGAL
636  740         1523 GOTO   SGT020 ( 712) -
637
638  741 SGT035   642 A=A-1  PT             -
639  742          642 A=A-1  PT             -
640                   LEGAL
641  743         1473 GOTO   SGT020 ( 712) -
642
643  744 SGT040   404 S8=    0              -
644  745            1 GSBLNG:GTSRCH         SEARCH
644  746            0
645  747          530 M=C                   -
646  750            1 GSBLNG:GETPC          A[3:0]_PGMCTR
646  751            0
647  752          160 N=C                   -
648  753          630 C=M                   C[3:0]_LBL ADDR
649  754         1546 ? A#C  X              -
650  755           47 GOC    SGT045 ( 761) -
651  756         1402 ? A<C  PT             -
652  757           63 GONC   SGT055 ( 765) -
653  760           33 GOTO   SGT050 ( 763) -
654  761 SGT045 1406 ? A<C  X              CALCULATE DISPLACEMENT
655  762           33 GONC   *+3    ( 765) -
656  763 SGT050   410 S8=    1              -
657  764          252 AC EX  WPT            -
658  765 SGT055     1 GSBLNG:CALDSP         CALCULATE DISPLACEMENT
658  766            0
659  767         1526 ? A#0  XS             >=MAX?
660  770          227 GOC    SGT060 (1012) YES
661  771         1746 A SL   X              PACK REL ADDR
662  772         1526 ? A#0  XS             >=MAX?
663  773          177 GOC    SGT060 (1012) YES
664  774         1746 A SL   X              -
665  775         1612 A SR   WPT            -
666  776          260 C=N                   -
667  777          252 AC EX  WPT            -
668 1000          414 ?S8=1                 -
669 1001           23 GONC   *+2    (1003) -
670 1002         1042 C=C+1  PT             -
671 1003          752 C=C+C  WPT            -
```

```
1004         752 C=C+C  WPT            -
1005         752 C=C+C  WPT            -
1006         746 C=C+C  X              -
1007        1074 RCR    2              -
1010           1 GSBLNG PTBYTA         -
1011           0
1012 SGT060  630 C=M                   PGMCTR_LBL ADDR
1013           1 GOLONG SGT019         -
1014           2

* CALDSP MOVED TO CN0


1015 SAROM  1034 PT=    2              PT_1 & A[13]_6
1016         620 LC     6              -
1017          74 RCR    3              -
1020         436 A=C    S              -
1021         630 C=M                   -
1022 SAR002  356 BC EX                 CONVERT ASCII CHAR TO LCD
1023         152 AB EX  WPT            -
1024           1 GSBLNG MASK           -
1025           0
1026           0 NOP
1027        1434 PT=    1              -
1030        1366 ? C#0  XS             SPECIAL CHARACTER?
1031          33 GONC   *+3    (1034)  NOP
1032         420 LC     4              ADJUST SPECIAL CHARACTER
1033        1434 PT=    1              -
1034         356 BC EX                 PLACE LCD CHAR IN STRING
1035         352 BC EX  WPT            -
1036        1074 RCR    2              -
1037        1352 ? C#0  WPT            DONE?
1040          43 GONC   SAR004 (1044)  YES
1041         676 A=A-1  S              7 CHARS?
1042          57 GOC    SAR006 (1047)  YES
1043        1573 GOTO   SAR002 (1022)  NXT CHAR
1044 SAR004 1074 RCR    2              RIGHT JUSTIFY
1045        1352 ? C#0  WPT            -
1046        1763 GONC   *-2    (1044)  -
1047 SAR006  530 M=C                   M_LCD CHAR STRING
1050         204 S5=    0              MAINFRAME TBL 3RD
1051         534 PT=    6              B[M]_C[M]_56K
1052         116 C=0                   -
1053        1160 DADD=C                -  (SEL CHIP 0)
1054         520 LC     5              -
1055 SAR011  372 BC EX  M              -
1056 SAR010  332 C=B    M              TABLE THERE?
1057        1634 PT=    0              - (G_ROM ID)
1060        1460 CXISA                 !!!!!!!SHOULD BE CXISA!!!!!!
1061         130 G=C                   -
1062        1072 C=C+1  M              -
1063        1460 CXISA                 !!!!!SHOULD BE CXISA!!!!!!
1064        1346 ? C#0  X              -
1065         127 GOC    SAR020 (1077)  YES
1066 SAR015  534 PT=    6              ADJUST ADDR
1067         332 C=B    M              -
1070        1042 C=C+1  PT             -
1071        1643 GONC   SAR011 (1055)  -
1072         120 LC     1              LOAD MAIN ADDR - 1 (11777 OCT)
1073         320 LC     3
```

```
729 1074          1720 LC      15
730 1075          1720 LC      15
731 1076           210 S5=     1               SEARCH MAINFRAME TBL NOW
732 1077 SAR020   1434 PT=     1               C[6:3]_LBL ADDR
733 1100 SAR021   1072 C=C+1   M               -
734 1101 SAR022   1460 CXISA                   -
735 1102           214 ?S5=1                   MAINFRAME SEARCH?
736 1103           627 GOC     SAR042 (1165)   YES
737 1104           346 BC EX   X               -
738 1105          1072 C=C+1   M               -
739 1106          1460 CXISA                   -
740 1107          1306 ? B#0   X               - (END OF TABLE?)
741 1110            37 GOC     SAR025 (1113)   -
742 1111          1346 ? C#0   X               -
743 1112          1543 GONC    SAR015 (1066)   -  (YES)
744 1113 SAR025    346 BC EX   X               -
745 1114           416 A=C                     -
746 1115           274 RCR     5               -
747 1116           502 A=A+C   PT              -
748 1117          1174 RCR     9
749 1120           246 AC EX   X
750 1121          1574 RCR     12
751 1122           312 C=B     WPT             -
752 1123           160 N=C                     SAVE LBL ADDR IN N
753 1124           674 RCR     11              -
754 1125           246 AC EX   X               -
755 1126           766 C=C+C   XS              -
756 1127           766 C=C+C   XS              -
757 1130           766 C=C+C   XS              -
758 1131           643 GONC    SAR045 (1215)   -
759 1132          1072 C=C+1   M               C[13]_# LBL CHARS
760 1133          1072 C=C+1   M               -
761 1134           416 A=C                     -
762 1135          1460 CXISA                   -
763 1136          1474 RCR     1               -
764 1137           436 A=C     S               -
765 1140          1170 C=REGN  9               -  (A[13:0]_ALPHA CHARS)
766 1141           256 AC EX                   -
767 1142          1176 C=C-1   S               -
768 1143          1072 C=C+1   M               -
769 1144 SAR030   1072 C=C+1   M               C[1:0]_1 LBL CHAR
770 1145          1460 CXISA                   EQUAL?
771 1146          1552 ? A#C   WPT             -
772 1147           147 GOC     SAR040 (1163)   NO
773 1150          1176 C=C-1   S               DEC LBL COUNT
774 1151          1616 A SR                    SHIFT A TO NXT CHAR
775 1152          1616 A SR                    -
776 1153          1376 ? C#0   S               END OF LBL?
777 1154            57 GOC     SAR035 (1161)   NOPE
778 1155          1512 ? A#0   WPT             END OF CHRS?
779 1156            57 GOC     SAR040 (1163)   NOPE
780 1157          1104 S9=     0               USER_TRUE
781 1160           743 GOTO    SAR055 (1254)   -
782 1161 SAR035   1512 ? A#0   WPT             END OF CHRS?
783 1162          1627 GOC     SAR030 (1144)   NOPE, TST NXT CHAR
784 1163 SAR040    274 RCR     5               GET NXT TBL ENTRY
785 1164          1143 GOTO    SAR021 (1100)   -
786
787 1165 SAR042     34 PT=     3               SET PTR
788 1166           406 A=C     X               A[2:0]_LBL ADDR
```

```
 789 1167         1506 ? A#0  X              END OF MAINFRAME TBL?
 790 1170           37 GOC    *+3    (1173) NOPE
 791 1171          116 C=0                   RETURN W/ERROR
 792 1172         1740 RTN                   -
 793 1173          460 LDI                   HOLE?
 794 1174         1737 CON    @1737          -
 795 1175         1406 ? A<C  X              -
 796 1176          107 GOC    SAR043 (1206) NOPE
 797 1177          706 A=A-C  X              SUBTRACT OFFSET
 798 1200           74 RCR    3              TBL ADDR_ TBL ADDR+DISPLACEMENT
 799 1201            2 A=0    PT             -
 800 1202         1012 C=A+C  WPT            -
 801 1203          674 RCR    11             -
 802 1204            1 GOLONG:SAR022         CHECK NEXT TBL ENTRY
 802 1205            2
 803 1206 SAR043   246 AC EX  X              -
 804 1207         1374 RCR    13             N_LBL ADDR
 805 1210         1712 C SR   WPT            -
 806 1211         1042 C=C+1  PT             -
 807 1212         1434 PT=    1              -
 808 1213          160 N=C                   -
 809 1214          674 RCR    11             TEST FOR ALBL MATCH
 810 1215 SAR045   416 A=C                   A_ALPHA STRING
 811 1216          630 C=M                   -
 812 1217          256 AC EX                 -
 813 1220 SAR047  1172 C=C-1  M              GET NXT CHAR
 814 1221         1460 CXISA                 -
 815 1222         1352 ? C#0  WPT            IS THERE A PROMPT STRING?
 816 1223          203 GONC   SAR048 (1243) NO
 817 1224          404 S8=    0              S8_END BIT
 818 1225         1730 CST EX                -
 819 1226         1214 ?S7=1                 -
 820 1227           33 GONC   *+3    (1232) -
 821 1230         1204 S7=    0              -
 822 1231          410 S8=    1              -
 823 1232         1730 CST EX                -
 824 1233         1552 ? A#C  WPT            EQUAL?
 825 1234           77 GOC    SAR048 (1243) NOPE
 826 1235         1616 A SR                  -
 827 1236         1616 A SR                  -
 828 1237          414 ?S8=1                 END OF LBL?
 829 1240          117 GOC    SAR050 (1251) YES
 830 1241         1512 ? A#0  WPT            END OF CHARS?
 831 1242         1567 GOC    SAR047 (1220) NOPE
 832 1243 SAR048   174 RCR    4              GET NXT ENTRY
 833 1244          214 ?S5=1                 REALIGN OLD ADDR
 834 1245           27 GOC    *+2    (1247) -
 835 1246         1474 RCR    1              -
 836 1247            1 GOLONG:SAR021         -
 836 1250            2
 837 1251 SAR050 1512 ? A#0  WPT            END OF CHARS?
 838 1252         1717 GOC    SAR048 (1243) NOPE
 839 1253         1110 S9=    1              UCODE_TRUE
 840 1254 SAR055   260 C=N                   C[3:0]_ADDR & F.C.
* NEXT TWO INSTRUCTIONS (PT=7,LC 0) MAY NOT BE NECESSARY.
 842 1255         1234 PT=    7              -
 843 1256           20 LC     0              -
 844 1257          214 ?S5=1                 XROM?
 845 1260          237 GOC    SAR060 (1303) NOPE
 846 1261          416 A=C                   C[7:4]_XROM F.C.
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```
   847 1262          1074 RCR    2             CONSTRUCT TABLE INDEX PART
   848 1263          1172 C=C-1  M             -
   849 1264          1172 C=C-1  M             -
   850 1265           772 C=C+C  M             -
   851 1266           772 C=C+C  M             -
   852 1267           772 C=C+C  M             -
   853 1270          1732 C SR   M             -
   854 1271           772 C=C+C  M             CONSTRUCT ROM ID PART
   855 1272           772 C=C+C  M             -
   856 1273           234 PT=    5             -
   857 1274           230 C=G                  -
   858 1275           772 C=C+C  M             -
   859 1276           772 C=C+C  M             -
   860 1277          1234 PT=    7             CONSTRUCT XROM FC PART
   861 1300          1220 LC     10            -
   862 1301            34 PT=    3             -
   863 1302           252 AC EX  WPT           C[3:0]_ROM ADDR & C[5:4]_F.C.
   864 1303 SARO60   1010 S2=    1             -
   865 1304          1740 RTN                  RETURN
   866
   867
   868
*  ASRCH - ALPHA SEARCH
*- LOCATE THE ADDRESS OF AN ALPHA STRING.  THE ALPHA
*- STRING MAY APPLY TO AN ALPHA LABEL IN RAM OR A
*- FUNCTION IN THE MAIN FRAME OR PLUG-IN ROMS. IF THE
*- FUNCTION IS LOCATED IN A PLUG-IN ROM, RETURN THE
*- XROM FUNCTION CODE.  IF THE FUNCTION IS LOCATED IN
*- THE MAINFRAME, RETURN ITS FUNCTION CODE.  IF THE
*- FUNCTION IS LOCATED IN RAM, RETURN THE ALPHA LABEL
*- ADDRESS.
*-
*- IN:  M[13:0] AND REG 9[13:0] = ALPHA LABEL (2 COPIES)
*-
*- OUT: C[3:0]= ADDRESS (IF USER LANG, THIS IS ADDRESS OF FIRST
*                        BYTE OF LABEL)
*-      C[7:4]= FUNCTION CODE
*-      S2=1/0 IMPLIES ROM/RAM ADDRESS
*-      C=0 IMPLIES NOT FOUND
*-      S9=1/0 IMPLIES MICROCODE/USER CODE
*-      S5=1 IMPLIES A MAINFRAME FUNCTION
*       CHIP 0 ENABLED
*-
*- USES: M,A,B,C,G,N,STATUS,PTR P,REG 9
*-       STATUS BITS 2,3,5,8,9
*- USES: 2 SUBROUTINE LEVELS
   893
   894
   895 1305 ASRCH    1570 C=REGN 13            A[3:0]_END ADDR  (RAM 1ST)
   896 1306            34 PT=    3             -
   897 1307           420 LC     4             C[2:0]_END LINK
   898 1310            34 PT=    3             -
   899 1311           412 A=C    WPT           -
   900 1312          1160 DADD=C                -
   901 1313            70 C=DATA                -
   902 1314          1074 RCR    2             -
   903 1315 SARA10   1346 ? C#0  X             END?
   904 1316             1 GOLNC  SAROM         YES
   904 1317             2
   905 1320             1 GSBLNG UPLINK        GET NXT LINK ADDR
```

```
   905 1321           0
   906 1322        1076 C=C+1   S              ALBL?
   907 1323        1723 GONC    SARA10 (1315) NOPE
   908 1324 SARA20 1174 RCR     9              G_# ALPHA LBL CHARS
   909 1325        1142 C=C-1   PT             -
   910 1326         130 G=C                    -
   911 1327         212 B=A     WPT            A[7:0]_LBL ADDR & CHAR ADDR
   912 1330         312 C=B     WPT            -
   913 1331         374 RCR     10             -
   914 1332         312 C=B     WPT            -
   915 1333         416 A=C                    GET 1ST CHAR
   916 1334           1 GSBLNG .INCAD2.        -
   916 1335           0
   917 1336           1 GSBLNG :INCADA         -
   917 1337           0
   918 1340         630 C=M                    B[13:0]_ALPHA STRING
   919 1341         356 BC EX                  -
   920 1342         156 AB EX                  -
   921 1343 SARA30  156 AB EX                  GET NXT BYT
   922 1344          34 PT=     3              -
   923 1345           1 GSBLNG .NXBYTA         -
   923 1346           0
   924 1347         156 AB EX                  -
   925 1350        1434 PT=     1              -
   926 1351        1552 ? A#C   WPT            EQUAL?
   927 1352         127 GOC     SARA40 (1364) NOPE
   928 1353        1616 A SR                   SHIFT TO NXTCHAR
   929 1354        1616 A SR                   -
   930 1355         230 C=G                    DEC COUNT LBL CHARS
   931 1356        1142 C=C-1   PT             -
   932 1357         130 G=C                    -
   933 1360        1342 ? C#0   PT             END LBL CHARS?
   934 1361         113 GONC    SARA50 (1372) YES
   935 1362        1512 ? A#0   WPT            END STR CHARS?
   936 1363        1607 GOC     SARA30 (1343) NOPE
   937 1364 SARA40   34 PT=     3              GET NXT LINK
   938 1365         316 C=B                    -
   939 1366         174 RCR     4              -
   940 1367         412 A=C     WPT            -
   941 1370         274 RCR     5              -
   942 1371        1243 GOTO    SARA10 (1315) -
   943 1372 SARA50 1512 ? A#0   WPT            END STR CHARS?
   944 1373        1717 GOC     SARA40 (1364) NOPE
   945 1374         106 C=0     X              ENABLE CHIP 0
   946 1375        1160 DADD=C                 -
   947 1376         316 C=B                    C[3:0]_ADDR
   948 1377         174 RCR     4              -
   949 1400        1004 S2=     0              RAM
   950 1401        1104 S9=     0              USERCODE_TRUE
   951 1402        1740 RTN                    RETURN
*
*  RTN - RETURN
*- POPS THE SUBROUTINE RETURN STACK IF RUNNING,
*- OTHERWISE, IT PLACES THE PROGRAM COUNTER AT THE
*- BEGINNING OF THE CURRENT PROGRAM
*- IN:  CHIP 0 SELECTED
*- OUT:
*- USES: STATUS BITS 13 & 12, C[13:0], A[13:0],
*-       B[3:0], M[13:0]
*- USES: 2 SUBROUTINE LEVELS
```

```
  962
  963
  964 1403 XRTN   1104 S9=     0              REMEMBER THIS IS RTN
  965 1404          34 PT=     3              -
  966 1405 RTN00  1314 ?S13=1                 RUNNING?
  967 1406          37 GOC     RTN10  (1411) YES
  968 1407         114 ?S4=1                  SSTFLAG?
  969 1410         473 GONC    RTN30  (1457) NOPE
  970 1411 RTN10  1370 C=REGN 11              POP RTN STK
  971 1412         416 A=C                    -
  972 1413        1470 C=REGN 12              -
  973 1414         252 AC EX  WPT             -
  974 1415         174 RCR    4               -
  975 1416        1352 ? C#0  WPT             -  (POP ZERO?)
  976 1417         353 GONC   RTN21  (1454) -  (YES)
  977 1420         310 S10=   1               ASSUME NEW PC IS IN ROM
  978 1421        1342 ? C#0  PT              -  (NEED UNPACK?)
  979 1422         107 GOC    RTN15  (1432) -  (NOPE)
  980 1423         304 S10=   0               NEW PC IS IN RAM
  981 1424         752 C=C+C  WPT             - (UNPACK)
  982 1425         752 C=C+C  WPT             -
  983 1426         752 C=C+C  WPT             -
  984 1427         746 C=C+C  X               -
  985 1430         157 GOC    RTN25  (1445) -
  986 1431        1706 C SR   X               -
  987 1432 RTN15  1450 REGN=C 12              -
  988 1433         256 AC EX                  -
  989 1434         112 C=0    WPT             -
  990 1435         174 RCR    4               -
  991 1436        1350 REGN=C 11              -
  992 1437        1770 C=REGN 15              LINE_FFF
  993 1440         106 C=0    X               -
  994 1441        1146 C=C-1  X               -
  995 1442        1750 REGN=C 15              -
  996 1443           1 GOLONG CHKRPC
  996 1444           2
  997
  998 1445 RTN25  1706 C SR   X               -
  999 1446        1066 C=C+1  XS              -
 1000                 LEGAL
 1001 1447        1633 GOTO   RTN15  (1432) -
*
*  XEND - EXECUTE END
*  WHEN EXECUTING FROM THE KEYBOARD, OR WHEN RUNNING AND
*- IF THE SUBROUTINE STACK IS EMPTY, THEN THE
*- PROGRAM COUNTER IS PLACED AT THE CURRENT
*- PROGRAM HEAD, OTHERWISE, A RETURN FUNCTION
*- IS PERFORMED
*- IN:
*- OUT:
*- USES: C[13:0], A[3:0], B[4:0]
*- USES: 2 SUBROUTINE LEVELS
 1013
 1014
 1015                 ENTRY  XEND
 1016      XEND
 1017                                        ROW LOGIC MAY LEAVE
 1018                                        SOME CHIP OTHER THAN
 1019                                        0 ENABLED.
 1020 1450         116 C=0                   SELECT CHIP 0
```

```
1021 1451          1160 DADD=C                  -
1022 1452          1110 S9=     1               REMEMBER THIS IS END
1023 1453          1323 GOTO    RTN00  (1405)
1024
1025 1454 RTN21    1304 S13=    0               CLEAR RUNNING FLAG
1026 1455          1114 ?S9=1                   IS THIS END?
1027 1456          1640 RTN NC                  NO, MUST BE RTN
1028 1457 RTN30    1770 C=REGN 15               LINE #_0
1029 1460           106 C=0     X               -
1030 1461          1750 REGN=C 15               -
1031 1462           314 ?S10=1                  ROM?
1032 1463           127 GOC     RTN35  (1475)   YES
1033 1464             1 GSBLNG FLINKP           GET END ADDRESS
1033 1465             0
1034 1466           474 RCR     8               -
1035 1467           412 A=C     WPT             -
1036 1470             1 GSBLNG CPGMHD           C[3:0]_HEAD ADDRESS
1036 1471             0
1037 1472 RTN33    1104 S9=     0               TELL DCRT10 TO RTN
1038 1473             1 GOLONG DCRT10           GO CLEAR SUBROUTINE STACK
1038 1474             2
1039
1040 1475 RTN35       1 GSBLNG ROMNED           A[3:0]_CPGMHD
1040 1476             0
1041 1477          1733 GOTO    RTN33  (1472)   -
1042
1043
1044
1045
1046
*-  ROW12 - ROW TWELVE LOGIC
*- DISTINGUISHES LONG NUMERIC LABELS, X<> FUNCTION,
*- END FUNCTION, AND ALPHA LABELS
*-
*- IN:  C[3:2]= FUNCTION CODE
*-      CHIP 0 SELECTED
*- USES: M[13:0], C[13:0], AND A[13:0]
*- USES: 1 SUBROUTINE LEVEL
1055
* NOTE PARSE GENERATES CD FOR THE FC OF "ALBL".  LOGIC AT ROW12A
* IS FOR KEYBOARD EXECUTION ONLY.
1058
1059 1500 ROW12A   1066 C=C+1   XS              ALBL F.C.?
1060 1501           257 GOC     ALBL   (1526)   YES, ALPHA LABEL
1061 1502 XENDA    1463 GOTO    XEND   (1450)   NO, MUST BE END
1062
1063 1503 ROW12     530 M=C                     SAVE F.C.
1064 1504          1066 C=C+1   XS              LONG LBL?
1065 1505           307 GOC     LBL    (1535)   YES
1066 1506          1066 C=C+1   XS              -
1067 1507             1 GOLC    X<>ROW          -
1067 1510             3
1068 1511          1314 ?S13=1                  RUNNING?
1069 1512            37 GOC     RW10   (1515)   YES
1070 1513           114 ?S4=1                   SSTFLAG?
1071 1514          1643 GONC    ROW12A (1500)   NOPE
1072 1515 RW10        1 GSBLNG GETPCA           ALBL?
1072 1516             0
1073 1517             1 GSBLNG INCAD            -
1073 1520             0
```

```
  1074 1521            1 GSBLNG NXTBYT          -
  1074 1522            0
  1075 1523         1074 RCR    2               -
  1076 1524         1076 C=C+1  S               -
  1077 1525         1553 GONC   XENDA  (1502) GOTO END
  1078
* ALBL - ALPHA LABEL
*- INCREMENT THE PROGRAM COUNTER PAST THE ALPHA LABEL,
*  AND DROP INTO SLBL
*- IN:  M[3:2]= ALPHA LABEL FUNCTION CODE
*- OUT: CHIP 0 SELECTED
*- USES: C[13:0], A[13:0], STATUS BITS 1 & 2, B[13:0]
*-       M[13:0]
*- USES: 2 SUBROUTINE LEVELS
  1087
  1088 1526 ALBL     630 C=M                     RECOVER F.C.
  1089 1527          416 A=C                     -
  1090 1530          106 C=0     X               -
  1091 1531         1160 DADD=C                  -
  1092 1532            1 GSBLNG GTAINC           ADVANCE PGMCTR
  1092 1533            0
  1093 1534           33 GOTO   SLBL   (1537)
*
*  LBL/SLBL - (NUMERIC) LABEL/SHORT LABEL
*- INCREMENTS THE PROGRAM COUNTER PAST A NUMERIC
*- LABEL, AND ROTATES THE GOOSE RIGHT ONE POSITION
*-
*- USES: 1 SUBROUTINE LEVEL
  1100
  1101
  1102 1535 LBL        1 GSBLNG INCGT2           INC PGMCTR
  1102 1536            0
  1103 1537 SLBL     214 ?S5=1                   DISPLAY GOT SOMETHING?
  1104                                           (MSGFLG?)
  1105 1540         1540 RTN C                   YES
  1106 1541            1 GOSUB  ENLCD
  1106 1542            0
  1107 1543         1670 RABCR                   ROTATE GOOSE
  1108 1544            1 GOLONG ENCP00
  1108 1545            2
  1109
*  ROW0 - ROW ZERO LOGIC
*- DISTINGUISHES NULLS FROM SHORT LABELS
*- SKIPS ALL NULLS
*- IN:  C[3:]= FUNCTION CODE
*-      PT= 3
*- OUT: PT= 3
*- USES: C[2]
  1117
  1118
  1119
  1120 1546 ROW0   1166 C=C-1  XS              -
  1121 1547         1703 GONC   SLBL   (1537) SHORT LBL
  1122 1550 NULL       1 GOLONG RUNING          SKIP ALL NULLS
  1122 1551            2
  1123
  1124
  1125
  1126                   ENTRY  ASN20
  1127                   ENTRY  XASN
```

```
1128
1129
1130
*  ASN - ASSIGN FUNCTION TO KEYCODE
*- THIS CODE PERFORMS AN ASSIGNMENT FUNCTION AND ALSO
*- CLEARS ASSIGNMENTS.  ROM FUNCTIONS ARE ASSIGNED
*- BY PLACING THE FUNCTION CODE & KEYCODE IN AN
*- ASSIGNMENT TABLE.  RAM FUNCTIONS ARE ASSIGNED BY
*- PLACING THE KEYCODE IN THE CORRESPONDING ALPHA
*- LABEL.  THE ASSIGNMENT BIT MAP IS MAINTAINED AND
*- ASN TABLE REGISTERS ARE CREATED BY THIS CODE ALSO.
*- IN:  A[1:0]= KEYCODE TO BE ASSIGNED/CLEARED
*-      REG 9 = ALPHA STRING/ZERO
*- OUT:
*- USES: A,B,C,M,N,G,REG 9,REG 10,STATUS BITS 3,8,9,2,5
*- USES: 3 SUBROUTINE LEVELS
1144
1145
1146 1552 XASN    1170 C=REGN 9              REMOVE ASSIGNMENT?
1147 1553          530 M=C                   -
1148 1554         1356 ? C#0                 -
1149 1555            1 GOLNC  ASN20          YES
1149 1556            2
1150 1557         1270 C=REGN 10             SAVE KEYCODE IN REG 10
1151 1560          252 AC EX  WPT            -
1152 1561         1250 REGN=C 10             -
1153 1562            1 GSBLNG ASRCH          C[3:0]_ALBL ADDR
1153 1563            0
1154 1564         1356 ? C#0                 ERROR?
1155 1565            1 GOLNC  SERR           YES
1155 1566            2
1156 1567         1150 REGN=C 9              REG 9_ALBL ADDR & F.C.
1157 1570         1270 C=REGN 10             A[2:1]_K.C.
1158 1571          406 A=C     X             -
1159 1572            1 GSBLNG TBITMA         TEST BIT MAP
1159 1573            0
1160 1574         1356 ? C#0                 BIT SET?
1161 1575           73 GONC   XASN02 (1604)  NO
1162 1576         1270 C=REGN 10             CLEAR KEYCODE ENTRY
1163 1577          416 A=C                   -
1164 1600         1410 S1=     1             -
1165 1601            1 GSBLNG GCPKC          -
1165 1602            0
1166 1603           33 GOTO   *+3    (1606)
1167 1604 XASN02     1 GSBLNG SRBMAP         SET BIT
1167 1605            0
1168 1606         1270 C=REGN 10             A[3:2]_K.C.  A[1:0]_0
1169 1607          406 A=C     X             -
1170 1610         1756 A SL                  -
1171 1611         1756 A SL                  -
1172 1612         1170 C=REGN 9              B[3:0]_F.C.
1173 1613          174 RCR    4             -
1174 1614          356 BC EX                 -
1175 1615         1014 ?S2=1                 PLACE IN RAM?
1176 1616          377 GOC    XASN05 (1655) NOPE
1177 1617         1170 C=REGN 9              C[3:0]_ALBL ADDRESS
1178 1620          256 AC EX                 YES
1179 1621         1074 RCR    2             -
1180 1622          356 BC EX                 SAVE K.C.
1181 1623           34 PT=     3             -
```

```
1182 1624            1 GSBLNG :INCAD2          -
1182 1625            0
1183 1626            1 GSBLNG :INCADA          -
1183 1627            0
1184 1630            1 GSBLNG :GTBYT           GET KEYCODE BYTE
1184 1631            0
1185 1632          156 AB EX                   TEST FOR ASSIGN SAME KEY
1186 1633         1434 PT=     1               -
1187 1634         1552 ? A#C   WPT             -
1188 1635         1640 RTN NC                  KEYS EQUAL
1189 1636          156 AB EX                   PLACE KEY CODE
1190 1637           34 PT=     3               -
1191 1640          530 M=C                     -
1192 1641          356 BC EX                   -
1193 1642            1 GSBLNG :PTBYTA          -
1193 1643            0
1194 1644         1434 PT=     1               TEST TO UPDATE BIT MAP
1195 1645          630 C=M                     -
1196 1646         1352 ? C#0   WPT             -
1197 1647         1640 RTN NC                  NOT NEEDED
1198 1650          256 AC EX                   -
1199 1651          106 C=0     X               -
1200 1652         1160 DADD=C                  -
1201 1653            1 GOLONG :TSTMAP          UPDATE BIT MAP
1201 1654            2
1202 1655 XASN05     1 GSBLNG :GCPKC           PLACE K.C. & F.C.
1202 1656            0
1203 1657           14 ?S3=1                    DONE?
1204 1660         1540 RTN C                   YES
1205 1661          116 C=0                     CONSTRUCT REGISTER TO INSERT
1206 1662          312 C=B     WPT             -
1207 1663          374 RCR     10              -
1208 1664          252 AC EX   WPT             -
1209 1665         1074 RCR     2               -
1210 1666         1176 C=C-1   S               -
1211 1667          356 BC EX                   B_REG TO INSERT
1212 1670            1 GSBLNG AVAILA          ANY ROOM?
1212 1671            0
1213 1672         1356 ? C#0                   -
1214 1673           77 GOC     ASN15  (1702) YES
1215 1674         1160 DADD=C                  ENABLE CHIP 0
1216 1675          156 AB EX
1217 1676            1 GOSUB   TSTMAP          CLEAR BIT IN BIT MAP
1217 1677            0
1218 1700            1 GOLONG :PACKE
1218 1701            2
1219
1220                   ENTRY   ASN15           ENTRY POINT MADE FOR CARD READER
*
1222 1702 ASN15    1160 DADD=C                 SELECT REGISTER
1223 1703          530 M=C                     SAVE ADDR
1224 1704           70 C=DATA                  SWITCH REG CONTENTS
1225 1705          356 BC EX                   -
1226 1706         1360 DATA=C                  -
1227 1707          630 C=M                     INCREMENT ADDR
1228 1710         1046 C=C+1   X               -
1229 1711         1406 ? A<C   X               END?
1230 1712         1703 GONC    ASN15  (1702)  -
1231 1713         1740 RTN                     RETURN
1232 1714 ASN20    216 B=A                     SAVE F.C. & K.C.
```

```
  1233 1715            1 GSBLNG :TSTMAP         UPDATE BIT MAP
  1233 1716            0
  1234 1717          156 AB EX                  A[1:0]_K.C.
  1235 1720         1410 S1=     1              -
  1236 1721            1 GOLONG :GCPKC          CLEAR K.C.
  1236 1722            2
*
* SAVRTN - SAVE RETURN ADDRESS IN REG 10 [3:0]
* SAVRC - SAVE RETURN CONDITIONED ON S7
* SAVR10 - SAVE THE ADDRESS IN THE A AND C REGISTERS [3:0]
*     SAVR10 REQUIRES PT=3 ON ENTRY
*
  1243                    ENTRY  SAVRTN
  1244                    ENTRY  SAVRC
  1245                    ENTRY  SAVR10
  1246 1723 SAVRTN     1 GOSUB  GETPC           RTNS PC IN BOTH A AND C
  1246 1724            0
  1247 1725 SAVR10   314 ?S10=1                 ROMFLAG?
  1248 1726            57 GOC    SAVR20 (1733) YES
  1249 1727           106 C=0    X              PACK RAM ADDRESS INTO 3 DIGITS
  1250 1730          1712 C SR   WPT
  1251 1731           506 A=A+C  X
  1252 1732             2 A=0    PT
  1253 1733 SAVR20  1270 C=REGN 10
  1254 1734           252 AC EX  WPT
  1255 1735          1250 REGN=C 10
  1256 1736          1740 RTN
*
  1258 1737 SAVRC   1214 ?S7=1                  XEQ?
  1259 1740          1637 GOC    SAVRTN (1723) YES
  1260 1741             6 A=0    X              SAVE X000 TO
  1261 1742            34 PT=    3               REMEMBER THIS IS
  1262 1743          1703 GOTO   SAVR20 (1733)   GTO
*
*
*
  1266                    ENTRY  IORUN
  1267 1744 IORUN    460 LDI
  1268 1745            13 CON    11             MAIN RUNNING LOOP
  1269                                          FALL INTO ROMCHK HERE
*
* ROMCHK - PLUG-IN ROM CHECK SUBROUTINE
* LOOKS AT LOCATIONS AT THE END OF ROM CHIPS 5-F
* IF THE LOCATION IS NON-ZERO, THEN DOES A GOTOC TO THAT LOCATION
* LOCATIONS TO BE CHECKED ARE SPECIFIED IN C.X ON ENTRY:
*      PAUSE LOOP (-FF4) ... C.X=12 NOTE - MUST RETURN IN A MULTIPLE
*          OF 80 STATES AND ADJUST PAUSETIMER ACCORDINGLY
*      MAIN RUNNING LOOP (-FF5) ... C.X=11
*      WAKE UP FROM DEEP SLEEP WITH NO KEY DOWN (-FF6) ... C.X=10
*      OFF LOCATION (-FF7) ... C.X=9
*      I/O SERVICE (-FF8) ... C.X=8
*      WAKEUP FROM DEEP SLEEP (-FF9) ... C.X=7
*      COLD START (-FFA) ... C.X=6
*
* FOR ENTRY: HEX MODE, P SELECTED, SS0 UP, CHIP 0 SELECTED
* PLUG-IN ROMS MUST PRESERVE C[10:3] AND RETURN TO RMCK10 WITH
*     HEX MODE, P SELECTED, STATUS SET 0 UP, AND CHIP 0 SELECTED.
*     PLUG-IN ROMS MAY RETURN TO RMCK15 (SAVING ONE WORD TIME) IF
*     ALL OF THE ABOVE CONDITIONS ARE SATISFIED AND IN ADDITION
*     PTR P=6.
```

```
* ALL SUBROUTINE LEVELS ARE AVAILABLE EXCEPT IN I/O SERVICE ENTRY.
* IF PKSEQ IS SET THEN I/O SERVICE ROUTINES MUST EITHER PRESERVE
* THREE SUBROUTINE RETURNS ON THE SUBROUTINE STACK OR ELSE TERMINATE
* THE PARTIAL KEY SEQUENCE.
*
  1295                      ENTRY  ROMCHK
  1296 1746 ROMCHK   406 A=C    X              SAVE ADDR IN A.X
  1297 1747         1004 S2=    0              CLEAR IOFLG
  1298 1750         1670 C=REGN 14
  1299 1751         1630 C=ST
  1300 1752         1650 REGN=C 14             STORE SS0
  1301 1753          246 AC EX  X              RESTORE ADDR
  1302                      ENTRY  RMCK05        PAUSE LOOP ENTERS HERE
  1303       RMCK05
  1304 1754         1474 RCR    1
  1305 1755          660 C=STK
  1306 1756         1374 RCR    13
  1307 1757           34 PT=    3
  1308 1760          420 LC     4
  1309 1761         1206 C=-C   X
  1310 1762          674 RCR    11
* C NOW HAS ROMCHK'S RETURN ADDRESS IN DIGITS 10:7 AND THE TARGET
* ADDRESS IN THE PLUG-IN ROMS IN DIGITS 6:3 (NOTE CHIP # IS 4 AT
* PRESENT, BUT WILL BE INCREMENTED TO 5, THE LOWEST POSSIBLE
* PLUG-IN ADDRESS).
  1315                      ENTRY  RMCK10
  1316 1763 RMCK10   534 PT=    6
  1317                      ENTRY  RMCK15
  1318 1764 RMCK15  1042 C=C+1  PT
  1319 1765           33 GONC   RMCK20 (1770)
  1320 1766          174 RCR    4
  1321 1767          740 GOTOC                 RETURN TO CALLING PGM
  1322
  1323 1770 RMCK20  1460 CXISA
  1324 1771         1346 ? C#0  X
  1325 1772         1723 GONC   RMCK15 (1764)
  1326 1773          740 GOTOC
  1327
  1328
  1329
*
  1331                      UNLIST
  1334                      END

  ERRORS :       0
```

SYMBOL TABLE

ALBL	1526	-	1501
ASN15	1702	-	1712 1673
ASN20	1714	-	
ASRCH	1305	-	
DOSRC1	343	-	
DOSRCH	344	-	
GTSRCH	337	-	
IORUN	1744	-	
LBL	1535	-	1505
NULL	1550	-	
RMCK05	1754	-	
RMCK10	1763	-	
RMCK15	1764	-	1772
RMCK20	1770	-	1765
ROMCHK	1746	-	
ROW0	1546	-	
ROW11	655	-	
ROW12	1503	-	
ROW12A	1500	-	1514
RTN00	1405	-	1453
RTN10	1411	-	1406
RTN15	1432	-	1447 1422
RTN21	1454	-	1417
RTN25	1445	-	1430
RTN30	1457	-	1410
RTN33	1472	-	1477
RTN35	1475	-	1463
RW10	1515	-	1512
SARA10	1315	-	1371 1323
SARA20	1324	-	
SARA30	1343	-	1363
SARA40	1364	-	1373 1352
SARA50	1372	-	1361
SAR002	1022	-	1043
SAR004	1044	-	1040
SAR006	1047	-	1042
SAR010	1056	-	
SAR011	1055	-	1071
SAR015	1066	-	1112
SAR020	1077	-	1065
SAR021	1100	-	1164
SAR022	1101	-	
SAR025	1113	-	1110
SAR030	1144	-	1162
SAR035	1161	-	1154
SAR040	1163	-	1156 1147
SAR042	1165	-	1103
SAR043	1206	-	1176
SAR045	1215	-	1131
SAR047	1220	-	1242
SAR048	1243	-	1252 1234 1223
SAR050	1251	-	1240
SAR055	1254	-	1160
SAR060	1303	-	1260
SAROM	1015	-	
SAVR10	1725	-	

SAVR20	1733	-	1743	1726					
SAVRC	1737	-							
SAVRTN	1723	-	1740						
SEARC1	64	-							
SEARCH	63	-							
SERR	350	-	325	277	270	264			
SERRXF	277	-	254	232					
SGT010	702	-	673						
SGT015	707	-	666						
SGT019	711	-							
SGT020	712	-	743	740	731	706	701		
SGT025	714	-	664						
SGT030	732	-	726						
SGT035	741	-	736						
SGT040	744	-	715						
SGT045	761	-	755						
SGT050	763	-	760						
SGT055	765	-	757						
SGT060	1012	-	773	770					
SLBL	1537	-	1547	1534					
SNR10	77	-	112						
SNR12	101	-	175	155	152	121	117	106	76
SNR50	120	-	114						
SNR55	125	-	214						
SNR60	150	-	134						
SNR65	153	-	167	163	157				
SNR70	156	-	110						
SNR72	176	-	171						
SNR73	206	-	177						
SNR80	211	-	161						
SNR010	3	-	37	24	16	13	7		
SNR012	4	-							
SNR020	20	-	11						
SNR030	52	-	27						
SNR040	57	-	17						
SNR050	61	-	42						
SNR09	2	-	55	51	31				
SNROM	0	-	71						
XASN	1552	-							
XASN02	1604	-	1575						
XASN05	1655	-	1616						
XEND	1450	-	1502						
XENDA	1502	-	1525						
XEQ20	362	-	453	355					
XEQ49	400	-	420						
XEQ50	401	-	361						
XEQC01	352	-	336						
XGA00	215	-							
XGI	307	-							
XGI05	330	-							
XGI07	332	-	306						
XGI30	227	-	316						
XGI40	237	-	245						
XGI50	246	-	240						
XGI52	250	-	225	223	221				
XGI54	257	-	226						
XGI55	261	-	256						
XGI57	301	-	262						
XGI60	302	-	260						
XGNN	406	-	474						

XGNN02	426	-	411	407
XGNN05	450	-	537	456
XGNN06	451	-		
XGNN10	422	-	451	334
XGNN12	424	-	377	
XGNN15	454	-	444	
XGNN20	475	-	427	
XGNN25	505	-	476	
XGNN30	520	-	542	
XGNN35	533	-	553	545
XGNN40	535	-		
XGNN50	540	-	516	
XGNN55	543	-	531	
XGNN60	546	-	526	
XGNN65	554	-	506	
XGNN70	574	-	570	
XGNN75	576	-	573	
XGNN80	600	-	572	
XGTO	405	-		
XRTN	1403	-		
XXEQ	457	-		

ENTRY TABLE

ASN15	1702	-
ASN20	1714	-
ASRCH	1305	-
DOSRC1	343	-
DOSRCH	344	-
GTSRCH	337	-
IORUN	1744	-
RMCK05	1754	-
RMCK10	1763	-
RMCK15	1764	-
ROMCHK	1746	-
ROW0	1546	-
ROW11	655	-
ROW12	1503	-
RTN30	1457	-
SAR021	1100	-
SAR022	1101	-
SAROM	1015	-
SAVR10	1725	-
SAVRC	1737	-
SAVRTN	1723	-
SEARC1	64	-
SEARCH	63	-
SERR	350	-
SGT019	711	-
SNR10	77	-
SNR12	101	-
SNROM	0	-
XASN	1552	-
XEND	1450	-
XEQC01	352	-
XGA00	215	-
XGI	307	-
XGI07	332	-
XGI57	301	-
XGNN10	422	-
XGNN12	424	-
XGNN40	535	-
XGTO	405	-
XRTN	1403	-
XXEQ	457	-

EXTERNAL REFERENCES

ADRFCH	312					
ADRFCH	313					
ASN20	1555					
ASN20	1556					
ASRCH	251	1562				
ASRCH	252	1563				
AVAILA	1670					
AVAILA	1671					
BCDBIN	317					
BCDBIN	320					
CALDSP	551	727	765			
CALDSP	552	730	766			
CHKRPC	1443					
CHKRPC	1444					
CLRSB2	401					
CLRSB2	402					
CLRSB3	375					
CLRSB3	376					
CPGMHD	172	1470				
CPGMHD	173	1471				
DCRT10	1473					
DCRT10	1474					
DECAD	304					
DECAD	305					
DECADA	137	142				
DECAD9	140	143				
DOSRC1	326	415				
DOSRC1	327	416				
DOSRCH	563					
DOSRCH	564					
ENCP00	1544					
ENCP00	1545					
ENLCD	1541					
ENLCD	1542					
ERRNE	350					
ERRNE	351					
FLINKP	1464					
FLINKP	1465					
GCPKC	1601	1655	1721			
GCPKC	1602	1656	1722			
GETPC	66	200	461	616	750	1723
GETPC	67	201	462	617	751	1724
GETPCA	500	1515				
GETPCA	501	1516				
GT3DBT	521	555				
GT3DBT	522	556				
GTAINC	1532					
GTAINC	1533					
GTBYT	1630					
GTBYT	1631					
GTBYTA	620					
GTBYTA	621					
GTLINK	164					
GTLINK	165					
GTSRCH	707	745				
GTSRCH	710	746				

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XGNN40   653
XGNN40   654

End of VASM assembly

VASM ROM ASSEMBLY          REV.  6/81A

OPTIONS: L C S

* HP41C MAINFRAME MICROCODE ADDRESSES @24000-25777
*
     4                    FILE   CN10B
     5                    ENTRY  AVAIL
     6                    ENTRY  AVAILA
     7                    ENTRY  BSTEP
     8                    ENTRY  BSTE2
     9                    ENTRY  BKROM2
    10                    ENTRY  BSTE
    11                    ENTRY  BSTEPA
    12                    ENTRY  DECAD
    13                    ENTRY  DECADA
    14                    ENTRY  FINEND
    15                    ENTRY  FLINK
    16                    ENTRY  GETPC
    17                    ENTRY  INCAD
    18                    ENTRY  INCADA
    19                    ENTRY  LINNM1
    20                    ENTRY  LINN1A
    21                    ENTRY  LINNUM
    22                    ENTRY  NXLDEL
    23                    ENTRY  NXLSST
    24                    ENTRY  FLINKA
    25                    ENTRY  FLINKM
    26                    ENTRY  FLINKP
    27                    ENTRY  GTBYT
    28                    ENTRY  GTB7TO
    29                    ENTRY  GETPCA
    30                    ENTRY  GTBYTA
    31                    ENTRY  GTONN
    32                    ENTRY  GTO.5
    33                    ENTRY  IN3B
    34                    ENTRY  INBYT
    35                    ENTRY  INBYTC
    36                    ENTRY  INBYTP
    37                    ENTRY  INBYT0
    38                    ENTRY  INBYT1
    39                    ENTRY  INCAD2
    40                    ENTRY  INCADP
    41                    ENTRY  INEX
    42                    ENTRY  INLIN
    43                    ENTRY  INSLIN
    44                    ENTRY  INLIN2
    45                    ENTRY  INSTR
    46                    ENTRY  INTXC
    47                    ENTRY  NROOM3
    48                    ENTRY  NXBYTA
    49                    ENTRY  NXBYT3
    50                    ENTRY  NXL1B
    51                    ENTRY  NXL3B2
    52                    ENTRY  NXLCHN
```

```
    53                      ENTRY  NXLIN
    54                      ENTRY  NXLINA
    55                      ENTRY  NXLIN3
    56                      ENTRY  NXLTX
    57                      ENTRY  PTBYTM
    58                      ENTRY  PUTPCL
    59                      ENTRY  SKPLIN
* PUT BYTE BRANCH TABLE
    61     0 TBLPBA    70 C=DATA                    7 ENTRY POINTS(0,2,4,...,12)
    62     1           443 GOTO    PBA0    (  45) BYTE 0
    63     2            70 C=DATA
    64     3           363 GOTO    PBA1    (  41) BYTE 1
    65     4            70 C=DATA
    66     5           303 GOTO    PBA2    (  35)
    67     6            70 C=DATA
    68     7           223 GOTO    PBA3    (  31)
    69    10            70 C=DATA
    70    11           143 GOTO    PBA4    (  25)
    71    12            70 C=DATA
    72    13            63 GOTO    PBA5    (  21)
    73    14 PBA6      70 C=DATA                    BYTE 6
    74    15          1574 RCR     12              ROTATE PROPER BYTE INTO POSITION
    75    16           312 C=B     WPT             STORE 1 (OR 2) BYTE(S)
    76    17          1074 RCR     2               RESTORE BYTE(S) TO PROPER POSITION
    77    20           263 GOTO    PBAEND  (  46) CLEAN UP
    78    21 PBA5      374 RCR     10
    79    22           312 C=B     WPT
    80    23           174 RCR     4
    81    24           223 GOTO    PBAEND  (  46)
    82    25 PBA4      474 RCR     8
    83    26           312 C=B     WPT
    84    27           574 RCR     6
    85    30           163 GOTO    PBAEND  (  46)
    86    31 PBA3      574 RCR     6
    87    32           312 C=B     WPT
    88    33           474 RCR     8
    89    34           123 GOTO    PBAEND  (  46)
    90    35 PBA2      174 RCR     4
    91    36           312 C=B     WPT
    92    37           374 RCR     10
    93    40            63 GOTO    PBAEND  (  46)
    94    41 PBA1     1074 RCR     2
    95    42           312 C=B     WPT
    96    43          1574 RCR     12
    97    44            23 GOTO    PBAEND  (  46)
    98    45 PBA0      312 C=B     WPT             NO ROTATION NEEDED HERE
    99    46 PBAEND   1360 DATA=C                  RESTORE REGISTER IN MEMORY
   100    47            34 PT=     3               RESTORE POINTER
   101    50          1740 RTN                     DONE!
   102    51 INB1     1074 RCR     2
   103    52           352 BC EX   WPT
   104    53          1574 RCR     12
   105    54           443 GOTO    INBEXA  ( 120)
*
   107                      ENTRY  ERRDE
   108    55 ERRDE       1 GOSUB  ERROR
   108    56              0
   109    57              0 XDEF   MSGDE
   110                      FILLTO:@57
* PUT LINK BRANCH TABLE
```

```
 112   60 TBLPTL   70 C=DATA                        7 ENTRY POINTS(0,2,4,...,12)
 113   61         403 GOTO   PTL0    ( 121) SPECIAL CASE ON BOUNDARY
 114   62          70 C=DATA
 115   63        1623 GOTO   PBA0    (  45)
 116   64          70 C=DATA
 117   65        1543 GOTO   PBA1    (  41)
 118   66          70 C=DATA
 119   67        1463 GOTO   PBA2    (  35)
 120   70          70 C=DATA
 121   71        1403 GOTO   PBA3    (  31)
 122   72          70 C=DATA
 123   73        1323 GOTO   PBA4    (  25)
 124   74          70 C=DATA
 125   75        1243 GOTO   PBA5    (  21)
 126   76 PBA6A  1163 GOTO   PBA6    (  14)
 127                FILLTO @77
       77        0000 NOP
* INSERT BYTE BRANCH TABLE
 129  100 TBLINB   70 C=DATA                        INSERT BYTE BRANCH TABLE
 130  101         533 GOTO   INB0    ( 154) ON 16 WORD BOUNDARY
 131  102          70 C=DATA
 132  103        1463 GOTO   INB1    (  51)
 133  104          70 C=DATA
 134  105         433 GOTO   INB2    ( 150)
 135  106          70 C=DATA
 136  107         353 GOTO   INB3    ( 144)
 137  110          70 C=DATA
 138  111         273 GOTO   INB4    ( 140)
 139  112          70 C=DATA
 140  113         213 GOTO   INB5    ( 134)
 141  114 INB6     70 C=DATA                        GET REGISTER TO INSERT INTO.
 142  115        1574 RCR    12                    POSITION BYTE OF INTEREST IN CC0-1]
 143  116         352 BC EX  WPT                   EXCHANGE BYTE WITH BYTE IN REGISTER
 144  117        1074 RCR    2                     PUT BYTE BACK INTO RIGHT POSITION IN
 145  120 INBEXA  353 GOTO   INBEX   ( 155) FINISH UP
 146  121 PTL0   1574 RCR    12                    PUT FIRST BYTE IN
 147  122         302 C=B    PT
 148  123         326 C=B    XS
 149  124        1074 RCR    2
 150  125        1360 DATA=C
 151  126         252 AC EX  WPT                   PUT IN SECOND BYTE
 152  127         412 A=C    WPT                   IN THE NEXT REGISTER
 153  130        1156 C=C-1
 154  131        1160 DADD=C
 155  132        1434 PT=    1
 156  133        1433 GOTO   PBA6A   (  76)
 157  134 INB5    374 RCR    10
 158  135         352 BC EX  WPT
 159  136         174 RCR    4
 160  137         163 GOTO   INBEX   ( 155)
 161  140 INB4    474 RCR    8
 162  141         352 BC EX  WPT
 163  142         574 RCR    6
 164  143         123 GOTO   INBEX   ( 155)
 165  144 INB3    574 RCR    6
 166  145         352 BC EX  WPT
 167  146         474 RCR    8
 168  147          63 GOTO   INBEX   ( 155)
 169  150 INB2    174 RCR    4
 170  151         352 BC EX  WPT
```

```
171  152          374 RCR    10
172  153           23 GOTO   INDEX  ( 155)
173  154 INB0     352 BC EX  WPT
174  155 INDEX   1312 ? B#0  WPT
175  156          107 GOC    INLIN  ( 166)
176  157         1360 DATA=C                 PUT REGISTER BACK
177  160          630 C=M                    INCREMENT CT BY 1
178  161         1076 C=C+1  S
179  162          256 AC EX                  RESTORE REGISTERS
180  163          106 C=0    X               WAKE UP CHIP 0
181  164         1160 DADD=C
182  165         1740 RTN                    DONE
183  166 INLIN      1 GOSUB  AVAIL           CHECK IF EMPTY REG. AVAILABLE
183  167           0
184  170 NROOM   1356 ? C#0                  EMPTY REGISTER?
185  171          723 GONC   NOROOM ( 263)   NO, ERROR EXIT
* INSERT ASSURED HERE.
187  172            1 GOSUB  FLINKM          FIND LINKS TO FIX UP CHAIN
187  173            0
188  174            1 GOSUB  FIXEND          FIX UP END
188  175            0
189  176          174 RCR    4               FIX UP FOLLOWING LINK
190  177            1 GOSUB  GTLNKA          GET LINK
190  200            0
191  201         1346 ? C#0  X               TOP ELEMENT OF CHAIN?
192  202           23 GONC   *+2    ( 204)   YES, DO NOTHING
193  203         1056 C=C+1                  ADD 1 TO REGISTER COUNT
194                   LEGAL
195  204            1 GOSUB  PTLINK          PUT LINK BACK
195  205            0
196  206          630 C=M
197  207          412 A=C    WPT
198  210         1474 RCR    1               PUT BYTE # IN C[XS]
199  211         1434 PT=    1               SET PT TO TOP DIGIT OF THE BYTE SPEC
200  212           43 GOTO   INL1   ( 216)   C[XS].
201  213 INL2    1166 C=C-1  XS
202  214         1734 INC PT
203  215         1734 INC PT
204  216 INL1    1166 C=C-1  XS
205  217         1743 GONC   INL2   ( 213)
206  220          116 C=0                    FIX UP CHAINHEAD
207  221         1160 DADD=C
208  222         1570 C=REGN 13
209  223         1156 C=C-1
210  224         1550 REGN=C 13              PUT BACK
211  225 INL3    1056 C=C+1                  MOVE REGISTERS DOWN
212  226         1160 DADD=C
213  227          346 BC EX  X
214  230           70 C=DATA
215  231          346 BC EX  X
216  232         1146 C=C-1  X
217  233         1160 DADD=C
218  234          346 BC EX  X
219  235         1360 DATA=C
220  236          346 BC EX  X
221  237         1046 C=C+1  X
222  240         1546 ? A#C  X               FINISHED?
223  241         1647 GOC    INL3   ( 225)   NO, MOVE ANOTHER LINE.
224  242          346 BC EX  X               CLEAN UP
225  243          256 AC EX
```

```
   226  244          1360 DATA=C                  STORE A TEMPORARILY
   227  245           116 C=0                     CREATE NULL REGISTER
   228  246           252 AC EX  WPT              PLACE NULLS IN BEGINNING OF REGISTER
   229  247           256 AC EX
   230  250            70 C=DATA                  RETRIEVE OLD A
   231  251           256 AC EX
   232  252          1360 DATA=C                  STORE LAST PART OF REGISTER
   233  253           630 C=M
   234  254          1160 DADD=C
   235  255            70 C=DATA
   236  256           112 C=0     WPT             STORE LAST PART OF REGISTER WITH 1 P
   237  257          1360 DATA=C                  MORE NULLS
   238  260           630 C=M                     GO BACK AND FINISH THE INSERT
   239  261             1 GOLONG INBYT1
   239  262             2
   240  263 NOROOM    630 C=M                     NO ROOM - ERROR EXIT
   241  264           412 A=C     WPT             ZERO PREVIOUSLY INSERTED STEPS
   242  265           103 GOTO    NROOM2 ( 275)
   243  266 NROOM1      1 GOSUB   DECSDA
   243  267             0
   244  270           106 C=0     X
   245  271             1 GOSUB   PTBYTM
   245  272             0
   246  273          1176 C=C-1   S               DONE?
   247  274           530 M=C
   248  275 NROOM2   1376 ? C#0   S
   249  276          1707 GOC     NROOM1 ( 266) NO, ZERO OUT SOME MORE BYTES.
   250  277          1114 ?S9=1                   SET RUNNING TO ASSURE BACK STEP
   251  300            23 GONC    *+2    ( 302) IF S9=1
   252  301          1310 S13=    1
   253  302 NROOM3      1 GOLONG  PACKE
   253  303             2
*
* AVAIL - FIND AN AVAILABLE REGISTER
* THIS SUBROUTINE PLACES CHAINHEAD-1 IN A[X] AND LOOKS
*- TO SEE IF CHAINHEAD-1 IS AVAINABLE FOR USE IN INSERTING
*- OR IN ASSIGNING. C[X] IS RETURNED AS 0 IF THERE IS NO ROOM.
*- IF THERE IS ROOM, C[X] IS RETURNED AS DECIMAL 192.
*- NOTHING IS ASSUMED AND PT IS RETURNED AS 3
* AVAILA - SAME AS AVAIL EXCEPT PT NOT SET AND REG 0 ASSUMMED
*--SELECTED.
*
   264  304 AVAIL     116 C=0
   265  305            34 PT=     3
   266  306          1160 DADD=C
   267  307 AVAILA   1570 C=REGN 13               GET CHAINHEAD ADDRESS
   268  310          1156 C=C-1
   269  311          1160 DADD=C                  SELECT CHAINHEAD-1 REGISTER
   270  312           406 A=C     X               SAVE ADDRESS IN A
   271  313            70 C=DATA                  GET THE REGISTER
   272  314          1356 ? C#0                   NON ZERO REGISTER?
   273  315            57 GOC     AVAIL1 ( 322) YES, ERROR EXIT
   274  316           460 LDI
   275  317           300 CON     192             REGISTER EXISTENT?
   276  320          1406 ? A<C   X
   277  321          1640 RTN NC                  YES, SUCCESS EXIT
   278  322 AVAIL1    116 C=0                     FAILURE EXIT
   279  323          1740 RTN
*
* BSTEP - BACK STEP
```

```
* WHEN CALLED, ASSUMES THE PROGRAM COUNTER IS POINTING
*- AT AN UNKNOWN LINE. THIS ROUTINE MOVES THE
*- PROGRAM COUNTER TO POINT AT THE BYTE JUST PRECEEDINT THE UNKNOWN
*- LINE.
* WORKS IN ROM OR RAM
* WILL BACK STEP PAST BEGINNING OF MEMORY TO END
*- IF LINE NUMBER = 1 OR 0.
* ASSUMES NOTHING
* USES A,B[0-3],C,M,N,S[0-7],3 SUB LEVELS
*
* BACK AROUND TO END CASE OF BACK STEP
  293  324 BSTEP2   314 ?S10=1                ROM FLAG?
  294  325          207 GOC     BSTEP3 ( 345) YES, DO BACK STEP IN ROM
  295  326            1 GOSUB   FLINKP        FIND THE END OF THE PROGRAM
  295  327            0
  296  330          474 RCR     8
  297  331          412 A=C     WPT
  298                                         MOVE BACK ONE BYTE
  299  332            1 GOSUB   PUTPCD        PUT PC THERE
  299  333            0
  300  334            1 GOLONG  LINNM1        CALCULATE NEW LINE NUMBER AND RTN
  300  335            2
  301  336 BSTEP      1 GOSUB   LINNUM        GET THE LINENUMBER
  301  337            0
  302  340         1146 C=C-1   X             0?
  303  341         1637 GOC     BSTEP2 ( 324) YES, GO TO END.
  304  342         1346 ? C#0   X             1?
  305  343         1613 GONC    BSTEP2 ( 324) YES, GO TO END.
  306  344         1750 REGN=C  15            NO, FIX LINE NUMBER
  307  345 BSTEP3     1 GOSUB   GETPC         GET PROGRAM COUNTER
  307  346            0
  308  347          314 ?S10=1                ROM FLAG
  309  350          457 GOC     BKROM  ( 415) ROM-
  310  351            1 GOSUB   FLINK         RAM
  310  352            0
  311  353 BSTEPA   730 CM EX                 SAVE ADDRESES IN M
  312  354         1512 ? A#0   WPT           TOP OF MEMORY?
  313  355           47 GOC     BST1   ( 361) NO
  314  356            1 GOSUB   FSTIN         YES - MOVE TO BEFORE FIRST INSTRUCTIC
  314  357            0
  315  360           33 GOTO    BST2   ( 363)
  316  361 BST1       1 GOSUB   DECADA        MOVE TO ADDRESS BEFORE LINK
  316  362            0
  317  363 BST2       1 GOSUB   GTBYTA        GET BYTE
  317  364            0
  318  365         1574 RCR     12
  319  366         1704 CLR ST               SET UP FOR NXLIN
  320  367          110 S4=     1
  321  370           73 GOTO    BSTML2 ( 377) GO FIND THE END OF THE CURRENT LINE
* REVISED BACK STEP MAIN LOOP
  323  371 BSTML   374 RCR     10            SAVE PREVIOUS 2 ADDRESSES
  324  372          312 C=B     WPT
  325  373          256 AC EX
  326  374          730 CM EX                 GET REGISTER BACK
  327  375            1 GOSUB   NXLIN         MOVE UP ONE LINE
  327  376            0
  328  377 BSTML2  730 CM EX
  329  400          212 B=A     WPT
  330  401          256 AC EX
  331  402         1406 ? A<C   X             MORE?
```

```
   332  403          1667 GOC     BSTML  ( 371) YES!
   333  404          1546 ? A#C   X              SAME REG?
   334  405            57 GOC     BSTML1 ( 412) NO, DONE
   335  406          1402 ? A<C   PT             MORE?
   336  407          1627 GOC     BSTML  ( 371) YES
   337  410          1552 ? A#C   WPT            DONE?
   338  411          1603 GONC    BSTML  ( 371) NO, DON'T QUIT ON EQUAL
   339  412 BSTML1    474 RCR     8              DONE-GET OLD ADDRESS
   340  413 BSTE        1 GOLONG  BSTE2          PUT IN PC
   340  414            2
* ROM BACK STEP-HERE
   342  415 BKROM     674 RCR     11              PUT PC IN PLACE
   343  416           410 ST=     1              SET GTONN BIT
   344  417 BKROM1   1460 CXISA                  GET BYTE
   345  420          1172 C=C-1   M              MOVE TO PREVIOUS BYTE
   346  421          1166 C=C-1   XS             STARTING BYTE?
   347  422          1757 GOC     BKROM1 ( 417) NO
   348  423            74 RCR     3              PUT IN PLACE
   349  424          1176 C=C-1   S              BEGIN?
   350  425             1 GOLNC   BKROM2         YES, GOTO LINE FFF OF PROG
   350  426             2
   351  427          1643 GOTO    BSTE   ( 413) NO, DONE!
*
* FIXEND - FIX END
*-SETS DECOMPILE AND PACK BITS IN AN END SPECIFIED
*-BY C[8-11]
*-PT=3 IN AND OUT
*-USES 1 SUB LEVEL
* USES A[0-3],B[0-3],M
*
   360  430 FIXEND   530 M=C                    SAVE ADDRESSES
   361  431           474 RCR     8              GET END ADDRESS
   362  432           412 A=C     WPT
   363  433             1 GOSUB   INCAD2         GET END BYTE
   363  434             0
   364  435             1 GOSUB   GTBYTA
   364  436             0
   365  437          1634 PT=     0              PUT DECOMPILE AND PACK BITS IN END
   366  440          1720 LC      15
   367  441 PTBYTN      1 GOSUB   PTBYTA
   367  442             0
   368  443           630 C=M                    RESTORE ADDRESS
   369  444          1740 RTN
*
* FLINK - FIND LINKS
* GIVEN AN ADDRESS IN MM FORM IN C[0-3]
* RETURNS THE FOLLOWING IN MM-FORM:
*
* FLINKP - SAME AS FLINK EXCEPT USES THE PC AS THE INPUT ADDRESS
*
* FLINKA - SAME AS FLINK EXCEPT INPUT ADDRESS IN A[0-3].
*
* A[0-3]- THE ADDRESS OF THE LINK PRECEEDING (HIGHER REG #)
*-THE INPUT ADDRESS.
* C[0-3]- THE INPUT ADRESS
* C[4-7]- THE ADDRESS OF THE NEXT LINK FOLLOWING THE INPUT
*- ADDRESS.
* C[8-11]- THE ADDRESS OF THE FIRST END FOLLOWING THE INPUT
*- ADDRESS
* M[0-2] AND M[13] - THE LINK PRECEEDING THE INPUT ADDRESS
```

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* NOTE- IF NO LINK PRECEEDES THE INPUT ADDRESS [TOP OF MEMORY]
*- THEN A[0-3] AND M SET TO 0
* USES A[0-3],B[0-3],C[0-11],M,1 SUB.LEVEL
* PT=3 ON RETURN
   391   445 FLINKP     1 GOSUB  GETPC          GET PROGRAM COUNTER
   391   446             0
   392   447 FLINKA   252 AC EX  WPT             MOVE ADDRESS TO C
   393   450 FLINK    730 CM EX
   394   451 FLINKM     1 GOSUB  GTFEND         GET THE FINAL END
   394   452             0
   395   453          1074 RCR    2              PUT IN PLACE
   396   454            33 GOTO   FLINK2 ( 457)
   397   455 FLINK1     1 GOSUB  UPLINK         MOVE UP 1 LINK
   397   456             0
   398   457 FLINK2   730 CM EX                  RETRIEVE ADDRESSES
   399   460          1406 ? A<C  X              SEE IF DONE
   400   461            77 GOC    FLINK3 ( 470) NO WAY - TRY AGAIN
   401   462          1546 ? A#C  X              CHECK FOR SAME REGISTER CASE
   402   463          1540 RTN C                 DONE!
   403   464          1402 ? A<C  PT             CHECK BYTE
   404   465            37 GOC    FLINK3 ( 470) TRY AGAIN
   405   466          1542 ? A#C  PT             ON LINK?
   406   467          1540 RTN C                 ALL DONE IF NOT EQUAL
   407   470 FLINK3   174 RCR    4              GO UP ANOTHER LINK
   408   471          212 B=A    WPT            PUT ADDRESS IN FOLLOWING LINK SPOT
   409   472          312 C=B    WPT
   410   473          374 RCR    10
   411   474          730 CM EX                 CHECK FOR END
   412   475          1076 C=C+1  S
   413   476          147 GOC    FLINK5 ( 512) CARRY IF ALPHA LABEL
   414   477          730 CM EX                 PUT ADDRESS IN FOLLOWING END SPOT
   415   500          474 RCR    8
   416   501          312 C=B    WPT
   417   502          574 RCR    6
   418   503          730 CM EX
   419   504          1504 S12=   0             CLEAR PRIVACY STATUS BIT
   420   505          1176 C=C-1  S             RESTORE END BYTE
   421   506          776 C=C+C  S              CHECK PRIVATE BIT FOR THIS PROGRAM
   422   507          776 C=C+C  S              IS IT 1
   423   510           23 GONC   *+2    ( 512) NO, LEAVE PRIVACY RESET
   424   511          1510 S12=   1             YES, SET PRIVACY STATUS
   425   512 FLINK5 1346 ? C#0  X               CHECK FOR END OF CHAIN
   426   513          1427 GOC    FLINK1 ( 455) NON ZERO - TRY AGAIN
   427   514           12 A=0    WPT            FIX UP END OF CHAIN EXIT
   428   515          116 C=0
   429   516          730 CM EX
   430   517          1740 RTN
*
* GETPC - RETRIEVES THE PC AFTER SELECTING CHIP 0 AND CREATES
*- THE MM ADDRESS FORM BY DOUBLING THE BYTE NUMBER IF THE
*- S10=0. THE RESULTING MM ADDRESS IS
*- STORED IN A[0-3]
* GETPCA - SAME AS GETPC EXCEPT CHIP 0 ASSUMED SELECTED.
* SETS PT=3
* USES A[0-3],AND C
*
   440   520 GETPC    116 C=0
   441   521          1160 DADD=C
   442   522 GETPCA 1470 C=REGN 12
   443   523           34 PT=    3
```

```
   444  524          314 ?S10=1
   445  525           27 GOC     *+2     ( 527)
   446  526          742 C=C+C   PT
   447  527          412 A=C     WPT
   448  530         1740 RTN
*
* GTONN - GOTO LINE NNN OF THE CURRENT PROGRAM
* REPLACES THE PROGRAM COUNTER WITH THE ADDRESS OF
*- THE LINE SPECIFIED BY A[0-2]
* FFF IN A[0-2] MEANS GTO..
* USES A,B[0-3]C,N,M,P,Q,S[0-7]
*
   456  531 GTONN     34 PT=     3               RSTORE POINTER TO MM PLACE
   457  532          256 AC EX                    PUT LINE# IN C
   458  533         1346 ? C#0   X                GOTO 0?
   459  534            1 GOLNC   RTN30            YES, EXECUTE KEYBOARD RETURN
   459  535            2
   460  536          132 C=0     M                CLEAN UP THE REGISTER
   461  537         1046 C=C+1   X                GTO..?
   462  540          217 GOC     GTO..   ( 561) YES.
   463  541         1046 C=C+1   X                GTO. ALPHA?
   464  542           73 GONC    GTONN2  ( 551) NOPE, GO ON
   465  543          460 LDI                     CREATE GOTO ALPHA FUNCTION CODE
   466  544           35 CON2    1       13
   467  545         1574 RCR     12               PUT IN PLACE
   468  546         1104 S9=     0               CLEAR ALPHA SEARCH BIT
   469  547            1 GOLONG  XROM1           GO TO THE LABEL
   469  550            2
   470  551 GTONN2  1146 C=C-1   X
   471  552         1146 C=C-1   X               RESTORE LINE NUMBER
   472  553          374 RCR     10              PUT IN PLACE
   473  554          410 S8=     1               SET GTONN BIT
   474  555            1 GOSUB   LINNIA          GO DO IT
   474  556            0
   475  557            1 GOLONG  NFRC            RETURN
   475  560            2
   476  561 GTO..   1570 C=REGN  13              GET CHAINHEAD ADDRESS
   477  562          420 LC      4
   478  563           34 PT=     3               SAVE FOR LATER
   479  564          412 A=C     WPT
   480  565          160 N=C
   481  566            1 GOSUB   GTLINK          IS THE PREVIOUS LINK AN END?
   481  567            0
   482  570         1346 ? C#0   X                IS IT THE TOP OF MEMORY?
   483  571           47 GOC     GTO.4   ( 575) NO, SEE IF PREVIOUS LINK IS AN END
   484  572            1 GOSUB   FSTIN           GO TO THE TOP OF MEMORY
   484  573            0
   485  574           73 GOTO    GTO.2   ( 603) SEE IF .END. IS THE FIRST INST.
   486  575 GTO.4      1 GOSUB   UPLINK          GET THE LINK
   486  576            0
   487  577         1076 C=C+1   S                IS IT AN ALPHA LABEL?
   488  600          157 GOC     GTO.1   ( 615) YES, PUT AN END IN.
   489  601            1 GOSUB   INCAD2          GO TO THE NEXT INSTRUCTION
   489  602            0
   490  603 GTO.2      1 GOSUB   NXBYTA          FIND THE ADDRESS OF THE NEXT LINE
   490  604            0
   491  605         1574 RCR     12              NULL?
   492  606         1342 ? C#0   PT
   493  607           37 GOC     GTO.2A  ( 612)
   494  610         1366 ? C#0   XS
```

```
   495  611          1723 GONC   GTO.2  ( 603) YES, NULL, KEEP LOOKING
   496  612 GTO.2A    260 C=N                  COMPARE ADDRESSES
   497  613          1552 ? A#C  WPT           SAME AS THE FINAL END?
   498  614           333 GONC   GTO.3  ( 647) YES, NO INSERT NEEDED.
* CREATE NEW FINAL END HERE
   500  615 GTO.1       1 GOSUB  AVAIL
   500  616             0
   501  617          1356 ? C#0                IS THERE ROOM?
   502  620             1 GOLNC  PACKE         NO, GO PACK!
   502  621             2
   503  622           234 PT=    5             MAKE NEW FINAL END
   504  623          1420 LC     12
   505  624            34 PT=    3
   506  625           460 LDI
   507  626           440 CON    @440          LINK= 1 REG.
   508  627          1360 DATA=C
   509  630           260 C=N                  FIX OLD END
   510  631          1160 DADD=C
   511  632          1146 C=C-1  X             CONSTRUCT ADDR OF NEW
   512  633           412 A=C    WPT            FINAL END AND SAVE IN
* A[3:0] FOR THE PUTPCD CALL LATER ON
* NOTE C[3] HERE IS 4, THE MN:BYTE COUNT FOR THE
* FIRST BYTE OF THE END.  N[3:0] WAS SET UP BACK AT GTO..
   516  634            70 C=DATA               GET OLD FINAL END
   517  635          1730 CST EX               TURN OFF FINAL END STATUS BIT
   518  636           204 S5=    0
   519  637          1010 S2=    1             TURN OF PACK BIT
   520  640          1730 CST EX
   521  641          1360 DATA=C               RETURN
   522  642           116 C=0                  FIX CHAINHEAD
   523  643          1160 DADD=C
   524  644          1570 C=REGN 13
   525  645          1146 C=C-1  X
   526  646          1550 REGN=C 13
   527  647 GTO.3     304 S10=   0             TURN OFF THE ROM FLAG
   528                                         FIX PC
   529  650             1 GOSUB  PUTPCD
   529  651             0
   530  652 GTO.5       1 GOSUB  PACKN         PACK MEMORY
   530  653             0
   531  654             1 GOSUB  RTN30         MAKE A ZERO LINE NUMBER
   531  655             0
   532  656             1 GOLONG NFRPU         CAN'T USE A RTN HERE.
   532  657             2
* THE GOLONG NFRPU IS NECESSARY HERE INSTEAD OF A SIMPLE
* RETURN BECAUSE WE GET HERE FROM CLP VIA DELLIN AND DELLIN
* USES UP ALL THE SUBROUTINE LEVELS, PUSHING THE NFRPU OFF
* THE TOP OF THE STACK.
*
* GTBYT - GET BYTE
* GENERALIZED ROUTINE FOR GETTING A BYTE OUT OF ROM OR RAM.
* GETS THE BYTE POINTED TO BY A[0-3] IN MM ADDRESS FORM AND
* PLACES IT IN C[0-1]
* GTBYTA - SAME AS GTBYT EXCEPT RAM ADDRESS'S ONLY WORK.
* USES A[0-3],AND C
*
   545  660 GTBYT     314 ?S10=1               ROM FLAG?
   546  661           123 GONC   GTBYTA ( 673) NO, GET RAM BYTE
   547  662 GTBYTO    256 AC EX                YES, GET ROM BYTE
   548  663           416 A=C
```

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   549  664          674 RCR    11
   550  665         1460 CXISA
   551  666         1740 RTN                    DONE
*
* NXBYTA - GET THE NEXT BYTE
* INCREMENTS A[0-3] IN MM FORMAT AND RETURNS THE BYTE
*- POINTED TO BY THIS ADDRESS IN C[0-1].
* ASSUMES PT=3 ON ENTRY
* RAM ONLY!
* USES 1 SUB LEVEL
*
* NXBYT3 - GET THE NEXT 3RD BYTE
* SAME AS NXBYTA EXCEPT INCREMENTS THE ADDRESS 3 BYTES INSTEAD
*- OF 1 BEFORE GETTING THE BYTE
*
   564  667 NXBYT3     1 GOSUB  INCAD2
   564  670            0
   565  671 NXBYTA     1 GOSUB  INCADA
   565  672            0
* GET A BYTE FROM RAM HERE
   567  673 GTBYTA   252 AC EX  WPT            GET BYTE OUT OF RAM
   568  674          412 A=C    WPT            SET  UP TABLE ADDRESS
   569  675         1160 DADD=C
   570  676          174 RCR    4
   571  677          460 LDI                   TABLE ON 16 WORD BOUNDARY
* TABLE JUMP
   573  700         1041 CON    @1041          TABLE -GET BYTE
   574  701          374 RCR    10
   575  702          740 GOTOC                 7 WAY BRANCH
   576                   ENTRY  CALDSP
   577  703 CALDSP   706 A=A-C  X              A[3:0]_PGMCTR-REL ADDR
   578  704          702 A=A-C  PT             -
   579  705         1640 RTN NC
   580  706          273 GOTO   INC2   ( 735)
*
* INCAD - INCREMENT ADDRESS
* INCREMENTS ROM OR RAM(MM FORM) ADDRESS IN A[0-3] IN PLACE.
* INCADA - SAME AS INCAD EXCEPT ASSUMES PT=3 AND ONLY RAM ADDRESSES.
* INCADP - SAME AS INCADA EXCEPT SET PT=3 ON ENTRY
* INCAD2 - INCREMENT ADDRESS BY TWO BYTES
* SAME AS 2 CALLS TO INCADA EXCEPT FASTER.
*
* DECAD - DECADA  DECREMENT ADDRESS
*-DECADA - ASSUMES ADDRESS IS A RAM ADDRESS
*-DECAD - RAM OR ROM
*-ADDRESS EXPECTED IN A[0-3] IN MM FORMAT
*-PT EXPECTED AT 3 FOR DECADA, ALWAYS RETURNED AT 3
   594  707 DECAD     34 PT=     3
   595  710          314 ?S10=1                ROM FLAG?
   596  711          267 GOC    DECADB ( 737)
   597  712 DECADA   542 A=A+1  PT
   598  713          542 A=A+1  PT
   599  714          542 A=A+1  PT
   600                   LEGAL
   601  715            1 GOLONG PATCH1         @740 IN QUAD 8
   601  716            2
   602  717 INCAD    314 ?S10=1                ROM FLAG?
   603  720          217 GOC    INCADB ( 741) YES, ROM INCREMENT.
   604  721 INCADP    34 PT=     3             NO,RAM ADDRESS TO INCREMENT
   605  722           43 GOTO   INCADA ( 726)
```

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   606  723 INCAD2  642 A=A-1  PT             BYTE 0?
   607  724          67 GOC    INC21  ( 732) YES, GO TO NEXT REG,BYTE 5
   608  725         642 A=A-1  PT             FINISH THE FIRST INCREMENT
   609  726 INCADA  642 A=A-1  PT             BYTE=0?
   610  727          57 GOC    INC1   ( 734) YES, GO TO NEXT REG, BYTE 6
   611  730         642 A=A-1  PT             NO, FINISH MOVING TO NEXT BYTE
   612  731        1740 RTN                   DONE
   613  732 INC21   642 A=A-1  PT             2 INC CASE, BTYE 5 DESIRED
   614  733         642 A=A-1  PT
   615  734 INC1    642 A=A-1  PT             SET C[PT] TO 12 (BYTE 6)
   616  735 INC2    642 A=A-1  PT
   617  736         642 A=A-1  PT
   618  737 DECADB  656 A=A-1                 DECREMENT REGISTER BY 1
   619  740        1740 RTN                   DONE
   620  741 INCADB  556 A=A+1                 POM INCREMENT
   621  742        1740 RTN                   DONE
*
* INBYT0 - INSERT A ZERO BYTE INTO MEMORY
* CONDITIONS THE SAME AS INBYT EXCEPT THAT G NEED NOT BE
*- SPECIFIED.
*
* INBYTC - SPECIAL INBYT ENTRY WHERE THE BYTE TO BE INSERTED IS
*- FOUND IN C[0-1].
*
* INBYTP - SAME AS INBYTP EXCEPT THAT THE PT POINTS TO THE
*- LAST DIGIT OF THE BYTE IN C TO BE INSERTED.
*
   633  743 INBYT0  106 C=0    X
   634  744 INBYTC 1634 PT=    0
   635  745 INBYTP  130 G=C
*
* INBYT - INSERT BYTE INTO PROGRAM MEMORY
*- INCREMENT A[0-3] IN NM FORMAT AND INSERT THE BYTE IN G INTO
*- PROGRAM MEMORY AT THAT LOCATION. MAKE SPACE OF NECCESSARY
*- BY INCREASING PROG LENGTH BY 1 REGISTER. FIX UP CHAINHEAD,
*- CURRENT PROGRAM HEAD AND CLOSEST LINK. ALSO INCREMENT CT
*- IN A[13]. CT IS USED TO KEEP TRACK OF THE NUMBER OF
*- SUCCESSFUL INSERTS IN A LINE IN CASE OF RUNNING OUT OF ROOM.
* DOES NOT RETURN IF NO ROOM. THE PREVIOUS [CT] BYTES SET TO 0
*- IF S9=1 THEN BACK STEP FORCED IN ERROR CASE.
* ASSUMES NOTHING.
* RETURNS CHIP 0 SELECTED AND PT=1
* USES A[0-11],B[0-3],C[0-3],N,G,PT,S9,AND 2 SUB LEVELS
*
* NOTE- INBYT0 MUST BE LOCATED RIGHT ABOVE HERE.
*
   652  746 INBYT     1 GOSUB  INCADP         MOVE TO RIGHT BYTE
   652  747           0
   653  750         256 AC EX                 SAVE ADDRESS
   654  751         530 M=C
   655  752 INBYT1 1160 DADD=C                WAKE UP THE RIGHT REGISTER
   656  753         174 RCR    4              DO 7 WAY BRANCH JUST LINE GTBYTA
   657  754        1634 PT=    0
   658  755         230 C=G                   PUT BYTE TO INSERT INTO B[0-1]
   659  756         346 BC EX  X
   660  757        1434 PT=    1              SET POINTER TO INSERT 2 DIGITS(1 BYTE
   661  760         460 LDI
* TABLE JUMP
   663  761        1204 CON    @1204
   664  762         374 RCR    10
```

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   665  763          740 GOTOC
*
* INSLIN - INSERT LINE
* THIS ROUTINE INSERTS A LINE AFTER THE CURRENT LINE POINTED TO
*- BY THE PC. DOES NOT SKIP CURRENT LINE IF THE LINE IS AN END OR
*- THE LINE NUMBER IS 0.
* LEAVES THE PC POINTING TO THE NEW LINE AND INCREMENTS THE LINE
*- NUMBER BY 1. IF NO ROOM, THE ENTIRE INSERT IS IGNORED.
* DIGIT OR TEST ENTRY NOT HANDLED BY THIS ROUTINE.
* THE LINE TO BE INSERTED HAS ITS FIRST BYTE IN C[13-12],THE
*- SECOND BYTE, IF NEEDED, IS IN C[11-10]. ALPHA OPERANDS ARE
*- IN REGISTER 9
* USES A,B,C,M,G,S[0-9]
*
   679  764 INSLIN     1 GOSUB  INSSUB          INTITIALIZE
   679  765            0
   680  766 INLIN2   216 B=A                     SAVE BYTES FOR LATER
   681  767          316 C=B                     GET FIRST BYTE READY FOR INSERT
   682  770         1534 PT=     12
   683  771          130 G=C
   684  772           36 A=0     S               INITIALIZE CT TO 0
   685  773            1 GOSUB  INBYT           INSERT 1 BYTE
   685  774            0
   686  775         1236 C=-C    S               DECODE NUMBER OF BYTES TO INSERT
   687  776          776 C=C+C   S               1 BYTE?
   688  777          133 GONC    IN2B   (1012) NO, MORE DECODE
   689 1000         1076 C=C+1   S               LINE 1?
   690 1001         1076 C=C+1   S
   691 1002          273 GONC    INEXA  (1031) NO, DONE!
* ALPHA OPERANDS HERE
   693 1003            1 GOSUB  INTXC           PREPARE TEXT CHARACTER
   693 1004            0
   694 1005            1 GOSUB  INBYTC          INSERT TEXT CHAR.
   694 1006            0
   695 1007            1 GOSUB  INSTR           OUTPUT TEXT STRING
   695 1010            0
   696 1011          203 GOTO    INEXA  (1031) DONE!
   697 1012 IN2B     776 C=C+C   S               2 BYTE?
   698 1013            1 GOLNC  IN3B            NO, MORE DECODE
   698 1014            2
   699 1015         1376 ? C#0   S               ROW 12?(NO ROW 11 CODES)
   700 1016          767 GOC     IN2BA  (1114) NO, ROWS 9-10
   701 1017         1534 PT=     12              CHECK FOR LBL NN
   702 1020         1042 C=C+1   PT              LBL NN?
   703 1021          113 GONC    IN2BB  (1032) NO, MORE DECODE
   704 1022          374 RCR     10              YES, CHECK FOR SHORT FORM
   705 1023         1046 C=C+1   X                NOTE-FF IS ILLEGAL ADDRESS
   706 1024         1434 PT=     1               15 CARRIED TO 10?
   707 1025         1342 ? C#0   PT              OR >15?
   708 1026          717 GOC     INN2B  (1117) YES, LONG FORM, NORMAL 2 BYTE
   709                   ENTRY   INSHRT
   710 1027 INSHRT     1 GOSUB  PTBYTA          SHORT FORM
   710 1030            0
   711 1031 INEXA    613 GOTO    INEX   (1112) DONE!
   712 1032 IN2BB   1042 C=C+1   PT              C<>REG?
   713 1033          647 GOC     INN2B  (1117) YES, NORMAL 2 BYTE
* LINKS OF THE CHAIN INSERTED HERE
   715 1034          404 S8=     0               CLEAR END BIT
   716 1035         1042 C=C+1   PT              END?
   717 1036           27 GOC     *+2    (1040) NO, ALPHA LABEL
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 718 1037          410 S8=     1               SET END BIT
 719 1040            1 GOSUB   INBYT0          PUT IN BYTE FOR LINK
 719 1041            0
 720 1042          460 LDI                     PUT OF IN EXP FIELD
 721 1043           17 CON     15
 722 1044          414 ?S8=1                   END?
 723 1045           43 GONC    INLNK1 (1051)  NO, ALPHA LABEL
 724 1046            1 GOSUB   INBYTC          OUTPUT OF (END BYTE)
 724 1047            0
 725 1050          123 GOTO    INLNK2 (1062)  GO FIX LINKS
 726 1051 INLNK1     1 GOSUB   INTXC           MAKE TEXT CHARACTER
 726 1052            0
 727 1053         1046 C=C+1   X               COUNT BYTE FOR KEYCODE
 728                   LEGAL
 729 1054            1 GOSUB   INBYTC          INSERT TEXT COUNT
 729 1055            0
 730 1056            1 GOSUB   INBYT0          INSERT ZERO BYTE FOR KEYCODE
 730 1057            0
 731 1060            1 GOSUB   INSTR           INSERT STRING
 731 1061            0
 732 1062 INLNK2     1 GOSUB   GETPC           FIX LINKS
 732 1063            0
 733 1064            1 GOSUB   INCADA          POINT TO FIRST BYTE OF NEW LINK
 733 1065            0
 734 1066            1 GOSUB   FLINKA          FIND LINKS
 734 1067            0
 735 1070            1 GOSUB   GENLNK          FIX CURRENT LINK
 735 1071            0
 736 1072          174 RCR     4
 737 1073            1 GOSUB   GENLNK          FIX PREVIOUS LINK
 737 1074            0
 738 1075          414 ?S8=1                   IF END,FIX PREVIOUS END
 739 1076          143 GONC    INEX   (1112)  NO, DONE
 740 1077          374 RCR     10              YES, PUT DECOMPILE BITS
 741 1100            1 GOSUB   FIXEND          IN PREVIOUS END
 741 1101            0
 742 1102          412 A=C     WPT             MOVE PC TO END OF "END"
 743 1103            1 GOSUB   INCAD2
 743 1104            0
 744 1105            1 GOSUB   PUTPC
 744 1106            0
 745 1107         1770 C=REGN  15              SET LINE # TO 000
 746 1110          106 C=0     X
 747 1111         1750 REGN=C  15
 748 1112 INEX       1 GOLONG  NFRC            DONE
 748 1113            2
 749 1114 IN2BA    776 C=C+C   S               SEPARATE ROWS 9 AND 10
 750 1115         1376 ? C#0   S
 751 1116           67 GOC     IN2R9  (1124)  ROW 9, MORE TO DO
 752 1117 INN2B    316 C=B                     ROW 10, NORMAL 2 BYTE
 753 1120          334 PT=     10
 754 1121            1 GOSUB   INBYTP          INSERT SECOND BYTE
 754 1122            0
 755 1123         1673 GOTO    INEX   (1112)  DONE
* ROW 9 HERE
 757 1124 IN2R9   1534 PT=     12
 758 1125         1142 C=C-1   PT              RCL?
 759 1126          103 GONC    IN2STO (1136)  NO,CHECK FOR STORE
 760 1127          634 PT=     11             YES, CHECK FOR SHORT FORM
 761 1130         1342 ? C#0   PT              <16?
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   762 1131          1667 GOC     INN2B  (1117) NO,LONG FORM.
   763 1132           220 LC      2             YES, MAKE SHORT FORM
   764 1133 INRCLS    374 RCR     10
   765 1134 INSHR2      1 GOLONG  INSHRT        INSERT IT
   765 1135             2
   766 1136 IN2STO   1142 C=C-1   PT             STO?
   767 1137          1603 GONC    INN2B  (1117) NO, STANDARD 2 BYTE
   768 1140           634 PT=     11            SHORT FORM?
   769 1141          1342 ? C#0   PT
   770 1142          1557 GOC     INN2B  (1117) NO, LONG FORM
   771 1143           320 LC      3
   772 1144          1673 GOTO    INRCLS (1133) SHORT FORM
* 3 BYTE FUNCTIONS HERE
   774 1145 IN3B        1 GOSUB   INBYT0        PUT OUT SECOND BYTE FOR COMPILE
   774 1146             0
   775 1147           776 C=C+C   S             XEQ OR GTO?
   776 1150          1376 ? C#0   S
   777 1151          1463 GONC    INN2B  (1117) XEQ-INSERT NORMAL ADDRESS
   778 1152           374 RCR     10            CHECK FOR SHORT FORM
   779 1153          1046 C=C+1   X              NOTE-FF IS ILLEGAL
   780 1154          1434 PT=     1
   781 1155          1342 ? C#0   PT            SHORT FORM?
   782 1156          1417 GOC     INN2B  (1117) NO, INSERT NORMAL ADDRESS
   783 1157          1320 LC      11            YES, SHORT FORM
   784 1160             1 GOSUB   DECAD         OVERWRITE FIRST BYTE
   784 1161             0
   785 1162          1523 GOTO    INSHR2 (1134)
*
* INSTR - INSERT STRING
* GIVEN REG A IN THE PROPER FORMAT FOR INBYT, INSERTS A
*- LABEL STRING FROM REG 9 INTO PROGRAM MEMORY
* USES THE SAME REGISTERS AS INBYT AND IN ADDITION ALL
*- OF C.
* USES 3 SUB LEVELS. RETURNS PT=1
*
   794 1163 INSTR    1170 C=REGN 9             GET THE REST OF THE STRING
   795 1164 INSTR1   1356 ? C#0                ALL DONE?
   796 1165          1640 RTN NC               YES, GO BACK.
   797 1166             1 GOSUB   INBYTC       NO, INSERT ANOTHER CHAR.
   797 1167             0
   798 1170          1170 C=REGN 9             SHIFT OUT INSERTED CHAR.
   799 1171          1716 C SR
   800 1172          1716 C SR
   801 1173          1150 REGN=C 9
   802 1174          1703 GOTO    INSTR1 (1164) GO AROUND AGAIN
*
* INTXC - PREPARE TEST CHARACTER FOR INSERT
* PLACES A TEXT CHARACTER OF THE PROPER SIZE IN C[0-1]
* WHICH IS NEEDED TO PRECEED THE TEXT STRING IN REG 9.
* USES ONLY C[X] AND M.
*
   809 1175 INTXC     460 LDI                  CREATE TEXT CHARACTER
   810 1176           360 CON2    15     0
   811 1177           256 AC EX                PLACE TEXT CHAR IN A
   812 1200           530 M=C                  SAVE A FOR LATER
   813 1201          1170 C=REGN 9             GET TEXT CHAR
   814 1202            43 GOTO    INTXC2 (1206)
   815 1203 INTXC1    546 A=A+1   X             ADD 1 TO TEXT CHAR
   816 1204          1716 C SR                 MOVE TO NEXT CHAR.
   817 1205          1716 C SR
```

```
   818 1206 INTXC2 1356 ? C#0                    ALL DONE?
   819 1207        1747 GOC    INTXC1 (1203) NO, COUNT SOME MORE.
   820 1210         630 C=M                      DONE, PUT THINGS BACK
   821 1211         256 AC EX                    RESTORE A
   822 1212        1740 RTN                      DONE
*
* LINNUM - LINE NUMBER
* WHEN CALLED EITHER RECALLS THE BINARY LINE NUMBER
*- OF THE CURRENT LINE FROM REGISTER 15 OR ELSE COMPUTES IT
*- IF THE LINE NUMBER STORED IS INVALID. IN ALL CASES THE
*- CORRECT LINE NUMBER IS RETORNED IN C[0-2]. IF COMPUTED,
*- THE PROPER LINE NUMBER IS STORED.
* ASSUMES CHIP 0 SELECTED ON INPUT.
* WORKS IN ROM OR RAM.
* USES 2 SUBROUTINE LEVELS.
* USES A,C,M,N,P,Q,B[0-3],S[0-8]. RETURNS P SELECTED IF LINE NUMBER
*- IS COMPUTED.
   835 1213 LINNUM 1770 C=REGN 15               GET LINE NUMBER
   836 1214        1046 C=C+1  X                VALID?
   837 1215          37 GOC    LINNM1 (1220)  NO, GO COMPUTE IT.
   838 1216        1146 C=C-1  X                RESTORE THE CORRECT NUMBER
   839 1217        1740 RTN
   840 1220 LINNM1  404 S8=    0                CLEAR GTONN BIT
   841 1221 BKROM2  116 C=0
   842 1222        1156 C=C-1                   SET TARGET LINE# = FFF
   843 1223 LINN1A  240 SEL P                   COMPUTE LINE NUMBER IN RAM
   844 1224         134 PT=    4                SET UP POINTERS FOR LATER
   845 1225         340 SEL Q
   846 1226         160 N=C                     STORE TARGET LINE#
   847 1227         314 ?S10=1                  ROM FLAG?
   848 1230         647 GOC    LINROM (1314) YES, COMPUTE LINE# IN ROM
   849 1231           1 GOSUB  FLINKP          FIND THE PREVIOUS LINK
   849 1232           0
   850 1233         414 ?S8=1                   GTONN?
   851 1234          23 GONC   *+2    (1236) NO, USE PC ADDRESS
   852 1235         474 RCR    8                YES, USE END ADDRESS AS TARGET
   853 1236         122 C=0    PQ               PREPARE FOR LINE NUMBER IN PQ FIELD
   854 1237         730 CM EX
   855 1240        1512 ? A#0  WPT              TOP OF MEMORY?
   856 1241         103 GONC   LINNM5 (1251) YES, GO TO FIRST INST.
   857 1242          33 GOTO   LINNM2 (1245)  GO FIND IT
   858 1243 LINNM3    1 GOSUB  UPLINK          FIND PREVIOUS END
   858 1244           0
   859 1245 LINNM2 1076 C=C+1  S                END?
   860 1246          63 GONC   LINNM4 (1254) YES, MOVE TO FINAL BYTE
   861 1247        1346 ? C#0  X                TOP OF MEMORY?
   862 1250        1737 GOC    LINNM3 (1243) NO, CONTINUE
   863 1251 LINNM5    1 GOSUB  FSTIN           YES, POSITION JUST BEFORE 1ST INST.
   863 1252           0
   864 1253          63 GOTO   LINNM6 (1261) GO COUNT LINES.
   865 1254 LINNM4    1 GOSUB  INCADA          END! SET UP FOR COUNTING LOOP
   865 1255           0
   866 1256           1 GOSUB  NXBYTA          POSITION TO LAST BYTE OF END
   866 1257           0
   867 1260        1574 RCR    12
   868 1261 LINNM6 1704 CLR ST                 SET UP FOR NXLIN
   869 1262         110 S4=    1
   870 1263         212 B=A    WPT              SAVE COUNTING ADDRESS IN B
   871 1264         730 CM EX                   STORE MEM REG IN C
   872 1265         416 A=C                     GET TARGET ADDRESS AND LINE CT TO A
```

```
  873 1266          260 C=N                     RETRIEVE THE TARGET LINE NUMBER
  874 1267          312 C=B     WPT             MERGE WITH THE COUNTING ADDRESS
* MAIN COUNTING LOOP
  876 1270 LINML    160 N=C                     SAVE THE CURRENT ADDRESS
  877 1271          256 AC EX
  878 1272          730 CM EX                   SAVE ADDRESS, GET STEPS
  879 1273 LINML1     1 GOSUB   NXLIN           MOVE TO THE NEXT LINE
  879 1274            0
  880 1275          730 CM EX                   GET ADDRESS
  881 1276         1062 C=C+1   PQ              ADD 1 TO LINE COUNT
  882 1277          256 AC EX                   TEST FOR DONE
  883 1300         1562 ? A#C   PQ              REACHED LINE NN
  884 1301          113 GONC    LINML2 (1312)  YES, GTONN EXIT.
  885 1302         1406 ? A<C   X               MORE?
  886 1303         1657 GOC     LINML  (1270)  YES.
  887 1304         1546 ? A#C   X               SAME REGISTER?
  888 1305           57 GOC     LINML2 (1312)  NO, DONE!
  889 1306         1402 ? A<C   PT              MORE?
  890 1307         1617 GOC     LINML  (1270)  YES
  891 1310         1542 ? A#C   PT              MORE? - DON'T STOP ON EQUAL.
  892 1311         1573 GONC    LINML  (1270)  YES
  893 1312 LINML2   256 AC EX                   SAVE NUMBER IN C
  894 1313          343 GOTO    LINEND (1347)  ALL DONE!
* CALCULATE LINE NUMBER IN ROM
  896 1314 LINROM     1 GOSUB   ROMHED          A[0-3]=ADDRESS OF BEGIN
  896 1315            0
  897 1316          116 C=0                     PREPARE A ZERO MANTISSA
  898 1317          252 AC EX   WPT             C=COUNTING REG, A[0-3]=0
  899 1320          530 M=C                     SAVE COUNTERS IN M
  900 1321          652 A=A-1   WPT             SET A[0-3]=FFFF
  901 1322          414 ?S8=1                   GTONN?
  902 1323            1 GSUBNC  GETPC           NO,GET ENDING ADDRESS
  902 1324            0
  903 1325          260 C=N                     GET ENDING LINE#
  904 1326          252 AC EX   WPT             FORM TARGET STRING
  905 1327          730 CM EX                   GET READY FOR LOOP
  906 1330          416 A=C                     PUT COUNTING ADDRESS'S IN A
  907 1331          504 S6=     0               CLEAR END BIT
  908 1332           53 GOTO    LINRM4 (1337)
  909 1333 LINRM2     1 GOSUB   SKPLIN          MOVE TO THE NEXT LINE
  909 1334            0
  910 1335          514 ?S6=1                   HIT AN END?
  911 1336           77 GOC     LINRM3 (1345)  YES, DONE!
  912 1337 LINRM4   562 A=A+1   PQ              NO, ADD 1 TO LINE #
  913 1340          630 C=M                     GET TARGETS
  914 1341         1422 ? A<C   PQ              REACHED THE LINE#?
  915 1342           33 GONC    LINRM3 (1345)  YES, DONE!
  916 1343         1412 ? A<C   WPT             REACHED THE ADDRESS?
  917 1344         1677 GOC     LINRM2 (1333)  NO, TRY AGAIN.
  918 1345 LINRM3   256 AC EX                   DONE!
  919 1346          160 N=C                     SAVE THE ADDRESS IN N
  920 1347 LINEND   174 RCR     4               PUT THE NEW LINE# IN A[X]
  921 1350          406 A=C     X
  922 1351            1 GOSUB   GETLIN          PLACE NUMBER IN REGISTER t5
  922 1352            0
  923 1353          240 SEL P                   SELECT P FOR RETURN
  924 1354           34 PT=     3
  925 1355         1514 ?S12=1                  PRIVATE PROGRAM?
  926 1356         1540 RTN C                   YES, RETURN FFF.
  927 1357          246 AC EX   X               PUT LINE NUMBER IN PLACE
```

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   928 1360          1750 REGN=C 15             PUT BACK
   929 1361           260 C=N
   930 1362 BSTE2     412 A=C     WPT
   931 1363 PUTPCL      1 GOSUB   PUTPC          PUT THE NEW ADDRESS IN THE PC
   931 1364             0
   932 1365          1770 C=REGN 15             GET THE LINE NUMBER
   933 1366          1740 RTN
*
* NXLIN - MOVE TO THE NEXT LINE
* SPECIAL RAM PROGRAM MEMORY TRAVERSAL SUBROUTINE
* GIVEN THE ADDRESS OF THE LAST BYTE OF A LINE IN MM FORMAT IN
*- A[0-3], AND ALSO IN C THE REGISTER POINTED TO BY A[0-2]
*- ROTATED SO THAT THE BYTE POINTED TO BY A[3] IS IN C[3-2].
* THE ROUTINE RETURNS A & C IN THE SAME FORMAT AS THEY WERE
*- INPUT BUT REFERRING TO THE NEXT LINE IN PROGRAM MEMORY.
* NOTE- IF THE BYTE NUMBER=0 THEN C[3-2] IS CORRECT, BUT THE
*- REST OF C MAY BE FROM A DIFFERENT REGISTER ON RETURN. ON
*- INPUT, C NEED NOT BE SPECIFIED.
* TRAILING NULLS ARE TREATED AS PART OF THE CURRENT PROGRAM STEP.
* USES B[0-3].
* PT=3 IN AND OUT
*
*
* SKPLIN -SKIP A LINE
* GIVEN THE ADDRESS OF THE LAST BYTE OF A PROGRAM LINE
*- IN A[0-3] IN MM FORMAT, RETURNS THE ADDRES OF THE
*- LAST BYTE OF THE NEXT LINE IN A[0-3].
* NULLS FOLLOWING THE CURRENT LINE ARE PROPERLY SKIPPED
* THE ROUTINE DOES NOTHING IF THE LINE TO BE SKIPPED IS
*- AND END.
*
* NXLSST - SAME AS SLPLIN, BUT THIS ENTRY WILL SKIP ENDS
*- BY GOING TO STEP 1 OF THE CURRENT PROGRAM.
*
* S6 SET TO 1 WHEN ENCOUTERING AN END.
* USES A[0-3],B[0-3],C,S0-7,1 SUB LEVEL
*
* NXLDEL - A SPECIAL ENTRY POINT INTO NXLIN HAS BEEN
*- CREATED FOR DELETE OPERATIONS. THIS ENTRY POINT
*- EXPECTS S7=1 AND GOES ON TO THE NORMAL RAM LINE SKIPPING
*- LOGIC. IF A CHAIN ELEMENT IS TO BE SKIPPED, SPECIAL
*- DELETE LOGIC IS EMPLOYED:
* THE PREVIOUS LINK IS ELARGED TO BRIDGE THE GAP
* IF AN END IS TO BE DELETED, SET S5=0. OTHERWISE ALL ENDS
*- ARE TREATED AS THE FINAL END.
* IF THE FINAL END, RETURN WITH THE SAME ADDRESS AS INPUT.
*
   974 1367 NXLSST 1704 CLR ST                SINGLE STEP ENTRY
   975 1370           33 GOTO    NXLSS1 (1373)
   976 1371 SKPLIN 1704 CLR ST
   977 1372          210 S5=     1              SET BIT TO BACK UP ON END
   978 1373 NXLSS1   314 ?S10=1                 ROM TO SKIP?
   979 1374           47 GOC     SKPROM (1400) YES GO DO IT
   980 1375 NXLDEL     1 GOSUB   NXBYTA         DELETE ENTRY
   980 1376            0
   981 1377          403 GOTO    NXLINA (1437)
* ROM SKIP LINE HERE
   983 1400 SKPROM   252 AC EX   WPT
   984 1401          674 RCR     11
   985 1402 SKPR10  1072 C=C+1   M
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```
 986 1403          1460 CXISA
 987 1404          1366 ? C#0   XS              1ST BYTE OF NEW FC?
 988 1405          1753 GONC    SKPR10 (1402)  NO. SKIP THIS NULL.
 989 1406 SKPR20   1072 C=C+1   M               SKIP THIS BYTE
 990 1407          1460 CXISA
 991 1410          1166 C=C-1   XS              CONTINUATION BYTE?
 992 1411          1757 GOC     SKPR20 (1406)  YES
 993 1412 SKPR30   1172 C=C-1   M               MUST BE 3RD BYTE OF END
 994                                            OR 1ST BYTE OF 2ND NEW FC
 995                                            BACK UP ONE BYTE
 996 1413          1166 C=C-1   XS              WAS IT 1ST BYTE OF 2ND FC?
 997 1414             1 GOLC    ROMH35         YES
 997 1415             3
 998 1416           510 S6=     1              MARK THE END
 999 1417           214 ?S5=1                  STOP AT END?
1000 1420             1 GOLNC   ROMHED         NO. GO TO TOP
1000 1421             2
1001 1422          1172 C=C-1   M               BACK UP 2ND BYTE
1002                    LEGAL
1003 1423          1673 GOTO    SKPR30 (1412)  GO BACK UP 1 MORE & EXIT
* NXLIN RAM TRAVERSAL LOGIC HERE
1005 1424 NXLIN    642 A=A-1   PT              MOVE TO THE NEXT BYTE
1006 1425          113 GONC    NXLIN1 (1436)
1007 1426          252 AC EX   WPT             GET THE NEXT REGISTER
1008 1427         1142 C=C-1   PT              SET BYTE NO. TO 6
1009 1430         1142 C=C-1   PT
1010 1431         1146 C=C-1   X               MOVE TO THE NEXT REGISTER
1011 1432         1160 DADD=C                  GET IT
1012 1433          412 A=C     WPT             SAVE THE NEW ADDRESS
1013 1434           70 C=DATA
1014 1435         1574 RCR     12              MOVE BYTE 6 INTO BYTE 0 POSITION
1015 1436 NXLIN1   642 A=A-1   PT              FINISH CHANGING THE BYTE NO.
1016 1437 NXLINA  1574 RCR     12              MOVE NEW BYTE INTO POSITION
1017 1440         1202 C=-C    PT              START DECODE
1018 1441          742 C=C+C   PT              1BYTE?
1019 1442          373 GONC    NXLIN2 (1501)  NO, MORE DECODE
1020 1443 NXLIB   1042 C=C+1   PT              1 BYTE INST. HERE
1021 1444         1042 C=C+1   PT              ROW 1?
1022 1445         1640 RTN NC                  NO, ALL DONE!
1023 1446          766 C=C+C   XS              DIG 0-7?
1024 1447           53 GONC    NXLDE  (1454)  YES
1025 1450          766 C=C+C   XS              DIG 8-9, . ,EEX?
1026 1451           33 GONC    NXLDE  (1454)  YES
1027 1452         1366 ? C#0   XS              GTO ALPHA,XEQ ALPHA?
1028 1453         1517 GOC     NXLIN  (1424)  YES, GET TEXT
* DIGIT ENTRY HERE
1030 1454 NXLDE    352 BC EX   WPT             SAVE THE CURRENT BYTE IN B
1031 1455          312 C=B     WPT             RESTORE C
1032 1456            1 GOSUB   NXL3B2          GET THE NEXT BYTE
1032 1457            0
1033 1460         1202 C=-C    PT              SEARCH FOR NON DIGIT ENTRY CODE
1034 1461          742 C=C+C   PT              1 BYTE FN?
1035 1462          123 GONC    NXLDE2 (1474)  NO, BACK UP 1 BYTE
1036 1463         1042 C=C+1   PT
1037 1464         1042 C=C+1   PT              ROW 1?
1038 1465           73 GONC    NXLDE2 (1474)  NO,BACK UP
1039 1466          766 C=C+C   XS              DIG 0-7?
1040 1467         1653 GONC    NXLDE  (1454)  YES, KEEP GOING
1041 1470          766 C=C+C   XS              DIG 8-9, . ,EEX?
1042 1471         1633 GONC    NXLDE  (1454)  YES, KEEP GOING
```

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1043 1472          1366 ? C#0  XS              CHS?
1044 1473          1613 GONC   NXLDE  (1454) YES, KEEP GOING
1045 1474 NXLDE2      1 GOSUB  DECADA         BACK UP ONE BYTE
1045 1475             0
1046 1476          1074 RCR    2               RESTORE THE REGISTER
1047 1477 NXLTX1    312 C=B    WPT             RETRIEVE OLD BYTE
1048 1500          1740 RTN                   DONE!
* 2 BYTE INSTRUCTIONS HERE
1050 1501 NXLIN2    742 C=C+C  PT              2 BYTE?
1051 1502           353 GONC   NXLIN3 (1537) NOPE, MORE DECODE
1052 1503          1342 ? C#0  PT              ROW 12?
1053 1504           377 GOC    NXL3B2 (1543) NO, INCREMENT 1 BYTE
1054 1505          1066 C=C+1  XS              LBL NN?
1055 1506           357 GOC    NXL3B2 (1543) YES, SIMPLE INCREMENT
1056 1507          1066 C=C+1  XS              X<>NN?
1057 1510           337 GOC    NXL3B2 (1543) YES
1058 1511 NXLCHN   1214 ?S7=1                  DELETE?
1059 1512             1 GOLC   SKPDEL          YES,SPECIAL LOGIC
1059 1513             3
1060 1514             1 GOSUB  NXL3B2          GET THE THIRD BYTE
1060 1515             0
1061 1516             1 GOSUB  NXL3B2
1061 1517             0
1062 1520          1042 C=C+1  PT              ALPHA LABEL?
1063 1521           467 GOC    NXLTX  (1567) YES, GO DO THE TEXT
1064 1522           510 S6=    1               NO, END - MARK IT
1065 1523           114 ?S4=1                  NORMAL CASE?
1066 1524          1540 RTN C                  YES, DONE!
1067 1525             1 GOSUB  DECADA          RESTORE ADDRESS OF 1ST BYTE OF LINK.
1067 1526             0
1068 1527             1 GOSUB  DECADA
1068 1530             0
1069 1531           214 ?S5=1                  SKPLIN?
1070 1532          1427 GOC    NXLDE2 (1474) YES, BACK UP
1071 1533             1 GOSUB  GTLINK          NO, SINGLE STEP
1071 1534             0
1072 1535             1 GOLONG :CPGMHD         GO TO THE TOP OF THE PROGRAM
1072 1536             2
* 3 BYTE INSTRUCTIONS HERE
1074 1537 NXLIN3    742 C=C+C  PT              3 BYTE?
1075 1540           213 GONC   NXLIN4 (1561) NO,MORE DECODE
1076 1541             1 GOSUB  NXL3B2          INCREMENT THE FIRST BYTE
1076 1542             0
1077 1543 NXL3B2    642 A=A-1  PT              INCREMENT 1 BYTE
1078 1544           123 GONC   NXL2B1 (1556)
1079 1545           252 AC EX  WPT
1080 1546          1420 LC     12
1081 1547            34 PT=    3
1082 1550          1146 C=C-1  X
1083 1551          1160 DADD=C
1084 1552           412 A=C    WPT
1085 1553            70 C=DATA
1086 1554           374 RCR    10
1087 1555          1740 RTN
1088 1556 NXL2B1    642 A=A-1  PT
1089 1557          1574 RCR    12
1090 1560          1740 RTN
* TEXT AND ROW 0 HERE
1092 1561 NXLIN4    742 C=C+C  PT              TEXT?
1093 1562            57 GOC    NXLTX  (1567) YES, GO TRAVERSE IT.
```

```
* ROW 0 HERE
  1095 1563 NXLR0   1366 ? C#0  XS              SHORT LABELS?
  1096 1564         1540 RTN C                  YES, ALL DONE!
  1097 1565            1 GOLONG NXLIN           SKIP OVER NULLS
  1097 1566            2
* TEXT HERE
  1099 1567 NXLTX   1166 C=C-1  XS
  1100 1570         1540 RTN C                  EXIT FOR FUNCTION CODE F0
  1101 1571 NXLTX2   352 BC EX  WPT             SAVE BYTE COUNT IN B
  1102 1572            1 GOSUB  NXL3B2          MOVE TO THE NEXT CHAR.
  1102 1573            0
  1103 1574          352 BC EX  WPT             RETRIEVE REMAINING CHAR COUNT.
  1104 1575         1166 C=C-1  XS              DEC. THE CHAR COUNT
  1105 1576         1733 GONC   NXLTX2 (1571) DONE?
  1106 1577         1003 GOTO   NXLTX1 (1477) YES, RESTORE THE C REGISTER
  1107
  1108
  1109
  1110                   ENTRY  GCPK04
  1111                   ENTRY  GCPK05
  1112                   ENTRY  GCPKC
  1113                   ENTRY  GCP112
  1114
*  GCPKC - GET/CLEAR/PLACE KEYCODE
*- DEPENDING UPON THE INPUT CONDITIONS, THIS SUBROUTINE
*- WILL GET, CLEAR OR PLACE A KEYCODE IN THE ASN
*- FUNCTION TABLE OR PROGRAM MEMORY, WHICHEVER IS
*- APPLICABLE.
*-
*- GET- IN:  A[1:0]= LOGICAL KEYCODE
*-           STATUS BIT 1= 0
*-      OUT: CHIP 0 SELECTED
*-           C[3:0]= CORRESPONDING FUNCTION CODE IF ROM
*-                 = CORRESPONDING LABEL ADDRESS IF RAM
*-           S3= 1 IMPLIES C[3:0] IS A RAM LABEL ADDRESS
*-           (IF DIGIT 3 = 0 THEN FUNCTION CODE IS 1 BYTE
*-            FUNCTION CODE)
*-
*- CLEAR- IN:  A[1:0]= LOGICAL KEYCODE
*-             STATUS BIT 1 = 1
*-        OUT: CHIP 0 SELECTED
*-
*- PLACE- IN:  A[3:2]= LOGICAL KEYCODE
*-             A[1:0]= ZERO
*              B[3:0] = FUNCTION CODE
*-        OUT: S3=1 IMPLIES FUNCTION WAS PLACED
*- USES:  A,B,C,M,N,STATUS BIT 3
*- USES:  1 SUBROUTINE LEVEL
  1140
  1141
  1142
  1143 1600 GCPKC      4 S3=    0             -
  1144 1601         1570 C=REGN 13             M_CHAINHEAD
  1145 1602           34 PT=    3
  1146 1603          420 LC     4             C[3:0]=FINAL END ADDR
  1147 1604          530 M=C                  SAVE FINAL ENS ADDR IN M
  1148 1605           34 PT=    3
  1149 1606          374 RCR    10
  1150 1607          312 C=B    WPT
  1151 1610          356 BC EX  W             SAVE .END. ADDR IN B[4:7] TOO
```

```
*
1153                    ENTRY  GCPKC0          SEARCH ALBLS FROM ANY LINK
1154 1611 GCPKC0   460 LDI                     C[2:0] _ 1ST REG
1155 1612          277 CON     191             -
1156 1613 GCPK10  1046 C=C+1   X               -
1157 1614          256 AC EX                   CHAINHEAD=REG?
1158 1615          730 MC EX                   -
1159 1616         1546 ? A#C   X               -
1160 1617          553 GONC    GCPK04 (1674)   YES, SEARCH ALBLS
1161 1620          730 MC EX                   RESTORE REGS
1162 1621          256 AC EX                   -
1163 1622         1160 DADD=C                  C_REG
1164 1623          160 N=C                     -
1165 1624           70 C=DATA                  -
1166 1625         1076 C=C+1   S                END ASNS?
1167 1626          503 GONC    GCPK05 (1676)   YES
1168 1627         1176 C=C-1   S                -
1169 1630          436 A=C     S               -
1170 1631 GCPK70  1434 PT=     1               INITIALIZE
1171 1632         1552 ? A#C   WPT             1ST KEYCODE?
1172 1633           43 GONC    GCPK80 (1637)   YES
1173 1634          574 RCR     6               2ND KEYCODE?
1174 1635         1552 ? A#C   WPT             -
1175 1636          347 GOC     GCPK20 (1672)   NOPE
1176 1637 GCPK80  1512 ? A#0   WPT             PLACE?
1177 1640          177 GOC     GCP100 (1657)   NOPE
1178 1641           34 PT=     3               -
1179 1642         1612 A SR    WPT             C[1:0]_K.C.
1180 1643         1612 A SR    WPT             -
1181 1644          246 AC EX   X               -
1182 1645          266 AC EX   XS              -
1183 1646         1074 RCR     2               PLACE THE FUNCTION CODE
1184 1647          312 C=B     WPT             -
1185 1650           10 S3=     1               FUNCTION PLACED
1186 1651 GCPK90   574 RCR     6               RESTORE REGISTER
1187 1652         1576 ? A#C   S               -
1188 1653           23 GONC    *+2     (1655)  -
1189 1654          574 RCR     6               -
1190 1655         1360 DATA=C                  RESTORE REGISTER
1191 1656           73 GOTO    GCP112 (1665)   -
1192 1657 GCP100  1414 ?S1=1                   CLEAR?
1193 1660           43 GONC    GCP110 (1664)   NOPE
1194 1661          112 C=0     WPT             ZERO OUT KEYCODE
1195 1662         1074 RCR     2               RESTORE REGISTER
1196 1663         1663 GOTO    GCPK90 (1651)   -
1197 1664 GCP110  1074 RCR     2               C[3:0]_FUNCTION CODE
1198 1665 GCP112   730 MC EX                   SELECT CHIP 0
1199 1666          106 C=0     X               -
1200 1667         1160 DADD=C                  -
1201 1670          730 MC EX                   -
1202 1671         1740 RTN                     RETURN
1203
1204 1672 GCPK20   260 C=N                     INCREMENT TO NXT REG
1205 1673         1203 GOTO    GCPK10 (1613)-
1206
1207 1674 GCPK04   730 MC EX                   RESTORE REGISTERS
1208 1675           23 GOTO    GCPK06 (1677)
1209 1676 GCPK05   256 AC EX                   B[5:4]_K.C.
1210 1677 GCPK06   374 RCR     10              -
1211 1700          356 BC EX                   -
```

```
1212 1701          160 N=C                     SAVE F.C. IN N
1213 1702          174 RCR     4               C[3:0]_CHAINHEAD
1214 1703           34 PT=     3
1215 1704          412 A=C     WPT
1216 1705            1 GOSUB   GTLINK
1216 1706            0
1217 1707 GCPK15  1346 ? C#0   X               END OF CHAIN?
1218 1710          313 GONC    GCPK55 (1741) YES, NOT FOUND
1219 1711            1 GSBLNG  UPLINK          GET NEXT LINK
1219 1712            0
1220 1713         1076 C=C+1   S               ALBL?
1221 1714         1733 GONC    GCPK15 (1707) NOPE
1222 1715          374 RCR     10              SAVE LINK & ADDR IN M
1223 1716          252 AC EX   WPT             -
1224 1717          416 A=C                     -
1225 1720          530 M=C                     -
1226 1721            1 GSBLNG  INCAD2          GET KEYCODE BYTE
1226 1722            0
1227 1723            1 GSBLNG  NXBYTA          -
1227 1724            0
1228 1725          212 B=A     WPT             -
1229 1726         1434 PT=     1               CORRECT K.C.?
1230 1727          332 C=B     M               -
1231 1730          174 RCR     4               -
1232 1731          412 A=C     WPT             -
1233 1732          374 RCR     10              -
1234 1733         1552 ? A#C   WPT             -
1235 1734          267 GOC     GCPK45 (1762) NOPE
1236 1735 GCPK25  1512 ? A#0   WPT             PLACE?
1237 1736          127 GOC     GCPK28 (1750) NO
1238 1737          106 C=0     X               -
1239 1740           34 PT=     3               -
1240 1741 GCPK55   332 C=B     M               A[1:0]_K.C.
1241 1742         1160 DADD=C                   -
1242 1743          174 RCR     4               -
1243 1744          416 A=C                     -
1244 1745          260 C=N                     RESTORE F.C.
1245 1746          356 BC EX                   -
1246 1747         1163 GOTO    GCP112 (1665) -
1247 1750 GCPK28  1414 ?S1=1                  GET?
1248 1751           63 GONC    GCPK35 (1757) YES
1249 1752          106 C=0     X               CLEAR K.C.
1250 1753          156 AB EX                   -
1251 1754            1 GSBLNG  PTBYTA          -
1251 1755            0
1252 1756         1073 GOTO    GCP112 (1665) -
1253 1757 GCPK35   630 C=M                     C[3:0]_LBL ADDR
1254 1760           10 S3=     1               RAM ADDR
1255 1761         1043 GOTO    GCP112 (1665) -
1256
1257 1762 GCPK45    34 PT=     3               PREPARE TO GET NXT LINK
1258 1763          630 C=M                     -
1259 1764          412 A=C     WPT             -
1260 1765          174 RCR     4               -
1261 1766         1213 GOTO    GCPK15 (1707) -
*
1263                   ENTRY   LEFTJ
*
* LEFT JUSTIFY LCD
*
```

```
1267 1767 LEFTJ    460 LDI
1268 1770           40 CON     32              BLANK
1269 1771          406 A=C     X
1270 1772         1434 PT=     1
1271 1773 LEFTJ1  1770 RABCL
1272 1774         1552 ? A#C   WPT
1273 1775         1763 GONC    LEFTJ1 (1773)
1274 1776         1670 RABCR
1275 1777         1740 RTN
1276
1277
1278
1279                   UNLIST

ERRORS :       0
```

SYMBOL TABLE

```
AVAIL    304   -
AVAIL1   322   -   315
AVAILA   307   -
BKROM    415   -   350
BKROM1   417   -   422
BKROM2  1221   -
BST1     361   -   355
BST2     363   -   360
BSTE     413   -   427
BSTE2   1362   -
BSTEP    336   -
BSTEP2   324   -   343  341
BSTEP3   345   -   325
BSTEPA   353   -
BSTML    371   -   411  407  403
BSTML1   412   -   405
BSTML2   377   -   370
CALDSP   703   -
DECAD    707   -
DECADA   712   -
DECADB   737   -   711
ERRDE     55   -
FIXEND   430   -
FLINK    450   -
FLINK1   455   -   513
FLINK2   457   -   454
FLINK3   470   -   465  461
FLINK5   512   -   476
FLINKA   447   -
FLINKM   451   -
FLINKP   445   -
GCP100  1657   -  1640
GCP110  1664   -  1660
GCP112  1665   -  1761 1756 1747 1656
GCPK04  1674   -  1617
GCPK05  1676   -  1626
GCPK06  1677   -  1675
GCPK10  1613   -  1673
GCPK15  1707   -  1766 1714
GCPK20  1672   -  1636
GCPK25  1735   -
GCPK28  1750   -  1736
GCPK35  1757   -  1751
GCPK45  1762   -  1734
GCPK55  1741   -  1710
GCPK70  1631   -
GCPK80  1637   -  1633
GCPK90  1651   -  1663
GCPKC   1600   -
GCPKC0  1611   -
GETPC    520   -
GETPCA   522   -
GTBYT    660   -
GTBYTA   673   -   661
GTBYTO   662   -
GTO..    561   -   540
```

```
GTO.1    615   -   600
GTO.2    603   -   611   574
GTO.2A   612   -   607
GTO.3    647   -   614
GTO.4    575   -   571
GTO.5    652   -
GTONN    531   -
GTONN2   551   -   542
IN2B    1012   -   777
IN2BA   1114   -  1016
IN2BB   1032   -  1021
IN2R9   1124   -  1116
IN2STO  1136   -  1126
IN3B    1145   -
INB0     154   -   101
INB1      51   -   103
INB2     150   -   105
INB3     144   -   107
INB4     140   -   111
INB5     134   -   113
INB6     114   -
INBEX    155   -   153   147   143   137   120
INBEXA   120   -    54
INBYT    746   -
INBYT0   743   -
INBYT1   752   -
INBYTC   744   -
INBYTP   745   -
INC1     734   -   727
INC2     735   -   706
INC21    732   -   724
INCAD    717   -
INCAD2   723   -
INCADA   726   -   722
INCADB   741   -   720
INCADP   721   -
INEX    1112   -  1123  1076  1031
INEXA   1031   -  1011  1002
INL1     216   -   212
INL2     213   -   217
INL3     225   -   241
INLIN    166   -   156
INLIN2   766   -
INLNK1  1051   -  1045
INLNK2  1062   -  1050
INN2B   1117   -  1156  1151  1142  1137  1131  1033  1026
INRCLS  1133   -  1144
INSHR2  1134   -  1162
INSHRT  1027   -
INSLIN   764   -
INSTR   1163   -
INSTR1  1164   -  1174
INTXC   1175   -
INTXC1  1203   -  1207
INTXC2  1206   -  1202
.EFTJ   1767   -
.EFTJ1  1773   -  1775
.INEND  1347   -  1313
.INML   1270   -  1311  1307  1303
.INML1  1273   -
```

```
LINML2  1312   -  1305 1301
LINN1A  1223   -
LINNM1  1220   -  1215
LINNM2  1245   -  1242
LINNM3  1243   -  1250
LINNM4  1254   -  1246
LINNM5  1251   -  1241
LINNM6  1261   -  1253
LINNUM  1213   -
LINRM2  1333   -  1344
LINRM3  1345   -  1342 1336
LINRM4  1337   -  1332
LINROM  1314   -  1230
NOROOM   263   -   171
NROOM    170   -
NROOM1   266   -   276
NROOM2   275   -   265
NROOM3   302   -
NXBYT3   667   -
NXBYTA   671   -
NXL1B   1443   -
NXL2B1  1556   -  1544
NXL3B2  1543   -  1510 1506 1504
NXLCHN  1511   -
NXLDE   1454   -  1473 1471 1467 1451 1447
NXLDE2  1474   -  1532 1465 1462
NXLDEL  1375   -
NXLIN   1424   -  1453
NXLIN1  1436   -  1425
NXLIN2  1501   -  1442
NXLIN3  1537   -  1502
NXLIN4  1561   -  1540
NXLINA  1437   -  1377
NXLR0   1563   -
NXLSS1  1373   -  1370
NXLSST  1367   -
NXLTX   1567   -  1562 1521
NXLTX1  1477   -  1577
NXLTX2  1571   -  1576
PBA0      45   -    63    1
PBA1      41   -    65    3
PBA2      35   -    67    5
PBA3      31   -    71    7
PBA4      25   -    73   11
PBA5      21   -    75   13
PBA6      14   -    76
PBA6A     76   -   133
PBAEND    46   -    44   40   34   30   24   20
PTBYTM   441   -
PTL0     121   -    61
PUTPCL  1363   -
SKPLIN  1371   -
SKPR10  1402   -  1405
SKPR20  1406   -  1411
SKPR30  1412   -  1423
SKPROM  1400   -  1374
TBLINB   100   -
TBLPBA     0   -
TBLPTL    60   -
```

ENTRY TABLE

AVAIL	304	-
AVAILA	307	-
BKROM2	1221	-
BSTE	413	-
BSTE2	1362	-
BSTEP	336	-
BSTEPA	353	-
CALDSP	703	-
DECAD	707	-
DECADA	712	-
ERRDE	55	-
FIXEND	430	-
FLINK	450	-
FLINKA	447	-
FLINKM	451	-
FLINKP	445	-
GCP112	1665	-
GCPK04	1674	-
GCPK05	1676	-
GCPKC	1600	-
GCPKC0	1611	-
GETPC	520	-
GETPCA	522	-
GTBYT	660	-
GTBYTA	673	-
GTBYTO	662	-
GTO.5	652	-
GTONN	531	-
IN3B	1145	-
INBYT	746	-
INBYT0	743	-
INBYT1	752	-
INBYTC	744	-
INBYTP	745	-
INCAD	717	-
INCAD2	723	-
INCADA	726	-
INCADP	721	-
INEX	1112	-
INLIN	166	-
INLIN2	766	-
INSHRT	1027	-
INSLIN	764	-
INSTR	1163	-
INTXC	1175	-
LEFTJ	1767	-
LINN1A	1223	-
LINNM1	1220	-
LINNUM	1213	-
NROOM3	302	-
NXBYT3	667	-
NXBYTA	671	-
NXL1B	1443	-
NXL3B2	1543	-
NXLCHN	1511	-
NXLDEL	1375	-

```
NXLIN   1424   -
NXLIN3  1537   -
NXLINA  1437   -
NXLSST  1367   -
NXLTX   1567   -
PTBYTM   441   -
PUTPCL  1363   -
SKPLIN  1371   -
```

EXTERNAL REFERENCES

AVAIL	166	615			
AVAIL	167	616			
BKROM2	425				
BKROM2	426				
BSTE2	413				
BSTE2	414				
CPGMHD	1535				
CPGMHD	1536				
DECAD	1160				
DECAD	1161				
DECADA	266	361	1474	1525	1527
DECADA	267	362	1475	1526	1530
ERROR	55				
ERROR	56				
FIXEND	174	1100			
FIXEND	175	1101			
FLINK	351				
FLINK	352				
FLINKA	1066				
FLINKA	1067				
FLINKM	172				
FLINKM	173				
FLINKP	326	1231			
FLINKP	327	1232			
FSTIN	356	572	1251		
FSTIN	357	573	1252		
GENLNK	1070	1073			
GENLNK	1071	1074			
GETLIN	1351				
GETLIN	1352				
GETPC	345	445	1062	1323	
GETPC	346	446	1063	1324	
GTBYTA	363	435			
GTBYTA	364	436			
GTFEND	451				
GTFEND	452				
GTLINK	566	1533	1705		
GTLINK	567	1534	1706		
GTLNKA	177				
GTLNKA	200				
IN3B	1013				
IN3B	1014				
INBYT	773				
INBYT	774				
INBYTO	1040	1056	1145		
INBYTO	1041	1057	1146		
INBYTI	261				
INBYTI	262				
INBYTC	1005	1046	1054	1166	
INBYTC	1006	1047	1055	1167	
INBYTP	1121				
INBYTP	1122				
INCAD2	433	601	667	1103	1721
INCAD2	434	602	670	1104	1722
INCADA	671	1064	1254		
INCADA	672	1065	1255		

```
INCADP   746
INCADP   747
INSHRT  1134
INSHRT  1135
INSSUB   764
INSSUB   765
INSTR   1007  1060
INSTR   1010  1061
INTXC   1003  1051
INTXC   1004  1052
LINN1A   555
LINN1A   556
LINNM1   334
LINNM1   335
LINNUM   336
LINNUM   337
MSGDE     57
NFRC     557  1112
NFRC     560  1113
NFRPU    656
NFRPU    657
NXBYTA   603  1256  1375  1723
NXBYTA   604  1257  1376  1724
NXL3B2  1456  1514  1516  1541  1572
NXL3B2  1457  1515  1517  1542  1573
NXLIN    375  1273  1565
NXLIN    376  1274  1566
PACKE    302   620
PACKE    303   621
PACKN    652
PACKN    653
PATCH1   715
PATCH1   716
PTBYTA   441  1027  1754
PTBYTA   442  1030  1755
PTBYTM   271
PTBYTM   272
PTLINK   204
PTLINK   205
PUTPC   1105  1363
PUTPC   1106  1364
PUTPCD   332   650
PUTPCD   333   651
ROMH35  1414
ROMH35  1415
ROMHED  1314  1420
ROMHED  1315  1421
RTN30    534   654
RTN30    535   655
SKPDEL  1512
SKPDEL  1513
SKPLIN  1333
SKPLIN  1334
UPLINK   455   575  1243  1711
UPLINK   456   576  1244  1712
XROW1    547
XROW1    550

End of VASM assembly
```

```
* HP41C MAINFRAME MICROCODE ADDRESSES @26000-27777
* CONTENTS:
*
     5                  FILE   CN11B
     6                  ENTRY  TXTLBL
     7                  ENTRY  TXTLB1
     8                  ENTRY  AOUT15
     9                  ENTRY  APHST*
    10                  ENTRY  APHDNW
    11                  ENTRY  APPEND
    12                  ENTRY  ARGOUT
    13                  ENTRY  ASCLCD
    14                  ENTRY  CLLCDE
    15                  ENTRY  CLRLCD
    16                  ENTRY  DATI06
    17                  ENTRY  DAT231
    18                  ENTRY  DAT260
    19                  ENTRY  DAT280
    20                  ENTRY  DAT300
    21                  ENTRY  DAT320
    22                  ENTRY  DAT400
    23                  ENTRY  DAT500
    24                  ENTRY  DATERT
    25                  ENTRY  DECMPL
    26                  ENTRY  INBCHS
    27                  ENTRY  INBYTJ
    28                  ENTRY  MASK
    29                  ENTRY  NXBYTO
    30                  ENTRY  NXTBYT
    31                  ENTRY  OPROMT
    32                  ENTRY  OUTLCD
    33                  ENTRY  ROLBAK
    34                  ENTRY  SCROL0
    35                  ENTRY  SCROLL
    36                  ENTRY  STBT10
    37                  ENTRY  STOLCC
    38                  ENTRY  TEXT
    39                  ENTRY  XROMNF
    40                  ENTRY  XECROM
*
* SPECIAL CHAR TABLE
*
    44    0 ASCTBL  177 CON    @177           LAZY T
    45    1         141 CON    @141           SMALL A
    46    2         142 CON    @142           SMALL B
    47    3         143 CON    @143           SMALL C
    48    4         144 CON    @144           SMALL D
    49    5         145 CON    @145           SMALL E
* LCD 106 OVERBAR ... HELIOS 0 SMALL DIAMOND
    51    6           0 CON    @0             LCD 106
    52    7         140 CON    96             SUPERSCRIPT T
* LCD 108 ONE-LEGGED HANGMAN ... HELIOS 6 UPPER CASE GAMMA
    54   10           6 CON    @6             LCD 108
* LCD 109 TWO-LEGGED HANGMAN ... HELIOS 4 ALPHA
    56   11           4 CON    4              LCD 109
* LCD 10A TWO-LEGGED ONE-ARMED HANGMAN ... HELIOS 5 BETA
```

```
   58   12           5 CON    5              LCD 10A
* LCD 10B COMPLETE HANGMAN ... HELIOS 1 LITTLE X
   60   13           1 CON    1              LCD 10B
   61   14          14 CON    @014           MU
   62   15          35 CON    29             NOT EQUAL SIGN
   63   16         176 CON    @176           SIGMA SIGN
   64   17          15 CON    13             ANGLE SIGN
*
*
* ARGOUT - OUTPUT ALPHA REGISTER TO DISPLAY
* CALLING SEQUENCE:
* IF S8=1, NO SCROLL, PROMPT
* IF S8=0, SCROLL, NO PROMPT
* IF S8=0, THEN S9 INDICATES WHETHER THE KEYBOARD HAS BEEN RESET
*          S9=1 : KEYBOARD ALREADY BEEN RESET
*          S9=0 : KEYBOARD NOT BEEN RESET
* BY SET/RESET S8,S9 THE KEYBOARD WILL REMAIN ALIVE DURING SCRLLING.
*        GOSUB  ARGOUT
* ASSUME NOTHING, RETURN WITH CHIP 0 ENABLE
* USED A,B,C. CALLED NXBYTA, ASCLCD. 2 SUB LEVELS.
*
   79   20 ARGOUT  116 C=0
   80   21         1760 PFAD=C
   81   22          134 PT=     4              LOAD FIRST CHAR ADDR
   82   23          620 LC      6               = 6008 (BYTE 3, REG.8)
   83   24          460 LDI
   84   25          214 CON2    8       12
   85   26         1474 RCR     1
   86   27          416 A=C
   87   30 AOUT05     1 GOSUB   NXBYTA
   87   31            0
   88   32         1434 PT=     1
   89   33         1352 ? C#0   WPT             IS A LEADING BLANK ?
   90   34          127 GOC     AOUT10 (  46) NO
   91   35          460 LDI
   92   36            5 CON2    0       5      CHECK END OF AREG.
   93   37           34 PT=     3
   94   40          102 C=0     PT
   95   41         1552 ? A#C   WPT             LAST CHAR IN AREG. ?
   96   42         1667 GOC     AOUT05 (  30) NO
   97   43            1 GOSUB   CLLCDE         CLEAR LCD
   97   44            0
   98   45          153 GOTO    AOUTR0 (  62)
   99   46 AOUT10 1074 RCR     2
  100   47            1 GOSUB   CLLCDE
  100   50            0
  101   51         1340 DISOFF
  102   52          453 GOTO    AOUT20 ( 117)
  103   53 AOUT15  156 AB EX   W
  104   54          460 LDI
  105   55            5 CON2    0       5
  106   56           34 PT=     3
  107   57          102 C=0     PT
  108   60         1552 ? A#C   WPT             END OF ALPHA REG. ?
  109   61          237 GOC     AOUT18 ( 104) NOT YET
  110   62 AOUTR0  236 B=A     S               B(13) _ LCD COUNTER
  111   63          460 LDI
  112   64           37 CON     @37
  113   65          414 ?S8=1                   PROMPT ?
  114   66           43 GONC    AOUT16 (  72) NO
```

```
   115   67         1750 SLSABC
   116   70          676 A=A-1  S              LCD FULL ?
   117   71           67 GOC    AOUTRT (  77) YES
   118   72 AOUT16 1046 C=C+1  X              @37+1 = @40
   119   73 AOUT17  676 A=A-1  S              DO WE HAVE TO LEFT JUSTIFY ?
   120   74           37 GOC    AOUTRT (  77) NO
   121   75         1750 SLSABC
   122   76         1753 GOTO   AOUT17 (  73)
   123   77 AOUTRT 1340 DISOFF
   124  100         1440 DISTOG              TURN DISPLAY ON AGAIN
   125  101          336 C=B    S
   126  102            1 GOLONG:STOLCC        SAVE THE LCD COUNTER
   126  103            2
   127  104 AOUT18 1536 ? A#0  S              LCD FULL ?
   128  105           47 GOC    AOUT19 ( 111) NO
   129  106          414 ?S8=1                SCROLL NEEDED ?
   130  107            1 GSUBNC:SCROLL        YES
   130  110            0
   131  111 AOUT19     1 GOSUB  ENCP00
   131  112            0
   132  113           34 PT=    3
   133  114            1 GOSUB  NXBYTA        GET NEXT CHAR
   133  115            0
   134  116         1074 RCR    2
   135  117 AOUT20   216 B=A    W
   136  120            1 GOSUB  ENLCD         ENABLE LCD
   136  121            0
   137  122         1574 RCR    12             C(1:0) _ CHAR
   138  123          126 C=0    XS             C(2) _ 0
   139  124            1 GOSUB  ASCLCD         SEND IT TO LCD
   139  125            0
   140  126         1253 GOTO   AOUT15 (  53)
*
* ASCLCD - SEND A ASCII CHAR TO LCD
* CALLED WITH ASCII IN C[1:0]
* ASSUME LCD ENABLE, RETURN WITH LCD ENABLE.
* USED A,X, B,S, C, 1 SUB LEVEL.
*     GOSUB  ASCLCD
*
   148  127 COLON   460 LDI
   149  130         200 CON2   8        0
   150  131         243 GOTO   PUNC   ( 155)
   151  132 COMMA   460 LDI
   152  133         300 CON2   12       0
   153  134         213 GOTO   PUNC   ( 155)
   154  135 ASCLCD  406 A=C    X
   155  136          26 A=0    XS
   156  137         460 LDI
   157  140          72 CON2   3        10
   158  141        1546 ? A#C  X              IS THIS A COLON ?
   159  142        1653 GONC   COLON  ( 127) YES
   160  143         460 LDI
   161  144          54 CON2   2        12
   162  145        1546 ? A#C  X              IS THIS A COMMA ?
   163  146        1643 GONC   COMMA  ( 132) YES
   164  147         460 LDI
   165  150          56 CON2   2        14
   166  151        1546 ? A#C  X              IS THIS A PERIOD ?
   167  152         367 GOC    MASK   ( 210) NO
   168  153 PERIOD  460 LDI
```

```
   169  154          100 CON2   4       0
   170  155 PUNC     406 A=C    X
   171  156         1670 FRSABC                LOOK AT PREVIOUS CHAR
   172  157         1730 CST EX
   173  160          514 ?S6=1                 IS THERE A PUNC. WITH IT ?
   174  161          137 GOC    PUNC10 ( 174) YES
   175  162         1214 ?S7=1                 IS THERE A PUNC. WITH IT?
   176  163          117 GOC    PUNC10 ( 174) YES
   177  164         1730 CST EX
   178  165         1334 PT=     13
   179  166         1420 LC      12
   180  167          436 A=C    S
   181  170          336 C=B    S
   182  171         1576 ? A#C  S              IS THIS THE FIRST CHAR ?
   183  172           63 GONC   OUTLCD ( 200) YES
   184  173          123 GOTO   PUNC20 ( 205)
   185  174 PUNC10 1730 CST EX
   186  175         1750 SLSABC                PUT THE PREVIOUS BACK
   187  176          460 LDI
   188  177           40 CON    @40            LOAD A BLANK
   189  200 OUTLCD 1336 ? B#0   S
   190  201           43 GONC   PUNC20 ( 205)
   191  202          176 AB EX  S
   192  203          676 A=A-1  S
   193  204          176 AB EX  S
   194  205 PUNC20 1560 C=CORA
   195  206         1750 SLSABC
   196  207         1740 RTN
*
* MASK - CONVERT A ASCII TO LCD CHAR FORM(NOT INCLUDING COMMA,
*        PERIOD AND COLON)
* CALLED WITH ASCII IN A[2:0].
* TWO CALLING SEQUENCE:
* 1.     GOSUB MASK
*        NOP
*        CALLED MASK FOLLOWED BY A NOP, THE LCD CHAR WILL RETURN
*        IN C[2:0]. CHIP ENABLE UNCHANGED.
*        USED A.X, C. ASSUME NOTHING. 1 SUB LEVEL.
* 2.     GOSUB MASK
*        <ANYTHING BUT NOP>
*        NOT FOLLOWED A NOP WILL CAUSE THE CHAR BEEN SEND TO DISPLAY,
*        RETURN WITH CHIP 0 ENABLE. USED A.X, B.S, C. 1 SUB LEVEL.
*        ASSUME LCD ENABLE.
*
   213  210 MASK     26 A=0    XS
   214  211          460 LDI
   215  212           40 CON    @40
   216  213         1406 ? A<C  X              ASCII < @40 ?
   217  214          227 GOC    MASK10 ( 236) YES, SPECIAL CHAR
   218  215          460 LDI
   219  216          140 CON    @140
   220  217         1406 ? A>C  X              ASCII > @137 ?
   221  220          163 GONC   MASK10 ( 236) YES, SPECIAL CHAR
   222  221          246 AC EX  X
   223  222         1730 CST EX
   224  223          504 S6=    0              MASK 6 BITS ONLY
   225  224         1730 CST EX
   226  225 MASKRT   406 A=C    X
   227  226          660 C=STK
   228  227         1460 CXISA
```

```
   229  230          560 STK=C
   230  231          246 AC EX  X
   231  232         1506 ? A#0  X
   232  233         1640 RTN NC
   233  234            6 A=0    X
   234  235         1433 GOTO   OUTECD ( 200)
   235  236 MASK10   116 C=0                    CHECK SPECIAL CHAR TABLE
   236  237          534 PT=    6
   237  240          220 LC     2              TABLE ENTRY AT 0000 OF QUAR 11
   238  241         1420 LC     12
   239  242           34 PT=    3
   240  243 MASK20  1460 CXISA                  LOAD 1 CHAR FROM TABLE
   241  244         1546 ? A#C  X              MATCH A SPECIAL CHAR ?
   242  245           63 GONC   MASK30 ( 253) YES
   243  246         1042 C=C+1  PT             POINT TO NEXT WORD
   244  247         1743 GONC   MASK20 ( 243) GO ON !
   245  250          460 LDI
   246  251           72 CON    @72            ALL SEGMENT IF NOT FOUND
   247  252         1533 GOTO   MASKRT ( 225)
   248  253 MASK30    74 RCR    3
   249  254          126 C=0    XS
   250  255         1066 C=C+1  XS             C[2:0] HAS THE SPECIAL CHAR
   251                   LEGAL
   252  256         1473 GOTO   MASKRT ( 225) REPLACE IT
*
*
* TEXT FUNCTION - EXECUTION OF TEXT FC IN RUN TIME
* ASSUME PGM COUNTER POINTING THE 1ST BYTE OF THE TEXT FUNCTION
* THIS ROUTINE WILL PICK UP THE CHAR FROM MEM AND STICK IT TO
* ALPHA REG. IF THE 1ST CHAR IS A LAZY T, THE STRING WILL BE
* APPENDING TO ALPHA REG. OTHERWISE, THE ALPHA REG WILL BE CLEARED
* BEFORE THE STRING GOES IN.
* CALLED APPEND. RETURN TO NFRPU. PC WILL POINT TO LAST BYTE OF TEXT
* FC ON EXIT.
*
   264  257 TEXT     16 A=0    W
   265  260           1 GOSUB  GETPC          GET PRM COUNTER
   265  261           0
   266  262           1 GOSUB  GTBYT
   266  263           0
   267  264         1434 PT=    1
   268  265          102 C=0    PT             C(1:0) _ STRING COUNTER
   269  266         1152 C=C-1  WPT
   270  267         1540 RTN C                 RTN IF "F0" F.C.
   271  270          374 RCR    10             C(4)   _ STRING COUNTER
   272  271          134 PT=    4              MOVE COUNTER TO A(4)
   273  272          402 A=C    PT
   274  273            1 GOSUB  NXTBYT         GET FIRST CHAR
   274  274            0
   275  275          216 B=A    W              SAVE THE COUNTER IN B
   276  276         1634 PT=    0
   277  277          130 G=C
   278  300          406 A=C    X
   279  301           26 A=0    XS
   280  302          106 C=0    X
   281  303         1160 DADD=C
   282  304          460 LDI
   283  305          177 CON    127            TEST FIRST CHAR
   284  306         1546 ? A#C  X              IS IT A LAZY "T"
   285  307            1 GSUBC  INTARG         NO, INITIALIZE ALPHA REG
```

```
   285  310            1
   286  311 TEXT30   316 C=B     W
   287  312          416 A=C     W
   288  313           34 PT=     3
   289  314          174 RCR     4              C.X _ STRING COUNTER
   290  315         1146 C=C-1   X              ALL DONE ?
   291  316            1 GOLC    PUTPC
   291  317            3
   292  320 TEXT40   374 RCR     10
   293  321          416 A=C     W
   294  322            1 GOSUB   NXTBYT         POINT TO NEXT CHAR
   294  323            0
   295  324          216 B=A     W              SAVE COUNTER IN B
   296  325         1634 PT=     0
   297  326          130 G=C
   298  327          106 C=0     X
   299  330         1160 DADD=C                 ENABLE CHIP 0
   300  331            1 GOSUB   APHDNW         STORE CHAR TO AREG.
   300  332            0
   301  333         1563 GOTO    TEXT30 ( 311)
*
* SCROLL - TURN ON THE DISPLAY AND DECIDE WHETHER TO HAVE A DELAY
*          AFTER PUSHING A CHAR OFF LEFT END.
* S8=1 MEANS SCROLL IS NOT REQUIRED, NO DELAY
* S9=1 MEANS KEYBOARD ALREADY BEEN RESET.
*      IF ANY KEY HIT WHEN S9=1, NO DELAY ANY MORE. THIS WAY THE
*      KEYBOARD WILL STAY ALIVE DURING SCROLLING.
* DESTROYS C.X  MAY SET S9
* MAY USE A SUBROUTINE LEVEL TO CALL RST05
*
   312  334 SCROLL 1340 DISOFF
   313  335         1440 DISTOG
   314  336 SCROL0   414 ?S8=1                  SCROLL REQUIRED ?
   315  337         1540 RTN C                  NO
   316  340         1114 ?S9=1                  HAS KEY BOARD BEEN RESET?
   317  341           77 GOC     SCROL2 ( 350) YES
   318  342         1710 RST KB
   319  343         1714 CHK KB
   320  344           67 GOC     SCROL5 ( 352) OLD KEY STILL DOWN
   321  345         1110 S9=     1              REMEMBER OLD KEY IS UP
   322  346            1 GOSUB   RST05          DELAY FOR DEBOUNCE
   322  347            0
   323  350 SCROL2 1714 CHK KB                  IS A NEW KEY DOWN ?
   324  351         1540 RTN C                  YES, NO SCROLL
   325  352 SCROL5   460 LDI
   326  353         1600 CON     @1600
   327  354          746 C=C+C   X              *** @1600 FOR FINAL PRODUCT *****
   328                                           **********************
   329  355 SROL10 1146 C=C-1   X
   330  356         1773 GONC    *-1     ( 355)
   331  357         1740 RTN
*
* CLEAR LCD
* CLRLCD - ASSUME LCD ENABLE
* CLLCDE - ENABLE LCD & CLEAR IT
*
   337  360 CLLCDE   460 LDI
   338  361            20 CON2    1       0
   339  362         1160 DADD=C                 DISABLE SLEEPER CHIP
   340  363          460 LDI
```

```
   341  364          375 CON2    15      13
   342  365         1760 PFAD=C                    ENABLE LCD CHIP
   343  366 CLRLCD   634 PT=     11
   344  367          112 C=0     WPT
   345  370          334 PT=     10
   346  371          220 LC      2
   347  372         1234 PT=     7
   348  373          220 LC      2
   349  374          134 PT=     4
   350  375          220 LC      2
   351  376         1434 PT=     1
   352  377          220 LC      2
   353  400          450 SRLABC
   354  401          450 SRLABC
   355  402          450 SRLABC
   356  403         1740 RTN
*
* NXTBYT - GET NEXT BYTE IN RAM OR ROM
*
   360                   ENTRY   NBYTA0
   361  404 NBYTA0     1 GOSUB   ENCF00
   361  405            0
   362                   ENTRY   NBYTAB
   363  406 NBYTAB   156 AB EX
   364  407 NXTBYT    34 PT=     3
   365  410          314 ?S10=1                     ROM MEMORY ?
   366  411            1 GOLNC   NXBYTA            NO
   366  412            2
   367  413 NXBYTO   556 A=A+1
   368                   LEGAL
   369  414            1 GOLONG  GTBYTO
   369  415            2
*
* APPEND - APPEND A CHAR TO ALPHA REG
* CHAR IN G
* ASSUMED CHIP 0 ENABLE. USED A,C. 1 SUB LEVEL
* TWO ENTRIES :
* 1. APPEND : WILL GIVE A WARNNING IF AREG FULL AND AUDIO ENABLE
* 2. APNDNW : NO WARNNING EVEN IF AREG FULL
*
   378  416 APPEND 1070 C=REGN 8                  CHECK IF AREG. ALMOST FULL?
   379  417         1434 PT=     1
   380  420         1074 RCR     2                 CHECK SECOND LAST CHAR
   381  421         1352 ? C#0   WPT               STILL EMPTY
   382  422            1 GSUBC   TONE?X            NO, GIVE A WARNING
   382  423            1
   383  424 APNDNW  1434 PT=     1
   384  425         1070 C=REGN 8
   385  426         1574 RCR     12
   386  427          416 A=C
   387  430          770 C=REGN 7
   388  431         1574 RCR     12
   389  432          412 A=C     WPT
   390  433          256 AC EX   W
   391  434         1050 REGN=C 8
   392  435          670 C=REGN 6
   393  436         1574 RCR     12
   394  437          412 A=C     WPT
   395  440          256 AC EX   W
   396  441          750 REGN=C 7
```

```
 397  442          570 C=REGN 5
 398  443         1574 RCR    12
 399  444          412 A=C    WPT
 400  445          256 AC EX  W
 401  446          650 REGN=C 6
 402  447          256 AC EX  W
 403  450         1634 PT=    0
 404  451          230 C=G
 405  452          550 REGN=C 5
 406  453         1740 RTN
*
* DATA ENTRY - WHEN PARSE DETECTS A DATAENTRY FC, IT PUTS THE FC
*              IN C[1:0] AND BRANCH TO HERE.
*
 411  454 DATENT  346 BC EX  X
 412  455            1 GOSUB  OFSHFT        RESET SHIFT
 412  456            0
 413  457          346 BC EX  X
 414  460          126 C=0    XS
 415  461          406 A=C    X             COPY FC TO A.X
 416  462         1634 PT=    0
 417  463          130 G=C                  COPY FC TO REG.G TOO
 418  464         1670 C=REGN 14
 419  465          574 RCR    6
 420  466         1730 CST EX
 421  467         1404 S1=    0             RESET CATLOG FLAG
 422  470         1730 CST EX
 423  471          474 RCR    8
 424  472         1650 REGN=C 14
 425  473          766 C=C+C  XS
 426  474          766 C=C+C  XS            ALREADY IN DATAENTRY ?
 427  475          457 GOC    DAT200 ( 542) YES
 428  476         1506 ? A#0  X             BACK ARROW ?
 429  477          207 GOC    DAT110 ( 517) NO
 430  500          214 ?S5=1                MSGFLAG SET ?
 431  501          347 GOC    DAT140 ( 535) YES
 432  502 DAT102    14 ?S3=1                PROGRAM MODE ?
 433  503           43 GONC   DAT105 ( 507) NO
 434  504          460 LDI
 435  505           13 CON    @013          DELETE
 436  506         1740 RTN                  RETURN TO PARSE
 437  507 DAT105  1214 ?S7=1                ALPHA MODE ?
 438  510           47 GOC    DAT106 ( 514) YES
 439  511          460 LDI
 440  512          167 CON2   7       7     CLX
 441  513         1740 RTN                  RETURN TO PARSE
 442  514 DAT106   460 LDI
 443  515          207 CON2   8       7     CLA
 444  516         1740 RTN
 445  517 DAT110   460 LDI
 446  520           34 CON2   1       12    LOAD CHS
 447  521         1546 ? A#C  X             IS IT A CHS ?
 448  522           47 GOC    DAT120 ( 526) NO
 449  523          460 LDI
 450  524          124 CON2   5       4     CHS FC
 451  525         1740 RTN                  RETURN TO PARSE
 452  526 DAT120     1 GOSUB  STFLGS        SET MSGFLG & DATAENTRY FLAG
 452  527            0
 453                                       STFLGS LEAVES SS ONE-HALF UP
 454  530           14 ?S3=1                ALPHA MODE ?
```

```
455  531           1 GOLNC  DIGST*          INITIALIZE DIGIT ENTRY
455  532           2
456  533           1 GOLONG APHST*          INITIALIZE ALPHA ENTRY
456  534           2
457  535 DAT140  204 ST=     0               CLEAR MSGFLAG
458  536        1670 C=REGN 14
459  537        1630 C=ST
460  540        1650 REGN=C 14
461  541         453 GOTO   DAT220 ( 606)
462  542 DAT200  219 ST=     1               SET MSGFLAG
463  543        1670 C=REGN 14
464  544        1630 C=ST
465  545        1650 REGN=C 14
466  546          14 ?S3=1                   PROGMODE ?
467  547         647 GOC    DAT300 ( 633) YES
468  550        1214 ?S7=1                  ALPHA MODE ?
469  551         253 GONC   DAT235 ( 576) NO
470  552 DAT230  460 LDI
471  553         177 CON    127
472  554         406 A=C    X
473  555        1634 PT=    0
474  556         230 C=G                    LOAD THE FC
475  557        1346 ? C#0  X               IS THIS A BACK ARROW ?
476  560           1 GOLNC  BAKAPH          YES
476  561           2
477  562        1546 ? A#C  X               IS THIS A LAZY "T"
478  563         257 GOC    DAT240 ( 610) NO
479  564           1 GOSUB  BLINK           BLINK AND IGNORE IT
479  565           0
480  566         203 GOTO   DAT220 ( 606)
481  567 DAT231 1670 C=REGN 14              SET NUMERIC DATA ENTRY FLAG
482  570         474 RCR    8                (FLAG 22)
483  571        1730 CST EX
484  572        1410 S1=    1               SET FLAG 22
485  573        1730 CST EX
486  574         574 RCR    6
487  575        1650 REGN=C 14
488  576 DAT235    1 GOSUB  DGENS8          TELL DIGENT NO CHS WHEN X=0
488  577          0
489  600          1 GOSUB  NOREG9
489  601          0
490  602          1 GOSUB  RG9LCD
490  603          0
491  604          1 GOSUB  RFDS55
491  605          0
492  606 DAT220    1 GOLONG NFRKB
492  607          2
493  610 DAT240    1 GOSUB  APPEND          APPEND TO ALPHA REG.
493  611          0
494  612        1170 C=REGN 9
495  613        1376 ? C#0  S               LCD FULL ?
496  614          67 GOC    DAT245 ( 622) NOT YET
497  615         376 BC EX  S
498  616           1 GOSUB  ENLCD
498  617           0
499  620        1670 FRSABC
500  621          33 GOTO   DAT260 ( 624)
501  622 DAT245    1 GOSUB  ROLBAK
501  623          0
502  624 DAT260  106 C=0    X
```

```
 503  625          230 C=G
 504  626            1 GOSUB  ASCLCD          SEND IT TO LCD
 504  627            0
 505  630 DAT280     1 GOSUB  OPROMT          OUT PUT THE FROMPT
 505  631            0
 506  632         1543 GOTO   DAT220 ( 606)
 507  633 DAT300  1214 ?S7=1                  ALPHA MODE ?
 508  634            1 GOLC   DAT500          YES
 508  635            3
*
* DIGIT ENTRY IN PRM MODE
*
 512  636            1 GOSUB  GETPC
 512  637            0
 513  640            1 GOSUB  DELLIN
 513  641            0
 514  642 DAT320   116 C=0
 515  643         1160 DADD=C                 ENABLE CHIP 0
 516  644            1 GOSUB  DGENS0          TELL DIGENT NO CHS WHEN X=0
 516  645            0
 517  646            1 GOSUB  GETPC
 517  647            0
 518  650           36 A=0    S              INITIALIZE CT
 519  651          216 B=A
 520  652            1 GOSUB  NXBYTA
 520  653            0
 521  654         1434 PT=     1
 522  655         1352 ? C#0   WPT            IS FIRST BYTE A NULL ?
 523  656           53 GONC   DAT322 ( 663) YES
 524  657          156 AB EX  W              OTHERWISE INSERT A NULL FIRST
 525  660            1 GOSUB  INBYT0
 525  661            0
 526  662           36 A=0    S
 527  663 DAT322   106 C=0    X
 528  664         1160 DADD=C                 ENABLE CHIP 0
 529  665         1014 ?S2=1                  MANTISSA NEGAIVE ?
 530  666           33 GONC   DAT325 ( 671) NO
 531  667            1 GOSUB  INBCHS          INSERT A CHS FIRST
 531  670            0
 532  671 DAT325   340 SEL Q
 533  672         1534 PT=     12
 534  673          240 SEL P
 535  674         1170 C=REGN 9               LOAD D.P. POS COUNTER IN REG.9(13)
 536  675         1240 SETDEC
 537  676         1376 ? C#0   S
 538  677          173 GONC   DAT333 ( 716)
 539  700         1236 C=-C    S              TENTH COMPLEMENT
 540  701         1140 SETHEX
 541  702          376 CB EX   S              SAVE THE D.P. POS IN REG.B
 542  703 DAT330   336 C=B     S              C.S _ D.P. POSITION
 543  704         1176 C=C-1   S              OUTPUT D.P. NOW ?
 544  705          133 GONC   DAT335 ( 720) NOT YET
 545  706         1614 ?S0=1                  D.P. HIT ?
 546  707          113 GONC   DAT335 ( 720) NO
 547  710          376 CB EX  S
 548  711          460 LDI
 549  712           32 CON2   1       10
 550  713            1 GOSUB  INBYTJ          INSERT A D.P. TO MEM
 550  714            0
 551  715         1663 GOTO   DAT330 ( 703)
```

```
552  716 DAT333 1176 C=C-1  S
553  717        1140 SETHEX
554  720 DAT335  376 BC EX  S
555  721         340 SEL Q
556  722        1324 ? PT=  13                  FINISHED DIGIT 0 ?
557  723         527 GOC    DAT380 ( 775) YES, ALL DONE
558  724        1170 C=REGN 9
559  725        1042 C=C+1  PT                  LAST DIGIT IN MANTISSA ?
560  726         257 GOC    DAT350 ( 753) YES
561  727        1024 ? PT=  2                   END OF MANTISSA ?
562  730         127 GOC    DAT345 ( 742) YES
563  731        1142 C=C-1  PT                  RESTORE THE DIGIT
564  732        1734 INC PT                     MOVE THE DIGIT TO G
565  733         120 LC     1
566  734         130 G=C
567  735        1724 DEC PT                     POINT TO NEXT DIGIT
568  736         240 SEL P
569  737           1 GOSUB  INBYT               INSET THE DIGIT
569  740           0
570  741        1423 GOTO   DAT330 ( 703)
571  742 DAT345 1414 ?S1=1                      EEX HIT ?
572  743         167 GOC    DAT370 ( 761) YES
573  744        1614 ?S0=1                      D.P. HIT ?
574  745         303 GONC   DAT380 ( 775) NO, NO PROMPT
575  746        1176 C=C-1  S                   D.P. AT DIGIT 3 ?
576  747         267 GOC    DAT380 ( 775) YES, NO PROMPT
577  750        1176 C=C-1  S                   D.P. AY DIGIT 4 ?
578  751         247 GOC    DAT380 ( 775) YES
579  752         303 GOTO   DAT390 (1002) PROMPT
580  753 DAT350 1424 ? PT=  1                   END OF EXP ?
581  754         267 GOC    DAT390 (1002) YES
582  755        1624 ? PT=  0                   END OF EXP ?
583  756         247 GOC    DAT390 (1002) YES
584  757 DAT360 1414 ?S1=1                      EEX HIT ?
585  760         223 GONC   DAT390 (1002) NO, WE ARE DONE
586  761 DAT370 1434 PT=    1
587  762         240 SEL P
588  763         460 LDI
589  764          33 CON2   1       11
590  765           1 GOSUB  INBYTJ              INSERT A EEX
590  766           0
591  767        1170 C=REGN 9
592  770        1366 ? C#0  XS                  EXP NEGATIVE ?
593  771        1123 GONC   DAT330 ( 703) NO
594  772           1 GOSUB  INBCHS              INSERT A CHS
594  773           0
595  774        1073 GOTO   DAT330 ( 703)
596  775 DAT380  240 SEL P
597  776           1 GOSUB  INBYT0
597  777           0
598 1000 DAT385  404 S8=    0                   NO PROMPT
599 1001          53 GOTO   DAT410 (1006)
600 1002 DAT390  240 SEL P
601 1003           1 GOSUB  INBYT0              INSERT A NULL AT TAIL
601 1004           0
602 1005 DAT400  410 S8=    1                   SAY PROMPT
603 1006 DAT410    1 GOSUB  DFILLF
603 1007           0
604 1010 DAT415    1 GOLONG NFRKB
604 1011           2
```

```
 605 1012 INBCHS   460 LDI
 606 1013           34 CON2    1       12      LOAD A CHS
 607 1014 INBYTJ 1634 PT=      0
 608 1015          130 G=C
 609 1016            1 GOLONG  INBYT
 609 1017            2
*
* ALPHA ENTRY IN PGM MODE
*
 613 1020 DAT500   460 LDI
 614 1021          177 CON     127
 615 1022         1546 ? A#C   X               IS IT A LAZY T ?
 616 1023         1623 GONC    DAT400 (1005) YES, IGNORE IT
 617 1024         1170 C=REGN  9
 618 1025         1506 ? A#0   X               IS IT A BACK ARROW ?
 619 1026          227 GOC     DAT510 (1050) NO
 620 1027         1176 C=C-1   S               STRING LENGTH -1
 621 1030         1376 ? C#0   S               ZERO LENGTH NOW ?
 622 1031           57 GOC     DAT505 (1036) NO
 623 1032            1 GOSUB   DATOFF          RESET DATAENTRY FLAG
 623 1033            0
 624 1034            1 GOLONG  XDELET
 624 1035            2
 625 1036 DAT505   256 AC EX   W
 626 1037            1 GOSUB   PTBYTA          ZERO LAST CHAR
 626 1040            0
 627 1041            1 GOSUB   DECADA          POINT BACK ONE CHAR
 627 1042            0
 628 1043 DAT507   106 C=0     X
 629 1044         1160 DADD=C                  ENABLE CHIP 0
 630 1045          256 AC EX   W
 631 1046         1150 REGN=C  9
 632 1047          143 GOTO    DAT520 (1063)
 633 1050 DAT510  1076 C=C+1   S               STRING LENGTH + 1
 634 1051           43 GONC    DAT515 (1055) STRING LENGTH <= 15
 635 1052            1 GOSUB   BLINK           STRING LENGTH > 15
 635 1053            0
 636 1054         1343 GOTO    DAT415 (1010) IGNORE THIS CHAR
 637 1055 DAT515   256 AC EX   W
 638 1056            1 GOSUB   INBYT           INSERT THIS CHAR
 638 1057            0
 639 1060          676 A=A-1   S
 640 1061            0 NOP
 641 1062         1613 GOTO    DAT507 (1043)
 642 1063 DAT520   436 A=C     S               A.S _ STRING LENGTH
 643 1064            1 GOSUB   GETPC
 643 1065            0
 644 1066            1 GOSUB   INCADA          POINT TO 1ST BYTE OF TEXT
 644 1067            0
 645 1070          276 AC EX   S               C.S = STRING LENGTH
 646 1071          436 A=C     S               SAVE THE LENGTH IN A.S
 647 1072         1374 RCR     13
 648 1073         1434 PT=     1
 649 1074         1720 LC      15              C(0:1) _ FX
 650 1075            1 GOSUB   PTBYTA          UPDATE STRING LENGTH
 650 1076            0
 651 1077          576 A=A+1   S               LENGTH = 15 ?
 652 1100         1007 GOC     DAT385 (1000) YES, NO PROMPT
 653 1101         1043 GOTO    DAT400 (1005)
 654 1102 ROLBAK  1170 C=REGN  9               LOAD LCD COUNTER
```

```
   655 1103          436 A=C     S              A(13) _ LCD COUNTER
   656 1104          236 B=A     S
   657 1105            1 GOSUB   ENLCD          ENABLE LCD CHIP
   657 1106            0
   658 1107 ROBK10  1536 ? A#0   S
   659 1110         1640 RTN NC
   660 1111          676 A=A-1   S
   661 1112         1670 FRSABC
   662 1113         1743 GOTO    ROBK10 (1107)
*
* OPROMT - OUTPUT A PROMPT CHAR AND LEFT JUSTIFY DISPLAY AND
*          AND UPDATE LCD COUNTER.
* THE LCD COUNTER IS IN B[13] WHEN COME IN, IT WILL BE UPDATED
* AND STORED TO REG.9[13] ON RETURN.
* THE COUNTER IS SET TO 12, EVERY TIME A CHAR SHIFT FROM RIGHT
* END TO DISPLAY THE COUNTER DECREMENT BY ONE.
* ASSUME LCD ENABLE. RETURN WITH CHIP 0 ENABLE.
* USED A[13],B[13], C[13], C[2:0],N. 1 SUB LEVEL.
*
   673 1114 OPROMT   460 LDI
   674 1115           37 CON     @37
   675 1116         1750 SLSABC
   676 1117          460 LDI
   677 1120           40 CON     @40
   678 1121          336 C=B     S
   679 1122         1176 C=C-1   S              LCD FULL ?
   680 1123          157 GOC     OPMT20 (1140) YES
   681 1124          436 A=C     S
   682 1125         1076 C=C+1   S              RESTORE LCD COUNTER
   683 1126 OPMT10  1536 ? A#0   S              STRING AT LEFT END ?
   684 1127           43 GONC    STOLCC (1133) YES
   685 1130         1750 SLSABC
   686 1131          676 A=A-1   S
   687 1132         1743 GONC    OPMT10 (1126)
   688 1133 STOLCC   106 C=0     X
   689 1134         1760 PFAD=C                 DISABLE LCD CHIP
   690 1135         1160 DADD=C                 ENABLE SLEEPER CHIP
   691 1136         1150 REGN=C 9
   692 1137         1740 RTN
   693 1140 OPMT20   136 C=0     S
   694 1141         1723 GOTO    STOLCC (1133)
*
* APHST* - INITIALIZE ALPHA ENTRY
* G HAS THE CHAR.
* CALLED BY DATAENTRY AND RETURN TO DATAENTRY
*
   700 1142 APHST*  1670 C=REGN 14
   701 1143         1530 ST=C                   LOAD SET #
   702 1144           14 ?S3=1                  PROGRAM MODE ?
   703 1145          467 GOC     APHST4 (1213) YES
   704 1146          474 RCR     8
   705 1147         1730 CST EX
   706 1150         1610 S0=     1              SET FLAG 23
   707 1151         1730 CST EX
   708 1152          574 RCR     6
   709 1153         1650 REGN=C 14
   710 1154          106 C=0     X
   711 1155         1634 PT=     0
   712 1156          230 C=G                    LOAD THE CHAR
   713 1157          406 A=C     X
```

```
  714 1160          460 LDI
  715 1161          177 CON     127
  716 1162         1546 ? A#C   X              IS THIS A LAZY "T" ?
  717 1163          177 GOC     APHST3 (1202) NO, CLEAR ALPHA REG.
  718 1164          570 C=REGN  5
  719 1165         1434 PT=     1
  720 1166         1352 ? C#0   WPT            ALPHA REG. EMPTY ?
  721 1167           77 GOC     APHST1 (1176) NO
  722 1170         1334 PT=     13
  723 1171         1420 LC      12             SET LCD COUNTER
  724 1172          376 BC EX   S
  725 1173            1 GOSUB   ENLCD
  725 1174            0
  726 1175           33 GOTO    APHST2 (1200)
  727 1176 APHST1     1 GOSUB   ROLBAK
  727 1177            0
  728 1200 APHST2     1 GOLONG  DAT280
  728 1201            2
  729 1202 APHST3     1 GOSUB   INTARG
  729 1203            0
  730 1204         1334 PT=     13
  731 1205         1420 LC      12
  732 1206          376 BC EX   S
  733 1207            1 GOSUB   CLLCDE
  733 1210            0
  734 1211            1 GOLONG  DAT260
  734 1212            2
  735 1213 APHST4     1 GOSUB   INSSUB          INCREMENT LINE #
  735 1214            0
  736 1215         1634 PT=     0
  737 1216          230 C=G
  738 1217          160 N=C                     SAVE THE CHAR IN N TEMP.
  739 1220            1 GOSUB   GETPC           LOAD THE PGM COUNPER
  739 1221            0
  740 1222           36 A=0     S
  741 1223          460 LDI
  742 1224          361 CON2    15      1       F1 - ONE CHAR TEXT STRING
  743 1225         1634 PT=     0
  744 1226          130 G=C
  745 1227            1 GOSUB   INBYT
  745 1230            0
  746 1231          260 C=N                     LOAD THE CHAR
  747 1232         1634 PT=     0
  748 1233          130 G=C
  749 1234            1 GOSUB   INBYT
  749 1235            0
  750 1236          256 AC EX   W
  751 1237         1176 C=C-1   S
  752 1240         1150 REGN=C  9              SAVE WORKING PTR IN REG.9
  753 1241            1 GOLONG  DAT400          EXIT FROM ALPHA ENTRY
  753 1242            2
*
* STBT10 - MOVE SOME STATUS BITS TO SCRATCH AREA (REG.8)
*      DIGIT(0) - 0 : D.P.HIT
*                 1 : EEX HIT
*                 2 : CHS HIT
*                 3 : MANTISSA NONZERO FLAG
*      DIGIT(1) - 4 : DIGIT GROUPING FLAG
*                 5 : DECIMAL POINT FLAG
*                 6 : ENG
```

```
*                7 : FIX
*      DIGIT(2) - # OF DIGITS
*
   766 1243 STBT10  116 C=0     W
   767 1244        1160 DADD=C
   768 1245         534 PT=     6
   769 1246        1420 LC      12
   770 1247         134 PT=     4
   771 1250        1720 LC      15
   772 1251        1420 LC      12
   773 1252         416 A=C     W              A _ 0000000C0FC000
   774 1253        1670 C=REGN  14
   775 1254        1660 C=C.A
   776 1255        1074 RCR     2
   777 1256         406 A=C     X
   778 1257         772 C=C+C   M              MOVE NO SEPERATOR & COMMA
   779 1260         772 C=C+C   M               TO LOWER TOW BITS IN A DIGIT
   780 1261         174 RCR     4
   781 1262         506 A=A+C   X
   782 1263        1070 C=REGN  8
   783 1264         674 RCR     11
   784 1265         246 C=A     X
   784 1266         406
   785 1267        1530 ST=C
   786 1270          74 RCR     3
   787 1271        1050 REGN=C  8
   788 1272        1740 RTN
*
* DECMPL - DECOMPILE
*
* CALLING SEQUENCE :
*          GOSUB  DECMPL
* ASSUME NOTHING. USED A,B,C,N, ST 0-9. 3 SUB LEVELS
* RETURN WITH CHIP 0 ENABLE AND LOAD STATUS.SET 0
*     AND R14 IN C (PACH12 IN CNO DEPENDS ON R14 IN C ON RTN)
*
* PACK AND DECOMPILE SHARE COMMON TERMINATION LOGIC
* PACK TERMINATES BY GOING EITHER TO DCPL00 OR TO DCPLRT.
* SINCE PACK CAN EITHER RETURN TO THE CALLING PROGRAM OR EXIT
* VIA ERROR, STATUS BIT S9 IS USED TO CONTROL WHAT TYPE OF
* TERMINATION IS DONE.  S9 IS CLEARED AT THE DECMPL ENTRY
* POINT, SO DECOMPILE ALWAYS RETURNS.  PACK SETS OR RESETS
* S9 AS NECESSARY BEFORE IT COMES TO THE DCPL00 OR DCPLRT ENTRIES.
*
* S8 AND S3 ARE USED INSIDE DECOMPILE.  S8 IS USED TO REMEMBER
* THE STATE OF THE DECOMPILE BIT IN ONE END WHILE TRAVELING UP
* THE LABEL CHAIN TO FIND THE NEXT PREVIOUS END.  S3 IS USED TO
* REMEMBER WHETHER ANY PROGRAM HAS BEEN DECOMPILED.  IF NO
* PROGRAM HAS BEEN DECOMPILED, THEN DECOMPILE SKIPS AROUND
* THE LOGIC TO ZERO OUT THE SUBROUTINE STACK.
*
   813 1273 DCPL17 1346 ? C#0  X              IS THIS AN CHAIN END ?
   814 1274         427 GOC    DCPL15 (1336) NO
   815 1275 DCPL20  116 C=0                   REMEMBER WE ARE AT 1ST PGM
   816 1276         160 N=C
   817 1277           1 GOSUB  FSTIN          GET REG0
   817 1300           0
   818 1301         463 GOTO   DCPL24 (1347)
*
   820 1302 DECMPL 1104 S9=    0
```

```
  821                    ENTRY  DCPL00
  822 1303 DCPL00     1 GOSUB  GTFEND          LOAD CHAIN HEAD
  822 1304            0
  823 1305          252 AC EX  WPT
  824 1306          160 N=C                    SAVE .END. ADDR IN N
  825 1307            4 S3=    0                REM NO PGM BEEN DECMPL YET
  826       DCPL05                              NEXT.END.ADDR IN C[3:0] HERE
  827 1310          412 A=C    WPT              LOAD END ADDR FROM C
  828 1311            1 GOSUB  INCAD2           POINT TO 3RD BYTE OF END
  828 1312            0
  829 1313            1 GOSUB  GTBYTA           GET 3RD BYTE OF END
  829 1314            0
  830 1315         1730 CST EX                  CHECK IF DECMPL BIT SET
  831 1316         1414 ?S1=1                   DECMPL BIT SET ?
  832 1317           47 GOC    DCPL07 (1323)   YES
  833 1320          404 S8=    0                REMEMBER NO DECMPL THIS PGM
  834 1321         1730 CST EX
  835 1322           63 GOTO   DCPL11 (1330)
  836 1323 DCPL07   410 S8=    1                SET S8 REMEMBER IT
  837 1324         1404 S1=    0                CLEAR DECMPL BIT
  838 1325         1730 CST EX
  839 1326            1 GOSUB  PTBYTA           PUT THE BYTE BACK
  839 1327            0
  840 1330 DCPL11   260 C=N
  841 1331          416 A=C
  842 1332            1 GOSUB  GTLINK
  842 1333            0
  843 1334         1346 ? C#0  X                CHAIN END ?
  844 1335         1403 GONC   DCPL20 (1275)   YES
* MOVES UP SEARCHING FOR END OR FIRST ALBL IN MEM
  846 1336 DCPL15     1 GOSUB  UPLINK           MOVES UP ONE LINK
  846 1337            0
  847 1340         1076 C=C+1  S                IS THIS BYTE AN END ?
  848 1341         1327 GOC    DCPL17 (1273)   NO, IS AN ALBL
  849 1342          252 C=A    WPT
  849 1343          412
  850 1344          160 N=C                    SAVE END ADDR IN N
  851 1345            1 GOSUB  INCAD2           POINT TO 3RD BYTE OF END
  851 1346            0
  852 1347 DCPL24   414 ?S8=1                  NEED DECMPL THIS PGM ?
  853 1350          353 GONC   DCPL70 (1405)   NO
  854 1351           10 S3=    1                REM AT LEAST DECMPL 1 PGM
  855 1352            1 GOSUB  GTBYTA
  855 1353            0
  856 1354         1574 RCR    12
  857 1355 DCPL25   642 A=A-1  PT               NEXT BYTE ON SAME REG.?
  858 1356          113 GONC   DCPL30 (1367)   YES
  859 1357          252 AC EX  WPT              NEXT BYTE IN NEXT REG.
  860 1360         1142 C=C-1  PT
  861 1361         1142 C=C-1  PT
  862 1362         1146 C=C-1  X                POINT TO NEXT REG.
  863 1363         1160 DADD=C
  864 1364          412 A=C    WPT
  865 1365           70 C=DATA                  LOAD NEXT REG.
  866 1366         1574 RCR    12
  867 1367 DCPL30   642 A=A-1  PT               POINT TO NEXT BYTE
  868 1370         1574 RCR    12              C(3:2) _ NEXT BYTE
  869 1371         1202 C=-C   PT               16 COMPLEMENT
  870 1372          742 C=C+C  PT               ONE BYTE ?
  871 1373         1627 GOC    DCPL25 (1355)   YES, GO ON TO NEXT LINE
```

```
   872 1374          742 C=C+C  PT             THREE BYTE LINE ?
   873 1375          357 GOC    DCPL40 (1432) NO, ITS TWO BYTES
   874 1376          742 C=C+C  PT             ROW 15 ?
   875 1377          567 GOC    DCPL45 (1455) NO, ITS ROW 13 OR 14
   876 1400          742 C=C+C  PT             TEST ROW 0 OR ROW 15
   877 1401         1543 GONC   DCPL25 (1355) ROW 0 IF NO CARRY
* TEXT ROW, LET THE "NXLIN" ROUTINE HANDLE IT
   879 1402 DCPL35     1 GOSUB  NXLTX
   879 1403            0
   880 1404         1513 GOTO   DCPL25 (1355) GO ON TO NEXT LINE
*
   882 1405 DCPL70   260 C=N                  GET STARTING ADDR
   883 1406         1346 ? C#0  X             JUST FINISHING 1ST PGM ?
   884 1407         1017 GOC    DCPL05 (1310) NO,KEEP GOING
   885 1410         1160 DADD=C
   886 1411           14 ?S3=1                HAS ANY PGM BEEN DECMPL ?
   887 1412          113 GONC   DCPL60 (1423) NO, DON'T CLEAR SUB STACK
   888                   ENTRY  DCPLRT
   889 1413 DCPLRT     1 GOSUB  GETPC          CLEAR THE SUBROUTINE STACK
   889 1414            0
   890                   ENTRY  DCRT10
   891 1415 DCRT10   116 C=0
   892 1416         1160 DADD=C
   893 1417         1350 REGN=C 11
   894 1420         1450 REGN=C 12
   895 1421            1 GOSUB  PUTPC
   895 1422            0
   896 1423 DCPL60  1670 C=REGN 14            PUT UP SS0
   897 1424         1530 ST=C
   898 1425         1114 ?S9=1
   899 1426         1640 RTN NC
   900                   ENTRY  ERRTA
   901 1427 ERRTA      1 GOSUB  ERROR
   901 1430            0
   902 1431            0 XDEF   MSGTA
*
* TWO BYTES ROW
   905 1432 DCPL40   742 C=C+C  PT             ROW 9 OR 10 ?
   906 1433          177 GOC    DCPL50 (1452) YES, SIMPLY SKIP 1 BYTE
   907 1434         1342 ? C#0  PT             ROW 12 ?
   908 1435          427 GOC    DCPL55 (1477) NO, ITS ROW 11
   909 1436         1066 C=C+1  XS             IS A LBL.NN ?
   910 1437          137 GOC    DCPL50 (1452) YES, SKIP 1 BYTE
   911 1440         1066 C=C+1  XS             IS A X<>.NN ?
   912 1441          117 GOC    DCPL50 (1452) YES
* ALBL OR END HERE
   914 1442 DCPL42     1 GOSUB  INCADA         SKIP OVER THE LINK
   914 1443            0
   915 1444            1 GOSUB  NXBYTA         LOAD THE THIRD BYTE
   915 1445            0
   916 1446         1574 RCR    12             MOVE IT TO C(3:2)
   917 1447         1042 C=C+1  PT             IS IT AN ALBL ?
   918 1450         1327 GOC    DCPL35 (1402) YES, TEXT STRING FOLLOWS
*
   920 1451         1343 GOTO   DCPL70 (1405) GOTO TAKE CARE OF END
   921 1452 DCPL50     1 GOSUB  NXL3B2
   921 1453            0
   922 1454 DCPL51  1013 GOTO   DCPL25 (1355)
* GTO.NN & XEQ.NN HERE (CLEAR 3 DIGITS LINK)
   924 1455 DCPL45     1 GOSUB  GTBYTA         GET THE FIRST BYTE AGAIN
```

```
   924 1456            0
   925 1457         1574 RCR    12             MOVE IT TO C(3:2)
   926 1460          126 C=0    XS             ZERO FIRST DIGIT OF LINK
   927 1461         1074 RCR    2
   928 1462            1 GOSUB  PTBYTA         PUT IT BACK TO MEM
   928 1463            0
   929 1464            1 GOSUB  NXBYTA         GET NEXT BYTE
   929 1465            0
   930 1466         1434 PT=    1
   931 1467          112 C=0    WPT            ZERO LAST TWO DIGITS OF LINK
   932 1470          356 BC EX  W              SAVE THE REG. IN B
   933 1471          316 C=B    W
   934 1472            1 GOSUB  PTBYTA         PUT BYTE
   934 1473            0
   935 1474          316 C=B
   936 1475         1574 RCR    12
   937 1476         1543 GOTO   DCPL50 (1452) INCREMENT 1 BYTE
* GTO.0-14 HERE ( 1 BYTE LINK)
   939 1477 DCPL55     1 GOSUB  NXBYTA         GET  THE LINK BYTE
   939 1500            0
   940 1501         1434 PT=    1
   941 1502          112 C=0    WPT
   942 1503          356 BC EX  W              SAVE THE REG. IN B
   943 1504          316 C=B    W
   944 1505            1 GOSUB  PTBYTA
   944 1506            0
   945 1507          316 C=B    W
   946 1510         1574 RCR    12
   947 1511         1433 GOTO   DCPL51 (1454)
*
* XECROM - DISPLAY ROM FUNCTION
* CALLED FROM DFILLF WHEN IT HAS A EXCROM FUNCTION.
* CALLED WITH A.X HAS THE 1ST BYTE OF THE 2 BYTE'S FC, PT=1.
*
   953 1512 XECROM   246 AC EX  X
   954 1513         1374 RCR    13
   955 1514          130 G=C                   SAVE 1ST BYTE IN G
   956 1515          156 AB EX  W
   957 1516            1 GOSUB  NXTBYT          GET THE SECOND BYTE
   957 1517            0
   958 1520         1034 PT=    2
   959 1521          230 C=G                   PUT 2 BYTES TOGETHER IN C[3:0]
   960 1522            1 GOSUB  GTRMAD         FIND IT IN THE ROM
   960 1523            0
   961 1524          303 GOTO   XROMNF (1554) ROM NOT PLUGED IN
   962 1525          256 AC EX  W
   963 1526          674 RCR    11             C.M _ XADR
   964 1527            1 GOSUB  ENLCD
   964 1530            0
   965 1531           14 ?S3=1                 XTYPE=0 ?
   966 1532          163 GONC   XROM10 (1550) YES, MICRO CODE FUNCTION
   967 1533         1072 C=C+1  M
   968 1534         1072 C=C+1  M              POINT TO THIRD BYTE OF ALBL
   969 1535         1460 CXISA                 GET 1ST BYTE OF TEXT STRING
   970 1536          406 A=C    X
   971 1537          646 A=A-1  X
   972 1540           74 RCR    3              C(3:0) _ 1ST BYTE ADDR
   973 1541         1056 C=C+1
   974 1542          356 BC EX  W              SAVE 1ST BYTE ADDR IN B
   975 1543            1 GOSUB  OUTROM         SEND "XROM" TO LCD
```

```
   975 1544                0
   976 1545              404 S8=     0               CLEAR S8 FOR TXRW10
   977 1546                1 GOLONG TXTROM          DISPLAY TEXT STRING FROM ROM
   977 1547                2
   978       XROM10
   979 1550                1 GOSUB  PROMF2
   979 1551                0
   980 1552 XROMRT         1 GOLONG DF150
   980 1553                2
*
* ROM NOT PLUG IN, DISPLAY ROM ID & FC #
*
   984 1554 XROMNF         1 GOSUB  ENLCD
   984 1555                0
   985 1556                1 GOSUB  OUTROM          SEND "XROM" TO LCD
   985 1557                0
   986 1560              316 C=B                    GET ROM ID
   987 1561               74 RCR    3
   988 1562              406 A=C    X
   989 1563               36 A=0    S
   990 1564                1 GOSUB  GENNUM
   990 1565                0
   991 1566             1670 FRSABC
   992 1567             1434 PT=    1
   993 1570             1720 LC     15
   994 1571             1750 SLSABC
   995 1572              146 AB EX  X               GET FUNCTION #
   996 1573               36 A=0    S
   997 1574                1 GOSUB  GENNUM
   997 1575                0
   998 1576             1543 GOTO   XROMRT (1552)
   999
  1000
  1001
  1002                       ENTRY  SRBMAP
  1003                       ENTRY  TBITMP
  1004                       ENTRY  TBITMA
  1005                       ENTRY  XROM
  1006
  1007
  1008
  1009
*  TBITMP - TEST BIT MAP
*- TEST THE CORRECT BIT MAP (SHIFTED/UNSHIFTED) TO
*- DETERMINE WHETHER A PARTICULAR KEY HAS BEEN
*- ASSIGNED OR NOT
*- IN:  A[2:1]= LOGICAL KEYCODE (0:79 FORM)
*-      CHIP 0 SELECTED
*- OUT: C=0 IMPLIES BIT NOT SET
*-      C#0 IMPLIES BIT SET
*-      M= BIT MAP
*-      CHIP 0 & APPROPRIATE REGISTER IS SELECTED
*- USES: C[13:0], A[13:0], M[13:0]
*
* TBITMA ENTRY - SAME AS TBITMP EXCEPT KC IS IN A[1:0] AND IS
* IN 1-80 FORM ON ENTRY
  1024
  1025
  1026
  1027 1577 TBITMA   646 A=A-1  X                  DECREMENT K.C.
```

```
1028 1600         1756 A SL                    A[2]_COL
1029 1601 TBITMP  1034 PT=     2               C[2]_4
1030 1602          420 LC      4               -
1031 1603         1604 S0=     0               S0_SHIFTSET
1032 1604         1020 LC      8               -
1033 1605         1434 PT=     1               -
1034 1606         1102 C=A-C   PT              -
1035 1607           37 GOC     *+3     (1612)  -
1036 1610          402 A=C     PT              -
1037 1611         1610 S0=     1               -
1038 1612          234 PT=     5               POSITION PTR AT COLUMN
1039 1613           33 GOTO    *+3     (1616)  -
1040 1614         1734 INC PT                   -
1041 1615         1734 INC PT                   -
1042 1616          666 A=A-1   XS              -
1043 1617         1753 GONC    *-3     (1614)  -
1044 1620         1746 A SL    X               A[2]_ROW
1045 1621         1426 ? A<C   XS              ROW<4?
1046 1622           37 GOC     *+3     (1625)  YES
1047 1623         1734 INC PT                   SET PTR
1048 1624          726 A=A-C   XS              -
1049 1625          116 C=0                      POSITON ROW,COL BIT
1050 1626         1624 ? PT=   0                -  (TOP ROW KEYS?)
1051 1627         1540 RTN C                    -  (YES)
1052 1630         1042 C=C+1   PT              -
1053                   LEGAL
1054 1631           23 GOTO    *+2     (1633)  -   (YES)
1055 1632          742 C=C+C   PT              -
1056 1633          666 A=A-1   XS              -
1057 1634         1763 GONC    *-2     (1632)  -
1058 1635          416 A=C                      A_MASK
1059 1636         1770 C=REGN  15              -
1060 1637         1614 ?S0=1                   SHIFTSET?
1061 1640           27 GOC     *+2     (1642)  NOPE
1062 1641         1270 C=REGN  10              -
1063 1642          530 M=C                     M_C_BIT MAP
1064 1643         1660 C=C.A                   ROW,COL BIT SET?
1065 1644         1740 RTN                     -
1066
1067
1068
1069
*  SRBMAP - SET/RESET BIT MAP
*- TOGGLE THE BIT DESIGNATED BY THE MASK FOUND IN
*- REGISTER C.
*- IN:  C[13:0]= BIT MAP MASK (RESULT OF TBITMP)
*-      M[13:0]= BIT MAP
*-      THE APPROPRIATE REGISTER MUST BE SELECTED
*- OUT: CHIP 0 SELECTED
*- USES: C[13:0], M[13:0], A[13:0]
1078
1079
1080
1081 1645 SRBMAP  1356 ? C#0                   SET?
1082 1646           47 GOC     SRBM10 (1652)  YES,RESET
1083 1647          630 C=M                     -
1084 1650         1002 C=A+C   PT              SET IT
1085                   LEGAL
1086 1651           43 GOTO    *+4     (1655)  -
1087 1652 SRBM10   630 C=M                     -
```

```
1088 1653          256 AC EX               -
1089 1654         1116 C=A-C               -
1090 1655         1360 DATA=C              RESTORE BIT MAP
1091 1656         1740 RTN                 RETURN
1092                   EJECT
```

```
* XROM - EXECUTE ROM FUNCTION
*- LOCATES ROM FUNCTION AND PREPARES IT FOR EXECUTION.
*- IF THE FUNCTION IS A USER LANGUAGE PROGRAM, A TRANSFER
*- IS MADE TO THE XEQ PROGRAM SEGMENT.  IF THE FUNCTION
*- IS MICRO CODED, A JUMP IS MADE DIRECTLY TO THE FUNCTION'S
*- EXECUTION POINT.
*  IN:  FIRST BYTE OF FC IS IN C
*       SECOND BYTE OF FC IS IN ST AND IN C[1:0]
*       PT=2
*       NUMERIC ARGUMENT, IF ANY, IS IN B.X
*       ALPHA ARGUMENT, IF ANY, IS IN REG 9
*- OUT: FOR MICROCODE FCNS, SS0 UP, NUMERIC ARG IN A.X, ALPHA ARG IN
*            REG 9, NFRPU ON THE STACK
*       FOR USER LANGUAGE FCNS, CURRENT ADDR SAVED IN R10[3:0],
*            NEW ADDR IN C[3:0], EXITS TO XGI57
*- USES: 1 SUBROUTINE LEVEL
  1109
  1110 1657 XROM    316 C=B                    SAVE NUMERIC ARGUMENT
  1111 1660         160 N=C                     IN N
  1112 1661         230 C=G                    RESTORE FC TO
  1113 1662        1630 C=ST                    C[3:0]
  1114 1663           1 GOSUB  GTRMAD
  1114 1664           0
  1115 1665         173 GOTO   XRM20  (1704) COULDN'T FIND IT
* GTRMAD RETURNS TO P+2 WITH FOUND ADDRESS IN A[3:0]
  1117 1666          14 ?S3=1                   USER LANGUAGE?
  1118 1667          77 GOC    XRM10  (1676) YES
  1119                                         MICROCODE FCN
  1120 1670        1670 C=REGN 14               PUT UP SS0
  1121 1671        1530 ST=C
  1122 1672         260 C=N                     RETRIEVE NUMERIC ARG TO A.X
  1123 1673         256 AC EX
  1124 1674         674 RCR    11
  1125 1675         740 GOTOC
  1126
  1127      XRM10                              USER LANGUAGE FCN
  1128 1676         156 AB EX                  SAVE NEW ADDR IN B
  1129 1677           1 GOSUB  SAVRTN          SAVE OLD ADDR IN R10
  1129 1700           0
  1130 1701         316 C=B                    PUT NEW ADDR IN C[3:0]
  1131 1702           1 GOLONG XGI57
  1131 1703           2
  1132
  1133 1704 XRM20     1 GOLONG ERRNE           REPORT ERROR
  1133 1705           2
  1134
  1135
  1136
  1137
  1138
  1139
  1140
  1141
  1142
  1143
  1144
*****************************************************
*TXTLBL-TEXT OF LABEL STRING
*THIS IS THE FRONT END FOR TEXT LBL
```

```
*GIVEN A PC IN A(0,3) POINTING AT THE FIRST BYTE
*OF AN ALPHA LBL THIS ROUTINE DISPLAYS THE ALPAH TEXT
*STRING.
*FOR ROM S2=1. FOR RAM S2=0.
*SETS STATUS FOR NO PROMT AND LCD NOT FULL.
*
* TXTLB1 - SAME AS TXTLBL EXCEPT CLEARS S4 ON ENTRY.
*      S4 IS USED TO DECIDE WHETHER TO CLEAR THE DISPLAY
*      BEFORE PUTTING UP THE TEXTSTRING.  S4=0 IMPLIES
*      CLEAR THE DISPLAY, S4=1 IMPLIES DON'T CLEAR FIRST.
*************************************************
  1159 1706 TXTLB1   104 S4=     0              REMEMBER TO CLEAR DISPLAY
  1160 1707 TXTLBL   404 S8=     0              NO PROMPT
  1161 1710         1404 S1=     0              LCD NOT FULL
  1162 1711         1014 ?S2=1                  ROM OR RAM?
  1163 1712          107 GOC     ROMSTG (1722) ROM
  1164 1713            1 GOSUB   INCADP        SET PT=3 INC ADR
  1164 1714            0
  1165 1715            1 GOSUB   NXBYTA        GET # CHR
  1165 1716            0
  1166 1717            1 GOSUB   INCADA        SKIP ASSIGN BIT
  1166 1720            0
  1167 1721           53 GOTO    CLRL   (1726)
  1168 1722 ROMSTG   556 A=A+1                  INC ADR
  1169                   LEGAL
  1170 1723            1 GOSUB   NXBYTO        GET # CHRT
  1170 1724            0
  1171 1725          556 A=A+1
  1172 1726 CLRL    1146 C=C-1   X
  1173 1727          346 BC EX   X
  1174 1730          156 AB EX                  COUNT IN A,ADR IN B
  1175 1731            1 GOSUB   ENLCD
  1175 1732            0
  1176 1733          114 ?S4=1                  SKIP CLEARING THE DISPLAY?
  1177 1734            1 GSUBNC  CLRLCD        NO. CLEAR THE DISPLAY
  1177 1735            0
  1178 1736            1 GOLONG  TXTSTR
  1178 1737            2
  1179
  1180                   ENTRY   STBT30
  1181                   ENTRY   STBT31
  1182 1740 STBT30   414 ?S8=1                  LAST PGM NEEDS PACK ?
  1183 1741           43 GONC    STBT31 (1745) NO
  1184 1742          356 BC EX   W
  1185 1743          530 M=C
  1186 1744          356 BC EX   W
  1187 1745 STBT31   404 S8=     0
  1188 1746         1730 CST EX
  1189 1747         1014 ?S2=1
  1190 1750           43 GONC    STBT32 (1754)
  1191 1751          410 S8=     1
  1192 1752         1004 S2=     0
  1193 1753         1410 S1=     1
  1194 1754 STBT32  1730 CST EX
  1195 1755         1740 RTN

  OUTROM - SHIFT "XROM " INTO THE LCD FROM THE RIGHT END

  FOR ENTRY, LCD MUST BE ENABLED
  USES C[6:0] AND ONE ADDITIONAL SUBROUTINE LEVEL
```

```
*
  1202                      ENTRY  OUTROM
  1203 1756 OUTROM     1    GOSUB  MESSL
  1203 1757            0
  1204 1760           30    CON    24              X
  1205 1761           22    CON    18              R
  1206 1762           17    CON    15              O
  1207 1763           15    CON    13              M
  1208 1764         1040    CON    @1040           BLANK
  1209 1765         1740    RTN
* RESERVE 2 WORDS AT THE END OF CN11 FOR THE CHIP 2 CHECKSUM AND
* TRAILER.
  1212
  1213                      FILLTO @1775
       1766         0000    NOP
       1767         0000    NOP
       1770         0000    NOP
       1771         0000    NOP
       1772         0000    NOP
       1773         0000    NOP
       1774         0000    NOP
       1775         0000    NOP
  1214 1776 REVLV2     6    CON    6               REV LEVEL= F
  1215 1777 CKSUM2     0    CON    @0000
  1216                      END

  ERRORS :       0
```

SYMBOL TABLE

AOUT05	30	-	42			
AOUT10	46	-	34			
AOUT15	53	-	126			
AOUT16	72	-	66			
AOUT17	73	-	76			
AOUT18	104	-	61			
AOUT19	111	-	105			
AOUT20	117	-	52			
AOUTR0	62	-	45			
AOUTRT	77	-	74	71		
APHST*	1142	-				
APHST1	1176	-	1167			
APHST2	1200	-	1175			
APHST3	1202	-	1163			
APHST4	1213	-	1145			
APHDNW	424	-				
APPEND	416	-				
ARGOUT	20	-				
ASCLCD	135	-				
ASCTBL	0	-				
CKSUM2	1777	-				
CLLCDE	360	-				
CLRL	1726	-	1721			
CLRLCD	366	-				
COLON	127	-	142			
COMMA	132	-	146			
DAT102	502	-				
DAT105	507	-	503			
DAT106	514	-	510			
DAT110	517	-	477			
DAT120	526	-	522			
DAT140	535	-	501			
DAT200	542	-	475			
DAT220	606	-	632	566	541	
DAT230	552	-				
DAT231	567	-				
DAT235	576	-	551			
DAT240	610	-	563			
DAT245	622	-	614			
DAT260	624	-	621			
DAT280	630	-				
DAT300	633	-	547			
DAT320	642	-				
DAT322	663	-	656			
DAT325	671	-	666			
DAT330	703	-	774	771	741	715
DAT333	716	-	677			
DAT335	720	-	707	705		
DAT345	742	-	730			
DAT350	753	-	726			
DAT360	757	-				
DAT370	761	-	743			
DAT380	775	-	751	747	745	723
DAT385	1000	-	1100			
DAT390	1002	-	760	756	754	752
DAT400	1005	-	1101	1023		

```
DAT410  1006   -  1001
DAT415  1010   -  1054
DAT500  1020   -
DAT505  1036   -  1031
DAT507  1043   -  1062
DAT510  1050   -  1026
DAT515  1055   -  1051
DAT520  1063   -  1047
DATENT   454   -
DCPL00  1303   -
DCPL05  1310   -  1407
DCPL07  1323   -  1317
DCPL11  1330   -  1322
DCPL15  1336   -  1274
DCPL17  1273   -  1341
DCPL20  1275   -  1335
DCPL24  1347   -  1301
DCPL25  1355   -  1454 1404 1401 1373
DCPL30  1367   -  1356
DCPL35  1402   -  1450
DCPL40  1432   -  1375
DCPL42  1442   -
DCPL45  1455   -  1377
DCPL50  1452   -  1476 1441 1437 1433
DCPL51  1454   -  1511
DCPL55  1477   -  1435
DCPL60  1423   -  1412
DCPL70  1405   -  1451 1350
DCPLRT  1413   -
DCRT10  1415   -
DECMPL  1302   -
ERRTA   1427   -
INBCHS  1012   -
INBYTJ  1014   -
MASK     210   -   152
MASK10   236   -   220  214
MASK20   243   -   247
MASK30   253   -   245
MASKRT   225   -   256  252
NBYTA0   404   -
NBYTAB   406   -
NXBYTO   413   -
NXTBYT   407   -
OPMT10  1126   -  1132
OPMT20  1140   -  1123
OPROMT  1114   -
OUTLCD   200   -   235  172
OUTROM  1756   -
PERIOD   153   -
PUNC     155   -   134  131
PUNC10   174   -   163  161
PUNC20   205   -   201  173
REVLV2  1776   -
ROBK10  1107   -  1113
ROLBAK  1102   -
ROMSTG  1722   -  1712
SCROL0   336   -
SCROL2   350   -   341
SCROL5   352   -   344
SCROLL   334   -
```

ENTRY TABLE

AOUT15	53	-
APHST*	1142	-
APHDNW	424	-
APPEND	416	-
ARGOUT	20	-
ASCLCD	135	-
CLLCDE	360	-
CLRLCD	366	-
DAT106	514	-
DAT231	567	-
DAT260	624	-
DAT280	630	-
DAT300	633	-
DAT320	642	-
DAT400	1005	-
DAT500	1020	-
DATENT	454	-
DCPL00	1303	-
DCPLRT	1413	-
DCRT10	1415	-
DECMPL	1302	-
ERRTA	1427	-
INBCHS	1012	-
INBYTJ	1014	-
MASK	210	-
NBYTA0	404	-
NBYTAB	406	-
NXBYTO	413	-
NXTBYT	407	-
OPROMT	1114	-
OUTLCD	200	-
OUTROM	1756	-
ROLBAK	1102	-
SCROL0	336	-
SCROLL	334	-
SRBMAP	1645	-
STBT10	1243	-
STBT30	1740	-
STBT31	1745	-
STOLCC	1133	-
TBITMA	1577	-
TBITMP	1601	-
TEXT	257	-
TXTLB1	1706	-
TXTLBL	1707	-
XECROM	1512	-
XROM	1657	-
XROMNF	1554	-

EXTERNAL REFERENCES

APHST*	533						
APHST*	534						
APNDNW	331						
APNDNW	332						
APPEND	610						
APPEND	611						
ASCLCD	124	626					
ASCLCD	125	627					
BAKAPH	560						
BAKAPH	561						
BLINK	564	1052					
BLINK	565	1053					
CLLCDE	43	47	1207				
CLLCDE	44	50	1210				
CLRLCD	1734						
CLRLCD	1735						
DAT260	1211						
DAT260	1212						
DAT280	1200						
DAT280	1201						
DAT400	1241						
DAT400	1242						
DAT500	634						
DAT500	635						
DATOFF	1032						
DATOFF	1033						
DECADA	1041						
DECADA	1042						
DELLIN	640						
DELLIN	641						
DF150	1552						
DF150	1553						
DFILLF	1006						
DFILLF	1007						
DGENS8	576	644					
DGENS8	577	645					
DIGST*	531						
DIGST*	532						
ENCP00	111	404					
ENCP00	112	405					
ENLCD	120	616	1105	1173	1527	1554	1731
ENLCD	121	617	1106	1174	1530	1555	1732
ERRNE	1704						
ERRNE	1705						
ERROR	1427						
ERROR	1430						
FSTIN	1277						
FSTIN	1300						
GENNUM	1564	1574					
GENNUM	1565	1575					
GETPC	260	636	646	1064	1220	1413	
GETPC	261	637	647	1065	1221	1414	
GTBYT	262						
GTBYT	263						
GTBYTA	1313	1352	1455				
GTBYTA	1314	1353	1456				

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ROLBAK   623  1177
RST05    346
RST05    347
SAVRTN  1677
SAVRTN  1700
SCROLL   107
SCROLL   110
STFLGS   526
STFLGS   527
STOLCC   102
STOLCC   103
TONE7X   422
TONE7X   423
TXTROM  1546
TXTROM  1547
TXTSTR  1736
TXTSTR  1737
UPLINK  1336
UPLINK  1337
XDELET  1034
XDELET  1035
XGI57   1702
XGI57   1703

End of VASM assembly
```