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0001     * NAME: (PAL-AP)          DOC. 70180311000          REV. H
0002     *
0003     * PURPOSE
0004     *
0005     *           TO PUNCH SELF-LOADING OBJECT TAPES OF ANY DESIRED
0006     *        SEGMENT OF MEMORY.
0007     * REVISION HISTORY
0008     *        REV          DATE          ECO NO.
0009     *        H
0010     *        G          01-05-72          10124
0011     *        F          06-08-71           9582
0012     *        E          08-21-68           6098
0013     *        D          02-15-68           5490
0014     *        C          12-19-67           5228
0015     *        B          10-25-67           4776
0016     *        A          10-28-66          RELEASED
0017     *
0018     *
0019     *
0020     *
0021     *
0022     *
0023     *
0024     *
0025     *
0026     * COPYRIGHT 1972 BY HONEYWELL INFORMATION SYSTEMS INC.
0027     ******************************************************************
0028          EJCT
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0029        *
0030        *
0031        * STORAGE
0032        *
0033        *     THIS PROGRAM OCCUPIES LESS THAN ONE SECTOR OF CORE.
0034        *
0035        *
0036        * USE
0037        *
0038        *     PAL-AP IS DISTRIBUTED IN PAL MODE AND IN RELOCATABLE OBJECT FORMAT
0039        *
0040        *     PAL MODE:
0041        *         ALL PAL-FORMAT PROGRAMS MUST BE LOADED IN THE FOLLOWING
0042        *         MANNER:
0043        *         1) THE KEY-IN LOADER (LOCATIONS 1-17) MUST BE MANUALLY
0044        *            SET AS FOLLOWS:       ASR        DIGITRONICS
0045        *
0046        *            1 STA    *57          010057     010057
0047        *            2 OCP    *0001/4      030004     030001
0048        *            3 INA    *1001/4      131004     131001
0049        *            4 JMP    *-1          002003     002003
0050        *            5 SNZ                 101040     101040
0051        *            6 JMP    *-3          002003     002003
0052        *            7 STA    0            010000     010000
0053        *           10 INA    *1001/4      131004     131001
0054        *           11 JMP    *-1          002010     002010
0055        *           12 LGL    8            041470     041470
0056        *           13 INA    *0001/4      130004     130001
0057        *           14 JMP    *-1          002013     002013
0058        *           15 STA*   0            110000     110000
0059        *           16 IRS    0            024000     024000
0060        *           17 SZE                 100040     100040
0061        *
0062        *         2) PLACE THE LEADER PORTION OF THE PROGRAM IN THE PAPER
0063        *            TAPE READER. SET THE P-COUNTER TO 000001 AND PRESS START.
0064        *            (SEE NOTE FOR ASR USERS.)
0065        *
0066        *            NOTE: WHEN USING AN ASR-33, MOMENTARILY PRESS THE START
0067        *            SWITCH ON THE READER AFTER PRESSING THE COMPUTER START
0068        *            BUTTON. WHEN USING AN ASR-35, SET THE MODE SWITCH
0069        *            TO KT, PRESS THE CONTROL KEY (CTRL) AND THE Q KEY
0070        *            SIMULTANEOUSLY, PRESS THE COMPUTER START BUTTON, AND
0071        *            SET THE READER SWITCH TO RUN.
0072        *            THE PROGRAM WILL SELF-LOAD FROM THIS POINT
0073        *            TO THE CORE AREA FROM WHICH IT WAS PUNCHED.
0074        *
0075        *     RELOCATABLE FORMAT
0076        *         1) LOAD THE PROGRAM AS ANY OTHER RELOCATABLE PROGRAM
0077        *         2) TO OUTPUT A PAL MODE TAPE, USE INSTRUCTIONS BELOW,
0078        *            USING LOAD POINT FOR FIRST ADDRESS, AND LOAD POINT
0079        *            PLUS *577 AS LAST ADDRESS.
0080        *
0081        *
0082        *     TO USE PROGRAM:
0083        *         1) MASTER CLEAR
0084        *         2) SET PROGRAM COUNTER TO XX000 WHERE XX IS THE SECTOR
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0085          *         INTO WHICH PAL-AP HAS BEEN LOADED.
0086          *         3) ENTER THE OUTPUT DEVICE CODE INTO THE A-REGISTER. IF
0087          *            THE ASR-33 IS TO BE USED, SET BIT 1 OF THE A-REGISTER
0088          *            AND TURN ON THE PUNCH. IF THE ASR-35 IS TO BE USED,
0089          *            SET BIT 2 OF THE A-REGISTER. IF THE HIGH SPEED
0090          *            PUNCH IS TO BE USED, LEAVE THE A-REGISTER CLEARED.
0091          *         4) PRESS START AND THE PROGRAM WILL HALT.
0092          *         5) ENTER INTO THE A-REGISTER THE FIRST ADDRESS OF THE PROGRAM
0093          *            BEING PUNCHED.
0094          *         6) PRESS START AND THE PROGRAM WILL HALT.
0095          *         7) ENTER INTO THE A-REGISTER THE LAST ADDRESS OF THE
0096          *            PROGRAM BEING PUNCHED.
0097          *         8) PRESS START AND THE SELECTED OUTPUT DEVICE WILL BEGIN
0098          *            PUNCHING TAPE.
0099          *         9) UPON COMPLETION OF THE PUNCH, IF ANOTHER TAPE IS TO BE
0100          *            PUNCHED ON THE SAME DEVICE, CONTINUE FROM STEP 5.
0101          *
0102          *
0103          *     TO GENERATE LOAD AND GO TAPES:
0104          *         SYSTEM BOOTSTRAP TAPES MAY BE PUNCHED BY CHANGING THREE
0105          *         LOCATIONS OF PAL-AP. ADDRESSING IS GIVEN IN OCTAL RELATIVE
0106          *         TO THE FIRST LOCATION OF PAL-AP (IT MUST BE THE FIRST
0107          *         LOCATION OF A SECTOR). LOCATIONS '613 AND '616 ARE BOTH
0108          *         "JMP '632" INSTRUCTIONS, AND SHOULD BE CHANGED TO
0109          *         "JMP* '632" INSTRUCTIONS - I.E. CHANGE FROM JUMP TO JUMP
0110          *         INDIRECT. LOCATION '632 SHOULD BE CHANGED FROM "OCT 12" TO
0111          *         "DAC PTR", WHERE PTR IS THE ABSOLUTE ADDRESS FOR
0112          *         EXECUTION AFTER LOADING THE PAPER TAPE BOOT.
0113          *
0114          *
0115          * METHOD
0116          *
0117          *     PAL-AP IS MADE UP OF TWO SECTIONS. THE PUNCH SECTION (INCLUDING
0118          *     THE BOOTSTRAP) OCCUPIES XX000-XX577. THE LOADER SECTION (READ IN
0119          *     BY THE BOOTSTRAP) OCCUPIES XX600-XX777. IN ADDITION TO THESE
0120          *     THE BOOTSTRAP SECTION WILL LOAD INTO LOCATIONS '20 THROUGH '57,
0121          *     AND WILL BE IN 8-8 FORMAT.
0122          *
0123          *
0124          *     ANY PAL MODE PROGRAM HAS THE FOLLOWING OVERALL STRUCTURE:
0125          *         1) PAL-AP FIRST PUNCHES ITS LOADER SECTION IN 8-8
0126          *            FORMAT FOLLOWED BY TWELVE INCHES OF LEADER.
0127          *         2) NEXT THE DESIRED PROGRAM IS PUNCHED IN PAL FORMAT WHICH
0128          *            IS "RECOGNIZED" BY THE LOADER.
0129          *     THE LOADER ON THE FRONT OF THE TAPE WILL LOAD ITSELF AND
0130          *     THEN WILL LOAD THE PAL-FORMAT PROGRAM.
0131          *
0132          *
0133          *     DATA IS PUNCHED IN BLOCKS OF 50 WORDS EACH. SALIENT
0134          *     CHARACTERISTICS OF THE BLOCK STRUCTURE AREA ARE AS FOLLOWS:
0135          *         1) A START OF MESSAGE CHARACTER (OCTAL 201) IS
0136          *            PUNCHED AT THE BEGINNING OF EACH BLOCK.
0137          *         2) FOLLOWING THIS, THE ADDRESS OF THE FIRST MEMORY
0138          *            LOCATION IS PUNCHED.
0139          *         3) EACH BLOCK IS ENDED BY:
0140          *            A) A CHECKSUM. THIS CONSISTS OF A WORD WHICH
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0141                    *                    IS THE EXCLUSIVE OR OF ALL WORDS PUNCHFD
0142                    *                    PLUS A WORD COUNT AND A BLOCK COUNT.
0143                    *                    (THE FIRST BLOCK IS ZERO AND FACH ONF THERE-
0144                    *                    AFTER IS INCREMENTFD BY ONF.)  THF
0145                    *                    CHECKSUM IS ROTATFD RIGHT ONF RIT FACH
0146                    *                    TIME ANOTHER WORD IS ADDED TO IT.
0147                    *                 B) AN END OF MESSAGE CHARACTER (OCTAL 223).
0148                    *                    THE EOM IS FOLLOWFD BY A RUROUT CHARACTFR (OCTAL 377)
0149                    *              4) SIX FRAMES OF LEADER ARF PUNCHFD RFTWFFN BLOCKS
0150                    *                 AND TWELVE INCHES OF LFADFR ARE PUNCHED
0151                    *                 AT THE BEGINNING AND END OF THE PROGRAM.
0152                    *
0153                    *           THE FORMAT OF THE PUNCHED WORDS IS AS FOLLOWS:
0154                    *              1) NON-ZERO WORDS ARE PUNCHFD IN "INVISIBLF CODF".
0155                    *                 EACH 16-BIT WORD IS WRITTFN AS A FOUR-BIT AND
0156                    *                 TWO SIX-BIT CHARACTERS ON TAPE. THF FOUR-RIT
0157                    *                 CHARACTER REPRESENTS THF HIGH-ORDFR FOUR
0158                    *                 BITS OF THE WORD. EACH SIX-BIT CHARACTFR
0159                    *                 HAS THE HIGH-ORDER BIT IN CHANNFL FIGHT AND THF
0160                    *                 FIVE LOW-ORDER BITS IN CHANNELS FIVF THROUGH
0161                    *                 ONE. ORDINARILY, NOTHING IS WRITTFN IN CHANNFLS
0162                    *                 EIGHT THROUGH FIVE OF THE FOUR-RIT CHARACTFR
0163                    *                 OR IN CHANNELS SIX AND SEVEN OF THF SIX-RIT
0164                    *                 CHARACTERS.
0165                    *              2) EIGHT CHARACTERS CAUSE SPFCIAL ACTION RY THF ASR.
0166                    *                 THESE ARE 023 AND 223 (X-OFF), 021 AND 221 (X-ON), 012
0167                    *                 AND 212 (LINE FEED), 005 AND 205 (WRU). THFSF ARF
0168                    *                 TRANSLATED INTO 177 AND 377, 176 AND 376, 175 AND
0169                    *                 375, 174 AND 374, RESPFCTIVFLY. IN THF CASF OF FACH OF
0170                    *                 THESE CHARACTERS, CHANNFLS SIX AND SFVFN ARF PUNCHFD.
0171                    *              3) WHEN ONE OR MORE CONSFCUTIVF ZFRO WORDS ARF
0172                    *                 ENCOUNTERED IN MEMORY. THFY ARF RFPRFSFNTFD BY
0173                    *                 ONE PUNCHED WORD. THIS CONSISTS OF THF TWO'S COMPLFMFNT
0174                    *                 OF THE NUMBER OF CONSECUTIVF ZERO WORDS FNCOUNTFRFD. IN
0175                    *                 ORDER TO DISTINGUISH THFSF Z-COUNT WORDS. CHANNFL FIGHT
0176                    *                 OF THE HIGH-ORDER (FOUR-BIT) CHARACTER IS PUNCHFD
0177                    *
0178                    *
0179                    *              NOTE: THE WORD COUNT CONSISTS OF THF TOTAL NUMBFR OF
0180                    *           WORDS ENCOUNTERED WHILE PUNCHING A BLOCK. INCLUDING ALL
0181                    *           ZERO WORDS.
0182                    *
0183                    *
0184                    *
0185           ****************************************************************************
0186                    REL
0187                    EXD                    ENTER EXTENDFD MODF
0188           *                               LOAD A WITH DEVICE CODF
0189 00000  000013      EXA                    ENABLE FXTFNDED ADDRESSING
0190 00001  0 04 00460  STA    CODE            SAVE DEVICF CODF
0191 00002  140040   BEGN CRA
0192 00003  000000      HLT                    ENTER FIRST ADDRFSS
0193 00004  0 04 00444  STA    FADD            SAVF IT
0194 00005  140040      CRA
0195 00006  000000      HLT                    ENTER LAST ADDRFSS
0196 00007  0 04 00445  STA    LADD            SAVF IT
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0197 00010    0 02 00460       LDA   CODE        PICKUP DEVICE CODE
0198 00011    101400           SMI               IS ASR-33 IN USE
0199 00012    0 01 00033       JMP   TF35        NO.
0200 00013    140040           CRA
0201 00014    0 04 00461       STA   PON
0202 00015    0 04 00462       STA   RUB
0203 00016    0 02 00427 SOCP  LDA   EASR
0204 00017    0 04 00056       STA   EPNC
0205 00020    0 02 00430       LDA   PASR        REPLACE OTA '2 WITH OTA '4.
0206 00021    0 04 00412 SOTA  STA   TPON+2      SET OTA'S
0207 00022    0 04 00415       STA   TPON+5      SET OTA'S
0208 00023    0 04 00131       STA   BGBL+5      SET OTA'S
0209 00024    0 04 00271       STA   XOF+2       SET OTA'S
0210 00025    0 04 00274       STA   XOF+5       SET OTA'S
0211 00026    0 04 00071       STA   LLOP+1      SET OTA'S
0212 00027    0 04 00363       STA   OK+1        SET OTA'S
0213 00030    0 04 00375       STA   P+2         SET OTA'S
0214 00031    0 04 00117       STA   QRUB+1
0215 00032    0 01 00052       JMP   CONT
0216 00033    0416 77    TF35  ALR   1           TEST FOR ASR-35
0217 00034    101400           SMI               IS ASR-35 IN USE
0218 00035    0 01 00043       JMP   HISP        NO.
0219 00036    0 02 00473       LDA   ='222
0220 00037    0 04 00461       STA   PON         INITIALIZE PUNCH
0221 00040    0 02 00472       LDA   ='377       AND RUBOUT CODES
0222 00041    0 04 00462       STA   RUB
0223 00042    0 01 00016       JMP   SOCP
0224 00043    140040     HISP  CRA               HIGH SPEED PUNCH IN USE
0225 00044    0 04 00461       STA   PON
0226 00045    0 04 00462       STA   RUB
0227 00046    0 02 00431       LDA   EBRP        OCP '2
0228 00047    0 04 00056       STA   EPNC
0229 00050    0 02 00432       LDA   PBRP        OTA '2
0230 00051    0 01 00021       JMP   SOTA        STORE IT AWAY
0231 00052    140040     CONT  CRA
0232 00053    0 04 00446       STA   BLCT        BLOCK COUNT
0233 00054    0 04 00450       STA   ZCNT        AND ZCOUNT
0234 00055    0 04 00443       STA   Z
0235 00056    14 0002    EPNC  OCP   '2          ENABLE PUNCH
0236 00057    0 10 00410       JST   TPON        TURN PUNCH ON
0237 00060    0 01 00077       JMP   LDR         GO TO PUNCH LEADER
0238 00061    0 000000   LEAD  DAC   **          ROUTINE TO PUNCH 12 INCHES OF LEADER
0239 00062    0 02 00436       LDA   N120        SET INDEX FOR 120 FRAMES
0240 00063    0 04 00453       STA   NDX         AND GO TO
0241 00064    0 01 00070       JMP   *+4         PUNCH
0242 00065    0 000000   PNC   DAC   **
0243 00066    0 02 00065       LDA   PNC         STORE RETURN ADDRESS
0244 00067    0 04 00061       STA   LEAD        IN LEAD
0245 00070    140040     LLOP  CRA               LEADER LOOP
0246 00071    74 0002          OTA   '2          OUTPUT LEADER
0247 00072    0 01 00071       JMP   *-1
0248 00073    0 12 00453       IRS   NDX
0249 00074    0 01 00070       JMP   *-4
0250 00075    0 04 00447       STA   WDCT
0251 00076   -0 01 00061       JMP*  LEAD        RETURN
0252 00077    0 10 00061 LDR   JST   LEAD        GO TO PUNCH 12 INCHES OF LEADER
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0253 00100    0 02 00471       LDA    ='52            GET FIRST RETURN FOR CHAR SUBROUTINE
0254 00101    0 04 00731       STA    CHAR
0255 00102    0 04 00704       STA    SWCH            INITIALIZE TO PRISTINE CONDITION
0256 00103    0 04 00715       STA    WORD            INITIALIZE TO PRISTINE CONDITION
0257 00104    0 02 00434       LDA    NBL1            LENGTH OF FIRST LEVEL BOOT (NEG)
0258 00105    0 04 00453       STA    NDX             FIRST
0259 00106    0 02 00440       LDA    LOAD            BLOCK
0260 00107    0 04 00401       STA    PN88            OF
0261 00110    0 10 00400       JST    PN              PUNCH BL1
0262 00111    0 12 00401       IRS    PN88            OMIT THE OCP OF BL2
0263 00112    0 12 00401       IRS    PN88            OMIT THE INA OF BL2
0264 00113    0 02 00437       LDA    NBL2            LENGTH OF SECOND LEVEL BOOT (NEG)
0265 00114    0 04 00453       STA    NDX             BLOCK
0266 00115    0 10 00400       JST    PN              PUNCH SECOND LEVEL BOOT
0267 00116    0 02 00472 ORUB  LDA    ='377
0268 00117    74 0002          OTA    '2
0269 00120    0 01 00117       JMP    *-1
0270 00121    0 10 00410       JST    TPON
0271 00122    0 10 00061       JST    LEAD            TURN PUNCH ON, PUNCH LEADER
0272 00123    0 01 00125       JMP    BGBL+1
0273                      *
0274                      *              BEGIN PUNCHING BLOCK OF CHARACTERS
0275                      *
0276 00124    0 10 00410 BGBL  JST    TPON
0277 00125    0 02 00433       LDA    N6              BEGIN BLOCK. SET INDEX FOR
0278 00126    0 04 00453       STA    NDX             SIX FRAMES OF LEADER
0279 00127    0 10 00065       JST    PNC             AND PUNCH
0280 00130    0 02 00441       LDA    SOM             LOAD START-OF-MESSAGE
0281 00131    74 0002          OTA    '2              PUNCH
0282 00132    0 01 00131       JMP    *-1             (DELAY IF PUNCH NOT READY)
0283 00133    0 02 00435       LDA    N50             INITIALIZE
0284 00134    0 04 00451       STA    PNCT            PUNCH COUNT
0285 00135    0 02 00446       LDA    BLCT            INITIALIZE CHECKSUM
0286 00136    0 04 00452       STA    CKSM            WITH BLOCKCOUNT
0287 00137    0 12 00446       IRS    BLCT            AND INCREMENT BLOCKCOUNT
0288 00140    0 02 00444       LDA    FADD            LOAD FIRST ADDRESS OF BLOCK
0289 00141    0 07 00470       SUB    =1
0290 00142    0 10 00277       JST    LOOP            AND PUNCH IT.
0291 00143    0 02 00443       LDA    Z
0292 00144    0 04 00450       STA    ZCNT
0293 00145    0 02 00455       LDA    SAVE
0294 00146    0 01 00150       JMP    *+2
0295 00147    0 12 00444 MOVE  IRS    FADD            INCREMENT FIRST ADDRESS
0296 00150    0 12 00447       IRS    WDCT            AND WORD COUNT
0297 00151    0 05 00452       ERA    CKSM            UPDATE CHECKSUM WITH
0298 00152    0406 77          ARR    1
0299 00153    0 04 00452       STA    CKSM            CHARACTER JUST PUNCHED
0300 00154    0 12 00451       IRS    PNCT            INCREMENT PUNCHCOUNT
0301 00155    0 01 00157       JMP    *+2             50 WORDS NOT YET PUNCHED
0302 00156    0 01 00226       JMP    ENBL            50 WORDS PUNCHED-END BLOCK
0303 00157    0 10 00207       JST    DECD            CHECK IF ZCOUNT ZERO
0304 00160    0 01 00221       JMP    GO              NO,PUNCH STORED WORD
0305 00161   -0 02 00444       LDA*   FADD            YES. LOAD NEXT WORD FROM MEMORY
0306 00162    100040           SZE                    IS IT ZERO
0307 00163    0 01 00201       JMP    NZZZ            NO
0308 00164    0 12 00450       IRS    ZCNT            YES,INCREMENT ZCOUNT
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0309 00165   0 12 00447       IRS   WDCT        AND WORDCOUNT
0310 00166   0 12 00444       IRS   FADD        AND FIRST ADDRESS
0311 00167   0 12 00451       IRS   PNCT        BUMP WORD COUNT
0312 00170   0 01 00213       JMP   CKLA        CHECK FOR LAST ADDRESS
0313 00171   0 02 00450       LDA   ZCNT        GO TERMINATE BLOCK
0314 00172   0 10 00277       JST   LOOP        PUNCH NO. OF ZERO WORDS
0315 00173   0 05 00452       ERA   CK$M        CALCULATE NEW CKSM
0316 00174   0406 77          ARR   1           *
0317 00175   0 04 00452       STA   CKSM        SAVE IT
0318 00176   140040           CRA               RESET ZCOUNT
0319 00177   0 04 00450       STA   ZCNT        DO IT
0320 00200   0 01 00226       JMP   ENBL        GO FINISH BLOCK
0321 00201   0 04 00454  NZZZ STA   WD          WORD NOT ZERO, STORE IT
0322 00202   0 02 00450       LDA   ZCNT        CHECK ZCOUNT
0323 00203   101040           SNZ               IS IT ZERO
0324 00204   0 01 00223       JMP   GO+2
0325 00205   0 10 00277       JST   LOOP        NO, TAKE ZCOUNT. PUNCH.
0326 00206   0 01 00151       JMP   MOVE+2      RETURN
0327 00207   0 000000  DECD DAC   **          DECISION SUBROUTINE
0328 00210   0 02 00450       LDA   ZCNT        CHECK ZCOUNT
0329 00211   101040           SNZ               IS IT ZERO
0330 00212   0 12 00207       IRS   DECD        YES, INCREMENT RETURN ADDRESS
0331 00213   0 02 00444  CKLA LDA   FADD        NO, CHECK
0332 00214   0 07 00470       SUB   =1
0333 00215   0 05 00445       ERA   LADD        LAST
0334 00216   100040           SZE               ADDRESS
0335 00217  -0 01 00207       JMP*  DECD        NOT REACHED, RETURN
0336 00220   0 01 00263       JMP   CHEK        LAST ADDRESS REACHED. CHECK ZCOUNT
0337 00221   140040     GO    CRA               RESTORE
0338 00222   0 04 00450       STA   ZCNT        ZCOUNT TO ZERO
0339 00223   0 02 00454       LDA   WD          TAKE STORED WORD
0340 00224   0 10 00277       JST   LOOP        AND PUNCH IT
0341 00225   0 01 00147       JMP   MOVE        AND CONTINUE.
0342                          *
0343                          *           END BLOCK
0344                          *
0345 00226   0 02 00450  ENBL LDA   ZCNT
0346 00227   0 04 00443       STA   Z
0347 00230   140040           CRA
0348 00231   0 04 00450       STA   ZCNT
0349 00232   0 02 00447       LDA   WDCT
0350 00233   0 05 00452       ERA   CKSM        WITH CHECKSUM
0351 00234   0 10 00277       JST   LOOP        AND PUNCH
0352 00235   0 10 00267       JST   XOF         PUNCH XOFF
0353 00236   0 01 00124       JMP   BGBL        BEGIN NEW BLOCK
0354 00237   0 10 00277  ZNZ  JST   LOOP        ZCOUNT NOT ZERO, PUNCH IT.
0355 00240   0 05 00452       ERA   CKSM        UPDATE
0356 00241   0406 77          ARR   1
0357 00242   0 04 00452       STA   CKSM        CHECKSUM
0358 00243   140040           CRA
0359 00244   0 04 00450       STA   ZCNT
0360 00245   0 02 00447       LDA   WDCT        LOAD WORD COUNT AND
0361 00246   0 05 00452       ERA   CKSM        ERA IT WITH CHECKSUM
0362 00247   0 10 00277       JST   LOOP        PUNCH CHECKSUM
0363 00250   0 10 00267       JST   XOF         PUNCH TWO XOF'S
0364 00251   0 10 00410       JST   TPON        TURN PUNCH ON
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0365 00252   0 10 00267        JST   XOF          SECOND XOF
0366 00253   0 10 00410        JST   TPON
0367 00254   0 10 00061        JST   LEAD         TURN PUNCH ON, PUNCH LEADER
0368 00255   0 02 00460        LDA   CODE         PICKUP OUTPUT DEVICE
0369 00256   0416 77           ALR   1            CHECK IF ASR-35
0370 00257   101400            SMI                *
0371 00260   100000            SKP                EITHER 33 OR H/S
0372 00261   0 10 00267        JST   XOF          STOP PUNCH ON ASR-35
0373 00262   0 01 00371        JMP   DONE         GO WRAP UP
0374 00263   0 02 00450  CHEK  LDA   ZCNT         IS ZCOUNT ZERO
0375 00264   100040            SZE
0376 00265   0 01 00237        JMP   ZNZ          NO, PUNCH IT
0377 00266   0 01 00245        JMP   ZNZ+6
0378 00267   0 000000    XOF   DAC   **           PUNCH XOFF ROUTINE
0379 00270   0 02 00442        LDA   XOFF         LOAD XOFF
0380 00271   74 0002           OTA   '2           PUNCH
0381 00272   0 01 00271        JMP   *-1          (DELAY IF PUNCH NOT READY)
0382 00273   0 02 00472        LDA   ='377
0383 00274   74 0002           OTA   '2
0384 00275   0 01 00274        JMP   *-1
0385 00276  -0 01 00267        JMP*  XOF          RETURN
0386 00277   0 000000    LOOP  DAC   **           MAIN PUNCH LOOP
0387 00300   0 10 00306        JST   TEST         IS WORD A ZCOUNT
0388 00301   0 05 00467        ERA   ='100000     YES, PUT ONE IN HIGH ORDER BIT
0389 00302   0 10 00331        JST   PNCH         PUNCH
0390 00303   0 10 00331        JST   PNCH         THREE
0391 00304   0 10 00331        JST   PNCH         CHARACTERS
0392 00305  -0 01 00277        JMP*  LOOP         RETURN
0393 00306   0 000000    TEST  DAC   **
0394 00307   0 04 00455        STA   SAVE         SAVE WORD
0395 00310   0 02 00450        LDA   ZCNT
0396 00311   101040            SNZ
0397 00312   0 01 00317        JMP   *+5
0398 00313   0 05 00466        ERA   =-1          TAKE TWO'S
0399 00314   0 06 00470        ADD   =1           COMPLEMENT
0400 00315   0 04 00455        STA   SAVE         UPDATE SAVE
0401 00316   0 01 00321        JMP   *+3          CONTINUE
0402 00317   0 12 00306        IRS   TEST         ZCOUNT ZERO, CONTINUE
0403 00320   0 02 00455        LDA   SAVE         REGAIN SAVE
0404 00321   0406 76           ARR   2            POSITION CHARACTER
0405 00322   0 04 00455        STA   SAVE
0406 00323   0 03 00465        ANA   ='36000      CLEAR TO CHARACTER
0407 00324  -0 01 00306        JMP*  TEST         RETURN
0408 00325   0404 66     HOB   LGR   10           CHANGE HIGH-ORDER
0409 00326   0 03 00464        ANA   ='37         BIT FROM CHANNEL 6
0410 00327   0 05 00463        ERA   ='200        TO CHANNEL 8
0411 00330   0 01 00335        JMP   *+5          AND GO TO PUNCH
0412 00331   0 000000    PNCH  DAC   **           PUNCH ROUTINE
0413 00332   100400            SPL                CHECK FOR
0414 00333   0 01 00325        JMP   HOB          HIGH ORDER BIT
0415 00334   0404 66           LGR   10           POSITION CHARACTER
0416 00335   0 04 00456        STA   SAVA         STORE IT
0417 00336   0 03 00464        ANA   ='37         SET UP FOR TRANSLATION CHECK
0418 00337   0 04 00457        STA   SAVB         STORE
0419 00340   0 02 00420        LDA   ADC1         LOAD ADDRESS OF TABLE
0420 00341   0 04 00421        STA   ADC2         SETUP FOR CHECK
```

```
0421  00342   -0 02 00421        LDA*  ADC2        LOAD FROM TABLE
0422  00343    101040            SNZ               CHECK FOR END OF TABLE
0423  00344    0 01 00362        JMP   OK          DONE, NO TRANSLATION NEEDED
0424  00345    0 03 00472        ANA   ='377       CLEAR 9 HIGH-ORDER BITS
0425  00346    0 05 00457        ERA   SAVB        CHECK FOR
0426  00347    101040            SNZ               MATCH
0427  00350    0 01 00353        JMP   TRNS        YES, TRANSLATE
0428  00351    0 12 00421        IRS   ADC2        NO, INCREMENT ADDRESS
0429  00352    0 01 00342        JMP   *-8         AND RETURN.
0430  00353    0 02 00456 TRNS LDA   SAVA        PICK UP ORIGINAL CHARACTER
0431  00354    0 03 00463        ANA   ='200       CLEAR ALL BUT BIT 8
0432  00355    0 04 00456        STA   SAVA        SAVE BIT
0433  00356   -0 02 00421        LDA*  ADC2        PICK UP SUBROUTINE
0434  00357    0404 70           LGR   8           CHARACTER
0435  00360    0 05 00456        ERA   SAVA        OBTAIN CORRECT BIT 8
0436  00361    0 01 00363        JMP   *+2         PUNCH
0437  00362    0 02 00456 OK   LDA   SAVA        NO TRANSLATION, GET CHARACTER
0438  00363    74 0002           OTA   '2          PUNCH
0439  00364    0 01 00363        JMP   *-1         (DELAY IF PUNCH NOT READY)
0440  00365    0 02 00455        LDA   SAVE        POSITION WORD
0441  00366    0416 72           ALR   6           FOR NEXT CHARACTER
0442  00367    0 04 00455        STA   SAVE        STORE CHARACTER
0443  00370   -0 01 00331        JMP*  PNCH        AND RETURN
0444  00371    14 0102  DONE OCP   '102
0445  00372    0 01 00002        JMP   BEGN        RESTART IF DESIRED
0446  00373    0 000000  P    DAC   **
0447  00374    0406 70           ARR   8
0448  00375    74 0002           OTA   '2          PUNCH
0449  00376    0 01 00375        JMP   *-1
0450  00377   -0 01 00373        JMP*  P
0451  00400    0 00 00000 PN   PZE   **
0452  00401    0 00 00000 PN88 PZE   **
0453  00402    0 10 00373        JST   P           PUNCH LOAD PROGRAM
0454  00403    0 10 00373        JST   P           IN 8-8 FORMAT
0455  00404    0 12 00401        IRS   PN88
0456  00405    0 12 00453        IRS   NDX
0457  00406    0 01 00401        JMP   PN88
0458  00407   -0 01 00400        JMP*  PN
0459  00410    0 000000  TPON DAC   **          TURN PUNCH ON
0460  00411    0 02 00461        LDA   PON         OUTPUT '222
0461  00412    74 0002           OTA   '2          IF ASR-35 IN USE.
0462  00413    0 01 00412        JMP   *-1
0463  00414    0 02 00462        LDA   RUB         OUTPUT '377
0464  00415    74 0002           OTA   '2          IF ASR-35 IN USE.
0465  00416    0 01 00415        JMP   *-1
0466  00417   -0 01 00410        JMP*  TPON
0467  00420    0 000422  ADC1 DAC   C1          ADDRESS OF C1
0468  00421             ADC2 BSS   1
0469                    *
0470                    * TRANSLATION TABLE.  ILLEGAL CHARACTER (7 LOW ORDER BITS)
0471                    * IN RIGHT-HAND HALF, AND SUBSTITUTION CHARACTER (7 LOW ORDER BITS)
0472                    * IN LEFT-HAND HALF.
0473                    *
0474  00422    077423   C1   OCT   77423,77021,76412,76005,0
      00423    077021
      00424    076412
```

```
      00425    076005
      00426    000000
0475                   *
0476  00427    14 0104  EASR OCP   '104
0477  00430    74 0004  PASR OTA   '4
0478  00431    14 0002  EBRP OCP   '2
0479  00432    74 0002  PBRP OTA   '2
0480  00433    177772   N6   DEC   -6
0481  00434    0 177740 NBL1 DAC   ST-BL2          NEGATIVE LENGTH OF FIRST LEVEL BOOT
0482  00435    177716   N50  DEC   -50
0483  00436    177610   N120 DEC   -120
0484  00437    0 177604 NBL2 DAC   WAIT-STPC-1     NEG LENGTH OF SECOND LEVEL BOOT
0485  00440    0 02 00540 LOAD LDA  ST             STARTING ADDRESS
0486  00441    000201   SOM  OCT   201
0487  00442    000223   XOFF OCT   223
0488  00443            Z    BSS   1
0489  00444            FADD BSS   1
0490  00445            LADD BSS   1
0491  00446            BLCT BSS   1
0492  00447            WDCT BSS   1
0493  00450            ZCNT BSS   1
0494  00451            PNCT BSS   1
0495  00452            CKSM BSS   1
0496  00453            NDX  BSS   1
0497  00454            WD   BSS   1
0498  00455            SAVE BSS   1
0499  00456            SAVA BSS   1
0500  00457            SAVB BSS   1
0501  00460            CODE BSS   1
0502  00461    000000  PON  BSZ   1
0503  00462    000000  RUB  BSZ   1
0504  00463    000200        FIN
      00464    000037
      00465    036000
      00466    177777
      00467    100000
      00470    000001
      00471    000052
      00472    000377
      00473    000222

0505  00474    000000        BSZ   '40
0506                   *
0507                   *          SYSTEM BOOTSTRAP
0508                   *
0509                        ORG   '540
0510  00540    0 000020 ST   DAC   '20       STARTING ADDRESS
0511                   *                   1 STA   '57      010057
0512                   *                   2 OCP   '000X    03000X
0513                   *                   3 INA   '100X    13100X
0514                   *                   4 JMP   *-1      002003
0515                   *                   5 SN7            101040
0516                   *                   6 JMP   *-3      002003
0517                   *                   7 STA   0        010000
0518                   *                  10 INA   '100X    13100X
0519                   *                  11 JMP   *-1      002010
```

```
0520                        *
0521                        *
0522                        *
0523                        *
0524                        *
0525                        *
0526 00541  0 01 00010      JMP   '10
0527 00542  0 02 00041      LDA   '41
0528 00543  0 04 00021      STA   '21
0529 00544  0 02 00057      LDA   '57
0530 00545  100040          SZE
0531 00546  0 04 00054      STA   '54
0532 00547  0 02 00054      LDA   '54
0533 00550  0 04 00000      STA   0
0534 00551  0 06 00055      ADD   '55
0535 00552  0 04 00055      STA   '55
0536 00553  000013          EXA
0537 00554  0 02 00013      LDA   '13
0538 00555  0 03 00044      ANA   '44
0539 00556  -0 04 00000     STA*  0
0540 00557  0 12 00000      IRS   0
0541 00560  0 02 00010      LDA   '10
0542 00561  0 01 00015      JMP   '15
0543 00562  0 01 00042      JMP   '42
0544 00563  0 04 00025      STA   '25
0545 00564  100000          SKP
0546 00565  077777          OCT   77777
0547 00566  101000          NOP
0548 00567  0 02 00051      LDA   '51
0549 00570  0 04 00020      STA   '20
0550 00571  0 01 00010      JMP   '10
0551 00572  -0 01 00054     JMP*  '54
0552 00573  140040          CRA
0553 00574  -0 01 00055     JMP*  '55
0554 00575  0 000600        DAC   BL2
0555 00576  000033          OCT   33
0556 00577  000000          OCT   0
0557                        *
0558                        *       LOADER
0559 00600  14 0001  BL2    OCP   1
0560 00601  54 0001         INA   1
0561                        *
0562 00602  0 01 00601 WAIT JMP   *-1
0563 00603  14 0101         OCP   '101      READER OFF IF ON
0564 00604  0 04 00022      STA   '22
0565 00605  0 05 00775      ERA   STPC      STOP CODE TEST
0566 00606  100040          SZE
0567 00607  -0 01 00731     JMP*  CHAR
0568 00610  -0 02 00731     LDA*  CHAR
0569 00611  0 05 00655      ERA   SCAN      TEST FOR SCAN MODE
0570 00612  101040          SNZ
0571 00613  0 01 00632      JMP   ENDT
0572 00614  0 02 00025      LDA   '25
0573 00615  101040          SNZ
0574 00616  0 01 00632      JMP   ENDT      END FILE EXIT
0575 00617  0 05 00020      ERA   '20
```

```
12 LGL    8         041470
13 INA    '000X     13000X
14 JMP    *-1        002013
15 STA*   0          110000
16 IRS    0          024000
17 SZE               100040
00020   TO FILL OUT BOOTSTRAP
00021   SET NEXT REENTRY
00022   *
00023   SET STARTING ADDRESS
00024   *
00025
00026
00027   *
00030
00031
00032
00033   SET IO ORDERS
00034
00035   *
00036   *
00037   *
00040   *
00041   SECOND REENTRY
00042   CLEAR WORDCOUNT
00043
00044
00045
00046   END.   SET UP FINAL REENTRY
00047   *
00050   *
00051
00052
00053   AUTOMATIC LOAD
00054   DEFAULT START
00055
00056   TERMINATE FIRST SECTION
```

```
0576  00620   0416 77           ALR    1
0577  00621   0 05 00021        ERA    '21
0578  00622   100040            SZE
0579  00623   0 01 00630        JMP    EROR
0580  00624   0 04 00025        STA    '25              RESET WORD COUNT
0581  00625   0 10 00731        JST    CHAR
0582  00626   0 12 00024  BUMP  IRS    '24              INCREMENT BLOCK COUNT
0583  00627   0 01 00634        JMP    STRT+1
0584  00630   000012     EROR   OCT    12               ERROR HALT
0585  00631   0 01 00630        JMP    *-1              HALT AGAIN IF STARTED
0586  00632   000012     ENDT   OCT    12               HALT. TAPE LOADED NORMALLY
0587  00633   0 04 00024  STRT  STA    '24              RESET BLOCK COUNT
0588  00634   140040            CRA
0589  00635   0 04 00022        STA    '22              RESET CHARACTER BUFFER
0590  00636   0 02 00010        LDA    '10              TEST FOR HIGH SPEED READER
0591  00637   0406 77           ARR    1
0592  00640   100400            SPL
0593  00641   0 01 00652        JMP    SCAN-3
0594  00642   34 0104           SKS    '104
0595  00643   0 01 00642        JMP    *-1
0596  00644   14 0104           OCP    '104
0597  00645   0 02 00766        LDA    ='221
0598  00646   74 0004           OTA    4
0599  00647   34 0104           SKS    '104
0600  00650   0 01 00647        JMP    *-1
0601  00651   14 0004           OCP    4
0602  00652   0 02 00022        LDA    '22
0603  00653   0 01 00655        JMP    *+2              TURN ON TELEPRINTER
0604  00654   0 10 00731        JST    CHAR             LEADER SCAN
0605  00655   0 05 00767  SCAN  ERA    ='22             START OF MESSAGE
0606  00656   100040            SZE
0607  00657   0 01 00654        JMP    *-3              *
0608  00660   0 04 00000        STA    0                *
0609  00661   0 04 00025        STA    '25              RESET WORD COUNT
0610  00662   0 02 00024        LDA    '24
0611  00663   0 04 00020        STA    '20              INITIALIZE BLOCK
0612  00664   0 10 00731        JST    CHAR
0613  00665   0 10 00704  DATA  JST    SWCH
0614  00666   0 01 00665        JMP    *-1              DO DATA LOAD
0615  00667   0 10 00715        JST    WORD             DO ZERO LOAD
0616  00670   0 05 00765        ERA    =2
0617  00671   0 04 00021        STA    '21
0618  00672   0 05 00020        ERA    '20
0619  00673   0406 77           ARR    1
0620  00674   0 04 00020        STA    '20
0621  00675   140040            CRA
0622  00676   -0 04 00000       STA*   0
0623  00677   0 12 00025        IRS    '25              ADD TO WORD COUNT
0624  00700   0 12 00000        IRS    0
0625  00701   0 12 00021        IRS    '21
0626  00702   0 01 00676        JMP    *-4              ADD TO WORD COUNT
0627  00703   0 01 00665        JMP    DATA
0628  00704   0 00 00052  SWCH  PZE    '52              INITIALIZED NONZERO CONSTANT
0629  00705   0 10 00715        JST    WORD
0630  00706   -0 04 00000       STA*   0
0631  00707   0 12 00000        IRS    0
```

0632	00710	0 12 00025		IRS	'25	ADD TO WORD COUNT
0633	00711	0 05 00020		ERA	'20	
0634	00712	0406 77		ARR	1	
0635	00713	0 04 00020		STA	'20	
0636	00714	-0 01 00704		JMP*	SWCH	
0637	00715	0 00 00052	WORD	PZE	'52	INITIALIZED NONZERO C
0638	00716	140040		CRA		
0639	00717	0 04 00021		STA	'21	
0640	00720	0 10 00731		JST	CHAR	
0641	00721	0 10 00731		JST	CHAR	
0642	00722	0 10 00731		JST	CHAR	
0643	00723	0414 70		LGL	8	
0644	00724	101400		SMI		TEST FOR ZERO-COUNT WORD
0645	00725	0 12 00704		IRS	SWCH	
0646	00726	0 02 00021		LDA	'21	
0647	00727	0406 77		ARR	1	
0648	00730	-0 01 00715		JMP*	WORD	FIRST TIME IN-RETURN VIA '52
0649	00731	0 000052	CHAR	DAC	'52	
0650	00732	0 02 00022		LDA	'22	
0651	00733	0414 70		LGL	8	
0652	00734	100400		SPL		
0653	00735	0 12 00021		IRS	'21	
0654	00736	0414 77		LGL	1	
0655	00737	0 05 00764		ERA	='174000	
0656	00740	101040		SNZ		
0657	00741	0 02 00763		LDA	='171000	
0658	00742	0 05 00762		ERA	='1000	
0659	00743	101040		SNZ		
0660	00744	0 02 00761		LDA	='167000	
0661	00745	0 05 00770		ERA	L1	
0662	00746	101040		SNZ		
0663	00747	0 02 00771		LDA	L2	
0664	00750	0 05 00762		ERA	='1000	
0665	00751	101040		SNZ		
0666	00752	0 02 00772		LDA	L3	
0667	00753	0 05 00773		ERA	L4	
0668	00754	0414 76		LGL	2	
0669	00755	0 05 00021		ERA	'21	IN ACC. READ NEXT.
0670	00756	0416 72		ALR	6	EXIT ON STOP CODE.
0671	00757	0 04 00021		STA	'21	OTHERWISE TRANSLATE
0672	00760	0 01 00600		JMP	WAIT-2	
0673	00761	167000		FIN		
	00762	001000				
	00763	171000				
	00764	174000				
	00765	000002				
	00766	000221				
	00767	000022				
0674	00770	002000	L1	OCT	2000	
0675	00771	154000	L2	OCT	154000	
0676	00772	157000	L3	OCT	157000	
0677	00773	176000	L4	OCT	176000	
0678	00774	000000		OCT	0	
0679	00775	000223	STPC	OCT	223	
0680			*		LOCATION	FUNCTION

```
0681                    *                        CHECKSUM
0682                    *        20              ACCUMULATOR
0683                    *        21              CHARACTER BUFFER
0684                    *        22              BLOCK COUNT
0685                    *        24              WORD COUNT
0686                    *        25
0687                         END
```

```
ADC1   000420   ADC2   000421   BEGN   000002   BGBL   000124
BL2    000600   BLCT   000446   BUMP   000626   C1     000422
CHAR   000731   CHEK   000263   CKLA   000213   CKSM   000452
CODE   000460   CONT   000052   DATA   000665   DECD   000207
DONE   000371   EASR   000427   EBRP   000431   ENBL   000226
ENDT   000632   EPNC   000056   EROR   000630   FADD   000444
GO     000221   HISP   000043   HOB    000325   L1     000770
L2     000771   L3     000772   L4     000773   LADD   000445
LDR    000077   LEAD   000061   LLOP   000070   LOAD   000440
LOOP   000277   MOVE   000147   N120   000436   N50    000435
N6     000433   NBL1   000434   NBL2   000437   NDX    000453
NZ72   000201   OK     000362   ORUB   000116   P      000373
PASR   000430   PBRP   000432   PN     000400   PN88   000401
PNC    000065   PNCH   000331   PNCT   000451   PON    000461
RUB    000462   SAVA   000456   SAVB   000457   SAVE   000455
SCAN   000655   SOCP   000016   SOM    000441   SOTA   000021
ST     000540   STPC   000775   STRT   000633   SWCH   000704
TEST   000306   TF35   000033   TPON   000410   TRNS   000353
WAIT   000602   WD     000454   WDCT   000447   WORD   000715
XOF    000267   XOFF   000442   Z      000443   ZCNT   000450
ZN7    000237
0000 WARNING OR ERROR FLAGS
DAP-16 MOD 2    REV. D    06-28-71
```

	467	ADC1	419					
	468	ADC2	420C	421	428C	433		
	191	BEGN	445J					
	276	BGBL	208C	272J	353J			
	559	BL2	481	554				
	491	BLCT	232C	285	287C			
N	582	BUMP						
	474	C1	467					
	649	CHAR	254C	567J	568	581J	604J	612J
			640J	641J	642J			
	374	CHEK	336J					
	331	CKLA	312J					
	495	CKSM	286C	297	299C	315	317C	350
			355	357C	361			
	501	CODE	190C	197	368			
	231	CONT	215J					
	613	DATA	627J					
	327	DECD	303J	330C	335J			
	444	DONE	373J					
	476	EASR	203					
	478	EBRP	227					
	345	ENBL	302J	320J				
	586	ENDT	571J	574J				
	235	EPNC	204C	228C				
	584	EROR	579J					
	489	FADD	193C	288	295C	305	310C	331
	337	GO	304J	324J				
	224	HISP	218J					
	408	HOB	414J					
	674	L1	661					
	675	L2	663					
	676	L3	666					
	677	L4	667					
	490	LADD	196C	333				
	252	LDR	237J					
	238	LEAD	244C	251J	252J	271J	367J	
	245	LLOP	211C					
	485	LOAD	259					
	386	LOOP	290J	314J	325J	340J	351J	354J
			362J	392J				
	295	MOVE	326J	341J				
	483	N120	239					
	482	N50	283					
	480	N6	277					
	481	NBL1	257					
	484	NBL2	264					
	496	NDX	240C	248C	258C	265C	278C	456C
	321	NZZZ	307J					
	437	OK	212C	423J				
	267	ORUB	214C					
	446	P	213C	450J	453J	454J		
	477	PASR	205					
	479	PBRP	229					
	451	PN	261J	266J	458J			
	452	PN88	260C	262C	263C	455C	457J	

242	PNC	243	279J			
412	PNCH	389J	390J	391J	443J	
494	PNCT	284C	300C	311C		
502	PON	201C	220C	225C	460	
503	RUB	202C	222C	226C	463	
499	SAVA	416C	430	432C	435	437
500	SAVB	418C	425			
498	SAVE	293	394C	400C	403	405C	440
		442C				
605	SCAN	569	593J			
203	SOCP	223J				
486	SOM	280				
206	SOTA	230J				
510	ST	481	485			
679	STPC	484	565			
587	STRT	583J				
628	SWCH	255C	613J	636J	645C	
393	TEST	387J	402C	407J		
216	TF35	199J				
459	TPON	206C	207C	236J	270J	276J	364J
		366J	466J			
430	TRNS	427J				
562	WAIT	484	672J			
497	WD	321C	339			
492	WDCT	250C	296C	309C	349	360
637	WORD	256C	615J	629J	648J	
378	XOF	209C	210C	352J	363J	365J	372J
		385J				
487	XOFF	379				
486	Z	234C	291	346C		
493	ZCNT	233C	292C	308C	313	319C	322
		328	338C	345	348C	359C	374
		395				
354	ZNZ	376J	377J			
	=*1000	658	664			
	=*100000	388				
	=*167000	660				
	=*171000	657				
	=*174000	655				
	=*200	410	431			
	=*22	605				
	=*221	597				
	=*222	219				
	=*36000	406				
	=*37	409	417			
	=*377	221	267	382	424	
	=*52	253				
	=-1	398				
	=1	289	332	399		
	=2	616				

```
 97  SYMBOLS
237  REFERS
687  RECORDS
  1  N FLAGS
```