UNIVAC SCIENTIFIC
1103 AF

COMPLETE OPERATIONAL SYSTEM

Symbolic Assembly Program
Diagnostic and Service Routines
Arithmetic Subroutines
Input - Output Routines

Lockheed MISSILE SYSTEMS DIVISION
A Division of Lockheed Aircraft Corporation

The system presented here was designed and developed by the Systems Development Group of the Computer Services Department to facilitate the solution of general scientific problems on the Univac 1103AF.

The following personnel joined in the planning and programming: Frank Brown, Tom Dewey, Ray Hedberg, Dave Nelson, Al Podvin, Don Richards, Bob Rock, Don Wilson, and Wolf Wootan. Special credit is given to Bernie Dove, Dr. Dick Talmadge, presently of IBM, and Jack Reynolds, also of IBM.

This system has been in successful operation on LMSD's two 1103AF computers since March 15, 1958.

A Basic Operational Scheduling System (BOSS Automonitor) is presently undergoing extensive testing and will become an integral part of the system in early September.

Requests for additional copies of this publication should be addressed to:

Executive Secretary, USE
Remington Rand Univac
Division of Sperry Rand Corp.
315 Fourth Avenue
New York 10, New York

SECTION I

SLAP

Symbolic Language Assembly Program

2-Core Version - R. Rock
1-Core Version - D. Richards

SYMBOLIC LANGUAGE ASSEMBLY PROGRAM (SLAP)

I. GENERAL DESCRIPTION

The Symbolic Language Assembly Program is a two-pass, decimal, symbolic assembly program which is designed to translate a Univac Scientific Model 1103A program coded in symbolic, decimal, and octal form into its final binary form.

At present, SLAP is designed for an 1103A with variable block tape mode and 8192 words of magnetic core storage. A maximum of 1024 tags, 100 constants, and 75 undefined tags is permitted.

The average assembly rate is 800 lines of coding per minute.

A sample coding sheet is included as Figure 2.

II. INPUT

SLAP accepts information from magnetic tape prepared by the Card-to-Tape Converter. The allocation with respect to the card column is as follows:

- 1-6 Location field. This field should contain a tag or be blank. If no tag appears, the field is ignored. A tag may contain as many as 6 alphanumeric characters, at least one of which must be alphabetic.
- 7-10 Standard 1103A mnemonic operation characters or pseudo-instruction symbols. Blank or zero operations are also valid. Octal operations will translate correctly but will cause an error indication.
- 13-24 U address field. This field may contain a reference to a tag, a constant, or a decimal or octal location, or it may be blank.
- 25-36 V address field. Same as the U address.
- 37-60 Comments. Up to 24 Hollerith characters are permissible.
- 75-80 Sequence number.

LOCKHEED AIRCRAFT CORPORATION–MISSILE SYSTEMS DIVISION

SLAP CODING SHEET

TITLE _____ DATE _____ PAGE ____ OF _____

JOB _____ RWA _____ CODED _____ CHECKED _____

TAG	OP	U	V	COMMENTS	SEQUENCE
1 6	7 . . 10	13 24	25 36	37 60	75 80

III. OUTPUT

SLAP yields the following outputs:

- An XS-3 tape containing a reproduction of the symbolic program, a listing of the sequence numbers from the cards, and a side-by-side octal translation for listing purposes.
- An octal XS-3 tape containing the octal translation and necessary information for loading of the program.

IV. REMARKS*

1. The storage and execution addresses will both begin at 00010_8 unless a pseudo SETL instruction is given.
2. The storage address will appear in the octal translation only if it differs from the execution address.
3. L is a special tag and will be translated as the execution address of the instruction in which it appears. L may not appear in the tag field.
4. FILL is a special tag and will be translated as 30000. FILL may not appear in the tag field.
5. The j of the repeat instruction appears in the operation field and may be written as RP1, RP2, RP3, or RPV, RPU, RPB.
6. The j of the Left Transmit instruction appears in the operation field and may be written as LT0, LT1, or LTL, LTR.
7. A and Q are special tags and will be translated as 32000 and 31000, respectively. They may not appear in the tag field.
8. If the content of the U field or the V field is numerical, it will be translated as a decimal integer. If the content of the field ends with B but is otherwise numerical, it will be translated as an octal integer.
9. Decimal increments less than 10^6 are permitted.
10. The Compiled Region is a block of consecutive cells set aside by SLAP for the constant pool and undefined tags. Normally it is located immediately after the last program address,

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* See Figure 3.

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ALPHA   MJ              BETA        See REMARK 1                        00010   45 00000 00454
        SETL    60000B) 300         See PSEUDO-INSTRUCTIONS
BETA    TV      BETA    ALPHA       See REMARK 2            60000   00454   16 00454 00010
        SJ      L+1     L+2         See REMARK 3            60001   00455   46 00456 00457
        MS              FILL        See REMARK 4            60002   00456   56 00000 30000
        RPV     3       L-2         See REMARK 5            60003   00457   75 10003 00455
DELTA   TP      BETA+1  BETA-1                              60004   00460   11 00455 00453
        SETL            S           See PSEUDO-INSTRUCTIONS
        LTR     12      DELTA+1     See REMARK 6                    60005   22 10014 00461
GAMMA   TN      A       Q           See REMARK 7                    60006   13 32000 31000
        SETL            1           See PSEUDO-INSTRUCTIONS
        RA      100B)   100         See REMARK 8            60007   00001   21 00100 00144
        ST      GAMMA+999 GAMMA-999 See REMARK 9            60010   00002   36 61754 56040
        MP      L(123)  L(123B)     See REMARK 10           60011   00003   11 00042 00043
K       EQLS    15                  See PSEUDO-INSTRUCTIONS
        SA      DELTA   K                                   60012   00004   32 00460 00017
        F       1.50    2           See PSEUDO-INSTRUCTIONS 60013   00005   21 04540 00000
        F       15000   -2                                  60014   00006   21 04540 00000
        S15     1       3           See PSEUDO-INSTRUCTIONS 60015   00007   00 01750 00000
        S  -    150     -1                                  60016   00010   77 77777 77760
        B       123                 See PSEUDO-INSTRUCTIONS 60017   00010   00 00000 00123
        B15     123                                         60020   00011   00 00123 00000
        RSRV    10B)    20          See PSEUDO-INSTRUCTIONS
        CALL    SINE                See PSEUDO-INSTRUCTIONS 60031   00036   37 00041 00037
SINE    QR      L(77)   SLAP        See WARNINGS            60032   00037   53 00044 00045  NOP         DEF
        TP      108B)   BETA+B                              60033   00040   11 00010 00454          OCT     DEC
        MJ              SINE/+3     See REMARK 11           60034   00041   45 00000 60035
                        CONSTANT POOL           L(123)      60035   00042   00 00000 00173
                                                L(123B)     60036   00043   00 00000 00123
                                                L(77)       60037   00044   00 00000 00115
                        UNDEFINED TAGS          SLAP        60040   00045   00 00000 00000
        END     DELTA/              See REMARK 12                       60004
```

Fig. 3 Sample SLAP Program

but the programmer may locate it wherever he wishes, with a pseudo SETL instruction immediately preceding the END instruction.

The Constant Pool contains all the constants, expressed in L(xx) form, in the program. SLAP will assign locations in the Constant Pool to octal and decimal integers less than 2^{28} and 10^{10}, respectively. A maximum of 100 constants of this type is permitted.

Undefined Tags are tags referred to in the program that have not appeared in the tag field. SLAP will assign to these tags locations immediately following the Constant Pool. A warning will be given for all such references. Initially, all cells set aside for undefined tags will be zero. A maximum of 75 undefined tags is permitted.

11. When a tag is followed immediately by a / (slash), the storage address (rather than the execution address) appears as the translation.

12. The U field of the END pseudo-instruction may be used for a symbolic, decimal, or octal starting address. The octal translation of this address will appear in PAK whenever the program has been completely loaded into memory.

V. PSEUDO-INSTRUCTIONS

SETL will set the storage and execution location counters as specified by the contents of U and V, respectively. References to tags are not permitted in the U and V fields. If either field is blank or zero, the corresponding location counter will not be changed. An E appearing in the U field will equate the storage location counter to the current execution location counter. An S in the V field will equate the execution location counter to the current storage location counter. (A tag in the tag field will translate as the location of the previous instruction plus one, not as the location specified by the SETL.)

RSRV will add the contents of U and V to the storage and execution location counters, respectively. References to tags in the U and V fields are not permitted.

EQLS will equate the tag appearing in the tag field to the contents of U. U may contain an octal or decimal integer or a reference to a tag. No tag defined by an EQLS may be used to define another tag.

CALL. See VII, Subroutines.

F will convert the decimal number appearing in the U field to a floating binary. A decimal point may appear anywhere in the U field. In the absence of a decimal point, the number is assumed to be an integer. Decimal scaling, if any, appears in the V field. If the scaling is negative, a minus sign must precede the scale factor. No sign is given for positive scale factors. The sign of the number appears in the low order of the operation field.

S will convert the decimal number appearing in the U field to a binary number whose scaling is specified in the operation field. A decimal point may appear anywhere in the U field. In the absence of a decimal point, the number is assumed to be an integer. Decimal scaling, if any, appears in the V field. If the scaling is negative. a minus sign must precede the scale factor. No sign is given for positive scale factors. The sign of the number appears in the low order of the operation field.

B will scale the octal number appearing in the U field as specified in the operation field.

XS3 will convert the first 6 digits of the U field (including blanks) into octal excess-three equivalents.

END will terminate assembly.

VI. WARNINGS

The following warnings may appear to the right of the octal translation on the symbolic listing and are indications of possible errors in the line of coding in which they appear.

- NOP - The operation is incorrect. The nearest valid machine instruction appears in the octal translation.
- DEF - Reference has been made to a tag that does not appear in the tag field of the program. SLAP assigns a cell in the compiled region for each undefined tag.
- DUP - Reference has been made to a tag that has appeared more than once in the tag field of the program. Any reference to a duplicate tag will be given the execution location of the line of coding in which the tag first appears.
- OCT - An octal location or constant contains a nonoctal character.

- DEC - A decimal location or constant contains a nondecimal character.

- EXP - The decimal scaling of a floating or stated point decimal number is either too large or too small. In either case the result is zero.

VII. SUBROUTINES

The CALL pseudo-instruction will generate the calling sequence referred to in the U address of the pseudo-instruction. For example, CALL SINE _____ will be translated as RJ SINE+2 SINE.

```
        SETL  50000B)       50000B)
START   RPB   2000          PASS1       BOOTSTRAP SLAP                    50000  75 33720 00010
        TP    PASS1/        PASS1        TO CORE                          50001  11 50002 00010
        SETL                2500B)
W       RSRV                21          W STORAGES                        02500
TEMP    RSRV                15          TEMPORARY BUFFER                  02525
CPT     RSRV                300         CONSTANT POOL                     02544
DTT     RSRV                25          DUPLICATE TAG TABLE               03220
UT      RSRV                75          UNDEFINED TAG TABLE               03251
BT      RSRV                340         OCTAL TAPE BUFFER                 03364
WT      RSRV                720         INPUT-OUTPUT BUFFER               04110
1BUF    RSRV                1025        SORT BUFFER                       05430
2BUF    RSRV                1025        SORT BUFFER                       07431
TT      RSRV                1025        TAG TABLE BUFFER                  11432
TL      RSRV                1025        TAG LOCATION BUFFER               13433
DSTORE  EQLS  50000B)                   DRUM BUFFER
        SETL                10B)
PASS1   RPV   1024          L+2         FILL TAG TABLE WITH       50002 00010  75 12000 00012
        TP    L-1           TT           LARGE ENTRIES            50003 00011  11 00010 11432
        LA    A             12          STORE OCTAL TAPE UNI-     50004 00012  54 32000 00014
        TP    A             T174         SERVO NUMBER IN T174     50005 00013  11 32000 01623
        ZJ    L+3           L+1         IF A IS ZERO NO OCTAL     50006 00014  47 00017 00015
        TP    T113-2        T113-1       TAPE WILL BE WRITTEN     50007 00015  11 01436 01437
        TP    T24+3         T24+4        SO GIMMICK OCTAL SETUP   50010 00016  11 00264 00265
        QJ    L+1           L+2         IF HIGH BIT IN Q IS ONE   50011 00017  44 00020 00021
        RA    T171+3        L(200000B)   KILL FINAL TAPE REWINDS   50012 00020  21 01607 02110
        LQ    Q             11          SUBSTITUTE LOW ORDER      50013 00021  55 31000 00013
        TP    Q             TEMP         4 BITS IN Q INTO THE     50014 00022  11 31000 02525
        TP    L(170000B)    Q            EF CODES THAT WRITE      50015 00023  11 02111 31000
        QS    TEMP          RWND5        AND REWIND THE SYMBOLIC  50016 00024  53 02525 02042
        QS    TEMP          WTP5         OUTPUT TAPE              50017 00025  53 02525 02041
        LQ    TEMP          21          SUBSTITUTE THE LOW ORDER  50020 00026  55 02525 00025
        TP    L(170000B)    Q            4 BITS IN U OF Q INTO    50021 00027  11 02111 31000
        QS    TEMP          RDTP4        THE EF CODES THAT READ,  50022 00030  53 02525 02035
        QS    TEMP          MBACK        MOVE BACK 1 BLOCK, MOVE  50023 00031  53 02525 02037
        QS    TEMP          RWND4        BACK N BLOCKS AND REW-   50024 00032  53 02525 02036
        QS    TEMP          MBCK1        IND THE INPUT TAPE       50025 00033  53 02525 02040
        EF                  RDTP4       START INPUT TAPE          50026 00034  17 00000 02035
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T1      RJ    T15          RDTAPE      READ ONE BLOCKETTE                50027 00035  37 00212 00176
        SP    W+13         36          MOVE SEQUENCE NUMBERS             50030 00036  31 02515 00044
        SA    W+14                      FROM POSITIONS 75-80              50031 00037  32 02516 00000
        LTL   12           W+11        TO 61-66 FOR OUTPUT               50032 00040  22 00014 02513
        RPB   11           L+2         STORE ONE INSTRUCTION             50033 00041  75 30013 00043
T2      TP    W+1          WT          IN 1980 WORD BUFFER               50034 00042  11 02501 04110
        TP    W+2          A           TEST OPERATION FIELD FOR          50035 00043  11 02502 32000
        EJ    END          T8          PSEUDO END INSTRUCTION            50036 00044  43 02063 00117
        RA    T2           L(11)       BUMP STORE INSTRUCTION            50037 00045  21 00042 02112
        RA    T136A        L(1)        BUMP INSTRUCTION TALLY            50040 00046  21 01475 02113
        RA    T136         L(1)        BUMP INSTRUCTION TALLY            50041 00047  21 01474 02113
T3      TJ    L(180)       T5          TEST FOR 180 INSTRUCTION          50042 00050  42 02114 00064
        TP    L(0)         T136        RESET INSTRUCTION TALLY           50043 00051  11 02115 01474
        TV    T149         T2          RESET STORE INSTRUCTION           50044 00052  16 01510 00042
        EF                 STAPE       STOP INPUT TAPE                   50045 00053  17 00000 02045
T4      RPB   1980         L+2         STORE 180 INSTRUCTIONS            50046 00054  75 33674 00056
        TP    WT           DSTORE      IN DRUM BUFFER (DSTORE)           50047 00055  11 04110 50000
        RA    L-1          L(1980)     BUMP DRUM STORE INSTR             50050 00056  21 00055 02116
        RA    T137         L(1)        BUMP DRUM STORE TALLY             50051 00057  21 01476 02113
        TJ    L(6)         L+3         TEST IF DRUM IS FULL              50052 00060  42 02117 00063
        TP    T148         T3          SET EXIT WHEN DRUM FULL           50053 00061  11 01507 00050
        TU    T5+2         T2+3        AND CHANGE BUMP INSTRCT           50054 00062  15 00066 00045
        EF                 RDTP4       START INPUT TAPE                  50055 00063  17 00000 02035
T5      RJ    T56          T50         IF LOCATION FIELD HAS A           50056 00064  37 00630 00566
        ZJ    L+1          T6          TAG LEAVE IN ACCUMLATOR           50057 00065  47 00066 00076
        TP    A            TT          STORE TAG IN TT TABLE             50060 00066  11 32000 11432
        RA    L-1          L(1)        BUMP TAG STORE                    50061 00067  21 00066 02113
        SP    T121         15          COMBINE STORAGE AND               50062 00070  31 01455 00017
T5A     AT    T120         TL          EXEC L CTRS INTO TL               50063 00071  35 01454 13433
        RA    L-1          L(1)        BUMP L COUNTER STORE              50064 00072  21 00071 02113
        RA    T128         L(100000B)  BUMP TAG TALLY                    50065 00073  21 01465 02120
        TJ    T129         T6          TEST FOR TOO MANY TAGS            50066 00074  42 01463 00076
        TV    T5+1         T5          GIMMICK EXIT                      50067 00075  16 00065 00064
T6      RJ    T75          T74         TEST FOR RSRV OR SETL             50070 00076  37 01043 01040
        EJ    EQLS         T7          TEST FOR EQLS                     50071 00077  43 02060 00107
        EJ    XS3          T6A         TEST FOR XS-3 PSEUDO OP           50072 00100  43 02071 00105
        EJ    W+2          L+2         IF NEITHER CONTINUE TEST          50073 00101  43 02502 00103
        MJ                 T1          GO BACK TO TAPE READ              50074 00102  45 00000 00035
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        RJ    T56          T51          TEST U FIELD FOR CONSTS      50075 00103  37 00630 00571
        RJ    T56          T52          TEST V FIELD FOR CONSTS      50076 00104  37 00630 00574
T6A     RPU   2            T1           BUMP LOCATION COUNTERS       50077 00105  75 20002 00035
        RA    T120         L(1)          GO BACK TO TAPE READ        50100 00106  21 01454 02113
T7      RPB   2            L+2          STORE U ADDRESS OF EQLS      50101 00107  75 30002 00111
        TP    W+3          BT+100        INSTR INTO BT BUFFER        50102 00110  11 02503 03530
        TV    T5A          L+2           FOR TRANSLATION BETWEEN     50103 00111  16 00071 00113
        RS    L+1          L(1)          PASSES STORE ADDRESS        50104 00112  23 00113 02113
        TN    T7+1                       OF THIS STORE IN TL         50105 00113  13 00110 00000
        RA    T7+1         L(2)          TABLE NEGATIVELY            50106 00114  21 00110 02121
        RA    T130         L(1)         BUMP EQUALS TALLY            50107 00115  21 01466 02113
        MJ                 T1           READ NEXT BLOCKETTE          50110 00116  45 00000 00035
T8      EF                 STAPE        STOP INPUT TAPE              50111 00117  17 00000 02045
        RS    T136A        L(1079)      TEST IF PROGRAM HAS          50112 00120  23 01475 02122
        SJ    L+1          L+3           MORE THAN 1080 WORDS        50113 00121  46 00122 00124
        RJ    T4           T4           STORE LAST BLOCK ON DRUM     50114 00122  37 00054 00054
        MJ                 PASS2        GO TO PASS 2                 50115 00123  45 00000 00126
        AT    MBACK        MBACK        COMPUTE NUMBER OF BLOCKS     50116 00124  35 02037 02037
        EF                 MBACK         TO MOVE BACK  MOVE BACK     50117 00125  17 00000 02037
PASS2   TP    T120         T134         STORE LAST EXECUTION ADD     50120 00126  11 01454 01472
        TP    T121         T135         STORE LAST STORAGE ADDR      50121 00127  11 01455 01473
        TP    L(10B)       T120         RESTORE EXECUTION COUNTR     50122 00130  11 02123 01454
        TP    L(10B)       T121         RESTORE STORAGE COUNTER      50123 00131  11 02123 01455
        TP    L(0)         SIND         CLEAR (SIND) INDICATOR       50124 00132  11 02115 02064
        TU    T67+1        T68+1        CHANGE EXIT FOR PASS 2       50125 00133  15 01006 01010
        TV    T69+1        T62-1        CHANGE EXIT FOR PASS 2       50126 00134  16 01014 00706
        TV    T155         T57-1        CHANGE EXIT FOR PASS 2       50127 00135  16 01516 00640
        RA    T127         T134         COMPUTE 1ST UDT ADDRESS      50130 00136  21 01464 01472
        RJ    T210A+1      SORT         SORT TAG TABLE               50131 00137  37 02024 01723
        RJ    T37          EQUALS       TRANSLATE EQLS COMMANDS      50132 00140  37 00314 00277
        RJ    T38+1        T38          TEST FOR DUPLICATE TAGS      50133 00141  37 00316 00315
        RPV   100          L+2          CLEAR BT-BT+99 FOR OCTAL     50134 00142  75 10144 00144
        TP    L(0)         BT            TAPE CONTROL INFORMTION     50135 00143  11 02115 03364
T10     RJ    T27          T26          FETCH SIX INSTRUCTIONS       50136 00144  37 00276 00270
        TP    BLNKS        W+11         SET W+11 TO BLANKS           50137 00145  11 02100 02513
        RPV   3            L+2          SET STORAGES W+17 TO         50140 00146  75 10003 00150
        TP    BLNKS        W+17          W+19 TO BLANKS              50141 00147  11 02100 02521
        RPB   11           L+2          BRING ONE INSTRUCTION        50142 00150  75 30013 00152
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T10A    TP    WT+1200        W+1              TO W STORAGES                    50143 00151  11 06370 02501
        RA    L-1            L(1300000B)      BUMP STORE COMMAND               50144 00152  21 00151 02124
        TP    BLNKS          T138             CLEAR ERROR INDICATOR            50145 00153  11 02100 01477
        SP    T120                            STORE EXECUTION ADDRESS          50146 00154  31 01454 00000
        TP    A              W+13              IN W+13 TEST IF EQUAL           50147 00155  11 32000 02515
        TP    BLNKS          W+12              TO STORAGE ADDRESS  IF          50150 00156  11 02100 02514
        EJ    T121           L+2               SO SET W+12 BLANK  IF           50151 00157  43 01455 00161
        TP    T121           W+12              NOT STORE STORAGE- W+12         50152 00160  11 01455 02514
        SP    W+2            18               TEST FOURTH POSITION             50153 00161  31 02502 00022
        SP    A                                OF OP IF NOT ZERO               50154 00162  31 32000 00000
        ZJ    T11            T11A              TEST FOR PSEUDO OPERS           50155 00163  47 00164 00171
T11     RJ    T75            T74              TEST FOR RSRV OR SETL            5Q156 00164  37 01043 01040
        EJ    EQLS           L+2              TEST FOR EQLS                    50157 00165  43 02060 00167
        EJ    W+2            L+3              TEST FOR NONE OF ABOVE           50160 00166  43 02502 00171
        RPV   6              T12              SET STORAGES W+14 - W+19         50161 00167  75 10006 00174
        TP    BLNKS          W+14              TO BLANKS                       50162 00170  11 02100 02516
T11A    RA    T120           L(1)             BUMP LOCATION COUNTER            50163 00171  21 01454 02113
        RA    T121           L(1)             BUMP LOCATION COUNTER            50164 00172  21 01455 02113
        MJ                   OFETCH           GO TO OPERATION LOOK UP          50165 00173  45 00000 00327
T12     RJ    T25            T21              STORE INSTRUCTION IN BUF         50166 00174  37 00267 00236
        SJ    T10            T10+2            TRANSLATE NEXT INSTRTION         50167 00175  46 00144 00146
RDTAPE  TV    T153           T13              PRESET TAPE LOAD                 50170 00176  16 01514 00204
        ER0                  A                READ IOA INTO A                  50171 00177  76 00000 32000
        EJ    L(1)           T14              TEST FOR PARITY ERROR            50172 00200  43 02113 00207
        EJ    L(2)           T15-1            TEST FOR END OF BLOCK            50173 00201  43 02121 00211
T12A    EJ    L(3)           T15+1            TEST FOR MOD3 ERROR              50174 00202  43 02125 00213
        EJ    L(4)           T16              TEST FOR END OF TAPE             50175 00203  43 02126 00215
T13     ER1                  W+1              READ ONE WORD INTO W+1           50176 00204  76 10000 02501
        RA    L-1            L(1)             BUMP TAPE LOAD COMMAND           50177 00205  21 00204 02113
        MJ                   RDTAPE+1         GO TO READ NEXT WORD             50200 00206  45 00000 00177
T14     TV    T12A           T15-1            SET SWITCH FOR PARITY            50201 00207  16 00202 00211
        MJ                   T13              READ REST OF BLOCK               50202 00210  45 00000 00204
        RJ    L              L+1              ONE SHOT SWITCH                  50203 00211  37 00211 00212
T15     MJ                                    SUCCESS EXIT                     50204 00212  45 00000 00000
        EF                   STAPE            STOP INPUT TAPE                  50205 00213  17 00000 02045
        EF                   MBCK1            MOVE BACK ONE BLOCK              50206 00214  17 00000 02040
T16     EF                   RDTP4            START INPUT TAPE                 50207 00215  17 00000 02035
        MJ                   RDTAPE           READ LAST BLOCK AGAIN            50210 00216  45 00000 00176
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T18     EF                      RDTP4           START INPUT TAPE                50211 00217  17 00000 02035
        TP      L(119)          TEMP+7          SET BLOCKETTE INDEX             50212 00220  11 02127 02534
        TV      T154            T19A            PRESET STORE COMMAND            50213 00221  16 01515 00227
T19     RJ      T15             RDTAPE          READ ONE BLOCKETTE              50214 00222  37 00212 00176
        SP      W+13            36              MOVE SEQUENCE NUMBERS           50215 00223  31 02515 00044
        SA      W+14                             FROM POSITIONS 75-80           50216 00224  32 02516 00000
        LTL     12              W+11              TO  61-66                     50217 00225  22 00014 02513
        RPB     11              L+2             STORE ONE INSTRUCTION           50220 00226  75 30013 00230
T19A    TP      W+1             WT+1200          INTO CORE BUFFER               50221 00227  11 02501 06370
        TP      W+2             A               TEST OPERATION FOR              50222 00230  11 02502 32000
        EJ      END             T20-1            END  INSTRUCTION               50223 00231  43 02063 00234
        RA      T19A            L(11)           BUMP STORE COMMAND              5Q224 00232  21 00227 02112
        IJ      TEMP+7          T19             TEST FOR 120 BLOCKETTES         50225 00233  41 02534 00222
        EF                      STAPE           STOP INPUT TAPE                 50226 00234  17 00000 02045
T20     MJ                                      EXIT                            50227 00235  45 00000 00000
T21     RPB     20              L+2             BLOCK TRANSFER ONE INSTR        50230 00236  75 30024 00240
        TP      W               WT               UCTION TO WT BUFFER            50231 00237  11 02500 04110
        RA      L-1             L(20)           BUMP STORE COMMAND              50232 00240  21 00237 02130
        RA      T139            L(1)            BUMP BLOCKETTE TALLY            50233 00241  21 01500 02113
        TJ      L(6)            T25             TEST FOR FULL BLOCK             50234 00242  42 02117 00267
T22     TP      L(0)            T139            RESET BLOCKETTE INDEX           50235 00243  11 02115 01500
        RA      T140            L(1)            BUMP BLOCK COUNT                50236 00244  21 01501 02113
        TJ      L(20)           T25             TEST FOR 20 BLOCKS              50237 00245  42 02130 00267
        TV      T149            T21+1           RESET STORE COMMAND             50240 00246  16 01510 00237
        TU      T149            T10A            RESET STORE COMMAND             50241 00247  15 01510 00151
        RS      T140            L(1)            BLOCK TALLY MINUS ONE           50242 00250  23 01501 02113
        EF                      WTP5            START OUTPUT TAPE               50243 00251  17 00000 02041
        TP      L(5)            TEMP+10         SET BLOCKETTE INDEX             50244 00252  11 02131 02537
T23     RPB     20              L+2             MOVE 20 WORDS TO W STOR         50245 00253  75 30024 00255
        TP      WT              W                AGES FOR WRITING               50246 00254  11 04110 02500
        RA      L-1             L(2400000B)     BUMP STORE COMMAND              50247 00255  21 00254 02132
        RJ      T113            XS3CON          CONVERT COMMAND TO XS-3         50250 00256  37 01440 01407
        RPV     20              L+2             WRITE ONE BLOCK OF              50251 00257  75 10024 00261
        EW1                     W                SYMBOLIC OUTPUT TAPE           50252 00260  77 10000 02500
T24     IJ      TEMP+10         T23             TEST FOR FULL BLOCK             50253 00261  41 02537 00253
        IJ      T140            T23-1           TEST BLOCK COUNT                50254 00262  41 01501 00252
        EF                      STAPE           STOP OUTPUT TAPE                50255 00263  17 00000 02045
        TU      T25             T23+1           RESET LOAD COMMAND              50256 00264  15 00267 00254
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        RJ    T102A        T102      STORE XS3 WORDS ON DRUM      50257 00265  37 01336 01330
        SN    L                      SET ACCUMULATOR MINUS        50260 00266  33 00266 00000
T25     MJ    WT                     EXIT                         50261 00267  45 04110 00000
T26     RPB   1320         L+2       BRING 120 INSTRUCTIONS       50262 00270  75 32450 00272
        TP    DSTORE       WT+1200    FROM DRUM TO WT BUFFER      50263 00271  11 50000 06370
        RA    L-1          L1320     BUMP FETCH INSTRUCTION       50264 00272  21 00271 02055
        RA    T141         L(1)      BUMP FETCH TALLY             50265 00273  21 01502 02113
        TJ    L(9)         L+2       TEST IF DRUM EMPTY           50266 00274  42 02133 00276
        TP    T151         T10       CHANGE FETCH INSTRUCTION     50267 00275  11 01512 00144
T27     MJ                           EXIT TO PASS 2               50270 00276  45 00000 00000
EQUALS  RS    T130         L(1)      TEST IF EQUALS INSTRUCT      50271 00277  23 01466 02113
        SJ    T37          L+1        IONS ARE PRESENT            50272 00300  46 00314 00301
T28     RA    T30          L(1)      IF SO TEST TL TABLE FOR      50273 00301  21 00312 02113
        RA    T29          L(100000B)  NEGATIVE NUMBERS  IF       50274 00302  21 00303 02120
T29     TP    TL-1         A          SO THE V ADDRESS OF         50275 00303  11 13432 32000
        SJ    L+1          T28        THIS NEGATIVE NUMBER        50276 00304  46 00305 00301
        SN    A            15         WILL CONTAIN THE ADD-       50277 00305  33 32000 00017
        TU    A            L+2        RESS IN THE BT BUFFER       50300 00306  15 32000 00310
        RPB   2            L+2        CONTAING THE CONTENTS       50301 00307  75 30002 00311
        TP                 W+3        OF THE U FIELD OF AN        50302 00310  11 00000 02503
        RJ    T69          T67        EQUALS COMMAND              50303 00311  37 01013 01005
T30     TP    A            TL-1       TRANSLATE THIS U FIELD      50304 00312  11 32000 13432
        IJ    T130         T28        AND STORE IN TL TABLE       50305 00313  41 01466 00301
T37     MJ                           EXIT                         50306 00314  45 00000 00000
T38     TP    TT           A         TEST TAG TABLE FOR           50307 00315  11 11432 32000
        EJ    PASS1                   DUPLICATE ENTRIES           50310 00316  43 00010 00000
        EJ    TT+1         T39        STORE ALL DUPLICATES        50311 00317  43 11433 00323
T38A    TU    L-1          T38        IN DTT TABLE  BUMP          50312 00320  15 00317 00315
        RA    L-2          L(100000B)  DUPLICATE TAG LOOKUP       50313 00321  21 00317 02120
        MJ                 T38        BY ONE FOR EACH ENTRY       50314 00322  45 00000 00315
T39     TP    A            DTT        IN DTT TABLE  THIS          50315 00323  11 32000 03220
        RA    L-1          L(1)       TEST ENDS WHEN A DUMMY      50316 00324  21 00323 02113
        RA    T62A         L(100000B)  FILL ENTRY IS FOUND IN     50317 00325  21 00711 02120
        MJ                 T38A        THE TT TABLE               50320 00326  45 00000 00320
OFETCH  LQ    W+2          Q+33      MASK OFF OPERATION INTO      50321 00327  55 02502 31041
        QT    OMASK        TEMP       TEMP AND ACCUMULATOR        50322 00330  51 02070 02525
        TJ    OTABLE+49    T39A      TEST IF GTR THAN RA          50323 00331  42 00443 00336
        TU    L-1          T39B      YES  SET TJ COMMAND          50324 00332  15 00331 00344
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                TJ    OTABLE+63     T39B-1      TEST IF GTR THAN TJ          50325 00333  42 00461 00343
                TU    L-1           T39B        YES  SET TJ COMMAND          50326 00334  15 00333 00344
                MJ    OTABLE        T39B-1      EXIT TO TABLE LOOKUP         50327 00335  45 00362 00343
T39A            TU    L-1           T39B        SET TJ COMMAND               50330 00336  15 00335 00344
                TJ    OTABLE+14     T39B-1      TEST IF GTR THAN EW          50331 00337  42 00400 00343
                TU    L-1           T39B        YES SET TJ COMMAND           50332 00340  15 00337 00344
                TJ    OTABLE+27     T39B-1      TEST IF GTR THAN LA          50333 00341  42 00415 00343
                TU    L-1           T39B        YES SET TJ COMMAND           50334 00342  15 00341 00344
                RPU   77            L+2         LOOK UP MNEUMONIC OPERAT     50335 00343  75 20115 00345
T39B            TJ    OTABLE        L+1          ION IN OTABLE AND STORE     50336 00344  42 00362 00345
                SN    Q             15           ITS OCTAL EQUIVALENT        50337 00345  33 31000 00017
                SA    T142                       IN W+14  IF EXACT ENTRY     50340 00346  32 01503 00000
                TU    T39B          T152         IS NOT IN TABLE STORE       50341 00347  15 00344 01513
                AT    T152          L+1          NEAREST OCTAL EQUIV-        50342 00350  35 01513 00351
                TP    OTABLE        Q            ALENT AND STORE NOP         50343 00351  11 00362 31000
                QT    OMASK         A            WARNING IN W+17  THEN       50344 00352  51 02070 32000
                SS    TEMP                       EXIT AS SPECIFIED BY        50345 00353  34 02525 00000
                ZJ    L+1           L+2          V ADDRESS OF CORRESP-       50346 00354  47 00355 00356
                TP    NOP           W+17         GNDING ENTRY IN OTABLE      50347 00355  11 02046 02521
                TV    Q             OTABLE-1     THIS ADDRESS SPECIFIES      50350 00356  16 31000 00361
                SP    Q             21           WHICH TRANSLATION ROU-      50351 00357  31 31000 00025
                LT                  W+14         TINE IS TO BE USED          50352 00360  22 00000 02516
                MJ                  FILL        EXIT AS DESCRIBED ABOVE      50353 00361  45 00000 30000
OTABLE                              T41         BLANK OPERATION              50354 00362  00 00000 00504
                      30300B)       T41         ZERO OPERATION               50355 00363  00 30300 00504
                01    21300B)       T40         OCTAL OPERATION              50356 00364  01 21300 00500
                02    46635B)       T41         AT                           50357 00365  02 46635 00504
                02    50000B)       T47         B- OCTAL CONSTANT            50360 00366  02 50000 00545
                02    51400B)       T47         B9 OCTAL CONST               50361 00367  02 51400 00545
                02    62437B)       T46         CALL SUBROUTINE              50362 00370  02 62437 00536
                02    62627B)       T41         CC                           50363 00371  02 62627 00504
                02    76737B)       T175        DUMP  (BOSS)                 50364 00372  02 76737 01624
                02    77073B)       T41         DV                           50365 00373  02 77073 00504
                03    03117B)       T41         EF                           50366 00374  03 03117 00504
                03    04443B)       T41         EJ                           50367 00375  03 04443 00504
                03    05000B)       T160        END                          50370 00376  03 05000 01520
                03    05476B)       T41         ER                           50371 00377  03 05476 00504
                03    07177B)       T41         EW                           50372 00400  03 07177 00504
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03   10000B)    T91+1      F- FLOATING DECIMAL          50373 00401  03 10000 01172
03   12464B)    T41        FA                           50374 00402  03 12464 00504
03   12767B)    T41        FD                           50375 00403  03 12767 00504
03   13402B)    T41        FI                           50376 00404  03 13402 00504
03   14766B)    T41        FM                           50377 00405  03 14766 00504
03   15201B)    T41        FP                           50400 00406  03 15201 00504
03   15405B)    T41        FR                           50401 00407  03 15405 00504
03   16565B)    T41        FS                           50402 00410  03 16565 00504
03   44441B)    T41        IJ                           50403 00411  03 44441 00504
03   45037B)    T178+2     IN     (BOSS)                50404 00412  03 45037 01645
03   45214B)    T41        IP                           50405 00413  03 45214 00504
04   40044B)    T41        J      (BOSS)                50406 00414  04 40044 00504
04   60046B)    T41        L      (BOSS)                50407 00415  04 60046 00504
04   62454B)    T41        LA                           50410 00416  04 62454 00504
04   65355B)    T41        LQ                           50411 00417  04 65355 00504
04   66622B)    T41        LT                           50412 00420  04 66622 00504
04   70047B)    T41        M      (BOSS)                50413 00421  04 70047 00504
04   72472B)    T41        MA                           50414 00422  04 72472 00504
04   74445B)    T41        MJ                           50415 00423  04 74445 00504
04   75137B)    T175       MOVE   (BOSS)                50416 00424  04 75137 01624
04   75271B)    T41        MP                           50417 00425  04 75271 00504
04   76556B)    T41        MS                           50420 00426  04 76556 00504
05   05204B)    T41        NP                           50421 00427  05 05204 00504
05   13137B)    T180+2     OFF    (BOSS)                50422 00430  05 13137 01655
05   15237B)    T179+1     OPER   (BOSS)                50423 00431  05 15237 01650
05   16737B)    T175       OUT    (BOSS)                50424 00432  05 16737 01624
05   20052B)    T41        P      (BOSS)                50425 00433  05 20052 00504
05   25461B)    T41        PR                           50426 00434  05 25461 00504
05   26557B)    T41        PS                           50427 00435  05 26557 00504
05   26763B)    T41        PU                           50430 00436  05 26763 00504
05   32452B)    T41        QA                           50431 00437  05 32452 00504
05   34444B)    T41        QJ                           50432 00440  05 34444 00504
05   36553B)    T41        QS                           50433 00441  05 36553 00504
05   36651B)    T41        QT                           50434 00442  05 36651 00504
05   40054B)    T41        B      (BOSS)                50435 00443  05 40054 00504
05   42421B)    T41        RA                           50436 00444  05 42421 00504
05   44437B)    T41        RJ                           50437 00445  05 44437 00504
05   45275B)    T41        RP                           50440 00446  05 45275 00504
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                05   46523B)      T41          RS                                50441 00447  05 46523 00504
                05   47137B)      T175         REWIND (BOSS)                     50442 00450  05 47137 01624
                06   50000B)      T99-1        STATED POINT                      50443 00451  06 50000 01262
                06   51400B)      T99-1        STATED POINT                      50444 00452  06 51400 01262
                06   52432B)      T41          SA                                50445 00453  06 52432 00504
                06   53174B)      T41          SF                                50446 00454  06 53174 00504
                06   54446B)      T41          SJ                                50447 00455  06 54446 00504
                06   55033B)      T41          SN                                50450 00456  06 55033 00504
                06   55231B)      T41          SP                                50451 00457  06 55231 00504
                06   56534B)      T41          SS                                50452 00460  06 56534 00504
                06   56636B)      T41          ST                                50453 00461  06 56636 00504
                06   64442B)      T41          TJ                                50454 00462  06 64442 00504
                06   64712B)      T41          TM                                50455 00463  06 64712 00504
                06   65013B)      T41          TN                                50456 00464  06 65013 00504
                06   65211B)      T41          TP                                50457 00465  06 65211 00504
                06   66715B)      T41          TU                                50460 00466  06 66715 00504
                06   67016B)      T41          TV                                50461 00467  06 67016 00504
                06   75203B)      T41          UP                                50462 00470  06 75203 00504
                07   10071B)      T41          W      (BOSS)                     50463 00471  07 10071 00504
                07   20072B)      T41          X      (BOSS)                     50464 00472  07 20072 00504
                07   26500B)      T49A         XS3                               50465 00473  07 26500 00563
                07   30073B)      T41          Y      (BOSS)                     50466 00474  07 30073 00504
                07   40074B)      T41          Z      (BOSS)                     50467 00475  07 40074 00504
                07   44447B)      T41          ZJ                                50470 00476  07 44447 00504
                07   77747B)      T41          ILLEGAL OP                        50471 00477  07 77747 00504
T40             TP   W+2          Q            CONVERT OCTAL OPERATION           50472 00500  11 02502 31000
                RJ   T81          T80+1         TO BINARY AND STORE IN           50473 00501  37 01106 01067
                TP   BLNKS        T138          W+14   CLEAR ERROR               50474 00502  11 02100 01477
                TP   A            W+14          INDICATOR                        50475 00503  11 32000 02516
T41             RJ   T69          T67          TRANSLATE U FIELD TO              50476 00504  37 01013 01005
                TP   T138         W+18          BINARY AND STORE IN W            50477 00505  11 01477 02522
                TP   BLNKS        T138          +15 STORE ERROR INDIC-           50500 00506  11 02100 01477
                TP   A            W+15          ATOR IN W+18 AND CLEAR           50501 00507  11 32000 02517
T42             RJ   L            L+1          ONE SHOT SWITCH                   50502 00510  37 00510 00511
                RJ   T69          T68          TRANSLATE V FIELD AND             50503 00511  37 01013 01007
                TP   T138         W+19          STORE IN W+16  STORE             50504 00512  11 01477 02523
                TP   A            W+16          ERROR INDICATOR IN W+19          50505 00513  11 32000 02520
T43             RJ   L            L+1          ONE SHOT SWITCH                   50506 00514  37 00514 00515
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        LQ    W+2          Q+18         TEST THIRD POSITION OF      50507 00515  55 02502 31022
        QT    L(77B)       A             OPERATION FIELD FOR ONE    50510 00516  51 02134 32000
        ZJ    L+1          T12           OF THE FOLLOWING CHAR-     50511 00517  47 00520 00174
        TJ    L(12B)       T45           ACTERS  IF BLANK EXIT      50512 00520  42 02135 00532
        EJ    L(54B)       T44+1         R                          50513 00521  43 02136 00530
        EJ    L(67B)       T44           U                          50514 00522  43 02137 00527
        EJ    L(70B)       T44+1         V                          50515 00523  43 02140 00530
        EJ    L(25B)       T44-1         B                          50516 00524  43 02141 00526
        MJ                 T12          JUMP TO STORE               50517 00525  45 00000 00174
        RA    W+15         L(10000B)    BUMP U BY 10000             50520 00526  21 02517 02142
T44     RA    W+15         L(10000B)    BUMP U BY 10000             50521 00527  21 02517 02142
        RA    W+15         L(10000B)    BUMP U BY 10000             50522 00530  21 02517 02142
        MJ                 T12          JUMP TO STORE               50523 00531  45 00000 00174
T45     SS    L(3)         12           IF OCTAL SUBTRACT 3         50524 00532  34 02125 00014
        SJ    T12          L+1          IF MINUS JUMP TO STORE      50525 00533  46 00174 00534
        AT    W+15         W+15         ADD DIGIT TO HIGH U         50526 00534  35 02517 02517
        MJ                 T12          JUMP TO STORE               50527 00535  45 00000 00174
T46     RJ    T69          T67          FOR CALL  LOOK UP U         50530 00536  37 01013 01005
        TP    A            TEMP+9       FIELD IN TAG TABLE  AND     50531 00537  11 32000 02536
        SA    L(2)                       GENERATE RJ SUBR+2          50532 00540  32 02121 00000
        RJ    T42          T41+1         SUBR  IN BINARY STORE      50533 00541  37 00510 00505
        SP    TEMP+9                     IN W+14 W+15 W+16 FOR       50534 00542  31 02536 00000
        RJ    T43          T42+2         OUTPUT                      50535 00543  37 00514 00512
        MJ                 T12          JUMP TO STORE               50536 00544  45 00000 00174
T47     TP    W+3          Q            FOR BINARY CONSTANTS        50537 00545  11 02503 31000
        RJ    T81          T80+1         CONVERT FIRST HALF OF U    50540 00546  37 01106 01067
        TP    W+4          Q             CONVERT 2ND HALF OF U      50541 00547  11 02504 31000
        RJ    T81          T80+2         AND COMBINE WITH FIRST     50542 00550  37 01106 01070
        TP    A            TEMP+6        STORE IN TEMP+6            50543 00551  11 32000 02533
        TP    W+2          Q            CONVERT THE SECOND AND      50544 00552  11 02502 31000
T48     LQ    Q            6             THIRD DIGITS OF THE        50545 00553  55 31000 00006
        RJ    T83          T82           OPERATION TO BINARY        50546 00554  37 01126 01107
        TV    A            L+1           AND STORE IN SHIFT INST    50547 00555  16 32000 00556
        SP    TEMP+6                     SCALE BINARY CONSTANT       50550 00556  31 02533 00000
        RJ    T87          T86           AND STORE IN W+14- W+16    50551 00557  37 01143 01140
        TP    L(0)         W+17         CLEAR WARNING               50552 00560  11 02115 02521
        TP    T138         W+18         STORE ERROR INDICATOR       50553 00561  11 01477 02522
T49     MJ                 T12          JUMP TO STORE               50554 00562  45 00000 00174
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T49A    SP    W+3
        RJ    T87          T86     FOR PSEUDO XS-3 OPERATON     50555 00563  31 02503 00000
        MJ                 T12      BREAK FIRST HALF OF U       50556 00564  37 01143 01140
T50     TU    T150         T53      INTO W+14 W+15 AND W+16     50557 00565  45 00000 00174
        TU    L+1          T54     SET UP T53   AND T54         50560 00566  15 01511 00576
        MJ    L(0)         T53      TO TEST IF A TAG IS         50561 00567  15 00570 00602
T51     TU    T153         T53      IN THE TAG FIELD            50562 00570  45 02115 00576
        TU    L+1          T54     SET UP  T53  AND  T54        50563 00571  15 01514 00576
        MJ    W+4          T53      TO DETERMINE THE CONT-      50564 00572  15 00573 00602
T52     TU    T154         T53      ENTS OF U                   50565 00573  45 02504 00576
        TU    T155         T54     SET UP  T53  AND  T54        50566 00574  15 01515 00576
T53     TP                 Q        TO TEST V FIELD             50567 00575  15 01516 00602
        QT    PSTOP        A       TEST IF FIELD CONTAINS       5Q570 00576  11 00000 31000
        ZJ    L+1          T56      NON-NUMERIC CHARACTERS      50571 00577  51 02101 32000
        SP    Q            36       IF NOT EXIT IF SO PLACE     50572 00600  47 00601 00630
T54     SA                           ENTIRE FIELD IN A LEFT      50573 00601  31 31000 00044
        TP    LPCT         TEMP+9   AND A RIGHT                 50574 00602  32 00000 00000
        LTL   6            Q       STORE LOOP COUNTER           50575 00603  11 02072 02536
        QJ    L+1          L+6     STORE 6 DIGITS IN Q          50576 00604  22 00006 31000
        QJ    L+1          T56+1   BEGIN TESTING FIELD FROM     50577 00605  44 00606 00613
        QJ    T55          L+1      THE LEFT UNTIL ONE OF       50600 00606  44 00607 00631
        QJ    T55A         L+1      THE FOLLOWING SPECIAL       50601 00607  44 00623 00610
        QJ    L+1          T55      CHARACTERS IS FOUND         50602 00610  44 00625 00611
        QJ    T56          T55     + - ( ) OR BLANK THEN        50603 00611  44 00612 00623
        QJ    T55          L+1     EXIT AT THIS POINT           50604 00612  44 00630 00623
        QJ    L+4          L+1      THE ACCUMULATOR WILL        50605 00613  44 00623 00614
        QJ    T55          L+1      APPEAR AS FOLLOWS (XS3)     50606 00614  44 00620 00615
        QJ    L+1          T56     +123  ABCDEF                 50607 00615  44 00623 00616
        QJ    T55          T56     -123  ABCDEF                 50610 00616  44 00617 00630
        QJ    L+1          T55     (1234B)    L                 50611 00617  44 00623 00630
        QJ    L+1          T55     (123)      L                 50612 00620  44 00621 00623
        QJ    T57          T55     )      1234B                 50613 00621  44 00622 00623
T55     LQ    TEMP+9       1       )   12345671                 50614 00622  44 00641 00623
        QJ    T54+2        T56     TEST IF 12 CHARACTERS        50615 00623  55 02536 00001
T55A    QJ    T55          L+1      HAVE BEEN TESTED            50616 00624  44 00604 00630
        QJ    T55          L+1     IF A / 64 CHARACTER IS       50617 00625  44 00623 00626
        TP    L(1)         SIND     SET INDICATOR (SIND)        50620 00626  44 00623 00627
T56     MJ                           TO ONE                      50621 00627  11 02113 02064
                                    TEST EXIT                    50622 00630  45 00000 00000
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        QJ    T55          L+1          IF ) IS THE 1ST SPECIAL     50623 00631  44 00623 00632
        QJ    T55          L+1           CHARACTER FOUND THE        50624 00632  44 00623 00633
        QJ    L+1          T55           DIGITS TO THE LEFT ARE     50625 00633  44 00634 00623
        QJ    L+1          T55           ASSUMED TO BE A DECIMAL    50626 00634  44 00635 00623
        TU    T53          L+1           NUMBER UNLESS THE ) IS     50627 00635  15 00576 00636
        SP    TEMP+10                    PRECEDED BY A B  THIS      50630 00636  31 02537 00000
        RJ    T81          T80           NUMBER IS CONVERTED TO     50631 00637  37 01106 01066
        MJ                 T56           BINARY AND LEFT IN A       50632 00640  45 00000 00630
T57     LTL   6            TEMP+5       A LEFT PARENTHESIS WAS      50633 00641  22 00006 02532
        LTR                TEMP+6        THE FIRST SPECIAL          50634 00642  22 10000 02533
        TP    BTST         Q             CHARACTER FOUND  THE       50635 00643  11 02073 31000
        QT    TEMP+5       A             INFORMATION TO THE         50636 00644  51 02532 32000
        ZJ    T58          L+1           RIGHT OF THIS CHARACTER    50637 00645  47 00655 00646
        QT    TEMP+6       A             IS ASSUMED TO BE EITHER    50640 00646  51 02533 32000
        ZJ    T58          L+1           A DECIMAL OR OCTAL         50641 00647  47 00655 00650
        TP    TEMP+5       Q             CONSTANT AND IS TO BE      50642 00650  11 02532 31000
        RJ    T83          T82           PLACED IN THE CONSTANT     50643 00651  37 01126 01107
        TP    TEMP+6       Q             POOL  IF A B IS PRESENT    50644 00652  11 02533 31000
        RJ    T83          T82+1         CONVERT AS A OCTAL         50645 00653  37 01126 01110
        MJ                 CPOOL         INTEGER IF NOT CONVERT     50646 00654  45 00000 00663
T58     TP    TEMP+5       Q             AS A DECIMAL INTEGER       50647 00655  11 02532 31000
        RJ    T81          T80+1         IN EITHER CASE LEAVE       50650 00656  37 01106 01067
        TP    TEMP+6       Q             RESULT IN THE ACCUM        50651 00657  11 02533 31000
        QJ    CPOOL        L+1           ULATOR AND GO TO CPOOL     50652 00660  44 00663 00661
        TP    TEMP+6       Q             CPOOL TO FIND THE LOC-     50653 00661  11 02533 31000
        RJ    T81          T80+2         ATION FOR THIS CONSTANT    50654 00662  37 01106 01070
CPOOL   SP    TEMP                      STORE TEMP IN ACCUM         50655 00663  31 02525 00000
        TU    T122         L+1          TEST IF CONSTANT HAS        50656 00664  15 01456 00665
        RP                 L+2           ALREADY BEEN ENTERED       50657 00665  75 00000 00667
        EJ    CPT          T59           INTO THE CONSTANT POOL     50660 00666  43 02544 00701
T58B    TP    A            CPT           IF NOT STORE IN POOL       50661 00667  11 32000 02544
        TU    T53          L+2          SET UP STORE                50662 00670  15 00576 00672
        RPB   2            L+2           AND STORE SYMBOLIC         50663 00671  75 30002 00673
        TP    TEMP+10      CPT+100       CONSTANT FOR LATER         50664 00672  11 02537 02710
        RA    T58B         L(1)          PRINTOUT BUMP STORE        50665 00673  21 00667 02113
        RA    L-2          L(2)          INSTRUCTIONS AND CONS-     50666 00674  21 00672 02121
        RA    T127         L(1)          TANT TALLY  IF CONSTANT    50667 00675  21 01464 02113
        RA    T122         L(100000B)    POOL IS FILLED ALTER       50670 00676  21 01456 02120
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        TJ    T123            L+2          REPEAT EXIT SO THAT ALL     50671 00677  42 01457 00701
        TV    CPOOL+3         CPOOL+2      NEW CONSTANTS WILL BE       50672 00700  16 00666 00665
T59     SP    T122                         IGNORED   COMPUTE           50673 00701  31 01456 00000
        LTL   21              A            EXECUTION LOCATION OF       50674 00702  22 00025 32000
        SS    Q                            CONSTANT IN QUESTION        50675 00703  34 31000 00000
        SS    L(1)                         AND LEAVE THIS LOCATION     50676 00704  34 02113 00000
        SA    T134                         IN THE ACCUMULATOR          50677 00705  32 01472 00000
        MJ                    T56        EXIT  CHANGED FOR PASS 2      50700 00706  45 00000 00630
T62     LT                    TEMP       SAVE INCREMENT IN TEMP        50701 00707  22 00000 02525
        LQ    A                          STORE ENTRY IN Q AND A        50702 00710  55 32000 00000
T62A    RPU                   L+4        TEST IF THIS TAG IS IN        50703 00711  75 20000 00715
        EJ    DTT             L+1         DUPLICATE TAG TABLE          50704 00712  43 03220 00713
        TP    A               Q          RELOAD Q WITH TAG             50705 00713  11 32000 31000
        TP    DUP             T138       STORE DUP IN ERROR IND        50706 00714  11 02053 01477
        EJ    L(46B)          T63B-3     TEST FOR L                    50707 00715  43 02143 00760
        EJ    L(24B)          T63A1      TEST FOR A                    50710 00716  43 02130 00754
        EJ    L(53B)          T63A1+2    TEST FOR Q                    50711 00717  43 02144 00756
        EJ    L(31344646B)    T63A1-2    TEST FOR FILL                 50712 00720  43 02145 00752
        TP    T63B+1          T63+2      THIS ROUTINE WILL LOOK        50713 00721  11 00764 00727
        TV    K               T63+2       UP THE TAG IN Q IN THE       50714 00722  16 00767 00727
        TU    T63B+2          T63A-2      TAG TABLE IF AN EQUAL-       50715 00723  15 00765 00732
        TU    T63A-2          T63B        ITY OCCURS THE LOCATION      50716 00724  15 00732 00763
T63     IJ    T63+2           L+1         ASSOCIATED WITH THAT         50717 00725  41 00727 00726
        TJ    T63B+1          T63A        TAG WILL BE LEFT IN THE      50720 00726  42 00764 00734
        SP    L(100000B)                  ACCUMULATOR  IF NO           50721 00727  31 02120 00000
        AT    T63B            L+2         EQUALITY OCCURS A DEF        50722 00730  35 00763 00732
        SP    Q                           WARNING WILL BE STORED       50723 00731  31 31000 00000
        SS    TT                          IN THE ERROR INDICATOR       50724 00732  34 11432 00000
        SJ    T63             T63-1       AND CONTROL SENT TO UND      50725 00733  46 00725 00724
T63A    TU    T63B            L+2         TAG TO STORE THIS TAG        50726 00734  15 00763 00736
        TP    Q               A           IN THE UNDEFINED TAG         50727 00735  11 31000 32000
        EJ    FILL            L+3         TABLE IF NOT ALREADY         50730 00736  43 30000 00741
        TP    DEF             T138        THERE AND ASSIGN IT AN       50731 00737  11 02051 01477
        MJ                    UNDTAG      ADDRESS INCREMENTS AND       50732 00740  45 00000 01017
        RA    T63B            T63B+3      DECREMENTS ARE IGNORED       50733 00741  21 00763 00766
        TU    A               L+1         FOR ALL UNDEFINED TAGS       50734 00742  15 32000 00743
        TP    FILL            Q          STORE LOCATION IN Q           50735 00743  11 30000 31000
        SP    SIND                       TEST STORAGE INDICATOR        50736 00744  31 02064 00000
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        ZJ    L+1          L+3          FOR ZERO                        50737 00745  47 00746 00750
        TP    L(0)         SIND         CLEAR INDICATOR                 50740 00746  11 02115 02064
        LQ    Q            21           SHIFT Q 21 FOR STORAGE          50741 00747  55 31000 00025
        QT    L(77777B)    TEMP+3       STORE LOCATION IN TEMP+3        50742 00750  51 02146 02530
        MJ                 T64          EXIT TO INCREMENT TEST          50743 00751  45 00000 00770
        TP    L(30000B)    TEMP+3       STORE 30000 FOR FILL            50744 00752  11 02147 02530
        MJ                 T64          EXIT TO INCREMENT TEST          50745 00753  45 00000 00770
T63A1   TP    L(32000B)    TEMP+3       STORE 32000 FOR A               50746 00754  11 02150 02530
        MJ                 T64          EXIT TO INCREMENT TEST          50747 00755  45 00000 00770
        TP    L(31000B)    TEMP+3       STORE 31000 FOR Q               50750 00756  11 02151 02530
        MJ                 T64          EXIT TO INCREMENT TEST          50751 00757  45 00000 00770
        SP    T120                      STORE L COUNTER MINUS           50752 00760  31 01454 00000
        ST    L(1)         TEMP+3        ONE INTO TEMP +3               50753 00761  36 02113 02530
        MJ                 T64          EXIT TO INCREMENT TEST          50754 00762  45 00000 00770
T63B    SS    FILL                      DUMMY TEST COMMAND              50755 00763  34 30000 00000
        SP    L(100000B)                END OF LOOKUP LOOP TEST         50756 00764  31 02120 00000
              TT                        ADDRESS OF FIRST TAG            50757 00765  00 11432 00000
              1025                      CELLS BETWEEN TT AND TL         50760 00766  00 02001 00000
K       B                               TABLE LOOKUP COUNT              50761 00767  00 00000 00000
T64     TP    TEMP         Q            STORE INCREMENT IN Q            50762 00770  11 02525 31000
        LQ    Q            A+6           AND A  IF ZERO EXIT            50763 00771  55 31000 32006
        ZJ    L+1          T66+1         IF NOT MASK OFF LEAD-          50764 00772  47 00773 01003
        QT    L(77B)       A             ING CHARACTER AND TEST         50765 00773  51 02134 32000
T65     EJ    L(64B)       T64+1         FOR MINUS SIGN OR /            50766 00774  43 02152 00771
        EJ    L(2)         T66-2         IF NOT - ASSUME +              50767 00775  43 02121 01000
        RJ    T83          T82          CONVERT POSITIVE INCRE-         50770 00776  37 01126 01107
        MJ                 T66           MENT LEAVE IN A                50771 00777  45 00000 01002
        RJ    T83          T82          CONVERT NEGATIVE INCRE-         50772 01000  37 01126 01107
        TN    A            A             MENT LEAVE IN A                50773 01001  13 32000 32000
T66     AT    TEMP+3       TEMP+3       ADD EXECUTION LOCATION          50774 01002  35 02530 02530
        SP    TEMP+3                     TO INCREMENT AND LEAVE          50775 01003  31 02530 00000
        MJ                               IN ACCUMULATOR                 50776 01004  45 00000 00000
T67     RJ    T56          T51          CONVERT CONTENTS OF U           50777 01005  37 00630 00571
        MJ    L+3          L+2           THEN JUMP TO ZERO TEST         51000 01006  45 01011 01010
T68     RJ    T56          T52          CONVERT CONTENTS OF V           51001 01007  37 00630 00574
        ZJ    T69          T69+1          IF TAG IS PRESENT             51002 01010  47 01013 01014
        RJ    T67-1        T62           LOOK UP EXECUTION LOC-         51003 01011  37 01004 00707
        SP    A                          ATION OF TAG AND LEAVE         51004 01012  31 32000 00000
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T69     MJ                                IN ACCUMULATOR AND EXIT     51005 01013  45 00000 00000
        EJ    Q           T69             TEST FOR BLANK FIELD        51006 01014  43 31000 01013
        RJ    T83         T82             CONVERT DECIMAL INTEGER     51007 01015  37 01126 01107
        MJ                T69              TO BINARY  LEAVE IN A      51010 01016  45 00000 01013
UNDTAG  TU    T125        L+1             SET UP REPEAT COMMAND       51011 01017  15 01461 01020
        RP                L+2             TEST IF UNDEFINED TAG       51012 01020  75 00000 01022
T70     EJ    UT          T72              HAS BEEN STORED BEFORE     51013 01021  43 03251 01034
        TP    A           UT              STORE UNDEFINED TAG         51014 01022  11 32000 03251
        RA    L-1         L(1)            BUMP UNDEFINED TAG STORE    51015 01023  21 01022 02113
        RA    T125        L(100000B)      BUMP UNDEFINED TAG TALLY    51016 01024  21 01461 02120
        TJ    T126        L+2             TEST FOR TOO MANY TAGS      51017 01025  42 01462 01027
        TV    T70         T70-1           CHANGE REPEAT EXIT          51020 01026  16 01021 01020
        SS    RPD                         COMPUTE EXECUTION           51021 01027  34 02075 00000
T71     LTL   21          A                ADDRESS OF UNDEFINED       51022 01030  22 00025 32000
        SA    T127                        TAG AND LEAVE IN ACCUM      51023 01031  32 01464 00000
        TP    DEF         T138            STORE DEF WARNING IN        51024 01032  11 02051 01477
        MJ                T67-1            ERROR INDICATOR   EXIT     51025 01033  45 00000 01004
T72     SN    Q           15              IF UNDEFINED TAG IS         51026 01034  33 31000 00017
        SA    T125                         ALREADY STORED COMPUTE     51027 01035  32 01461 00000
        SS    L(100000B)                   ITS EXECUTION ADDRESS      51030 01036  34 02120 00000
        MJ                T71              AND LEAVE IN ACCUM         51031 01037  45 00000 01030
T74     TP    W+2         A               TEST OPERATION FIELD FOR    51032 01040  11 02502 32000
        EJ    RSRV        T77              RSRV OR SETL PSEUDO        51033 01041  43 02061 01061
        EJ    SETL        L+2              INSTRUCTIONS               51034 01042  43 02062 01044
T75     MJ                                 TO USE RJ T75 T74          51035 01043  45 00000 00000
        TP    W+3         A               IF SETL TEST IF U FIELD     51036 01044  11 02503 32000
        EJ    E           L+3              HAS SPECIAL TAG E          51037 01045  43 02056 01050
        RJ    T69         T67             NO TRANSLATE U FIELD        51040 01046  37 01013 01005
        ZJ    L+2         L+3              IF ZERO IGNORE  IF NOT     51041 01047  47 01051 01052
        TP    T120        A                REPLACE STORAGE LOCATN     51042 01050  11 01454 32000
        TP    A           T121             COUNTER WITH U IF SO       51043 01051  11 32000 01455
        TP    W+5         A                REPLACE WITH EXEC LCTR     51044 01052  11 02505 32000
T76     EJ    S           L+3             TEST IF V FIELD IS S        51045 01053  43 02057 01056
        RJ    T69         T68              NO TRANSLATE V AND REP     51046 01054  37 01013 01007
        ZJ    L+2         L+3              LACE EXECUTION L COUNTR    51047 01055  47 01057 01060
        TP    T121        A                YES REPLACE WITH STOR-     51050 01056  11 01455 32000
        TP    A           T120             AGE LOCATION COUNTER       51051 01057  11 32000 01454
        MJ                T75              AND EXIT BACK TO T75       51052 01060  45 00000 01043
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T77     RJ    T69          T67          IF RSRV ADD THE CONTENTS     51053 01061  37 01013 01005
        AT    T121         T121          OF U AND V TO THE           51054 01062  35 01455 01455
        RJ    T69          T68           STORAGE AND EXECUTION       51055 01063  37 01013 01007
        AT    T120         T120          LOCATION COUNTERS RESP      51056 01064  35 01454 01454
        MJ                 T75           ECTIVELEY EXIT TO T75       51057 01065  45 00000 01043
T80     TP    A            Q            THIS IS A CLOSED SUB-        51060 01066  11 32000 31000
        TP    L(0)         TEMP          ROUTINE THAT WILL CON-      51061 01067  11 02115 02525
        TP    L(5)         TEMP+1        VERT THE FIVE HI  ORDER     51062 01070  11 02131 02526
        LQ    Q            6             OCTAL XS3 CHARACTERS        51063 01071  55 31000 00006
        QT    L(77B)       A             IN THE RIGHT HALF OF        51064 01072  51 02134 32000
        EJ    L(2)         T81-2         THE ACCUM TO BINARY         51065 01073  43 02121 01104
        ST    L(3)         TEMP+2        AND LEAVE THE RESULT        51066 01074  36 02125 02527
        SJ    T81-1        L+1           IN THE ACCUMULATOR          51067 01075  46 01105 01076
        TJ    L(8)         L+4           THE CONVERSION WILL         51070 01076  42 02123 01102
        EJ    L(22B)       T81-1         END AFTER 5 CHARACTERS      51071 01077  43 02153 01105
        TP    OCT          T138          HAVE BEEN CONVERTED OR      51072 01100  11 02050 01477
        MJ                 T81-1         A NON OCTAL CHARACTER       51073 01101  45 00000 01105
        SP    TEMP         3             HAS BEEN FOUND  IF THIS     51074 01102  31 02525 00003
        AT    TEMP+2       TEMP          CHARACTER IS NOT B OR       51075 01103  35 02527 02525
        IJ    TEMP+1       T80+3         BLANK AN OCT WILL BE        51076 01104  41 02526 01071
        SP    TEMP                       STORED IN ERR INDICATOR     51077 01105  31 02525 00000
T81     MJ                               TO USE RJ T81 T80           51100 01106  45 00000 00000
T82     TP    L(0)         TEMP         THIS IS A CLOSED SUB-        51101 01107  11 02115 02525
        TP    L(5)         TEMP+2        ROUTINE THAT WILL CON       51102 01110  11 02131 02527
        LQ    Q            6             VERT THE FIVE HI ORDER      51103 01111  55 31000 00006
        QT    L(77B)       A             DECIMAL XS3 CHARACTERS      51104 01112  51 02134 32000
        ST    L(3)         TEMP+1        IN Q TO BINARY AND          51105 01113  36 02125 02526
        SJ    T83-1        L+1           LEAVE THE RESULT IN THE     51106 01114  46 01125 01115
        TJ    L(10)        T82A          ACCUMULATOR  THE CON        51107 01115  42 02135 01121
        EJ    L(40B)       T83-1         VERSION WILL END AFTER      51110 01116  43 02154 01125
        TP    DEC          T138          5 CHARACTERS HAVE BEEN      51111 01117  11 02047 01477
        MJ                 T83-1         CONVERTED OR A NON DEC      51112 01120  45 00000 01125
T82A    SP    TEMP         2             IMAL CHARACTER HAS BEEN     51113 01121  31 02525 00002
        SA    TEMP         1             FOUND  IF THIS CHARACT      51114 01122  32 02525 00001
        AT    TEMP+1       TEMP          ER IS NOT ) OR BLANK        51115 01123  35 02526 02525
        IJ    TEMP+2       T82+2         A DEC WARNING WILL BE       51116 01124  41 02527 01111
        SP    TEMP                       STORED IN ERR INDICATOR     51117 01125  31 02525 00000
T83     MJ                               TO USE RJ T83 T82           51120 01126  45 00000 00000
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T84     TP    L(4)       TEMP+1     THIS IS A CLOSED SUB-      51121 01127  11 02126 02526
        LTR   21         Q           ROUTINE THAT WILL CON-    51122 01130  22 10025 31000
        TP    L(0)       TEMP        VERT THE FIVE LOW         51123 01131  11 02115 02525
        LQ    Q          3           ORDER DIGITS OF A         51124 01132  55 31000 00003
        SP    TEMP       6           RIGHT TO XS-3 OCTAL       51125 01133  31 02525 00006
        QA    L(7)       TEMP        AND LEAVE THE RESULT      51126 01134  52 02155 02525
        IJ    TEMP+1     L-3         IN THE ACCUMULATOR        51127 01135  41 02526 01132
        RA    TEMP       XS3Z        TO USE  RJ T85 T84        51130 01136  21 02525 02077
T85     MJ                           EXIT                      51131 01137  45 00000 00000
T86     TP    A          W+16        STORE LOW 5 OCTAL DIGITS  51132 01140  11 32000 02520
        LTL   6          W+14         OF A INTO W+16 NEXT 5    51133 01141  22 00006 02516
        LTL   15         W+15        IN W+15 AND HIGH ORDER    51134 01142  22 00017 02517
T87     MJ                           2 INTO W+14 AND EXIT      51135 01143  45 00000 00000
FLDEC   RPV   4          L+2         CLEAR FOUR TEMPORARY      51136 01144  75 10004 01146
        TP    L(0)       TEMP         CELLS  TEMP TO TEMP+3    51137 01145  11 02115 02525
        TP    L(5)       TEMP+5      SET INDEX TO 5            51140 01146  11 02131 02532
        LQ    TEMP+4     6           MASK OFF LEADING CHAR-    51141 01147  55 02531 00006
        QT    L(77B)     A            ACTER TO ACCUMULATOR     51142 01150  51 02134 32000
        EJ    L(31B)     T91         TEST FOR F                51143 01151  43 02156 01171
        EJ    L(0)       T91          TEST FOR BLANK COLUMN    51144 01152  43 02115 01171
        EJ    L(22B)     T91-2        TEST FOR DECIMAL POINT   51145 01153  43 02153 01167
        EJ    L(2)       T91          TEST FOR MINUS SIGN      51146 01154  43 02121 01171
        ST    L(3)       TEMP+12      SUBTRACT 3 AND STORE     51147 01155  36 02125 02541
        TJ    L(10)      L+4          TEST FOR NON DECIMAL     51150 01156  42 02135 01162
T90     TP    L(0)       TEMP         CLEAR RESULT CELL        51151 01157  11 02115 02525
        TP    DEC        W+18         SET ERROR INDICATOR      51152 01160  11 02047 02522
        MJ               T98+1        JUMP TO ERROR EXIT       51153 01161  45 00000 01260
        SP    TEMP       2           MULTIPLY INTEGER TO DATE  51154 01162  31 02525 00002
        SA    TEMP       1            BY 12  AND ADD IN THIS   51155 01163  32 02525 00001
        AT    TEMP+12    TEMP         DIGIT  STORE IN TEMP     51156 01164  35 02541 02525
        RA    TEMP+1     TEMP+2      BUMP DECIMAL PLACE COUNT  51157 01165  21 02526 02527
        MJ               L+2         JUMP TO DIGIT INDEX TEST  51160 01166  45 00000 01170
        RA    TEMP+2     L(1)        SET DECIMAL PLACE ADDER   51161 01167  21 02527 02113
        IJ    TEMP+5     FLDEC+3     TEST FOR 6 DIGITS         51162 01170  41 02532 01147
T91     MJ                           EXIT                      51163 01171  45 00000 00000
        TP    W+3        TEMP+4      STORE 1ST 6 DIGITS OF U   51164 01172  11 02503 02531
        RJ    T91        FLDEC        IN TEMP+4 TO BE CONV-    51165 01173  37 01171 01144
        EJ    L(2)       T91-1        ERTED TO BINARY          51166 01174  43 02121 01170
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      SP    W+4          24          STORE NEXT 4 DIGITS OF      51167 01175  31 02504 00030
      LTL                A            U INTO TEMP+4 TO BE        51170 01176  22 00000 32000
      LTR   12           TEMP+4       CONVERTED TO BINARY AND    51171 01177  22 10014 02531
      RJ    T91          FLDEC+2      AND ADDED TO FIRST SIX     51172 01200  37 01171 01146
      EJ    L(2)         T90         TEST FOR MINUS SIGN         51173 01201  43 02121 01157
      TP    TEMP         TEMP+7      STORE MANTISSA IN TEMP+7    51174 01202  11 02525 02534
      TP    TEMP+1       TEMP+8      SAVE DECIMAL PLACE COUNT    51175 01203  11 02526 02535
      TP    W+5          TEMP+4      STORE EXPONENT IN TEMP+4    51176 01204  11 02505 02531
T92   RJ    T91          FLDEC       TO BE CONVERTED TO BIN-     51177 01205  37 01171 01144
      EJ    L(2)         T91-2        ARY AND STORE IN TEMP      51200 01206  43 02121 01167
      SP    TEMP+1                    AND ITS SIGN IN TEMP+1     51201 01207  31 02526 00000
      ZJ    L+1          L+2         TEST IF SIGN IS NEGATIVE    51202 01210  47 01211 01212
      TN    TEMP         TEMP        IF SO NEGATE EXPONENT       51203 01211  13 02525 02525
      RS    TEMP         TEMP+8      EXPONENT- DECIMAL PLACES    51204 01212  23 02525 02535
      TM    TEMP         TEMP+2      STORE ABSOLUTE VALUE OF     51205 01213  12 02525 02527
T93   TP    1S34         TEMP+4       EXPONENT IN TEMP+2         51206 01214  11 02065 02531
      SP    TEMP+2                   TEST IF EXPONENT IS TOO     51207 01215  31 02527 00000
      TJ    L(54B)       L+6          LARGE OR TOO SMALL IF      51210 01216  42 02136 01224
      MJ                 T98          SO EXIT TO ERR ROUTINE     51211 01217  45 00000 01257
      SP    TEMP+4       2           COMPUTE 10 TO THE NTH       51212 01220  31 02531 00002
      SA    TEMP+4       1            POWER WHERE N IS THE       51213 01221  32 02531 00001
T94   SF    A            TEMP+3       ABSOLUTE VALUE OF THE      51214 01222  74 32000 02530
      TP    A            TEMP+4       EXPONENT - DECIMAL PL-     51215 01223  11 32000 02531
      IJ    TEMP+2       L-4          ACES  STORE IN TEMP+4      51216 01224  41 02527 01220
      MP    TEMP         L10B2       MULT EXPONENT X LOG10B2     51217 01225  71 02525 02066
      LT    3            TEMP+6       SAVE INTEGER PART          51220 01226  22 00003 02533
      SJ    L+1          L+4         TEST FOR NEGATIVE EXPON     51221 01227  46 01230 01233
      RS    TEMP+6       L(1)        IF SO SUBTRACT ONE FROM     51222 01230  23 02533 02113
T95   SP    1S34         35           INTEGER PART AND RECIP     51223 01231  31 02065 00043
      DV    TEMP+4       TEMP+4       ROCATE EXPONENT (TEMP+4    51224 01232  73 02531 02531
      MP    TEMP+4       TEMP+7      MULT 10 TO NTHX MANTISSA    51225 01233  71 02531 02534
      ZJ    L+1          T98+1       TEST FOR ZERO               51226 01234  47 01235 01260
      SF    A            TEMP+3      NORMALIZE ABOVE PRODUCT     51227 01235  74 32000 02530
      TP    A            TEMP+7       AND SAVE SF COUNT          51230 01236  11 32000 02534
      RA    TEMP+6       TEMP+3      ADD COUNT TO INTEGER PRT    51231 01237  21 02533 02530
      AT    L(1)         TEMP+6      ADD ONE TO THIS SUM         51232 01240  35 02113 02533
T96   LQ    W+2          Q+6         BREAK OPERATION FIELD IN    51233 01241  55 02502 31006
      TP    Q            TEMP+4       TWO PARTS STORE BINARY     51234 01242  11 31000 02531
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        LQ    Q           18          SCALE FACTOR IN TEMP+4      51235 01243  55 31000 00022
        QT    L(77B)      TEMP+9      AND SIGN IN TEMP+9          51236 01244  51 02134 02536
T97     RJ    L           L+1        ONE SHOT SWITCH             51237 01245  37 01245 01246
        RA    TEMP+6      L(200B)    ADD 200 TO CHARACTERITIC    51240 01246  21 02533 02157
        RA    TEMP+7      L(200B)    ADD 200 TO MANTISSA         51241 01247  21 02534 02157
        EJ    A           L+3        TEST FOR ROUND CARRY        51242 01250  43 32000 01253
        RA    TEMP+6      L(1)       ADD 1 TO CHARACTERISTIC     51243 01251  21 02533 02113
        SP    1S34                   SET MANTISSA TO 1 S 34      51244 01252  31 02065 00000
        LT    28          Q          COMBINE CHARACTERISTIC      51245 01253  22 00034 31000
        SP    TEMP+6      27          AND MANTISSA AND PUT       51246 01254  31 02533 00033
        AT    Q           Q           IN A AND Q                 51247 01255  35 31000 31000
        EJ    A           T99A       TEST IF CHARACTERISTIC      51250 01256  43 32000 01274
T98     TP    EXP         W+18        IS TOO LARGE IF SO SET     51251 01257  11 02054 02522
        TP    L(0)        Q           TO ZERO AND GO TO ERROR    51252 01260  11 02115 31000
        MJ                T99B-1     EXIT                        51253 01261  45 00000 01277
        TP    BLNKS       W+17       CLEAR ERROR INDICATOR       51254 01262  11 02100 02521
T99     RJ    T97         T91+1      ENTRANCE FOR STATED PT      51255 01263  37 01245 01172
        RJ    T91         FLDEC      CONVERT MANTISSA            51256 01264  37 01171 01144
        RA    TEMP+6      TEMP       CONVERT SCALING             51257 01265  21 02533 02525
        SA    L(1)                   ADD ONE                     51260 01266  32 02113 00000
        SJ    T98         L+1        TEST FOR MINUS              51261 01267  46 01257 01270
        TV    A           L+1        SET UP SHIFT                51262 01270  16 32000 01271
        SP    TEMP+7                 ROUND MANTISSA              51263 01271  31 02534 00000
        SA    1S35                   AND SHIFT                   51264 01272  32 02067 00000
        LT                Q          STORE IN Q                  51265 01273  22 00000 31000
T99A    RS    TEMP+9      L(2)       TEST SIGN OF NUMBER         51266 01274  23 02536 02121
        ZJ    L+2         L+1        IF NEGATIVE COMPLEMENT      51267 01275  47 01277 01276
        TN    Q           Q           PACKED NUMBER IN Q         51270 01276  13 31000 31000
        SP    Q                      SPLIT OFF RESULT INTO       51271 01277  31 31000 00000
T99B    RJ    L           L+1        ONE SHOT SWITCH             51272 01300  37 01300 01301
        RJ    T87         T86        W+14 W+15 W+16              51273 01301  37 01143 01140
T100    RJ    T97         T97        RESTORE SWITCH              51274 01302  37 01245 01245
        MJ                T12        EXIT TO STORE FOR WRITE     51275 01303  45 00000 00174
WBTAPE  SP    TEMP+6                 TEST IF STORAGE ADDRESS     51276 01304  31 02533 00000
        EJ    BLNKS       L+2         IS BLANK IF SO USE         51277 01305  43 02100 01307
        TP    TEMP+6      TEMP+7      EXECUTION ADDRESS AS       51300 01306  11 02533 02534
        TP    TEMP+7      Q           NEXT STORAGE ADDRESS       51301 01307  11 02534 31000
        SP    Q                      TEST IF THIS ADDRESS IS     51302 01310  31 31000 00000
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        SS    BT                        ONE GTR THAN PREVIOUS      51303 01311  34 03364 00000
        TP    Q           BT            ADDRESS AND SAVE IN        51304 01312  11 31000 03364
        EJ    L(1)        L+4           BT  IF NOT GTR STORE       51305 01313  43 02113 01317
        TP    Q           BT+1          ALSO IN BT+N WHERE N       51306 01314  11 31000 03365
        RA    L-1         L(2)          IS ODD INTEGER STORE       51307 01315  21 01314 02121
        RA    L+1         L(200000B)    INDEX IN BT+K WHERE K      51310 01316  21 01317 02110
        RA    BT          L(1)          IS AN EVEN INTEGER         51311 01317  21 03364 02113
        SP    W+14        30          COMBINE XS3 INSTRUCTION      51312 01320  31 02516 00036
        SA    W+15        30            INTO 2 COMPUTER WORDS      51313 01321  32 02517 00036
        SA    W+16                      AND STORE STARTING IN      51314 01322  32 02520 00000
        RPV   2           L+2           BT+100  BUMP WORD         51315 01323  75 10002 01325
T100A   LTR   36          BT+100        COUNTER BY 2 TO DETER-     51316 01324  22 10044 03530
        RA    L-1         L(2)          MINE DRUM STORAGE ADD-     51317 01325  21 01324 02121
        RA    T102+3      L(2)          RESS OF NEXT BLOCK         51320 01326  21 01333 02121
T101    MJ                              TRANSFER AND EXIT          51321 01327  45 00000 00000
T102    TV    T157        T100A       RESET CORE BUFFER STORE      51322 01330  16 01517 01324
        RPB   240         L+3         BLOCK TRANSFER XS3 INST      51323 01331  75 30360 01334
        TP    BT+100      DSTORE        RUCTIONS TO DRUM           51324 01332  11 03530 50000
        B                             XS-3 WORD COUNTER            51325 01333  00 00000 00000
        RA    L-2         L-1         BUMP BLOCK STORE ADDRESS     51326 01334  21 01332 01333
        TP    L(0)        L-2         CLEAR WORD COUNTER           51327 01335  11 02115 01333
T102A   MJ                            EXIT                       51330 01336  45 00000 00000
        RPB   1728        L+2         TO WRITE OCTAL BLOCK         51331 01337  75 33300 01341
T103    TP    DSTORE      TT            TRANSFER XS3 WORDS FROM    51332 01340  11 50000 11432
        EF                WTP6          DRUM-CORE START TAPE       51333 01341  17 00000 02043
T104    RPV   20          L+2         SET W STORAGES TO XS3        51334 01342  75 10024 01344
        TP    Z3S         W             ZEROES                     51335 01343  11 02076 02500
        SP    BT+1                    TEST STORAGE ADDRESS         51336 01344  31 03365 00000
        ZJ    L+1         T108A         IF ZERO EXIT  IF NOT       51337 01345  47 01346 01401
        RJ    T85         T84           CONVERT TO XS-3  AND       51340 01346  37 01137 01127
        TP    A           W             STORE IN W                 51341 01347  11 32000 02500
T105    IJ    BT+2        T106-1      TEST INDEX FOR THIS STO      51342 01350  41 03366 01354
        RA    L-5         L(200000B)    RAGE ADDRESS IF ZERO       51343 01351  21 01344 02110
        RA    L-2         L(200000B)    FETCH NEXT STORAGE ADD     51344 01352  21 01350 02110
        MJ                T107          RESS  IF NOT STORE XSO     51345 01353  45 00000 01365
        RPB   2           L+2           INSTRUCTION IN WT+1-2      51346 01354  75 30002 01356
T106    TP    TT          W+1         TEST IF INDEX IS ZERO        51347 01355  11 11432 02501
        ZJ    L+2         L+1           IF SO SET BLOCKETTE        51350 01356  47 01360 01357
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                TP    L(1)          T144          INDEX TO ONE                    51351 01357  11 02113 01504
                RA    L-3           L(200002B)    BUMP STORE BY 2                 51352 01360  21 01355 02160
                RA    W+13          WDA           BUMP DRUM TO CORE TRAN-         51353 01361  21 02515 02074
                RA    T103          L(200000B)     SFER BY 2                      51354 01362  21 01340 02110
                IJ    T144          T105          TEST FOR FULL BLOCKETTE         51355 01363  41 01504 01350
                TU    T104+2        T107A         SET UP COMMAND TO BUMP          51356 01364  15 01344 01371
T107            TP    L(5)          T144           STORAGE ADDRESS BY SIX         51357 01365  11 02131 01504
                RPV   20            L+2           WRITE ONE BLOCKETTE             51360 01366  75 10024 01370
                EW1                 W              FROM W STORAGES                51361 01367  77 10000 02500
                TV    T153          T106          RESET STORE COMMAND             51362 01370  16 01514 01355
T107A           RA                  L(6)          BUMP STORAGE ADDRESS            51363 01371  21 00000 02117
                IJ    T145          T104          TEST FOR FULL BLOCK             51364 01372  41 01505 01342
                TP    L(5)          T145          RESET BLOCKETTE INDEX           51365 01373  11 02131 01505
T108            IJ    T146          T104          TEST IF 21 BLOCKS HAVE          51366 01374  41 01506 01342
                TP    L(24B)        T146           BEEN WRITTEN RESET             51367 01375  11 02130 01506
                EF    TT            STAPE          INDEX AND STOP TAPE            51370 01376  17 11432 02045
                TU    L-1           T106          RESET STORE COMMAND             51371 01377  15 01376 01355
                MJ                  T103-1        GO BACK TO DRUM-CORE TR         51372 01400  45 00000 01337
T108A           TP    L(1)          T146          SET FREE RUN BLOCK COUNT        51373 01401  11 02113 01506
                TP    PSTOP         W             STORE PRINTER STOP IN W         51374 01402  11 02101 02500
                RJ    T108          T107+1        WRITE LAST BLOCKETTE            51375 01403  37 01374 01366
                EF                  STAPE         STOP OCTAL TAPE                 51376 01404  17 00000 02045
                EF                  RWND6         REWIND OCTAL TAPE               51377 01405  17 00000 02044
T109            MJ                                EXIT                            51400 01406  45 00000 00000
XS3CON          SP    W+1                         SHIFT TAG LEFT THREE            51401 01407  31 02501 00000
                LTL   18            W              XS-3 POSITIONS STORE IN        51402 01410  22 00022 02500
                TP    A             W+1            W AND W+1                      51403 01411  11 32000 02501
                SP    W+12                        SAVE STORAGE ADDRESS IN         51404 01412  31 02514 00000
                TP    A             TEMP+6         TEMP+6 AND TEST IF             51405 01413  11 32000 02533
                EJ    BLNKS         L+3            BLANK DO NOT CONVERT           51406 01414  43 02100 01417
T110            RJ    T85           T84           CONVERT TO XS-3 AND             51407 01415  37 01137 01127
                TP    A             W+12           STORE IN W+12                  51410 01416  11 32000 02514
                SP    W+13                        SAVE EXECUTION ADDRESS          51411 01417  31 02515 00000
                TP    A             TEMP+7         IN TEMP+7 AND TEST IF          51412 01420  11 32000 02534
                EJ    BLNKS         T113           BLANK DO NOT CONVERT           51413 01421  43 02100 01440
                RJ    T85           T84           CONVERT TO XS-3 AND             51414 01422  37 01137 01127
                TP    A             W+13           STORE IN W+13                  51415 01423  11 32000 02515
T111            SP    W+14                        TEST IF OP IS BLANK IF          51416 01424  31 02516 00000
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        EJ    BLNKS       T114      SO  JUMP TO RSRV TEST          51417 01425  43 02100 01441
        RJ    T85         T84     CONVERT TO XS-3  SPLIT          51420 01426  37 01137 01127
        LQ    A           A+24       OFF TWO LOW ORDER CHAR       51421 01427  55 32000 32030
        LTL   12          W+14       ACTERS STORE IN W+14         51422 01430  22 00014 02516
        SP    W+15                  STORE U FIELD IN ACCUM       51423 01431  31 02517 00000
        RJ    T85         T84        CONVERT TO XS-3              51424 01432  37 01137 01127
T112    TP    A           W+15       STORE IN W+15                51425 01433  11 32000 02517
        SP    W+16                  STORE V FIELD IN ACCUM       51426 01434  31 02520 00000
        RJ    T85         T84        CONVERT TO XS-3              51427 01435  37 01137 01127
        TP    A           W+16       STORE IN W+16                51430 01436  11 32000 02520
        RJ    T101        WBTAPE    SET UP OCTAL TAPE BUFFER      51431 01437  37 01327 01304
T113    MJ                          EXIT                         51432 01440  45 00000 00000
T114    TP    W+2         A         TEST LOCATION FIELD FOR      51433 01441  11 02502 32000
        EJ    RSRV        T115       IF SO JUMP TO T115          51434 01442  43 02061 01445
        RPV   2           T113      SET STORAGE AND EXECUTON     51435 01443  75 10002 01440
        TP    BLNKS       W+12       TO ZERO FOR EQLS + SETL     51436 01444  11 02100 02514
T115    SP    W+3                   TEST IF U FIELD OF RSRV      51437 01445  31 02503 00000
        ZJ    L+2         L+1        IS ZERO IF SO CLEAR         51440 01446  47 01450 01447
        TP    BLNKS       W+12       STORAGE ADDRESS             51441 01447  11 02100 02514
        SP    W+5                   TEST IF V FIELD OF RSRV      51442 01450  31 02505 00000
        ZJ    T113        L+1        IS ZERO IF SO CLEAR         51443 01451  47 01440 01452
        TP    BLNKS       W+13       EXECUTION ADDRESS           51444 01452  11 02100 02515
        MJ                T113      JUMP TO CONVERSION EXIT      51445 01453  45 00000 01440
T120                      10B)      EXECUTION LOCATION CTR       51446 01454  00 00000 00010
T121                      10B)      STORAGE LOCATION COUNTER     51447 01455  00 00000 00010
T122          20000B)                L( TYPE CONSTANT TALLY      51450 01456  00 20000 00000
T123          20144B)                L( TYPE CONSTANT MAXIMUM    51451 01457  00 20144 00000
T124                                 ADDRESS OF 1ST CONSTANT      51452 01460  00 00000 00000
T125          20000B)                UNDEFINED TAG TALLY         51453 01461  00 20000 00000
T126          20113B)                UNDEFINED TAG MAXIMUM       51454 01462  00 20113 00000
T129          21750B)                TAG MAXIMUM                 51455 01463  00 21750 00000
T127                                 ADDRESS OF 1ST UNDEF TAG     51456 01464  00 00000 00000
T128          20000B)                TAG TALLY                   51457 01465  00 20000 00000
T130                                 EQLS TALLY                  51460 01466  00 00000 00000
T131                                 EQLS MAXIMUM                51461 01467  00 00000 00000
T132                                 DUPLICATE TAG TALLY         51462 01470  00 00000 00000
T133                                 DUPLICATE TAG MAXIMUM       51463 01471  00 00000 00000
T134                                 LAST EXECUTION ADDRESS      51464 01472  00 00000 00000
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T135                                                LAST STORAGE ADDRESS          51465 01473  00 00000 00000
T136                                                INPUT BLOCKETTE COUNT         51466 01474  00 00000 00000
T136A                                               INPUT BLOCKETTE TALLY         51467 01475  00 00000 00000
T137                                                DRUM STORE TALLY              51470 01476  00 00000 00000
T138                                                ERROR INDICATOR               51471 01477  00 00000 00000
T139    B                                           BLOCKETTE TALLY               51472 01500  00 00000 00000
T140                                                OUTPUT BLOCK TALLY            51473 01501  00 00000 00000
T141                                                DRUM TO CORE TALLY            51474 01502  00 00000 00000
T142          20114B)                               OPERATION TABLE TALLY         51475 01503  00 20114 00000
T144    B     5                                     OCTAL TAPE BLOCKET TEST       51476 01504  00 00000 00005
T145    B     5                                     OCTAL TAPE BLOCKET TALLY      51477 01505  00 00000 00005
T146    B     24                                    OCTAL TAPE BLOCK TALLY        51500 01506  00 00000 00024
T148    MJ                  T5                      DUMMY COMMAND                 51501 01507  45 00000 00064
T149          WT+1200       WT                      RESETTING CONSTANT            51502 01510  00 06370 04110
T150          W+1           WT+1200                 RESETTING CONSTANT            51503 01511  00 02501 06370
T151    RJ    T20           T18                     TO READ INPUT TAPE            51504 01512  37 00235 00217
T152    TP    OTABLE        Q                       FOR OPERATION LOOKUP          51505 01513  11 00362 31000
T153          W+3           W+1                     RESETTING CONSTANT            51506 01514  00 02503 02501
T154          W+5           WT+1200                 RESETTING CONSTANT            51507 01515  00 02505 06370
T155          W+6           T69-1                   RESETTING CONSTANT            51510 01516  00 02506 01012
T157                        BT+100                  RESETTING CONSTANT            51511 01517  00 00000 03530
T160    RPB   20            L+2                     SAVE END INSTRUCTION          51512 01520  75 30024 01522
        TP    W+1           2BUF+900                 IN 2BUF+900                  51513 01521  11 02501 11235
        RS    T122          RPD                     TEST IF L( TYPE CONSTANT      51514 01522  23 01456 02075
        SJ    T165          L+1                      HAVE BEEN USED               51515 01523  46 01552 01524
        RPV   20            L+2                     SET STORAGES W - W+19         51516 01524  75 10024 01526
        TP    BLNKS         W                        TO BLANKS                    51517 01525  11 02100 02500
        RPB   3             L+2                     STORE THE WORDS CONSTANT      51520 01526  75 30003 01530
T161    TP    CPRINT        W+5                      POOL IN W+5 - W+7            51521 01527  11 02102 02505
        LTL   21            TEMP+5                  SETUP CONSTANT INDEX          51522 01530  22 00025 02532
        TP    T134          W+13                    STORE EXECUTION ADDRESS       51523 01531  11 01472 02515
        RA    T134          L(1)                    BUMP EXECUTION ADDRESS        51524 01532  21 01472 02113
        SS    T135                                  TEST IF STORAGE ADDRESS       51525 01533  34 01473 00000
T162    EJ    L(1)          L+2                      EQUALS EXECUTION ADDR-       51526 01534  43 02113 01536
        TP    T135          W+12                     IF NOT STORE IN W+12         51527 01535  11 01473 02514
        RA    T135          L(1)                    BUMP STORAGE ADDRESS          51530 01536  21 01473 02113
        RJ    L             L+1                     ONE SHOT SWITCH               51531 01537  37 01537 01540
T163    SP    CPT                                   SPLIT BINARY CONSTANT         51532 01540  31 02544 00000
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        RJ    T87          T86           AND STORE IN W+14 -W+16     51533 01541  37 01143 01140
        RA    L-2          L(100000B)    BUMP CONSTANT POOL FETCH    51534 01542  21 01540 02120
        RPB   2            L+2           STORE SYMBOLIC CONSTANT     51535 01543  75 30002 01545
        TP    CPT+100      W+9            INTO W+9 AND W+10          51536 01544  11 02710 02511
T164    RA    L-1          L(200000B)    BUMP FETCH                  51537 01545  21 01544 02110
        RJ    T25          T21           STORE IN OUTPUT BUFFER      51540 01546  37 00267 00236
        RPV   3            L+2           CLEAR STORAGES              51541 01547  75 10003 01551
        TP    L(0)         W+5            W+5 TO W+7                 51542 01550  11 02115 02505
        IJ    TEMP+5       T161+2        TEST FOR ALL CONSTANTS      51543 01551  41 02532 01531
T165    RS    T125         RPD           TEST FOR UNDEFINED TAGS     51544 01552  23 01461 02075
        SJ    T170-1       L+1            IF NOT EXIT  IF SO         51545 01553  46 01572 01554
        RPV   20           L+2           CLEAR STORAGES              51546 01554  75 10024 01556
        TP    BLNKS        W              W TO W+19                  51547 01555  11 02100 02500
        RPB   3            L+2           STORE THE WORDS UNDEFIN     51550 01556  75 30003 01560
T166    TP    UTPRNT       W+5            ED TAGS IN W+5 TO W+7      51551 01557  11 02105 02505
        LTL   21           TEMP+5        SET UP UNDEF TAG INDEX      51552 01560  22 00025 02532
        SP    L(0)                       SET OCTAL TRANSLATION TO    51553 01561  31 02115 00000
        RJ    T87          T86            ZERO FOR UNDEFINED TAGS    51554 01562  37 01143 01140
        RJ    T163-1       T161+2        STORE IN W+14 W+15 W+16     51555 01563  37 01537 01531
        TP    UT           W+9           STORE UNDFD TAG IN W+9      51556 01564  11 03251 02511
T167    RA    L-1          L(100000B)    BUMP FETCH                  51557 01565  21 01564 02120
        RJ    T25          T21           STORE IN OUTPUT BUFFER      51560 01566  37 00267 00236
        RPV   3            L+2           CLEAR STORAGES W+5 W+6      51561 01567  75 10003 01571
        TP    L(0)         W+5            AND W+7                    51562 01570  11 02115 02505
        IJ    TEMP+5       T166+2        TEST FOR ALL UNDEFND TAG    51563 01571  41 02532 01561
        RPB   20           L+2           BRING END INSTRUCTION       51564 01572  75 30024 01574
T170    TP    2BUF+900     W+1            IN W STORAGES              51565 01573  11 11235 02501
        RJ    T69          T67           TRANSLATE U ADD OF END      51566 01574  37 01013 01005
        RJ    T85          T84           CONVERT TO XS-3             51567 01575  37 01137 01127
        RPV   8            L+2           CLEAR STORAGES              51570 01576  75 10010 01600
        TP    BLNKS        W+12           W+12 TO W+19               51571 01577  11 02100 02514
        TP    A            W+15          STORE STARTING ADDRESS      51572 01600  11 32000 02517
        RJ    T25          T21           STORE IN OUTPUT BUFFER      51573 01601  37 00267 00236
        TP    PSTOP        W+2           STORE PRTR STOP IN W+2      51574 01602  11 02101 02502
        RJ    T25          T21           STORE IN OUTPUT BUFFER      51575 01603  37 00267 00236
T171    SJ    L+4          L+1           IF TAPE DID NOT WRITE       51576 01604  46 01610 01605
        TP    T22+3        T22+2          GIMMICK TEST               51577 01605  11 00246 00245
        RJ    T25          T21           WRITE LAST BLOCK OF         51600 01606  37 00267 00236
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        SJ    L+1           L-1          SYMBOLIC TAPE                  51601 01607  46 01610 01606
        EF                  RWND4        REWIND INPUT TAPE              51602 01610  17 00000 02036
T172    EF                  RWND5        REWIND OUTPUT TAPE             51603 01611  17 00000 02042
        SP    T174                       TEST IF OCTAL TAPE             51604 01612  31 01623 00000
        ZJ    L+1           T173         IS TO BE WRITTEN               51605 01613  47 01614 01620
        TP    L(170000B)    Q            STORE MASK IN Q                51606 01614  11 02111 31000
        QS    T174          WTP6         SET OCTAL TAPE WRITE           51607 01615  53 01623 02043
        QS    T174          RWND6        SET OCTAL TAPE REWIND          51610 01616  53 01623 02044
        RJ    T109          T102A+1      WRITE OCTAL TAPE               51611 01617  37 01406 01337
T173    TV    L(40011B)     40035B)      SET FINAL STOP EXIT            51612 01620  16 02161 40035
        RS    Q             Q            CLEAR A + Q                    51613 01621  23 31000 31000
        MJ                  40034B)      FINAL STOP                     51614 01622  45 00000 40034
T174    B                                OCTAL TAPE INDICATOR           51615 01623  00 00000 00000
T175    RJ    T177          T177         SET NONSHIFT SWITCH            51616 01624  37 01640 01640
        TP    T182          W+15         STORE BOSS EXIT IN W+15        51617 01625  11 01664 02517
        TP    W+5           A            LOOK UP V ADDRESS IN           51620 01626  11 02505 32000
        RPU   30            L+2           TABLE BEGINNING IN T182       51621 01627  75 20036 01631
        EJ    T182+1        L+4           +1  IF NOT THERE SRORE        51622 01630  43 01665 01634
T176    SP    L(0)                        DEF WARNING IN ERROR           51623 01631  31 02115 00000
        TP    ILL           T138         INDICATOR AND SET              51624 01632  11 02052 01477
        MJ                  T178          ACCUMULATOR TO ZERO           51625 01633  45 00000 01643
        SN    Q             15           COMPUTE LOCATION + 1           51626 01634  33 31000 00017
        SA    T181                        OF ENTRY IN TABLE THAT         51627 01635  32 01657 00000
        AT    T181+1        L+1          MATCHES AND STORE IT           51630 01636  35 01660 01637
        TP    T182+1        Q             IN Q                          51631 01637  11 01665 31000
T177    RJ    L             L+1           ONE SHOT SWITCH               51632 01640  37 01640 01641
        QT    T181+2        A            MASK OFF LOW ORDER 6           51633 01641  51 01661 32000
        ZJ    L+1           T176+1        DIGITS IF ZERO  -             51634 01642  47 01643 01632
T178    RJ    T43           T43-2         AND STORE IN W+16             51635 01643  37 00514 00512
        MJ                  T12          EXIT                           51636 01644  45 00000 00174
        RJ    T177          T175+1       ENTER FOR IN BOSS              51637 01645  37 01640 01625
        LQ    Q             21           SHIFT Q 15 PLACES TO RT        51640 01646  55 31000 00025
T179    MJ                  T177+1       EXIR                           51641 01647  45 00000 01641
        RJ    T69           T68          TRANSLATE V ADDRESS            51642 01650  37 01013 01007
        TP    T138          W+19         STORE ERROR INDICATOR          51643 01651  11 01477 02523
        SA    T181+3                     ADD DUMMY COMMAND              51644 01652  32 01662 00000
T180    RJ    T87           T86          STORE IN W+14 W+15 W+16        51645 01653  37 01143 01140
        MJ                  T12          EXIT TO STORE ROUTINE          51646 01654  45 00000 00174
```

```
        SP    T182-1                    STORE DUMMY IN A          51647 01655  31 01663 00000
        MJ                  T180        EXIT                      51650 01656  45 00000 01653
T181            20036B)                 BOSS TABLE TALLY          51651 01657  00 20036 00000
        TP    T182+1        Q           DUMMY COMMAND             51652 01660  11 01665 31000
        B     777777                    V MASK                    51653 01661  00 00007 77777
        RJ    X2X           OPTABL      DUMMY COMMAND             51654 01662  37 17633 17634
        RJ    X2X           BOSS        DUMMY COMMAND             51655 01663  37 17633 17634
T182                        X2X         BOSS EXIT                 51656 01664  00 00000 17633
        XS3   FLDEC                     FLDEC                     51657 01665  31 46273 02600
              PSUEDO+2      PSUEDO+6    IN OUT                    51660 01666  00 17727 17733
        XS3   OCTAL                     OCTAL                     51661 01667  51 26662 44600
              PSUEDO        PSUEDO+4    IN OUT                    51662 01670  00 17725 17731
        XS3   FIXBIN                    BIXBIN                    51663 01671  31 34722 53450
              PSUEDO+8      PSUEDO+12   IN OUT                    51664 01672  00 17735 17741
        XS3   VARBIN                    VARBIN                    51665 01673  70 24542 53450
              PSUEDO+10     PSUEDO+14   IN OUT                    51666 01674  00 17737 17743
        XS3   VARCAR                    VARCAR                    51667 01675  70 24542 62454
              PSUEDO+18                 IN                        51670 01676  00 17747 00000
        XS3   ALPHAN                    ALPHAN                    51671 01677  24 46523 32450
                            PSUEDO+16       OUT                   51672 01700  00 00000 17745
        XS3   FWD                       FWD                       51673 01701  31 71270 00000
                            PSUEDO+37       OUT                   51674 01702  00 00000 17772
        XS3   BACK                      BACK                      51675 01703  25 24264 50000
                            PSUEDO+39       OUT                   51676 01704  00 00000 17774
        XS3   BINARY                    BINARY                    51677 01705  25 34502 45473
                            PSUEDO+26       OUT                   51700 01706  00 00000 17757
        XS3   XS3                       XS3                       51701 01707  72 65060 00000
                            PSUEDO+28       OUT                   51702 01710  00 00000 17761
        XS3   W                         W                         51703 01711  71 00000 00000
                            PSUEDO+29       OUT                   51704 01712  00 00000 17762
        XS3   X                         X                         51705 01713  72 00000 00000
                            PSUEDO+31       OUT                   51706 01714  00 00000 17764
        XS3   Y                         Y                         51707 01715  73 00000 00000
                            PSUEDO+33       OUT                   51710 01716  00 00000 17766
        XS3   Z                         Z                         51711 01717  74 00000 00000
                            PSUEDO+35       OUT                   51712 01720  00 00000 17770
        XS3   TABLE                     TABLE                     51713 01721  66 24254 63000
              PSUEDO+41                 IN                        51714 01722  00 17776 00000
```

```
OPTABL  EQLS  17634B)                    DEFINITION FOR BOSS
X2X     EQLS  17633B)                    DEFINITION FOR BOSS
PSUEDO  EQLS  17725B)                    DEFINITION FOR BOSS
BOSS    EQLS  17634B)                    DEFINITION FOR BOSS
SORT    SP    T128                       SUBTRACT HIGH ORDER 2      51715 01723  31 01465 00000
        SS    RPD                         FROM TAG TALLY AND        51716 01724  34 02075 00000
        AT    L(100000B)    Q             LEAVE IN U PART OF Q      51717 01725  35 02120 31000
        RA    T210+1        Q           THIS IS A CLOSED SUB-       51720 01726  21 02016 31000
T200    RA    T210A         Q            ROUTINE THAT WILL SORT     51721 01727  21 02023 31000
        RA    T203          Q            THE TAG TABLE BEGINNING    51722 01730  21 01752 31000
        RA    T208+2        Q            AT THE SYMBOLIC LOCATON    51723 01731  21 02006 31000
        RA    T209          Q            TT INTO AN ASCENDING       51724 01732  21 02011 31000
        RA    T209+2        Q            SEQUENCE WHERE EACH        51725 01733  21 02013 31000
T201    RA    T210+2        Q            ENTRY IS TREATED AS A      51726 01734  21 02017 31000
        RA    T210A-2       Q            36 BIT NUMBER WITHOUT      51727 01735  21 02021 31000
        RA    T210A+1       Q            SIGN  THE LOCATIONS        51730 01736  21 02024 31000
        LQ    Q             21           ASSOCIATED WITH THE        51731 01737  55 31000 00025
        RA    T212          Q            ENTRIES IN THE TT TABLE    51732 01740  21 02030 31000
T202    RA    T210          Q            BEGIN IN THE SYMBOLIC      51733 01741  21 02015 31000
        TP    L(1)          TEMP         LOCATION TL  THE TL       51734 01742  11 02113 02525
        RA    K             L(1)         TABLE IS 1024 WORDS        51735 01743  21 00767 02113
        LA    TEMP          1            LONG AND CONTAINS BOTH     51736 01744  54 02525 00001
        TJ    Q             L-2          STORAGE AND EXECUTION      51737 01745  42 31000 01743
        TV    Q             T211+1       LOCATIONS IN U AND V       51740 01746  16 31000 02027
        IJ    T211+1        L+1          AND IS LOCATED 1025        51741 01747  41 02027 01750
        TP    L(1)          Q            CELLS AWAY FROM THE        51742 01750  11 02113 31000
        SP    T211                       TAGS THEY ARE ASSOCIATD    51743 01751  31 02026 00000
T203    RPV                 L+2          WITH  THIS ROUTINES        51744 01752  75 10000 01754
        AT    L(100000B)    1BUF         REQUIRES 2 BUFFERS EACH    51745 01753  35 02120 05430
        TV    T211+1        T212+1       EQUAL IN LENGTH TO THE     51746 01754  16 02027 02031
        TU    T210A-1       T204+3       SIZE OF THE  TAG TABLE     51747 01755  15 02022 01762
        TU    T211+1        T205+1       THESE BUFFERS ARE NAMED    51750 01756  15 02027 01766
T204    TU    T211+1        T206+1       1BUF AND 2 BUF  THE        51751 01757  15 02027 01773
        TV    T211          T205+1       SORTED TABLES ARE LEFT     51752 01760  16 02026 01766
        TV    T203+1        T206+1       IN THEIR ORIGINAL          51753 01761  16 01753 01773
        TU                  T205-1       BUFFERS AT THE TERMI-      51754 01762  15 00000 01764
        RA    L-1           L(100000B)   NATION OF THE SORT         51755 01763  21 01762 02120
        QT    FILL          A            THE TL TABLE IS TESTED     51756 01764  51 30000 32000
```

```
T205    ZJ    L+1          T206+1       BIT BY BIT BEGINNING          51757 01765  47 01766 01773
        TP    FILL         FILL         IN THE LOW ORDER POSTON       51760 01766  11 30000 30000
        RA    L-1          L(100001B)   WHEN A ZERO IS FOUND          51761 01767  21 01766 02162
        TU    A            T206+1       THE CORRESPONDING DUMMY       51762 01770  15 32000 01773
        IJ    T212+1       T204+3       TP COMMAND IS PLACED          51763 01771  41 02031 01762
T206    MJ                 T207         IN 1BUF  WHEN A ONE           51764 01772  45 00000 01777
        TP    FILL         FILL         IS FOUND THE CORRESP-         51765 01773  11 30000 30000
        RA    L-1          L(100001B)   ONDING TP DUMMY IS            51766 01774  21 01773 02162
        TU    A            T205+1       PLACED IN THE 2BUF            51767 01775  15 32000 01766
        IJ    T212+1       T204+3       WHEN ONE BIT OF EACH          51770 01776  41 02031 01762
T207    TV    T206+1       T208         ENTRY IN THE TL TABLE         51771 01777  16 01773 02004
        SP    T212                      HAS BEEN TESTED THE           51772 02000  31 02030 00000
        SS    T208         15           TP DUMMIES REPRESENTING       51773 02001  34 02004 00017
        AT    T213         L+1          ONES ARE MOVED TO THE         51774 02002  35 02033 02003
        RP                 L+2          1BUF BUFFER IMMEDIATELY       51775 02003  75 00000 02005
T208    TP    2BUF         FILL         FOLLOWING THE ZERO TP         51776 02004  11 07431 30000
        QJ    L+1          T203+2       DUMMIES  WHEN ALL 36          51777 02005  44 02006 01754
        RPB                L+2          BITS OF EACH ENTRY HAVE       52000 02006  75 30000 02010
        TU    1BUF         2BUF         BEEN TESTED A MJ COMM-        52001 02007  15 05430 07431
        SP    T211                      AND IS STORED AFTER THE       52002 02010  31 02026 00000
T209    RPV                L+2          LAST DUMMY TP COMMAND         52003 02011  75 10000 02013
        AT    L(1)         1BUF         THE DUMMY TP COMMANDS         52004 02012  35 02113 05430
        RPB                L+2          ARE THEN OBEYED THESE         52005 02013  75 30000 02015
        TU    2BUF         1BUF         WILL SHUFFLE THE TABLES       52006 02014  15 07431 05430
T210    TP    T213+1       1BUF         INTO THEIR PROPER SEP-        52007 02015  11 02034 05430
        RJ    1BUF         1BUF         UENCE  THE APROXIMATE         52010 02016  37 05430 05430
        RPB                L+2          SORTING SPEED IS 1.3          52011 02017  75 30000 02021
        TP    2BUF+1       TT           SECONDS PER 100 ENTRIES       52012 02020  11 07432 11432
        RPU                L+2          A MAXIMUM OF 1024             52013 02021  75 20000 02023
        RA    1BUF         T212+2       ENTRIES MAY BE SORTED         52014 02022  21 05430 02032
T210A   RJ    1BUF         1BUF       THE ENTRY POINT FOR THIS        52015 02023  37 05430 05430
        RPB                FILL         SORT ROUTINE IS AT THE        52016 02024  75 30000 30000
        TP    2BUF+1       TL           SYMBOLIC LOCATION SORT        52017 02025  11 07432 13433
T211    TP    TT-1         2BUF         THE EXIT POINT IS             52020 02026  11 11431 07431
              1BUF                      AT THE SYMBOLIC LOCA-         52021 02027  00 05430 00000
T212    TP    2BUF         1BUF         TION T210A + 1                52022 02030  11 07431 05430
        B                             WORKING STORAGE                52023 02031  00 00000 00000
              1025                    TAG LOCATION - TAG TABLE       52024 02032  00 02001 00000
```

```
T213    RPB              T208+1                                  52025 02033  75 30000 02005
        MJ               FILL                                    52026 02034  45 00000 30000
RDTP4   B    020006240000          READ INPUT TAPE               52027 02035  02 00062 40000
RWND4   B    020020040000          REWIND INPUT TAPE             52030 02036  02 00200 40000
MBACK   B    020007440000          MOVE INPUT TAPE BACK          52031 02037  02 00074 40000
MBCK1   B    020007440001          MOVE INPUT TAPE BACK 1        52032 02040  02 00074 40001
WTP5    B    020004650000          WRITE OUTPUT TAPE             52033 02041  02 00046 50000
RWND5   B    020020050000          REWIND OUTPUT TAPE            52034 02042  02 00200 50000
WTP6    B    020014660000          WRITE OCTAL TAPE              52035 02043  02 00146 60000
RWND6   B    020020060000          REWIND OCTAL TAPE             52036 02044  02 00200 60000
STAPE   B    020060000000          STOP TAPE                     52037 02045  02 00600 00000
NOP     XS3     NOP                ---NOP WARNING                52040 02046  00 00005 05152
DEC     XS3     DEC                ---DEC WARNING                52041 02047  00 00002 73026
OCT     XS3     OCT                ---OCT WARNING                52042 02050  00 00005 12666
DEF     XS3     DEF                ---DEF WARNING                52043 02051  00 00002 73031
ILL     XS3     ILL                ---ILL WARNING (BOSS)         52044 02052  00 00003 44646
DUP     XS3     DUP                ---DUP WARNING                52045 02053  00 00002 76752
EXP     XS3     EXP                ---EXP WARNING                52046 02054  00 00003 07252
L1320        1320                  DRUM FETCH CONSTANT           52047 02055  00 02450 00000
E       XS3  E                     E  (TEST CONSTANT)            52050 02056  30 00000 00000
S       XS3  S                     S  (TEST CONSTANT)            52051 02057  65 00000 00000
EQLS    XS3  EQLS                  EQLS (TEST CONSTANT)          52052 02060  30 53466 50000
RSRV    XS3  RSRV                  RSRV (TEST CONSTANT)          52053 02061  54 65547 00000
SETL    XS3  SETL                  SETL (TEST CONSTANT)          52054 02062  65 30664 60000
END     XS3  END                   END  (TEST CONSTANT)          52055 02063  30 50270 00000
SIND                               STORAGE INDICATOR             52056 02064  00 00000 00000
1S34    B34  1                     ONE SCALED 34                 52057 02065  20 00000 00000
L10B2   B    324464741135          LOG 10 BASE 2 SCALED 33       52060 02066  32 44647 41135
1S35    B    400000000000          ONE SCALED 35                 52061 02067  40 00000 00000
OMASK   B    077770000000          OPERATION MASK                52062 02070  07 77700 00000
XS3     B    726500000000          XS3                           52063 02071  72 65000 00000
LPCT    B    377737773777          LOOP COUNTER                  52064 02072  37 77377 73777
BTST    B    202020202020          TEST FOR LETTERS A B C D      52065 02073  20 20202 02020
WDA     B    000100000000          OCTAL TAPE WORD ADDER         52066 02074  00 01000 00000
RPD          20001B)               REPEAT DUMMY                  52067 02075  00 20001 00000
Z3S     B    030303030303          SIX XS3 ZEROES                52070 02076  03 03030 30303
XS3Z    B    000303030303          FIVE XS3 ZEROES               52071 02077  00 03030 30303
BLNKS   B    010101010101          BLANKS                        52072 02100  01 01010 10101
```

```
PSTOP   B     606060606060                PRINTER STOP                    52073 02101  60 60606 06060
CPRINT  XS3    CONST                      (CONSTANT POOL) HEADING         52074 02102  00 26515 06566
        XS3   ANT  P                       FOR SYMBOLIC OUTPUT            52075 02103  24 50660 00052
        XS3   OOL                          LISTING                        52076 02104  51 51460 00000
UTPRNT  XS3    UNDEF                      (UNDEFINED TAG) HEADING         52077 02105  00 67502 73031
        XS3   INED                         FOR SYMBOLIC OUTPUT            52100 02106  34 50302 70000
        XS3   TAGS                         LISTING                        52101 02107  66 24326 50000
                          CONSTANT  P  OOL          L(200000B)             52102 02110  00 00002 00000
                                                    L(170000B)             52103 02111  00 00001 70000
                                                    L(11)                  52104 02112  00 00000 00013
                                                    L(1)                   52105 02113  00 00000 00001
                                                    L(180)                 52106 02114  00 00000 00264
                                                    L(0)                   52107 02115  00 00000 00000
                                                    L(1980)                52110 02116  00 00000 03674
                                                    L(6)                   52111 02117  00 00000 00006
                                                    L(100000B)             52112 02120  00 00001 00000
                                                    L(2)                   52113 02121  00 00000 00002
                                                    L(1079)                52114 02122  00 00000 02067
                                                    L(10B)                 52115 02123  00 00000 00010
                                                    L(1300000B)            52116 02124  00 00013 00000
                                                    L(3)                   52117 02125  00 00000 00003
                                                    L(4)                   52120 02126  00 00000 00004
                                                    L(119)                 52121 02127  00 00000 00167
                                                    L(20)                  52122 02130  00 00000 00024
                                                    L(5)                   52123 02131  00 00000 00005
                                                    L(2400000B)            52124 02132  00 00024 00000
                                                    L(9)                   52125 02133  00 00000 00011
                                                    L(77B)                 52126 02134  00 00000 00077
                                                    L(12B)                 52127 02135  00 00000 00012
                                                    L(54B)                 52130 02136  00 00000 00054
                                                    L(67B)                 52131 02137  00 00000 00067
                                                    L(70B)                 52132 02140  00 00000 00070
                                                    L(25B)                 52133 02141  00 00000 00025
                                                    L(10000B)              52134 02142  00 00000 10000
                                                    L(46B)                 52135 02143  00 00000 00046
                                                    L(53B)                 52136 02144  00 00000 00053
                                                    L(31344646B)           52137 02145  00 00313 44646
                                                    L(77777B)              52140 02146  00 00000 77777
```

```
                                    L(30000B)       52141 02147   00 00000 30000
                                    L(32000B)       52142 02150   00 00000 32000
                                    L(31000B)       52143 02151   00 00000 31000
                                    L(64B)          52144 02152   00 00000 00064
                                    L(22B)          52145 02153   00 00000 00022
                                    L(40B)          52146 02154   00 00000 00040
                                    L(7)            52147 02155   00 00000 00007
                                    L(31B)          52150 02156   00 00000 00031
                                    L(200B)         52151 02157   00 00000 00200
                                    L(200002B)      52152 02160   00 00002 00002
                                    L(40011B)       52153 02161   00 00000 40011
                                    L(100001B)      52154 02162   00 00001 00001
    END  START          PROGRAM BEGINS AT START                       50000
```

ONE CORE VERSION OF SLAP

The one-core version of the Symbolic Language Assembly Program differs from the two-core version as follows:

I. No more than 4096 words of magnetic core storage are used.

II. All tape operations are performed in fixed block mode.

III. Input may be either on cards or on tape.

A. Card input option. Entry point is the first word of the program. If a card mispick occurs, operation may be resumed by cycling the card into correct position and starting at location 00075. In assembling programs of more than 1152 instructions, an additional servo is used for intermediate data storage.

B. Tape input option. Entry point is the third word of the program.

IV. The program produces a symbolic XS3 tape only; no octal XS3 tape is written.

V. The following maximum limits are in force:

A. Number of tags - 768

B. Number of undefined tags - 75

C. Number of constants - 75

D. Number of EQLS instructions in tape mode - 60
in card mode - 30

VI. The content of the Q-register may be used to specify the input servo (which is used as the intermediate servo in card mode) and the output servo. If the operation field is zero, the u-field contains a number from 1 to 10 inclusive, and the v-field contains a number from 1 to 10 inclusive, then the input and output servo numbers are taken from the u and v fields respectively. If not, servo 4 is used for input and servo 5 for output.

```
         SETL  50000B)       50000B)
         RPB   2000          PASS1       CARD START                          50000  77 33720 00010
         TP    L+3           PASS1       BOOTSTRAP SLAP TO CORE              50001  11 50004 00010
         RPB   2000          T2          TAPE START                          50002  75 33720 00035
         TP    L+1           PASS1                                           50003  11 50004 00010
         SETL                2130B)
W        RSRV                21          W STORAGES
TEMP     RSRV                20          TEMPORARY STORAGE
CPT      RSRV                225         CONSTANT POOL
DTT      RSRV                25          DUPLICATE TAG TABLE
UT       RSRV                75          UNDEFINED TAG TABLE
TT       RSRV                769         TAG TABLE
TL       RSRV                769         TAG LOCATION TABLE
WT       RSRV                720         INPUT-OUTPUT BUFFER
WT2      RSRV                240         PASS2 INPUT SECTION
EB       RSRV                120         EQLS COMMAND BUFFER
1BUF     EQLS  WT                        FIRST SORT BUFFER
2BUF     EQLS  TL                        SECOND SORT BUFFER
DSTORE   EQLS  50000B)                   DRUM STORAGE FOR CODING
TLDRUM   EQLS  76400B)                   DRUM STORAGE DURING SORT
         SETL                10B)
PASS1    TP    T2+3          T8+4        SET CARD EXIT                 50004 00010  11 00040 00301
         SP    G             21          IF THE U AND V ADDRESSES      50005 00011  31 31000 00025
         LTL                 TEMP         OF Q ARE BOTH IN THE         50006 00012  22 00000 02155
         SP    A             15           RANGE 1-10, USE THEM AS      50007 00013  31 32000 00017
         LTL                 TEMP+1       INPUT AND OUTPUT SERVO       50010 00014  22 00000 02156
         SP    L(10)                      NUMBERS RESPECTIVELY.        50011 00015  31 02045 00000
         TJ    TEMP          T1           IF NOT, USE SERVO 4 FOR      50012 00016  42 02155 00031
         TJ    TEMP+1        T1           INPUT AND SERVO 5 FOR        50013 00017  42 02156 00031
         LA    TEMP          12           OUTPUT.                      50014 00020  54 02155 00014
         ZJ    L+1           T1                                        50015 00021  47 00022 00031
         LA    TEMP+1        12                                        50016 00022  54 02156 00014
         ZJ    L+1           T1                                        50017 00023  47 00024 00031
         TP    L(170000B)    Q                                         50020 00024  11 02046 31000
         RPV   5             L+2                                       50021 00025  75 10005 00027
         QS    TEMP          RDTP4       SET UP INPUT SERVO NO         50022 00026  53 02155 01777
         QS    TEMP+1        RWND5       SET UP OUTPUT SERVO NO        50023 00027  53 02156 01776
         QS    TEMP+1        WTP5                                      50024 00030  53 02156 01775
```

```
T1      RPV   769          L+2          FILL TAG TABLE WITH          50025 00031  75 11401 00033
        TP    L-1          TT            LARGE ENTRIES               50026 00032  11 00031 02706
        EF                 RDCARD       START CARD READER            50027 00033  17 00000 01774
        MJ                 RDCD                                      50030 00034  45 00000 00041
T2      RJ    T1           PASS1+1      TAPE START  SET SERVOS       50031 00035  37 00031 00011
        EF                 RDTP4        START TAPE                   50032 00036  17 00000 01777
        MJ                 RDTP                                      50033 00037  45 00000 00160
        MJ                 T8C          CARD PRESET FOR T8+4         50034 00040  45 00000 00321
RDCD    RPV   60           L+2          CARD READ SUBROUTINE         50035 00041  75 10074 00043
        TP    L(0)         EB+60        THIS LOOP READS ONE CARD     50036 00042  11 02047 07704
        TP    L(14B)       TEMP+13       TRANSLATING THE 1ST 60      50037 00043  11 02050 02172
        TU    T3A-1        T3            COLUMNS INTO 60 OCTAL       50040 00044  15 00070 00052
        TP    L(35)        TEMP+15       NUMBERS STORED FROM         50041 00045  11 02051 02174
        ER0                Q             EB+60 TO EB+119             50042 00046  76 00000 31000
        ER1                Q             FOR EACH COLUMN A PUNCH     50043 00047  76 10000 31000
        ER1                TEMP+14       IN THE 9 ROW ADDS 14 TO     50044 00050  76 10000 02173
        QJ    L+1          L+2           THE CORRESPONDING CELL      50045 00051  44 00052 00053
T3      RA    EB+60        TEMP+13       LIKEWISE   8 ADDS 13,       50046 00052  21 07704 02172
        RA    L-1          L(100000B)    7 ADDS 12, 6 ADDS 11,       50047 00053  21 00052 02052
        IJ    TEMP+15      L-3           5 ADDS 10, 4 ADDS 7,        50050 00054  41 02174 00051
        RJ    L            L+1           3 ADDS 6, 2 ADDS 5,         50051 00055  37 00055 00056
        TP    L(23)        TEMP+15       1 ADDS 4, 0 ADDS 60,        50052 00056  11 02053 02174
        TP    TEMP+14      Q             11 ADDS 40, 12 ADDS 20.     50053 00057  11 02173 31000
        RJ    L-3          T3-1          THE RESULTING COLUMN        50054 00060  37 00055 00051
        RS    TEMP+13      L(1)          TOTALS GIVE THE CORRECT     50055 00061  23 02172 02054
        EJ    L(3)         L+4           OCTAL XS3 VALUES FOR        50056 00062  43 02055 00066
        TJ    L(17B)       RDCD+3        ALL BUT 11 LEGAL KEY-       50057 00063  42 02056 00044
        ST    L(17B)       TEMP+13       PUNCH CHARACTERS. THESE     50060 00064  36 02056 02172
        ZJ    RDCD+3       T3A           11 ARE TRANSLATED IN        50061 00065  47 00044 00071
        TP    L(60B)       TEMP+13       THE LOOP WHICH STARTS       50062 00066  11 02057 02172
        MJ                 RDCD+3        AT T4.                      50063 00067  45 00000 00044
              EB+60        WT           USED FOR RESETS              50064 00070  00 07704 05710
T3A     SP    EB+66        6            TEST FOR END INSTRUCTION     50065 00071  31 07712 00006
        SA    EB+67        6                                         50066 00072  32 07713 00006
        SA    EB+68        18                                        50067 00073  32 07714 00022
        EJ    END          CDEND                                     50070 00074  43 02021 00151
        EF                 RDCARD       START RDR--MISPICK START     50071 00075  17 00000 01774
        RP    460          L+2          STALL FOR MISPICK IF         50072 00076  75 00714 00100
```

```
                LA    L           72          THERE IS ONE                    50073 00077  54 00077 00110
                RJ    L           L+1        ONE-SHOT SWITCH                  50074 00100  37 00100 00101
                TU    T3A-1       T4+4       PRESET WORD FETCH                50075 00101  15 00070 00106
T4              RPV   10          L+2        THIS LOOP CHANGES THE            50076 00102  75 10012 00104
                TR    L(0)        W+1         OCTAL TOTALS CORRESPOND         50077 00103  11 02047 02131
                TP    L(9)        TEMP+14     ING TO THE 11 SPECIAL           50100 00104  11 02060 02173
                TP    L(5)        TEMP+13     KEYPUNCH CHARACTERS             50101 00105  11 02061 02172
                LQ    EB+60       A           INTO CORRECT XS3 CODES.         50102 00106  55 07704 32000
                ZJ    L+1         T4A         WHEN ONE OF THESE OCTAL         50103 00107  47 00110 00137
                QT    L(14B)      A           TOTALS IS ENCOUNTERED           50104 00110  51 02050 32000
                ZJ    T4A         L+1         CONTROL GOES TO THE 0           50105 00111  47 00137 00112
                LQ    Q           34          20 40 OR 60 BANK ACCORD         50106 00112  55 31000 00042
                QT    L(14B)      A           INGLY AND ADJUSTS IT.           50107 00113  51 02050 32000
                LQ    Q           2          NO SPECIAL PROVISION IS          50110 00114  55 31000 00002
                QA    L(3)        A           MADE FOR ILLEGAL PUNCH          50111 00115  52 02055 32000
                AT    L+1         L+1         COMBINATIONS                    50112 00116  35 00117 00117
                RJ    L           L+1        GO TO 0 20 40 OR 60 BANK         50113 00117  37 00117 00120
                RA    Q           L(3)       0 BANK. CHANGE 100 TO 23         50114 00120  21 31000 02055
                RA    Q           L(3)                  OR 101 TO 21          50115 00121  21 31000 02055
                RS    Q           L(63B)                OR 102 TO 17          50116 00122  23 31000 02062
                MJ                T4A        DEPENDING ON ENTRY POINT         50117 00123  45 00000 00137
                RA    Q           L(2)       20 BANK. CHANGE 20 TO 63         50120 00124  21 31000 02063
                RA    Q           L(41B)                OR 21 TO 62           50121 00125  21 31000 02064
                MJ                T4A        DEPENDING ON ENTRY POINT         50122 00126  45 00000 00137
                MJ                T4A        DUMMY JUMP                       50123 00127  45 00000 00137
                RS    Q           L(17B)     40 BANK. CHANGE 40 TO 02         50124 00130  23 31000 02056
                RS    Q           L(20B)                OR 41 TO 22           50125 00131  23 31000 02065
                RA    Q           L(1)                  OR 42 TO 43           50126 00132  21 31000 02054
                MJ                T4A        DEPENDING ON ENTRY POINT         50127 00133  45 00000 00137
                RS    Q           L(51B)     60 BANK. CHANGE 60 TO 03         50130 00134  23 31000 02066
                MJ                L+1                   OR 61 TO 55           50131 00135  45 00000 00136
                RS    Q           L(4)                  OR 62 TO 56           50132 00136  23 31000 02067
T4A             LA    W+1         6          THIS PART OF THE LOOP            50133 00137  54 02131 00006
                AT    Q           W+1         PACKS THE 60 CORRECT            50134 00140  35 31000 02131
                RA    T4+4        L(100000B)  XS3 CODES STORED FROM           50135 00141  21 00106 02052
                IJ    TEMP+13     T4+4        EB+60 ON INTO 10 WORDS          50136 00142  41 02172 00106
                RA    T4A         L(100000B)  W+1 TO W+10. THE CARD           50137 00143  21 00137 02052
                RA    T4A+1       L(1)        INSTRUCTION IS NOW              50140 00144  21 00140 02054
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        IJ    TEMP+14     T4+3          READY FOR PROCESSING      50141 00145  41 02173 00105
        RS    T4A         L(1200000B)   EXACTLY AS IF IT HAD      50142 00146  23 00137 02070
        RS    T4A+1       L(10)         BEEN READ FROM TAPE       50143 00147  23 00140 02045
        MJ                T5-1                                    50144 00150  45 00000 00240
CDEND   RJ    L-1         T4-1          TRANSLATE END INSTRUCTN   50145 00151  37 00150 00101
        RJ    T8          T8            TRANSFER END TO WT BFR    50146 00152  37 00275 00275
        TP    T8+4        A             TEST FOR FULL DRUM        50147 00153  11 00301 32000
        EJ    T2+3        BADBK-2       NO TRANSFR GROUP TO DRUM  50150 00154  43 00040 00204
        RJ    T9B         T9A           WRITE LAST BLOCK          50151 00155  37 00355 00342
        EF                RWND4         REWIND 4                  50152 00156  17 00000 02003
        MJ                PASS2         GO TO SECOND PASS         50153 00157  45 00000 00360
RDTP    RPV   20          L+2           TAPE SUBROUTINE           50154 00160  75 10024 00162
        ER1               W+1           READ IN BLOCKETTE         50155 00161  76 10000 02131
        TP    W+2         A                                       50156 00162  11 02132 32000
        EJ    END         TPEND         TEST FOR END INSTRUCTION  50157 00163  43 02021 00172
        RA    T136        L(1)          BUMP BLOCKETTE COUNTER    50160 00164  21 01544 02054
        TJ    L(6)        L+4           TEST FOR BLOCK            50161 00165  42 02071 00171
        ER0               A             IF SO CHECK PARITY        50162 00166  76 00000 32000
        ZJ    BADBK       L+1           IF BAD BLOCK, JUMP DOWN   50163 00167  47 00206 00170
        RA    T136B       L(1)          BUMP BLOCK COUNTER        50164 00170  21 01546 02054
        MJ                T5-1          PROCEED TO PROCESSING     50165 00171  45 00000 00240
TPEND   RJ    T8          T8            TRANSFER END TO WT BFR    50166 00172  37 00275 00275
        TV    T2+2        RDTP+5        SET TO AVOID PROCESSING   50167 00173  16 00037 00165
        RJ    RDTP+9      RDTP+4        SET TO COMPLETE BLOCK     50170 00174  37 00171 00164
        EF                STAPE         STOP TAPE                 50171 00175  17 00000 02004
        RS    T136B       L(192)        IF DRUM IS FULL MOVE      50172 00176  23 01546 02072
        SJ    L+5         L+1            TAPE BACK FOR SECOND     50173 00177  46 00204 00200
        ZJ    L+1         L+4            PASS.                    50174 00200  47 00201 00204
        AT    MBACK       MBACK          IF NOT, JUMP TO          50175 00201  35 02001 02001
        EF                MBACK          TRANSFER LAST INSTRUCT   50176 00202  17 00000 02001
        MJ                PASS2          IONS TO DRUM             50177 00203  45 00000 00360
        RJ    T8D+2       T8D+2                                   50200 00204  37 00331 00331
        MJ                PASS2         GO TO SECOND PASS         50201 00205  45 00000 00360
BADBK   EF                MBCK1         MOVE BACK ONE BLOCK       50202 00206  17 00000 02000
        RS    T136A       L(5)          RESET INSTRUCTION COUNTR  50203 00207  23 01545 02061
        TV    T3A-1       T8+1          RESET STORAGE INST        50204 00210  16 00070 00276
        RS    T5+2        T128A         RESET TAG AND LOCATION    50205 00211  23 00243 01533
        RS    T5A         T128A          STORAGE INSTRUCTIONS     50206 00212  23 00246 01533
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                LQ    T128A          15                                    50207 00213  55 01533 00017
                RS    T128           Q              RESET TAG TALLY        50210 00214  23 01532 31000
                TJ    T129           L+2            TEST IF TOO MANY TAGS  50211 00215  42 01534 00217
                MJ                   L+2            YES                    50212 00216  45 00000 00220
                TV    T6-2           T5+1           NO UNSET GIMMICK EXIT  50213 00217  16 00252 00242
                RS    T130           T130A          RESET EQUALS TALLY     50214 00220  23 01535 01536
                LQ    T130A          1                                     50215 00221  55 01536 00001
                RS    T7+1           Q              RESET EQLS STORAGE INST 50216 00222  23 00266 31000
                RS    CPOOL+3        T122A          RESET CONSTANT POOL    50217 00223  23 01047 01524
                RS    T127           T122A           STORAGE INSTRUCTIONS  50220 00224  23 01531 01524
                LQ    T122A          1              RESET TALLY + 1ST UNDEF 50221 00225  55 01524 00001
                RS    CPOOL+5        Q               ADDRESS               50222 00226  23 01051 31000
                LQ    Q              14                                    50223 00227  55 31000 00016
                RS    T122           Q                                     50224 00230  23 01523 31000
                TJ    T123           L+2            TEST IF POOL IS FILLED 50225 00231  42 01525 00233
                MJ                   L+2            YES                    50226 00232  45 00000 00234
                TV    L+4            CPOOL+1        NO RESET TO ACCEPT MORE 50227 00233  16 00237 01045
                EF                   RDTP4          START TAPE             50230 00234  17 00000 01777
                RPB   2              T8B+2          RESTORE LOCATION CNTRS 50231 00235  75 30002 00312
                TP    T121A          T120            AND GO TO CLEAR COUNTS50232 00236  11 01521 01517
                                     CPOOL+3        ADDRESS FOR CPOOL+1    50233 00237  00 00000 01047
                RA    T136A          L(1)           BUMP INSTRUCTION COUNTER50234 00240  21 01545 02054
T5              RJ    T56            T50            TEST LOCATION FIELD FOR50235 00241  37 01011 00747
                ZJ    L+1            T6              TAG                   50236 00242  47 00243 00254
                TP    A              TT             STORE TAG IN TAG TABLE 50237 00243  11 32000 02706
                RA    L-1            L(1)           BUMP TAG STORE         50240 00244  21 00243 02054
                SP    T121           15             COMBINE STORAGE AND    50241 00245  31 01520 00017
T5A             AT    T120           TL              EXEC L CTRS INTO TL   50242 00246  35 01517 04307
                RA    L-1            L(1)           BUMP L COUNTER STORE   50243 00247  21 00246 02054
                RA    T128A          L(1)           BUMP TAG COUNT         50244 00250  21 01533 02054
                RA    T128           L(100000B)     BUMP TAG TALLY         50245 00251  21 01532 02052
                TJ    T129           T6             TEST FOR TOO MANY TAGS 50246 00252  42 01534 00254
                TV    T5+1           T5             GIMMICK EXIT           50247 00253  16 00242 00241
T6              RJ    T75            T74            TEST FOR RSRV OR SETL  50250 00254  37 01225 01222
                EJ    EQLS           T7             TEST FOR EQLS          50251 00255  43 02015 00265
                EJ    XS3            T7-2           TEST FOR XS3 PSEUDO OP 50252 00256  43 02020 00263
                EJ    W+2            L+2            IF NEITHER CONTINUE TEST50253 00257  43 02132 00261
                MJ                   T8             GO TO STORE INSTRUCTION50254 00260  45 00000 00275
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      RJ    T56         T51       TEST U FIELD FOR CONSTS      50255 00261  37 01011 00752
      RJ    T56         T52       TEST V FIELD FOR CONSTS      50256 00262  37 01011 00755
      RPU   2           T8        BUMP LOC COUNTERS            50257 00263  75 20002 00275
      RA    T120        L(1)      GO TO STORE INSTRUCTION      50260 00264  21 01517 02054
T7    RPB   2           L+2       STORE U ADDRESS OF EQLS      50261 00265  75 30002 00267
      TP    W+3         EB         INST INTO EQUALS BUFFER     50262 00266  11 02133 07610
      TV    T5A         L+2        FOR TRANSLATION BETWEEN     50263 00267  16 00246 00271
      RS    L+1         L(1)       PASSES STORE ADDRESS        50264 00270  23 00271 02054
      TN    T7+1                   OF THIS STORE IN TL         50265 00271  13 00266 00000
      RA    T7+1        L(2)       TABLE                       50266 00272  21 00266 02063
      RA    T130        L(1)      BUMP EQUALS TALLY            50267 00273  21 01535 02054
      RA    T130A       L(1)      BUMP EQLS COUNT              50270 00274  21 01536 02054
T8    RPB   10          L+2       TRANSFER INSTRUCTION         50271 00275  75 30012 00277
      TP    W+1         WT         TO BUFFER                   50272 00276  11 02131 05710
      RA    L-1         L(10)     BUMP STORAGE INST            50273 00277  21 00276 02045
      TP    T136A       A         FETCH INSTRUCTION COUNT      50274 00300  11 01545 32000
      MJ                L+1       EXIT IF IN CARD MODE         50275 00301  45 00000 00302
      TJ    L(96)       T8B       TEST FOR 96 INSTRUCTIONS     50276 00302  42 02073 00310
      EF                STAPE     YES  STOP TAPE               50277 00303  17 00000 02004
      RJ    T8D+6       T8D       GO TO DRUM TRNSFR SUBRTN     50300 00304  37 00335 00327
      TJ    L(12)       T8B-1     IS DRUM FULL                 50301 00305  42 02050 00307
      TV    T8+5        T8        YES SET GIMMICK EXIT         50302 00306  16 00302 00275
      EF                RDTP4     START TAPE                   50303 00307  17 00000 01777
T8B   TP    T136        A         TEST FOR BLOCK END           50304 00310  11 01544 32000
      TJ    L(6)        RDTP      IF NOT RETURN TO READ        50305 00311  42 02071 00160
      TP    L(0)        T136      CLEAR BLOCKETTE COUNTER      50306 00312  11 02047 01544
      TP    L(0)        T128A     CLEAR TAG COUNT              50307 00313  11 02047 01533
      TP    L(0)        T130A     CLEAR EQLS COUNT             50310 00314  11 02047 01536
      TP    L(0)        T122A     CLEAR CONSTANT COUNT         50311 00315  11 02047 01524
      TV    T8+1        T3A-1     SAVE STORAGE INSTRUCTION     50312 00316  16 00276 00070
      RPB   2           RDTP      SAVE LOCATION COUNTERS       50313 00317  75 30002 00160
      TP    T120        T121A      AND RETURN TO READ          50314 00320  11 01517 01521
T8C   TJ    L(96)       L+4       TEST FOR 96 INSTRUCTIONS     50315 00321  42 02073 00325
      RJ    T8D+6       T8D       YES GO TO DM TNSFR SUBRT     50316 00322  37 00335 00327
      TJ    L(12)       L+2       IS DRUM FULL                 50317 00323  42 02050 00325
      TV    L+2         T8+4      SET EXIT TO T9               50320 00324  16 00326 00301
      MJ                RDCD      BACK TO READ                 50321 00325  45 00000 00041
                        T9        SETTING FOR EXIT             50322 00326  00 00000 00336
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T8D     TV    T149        T8+1        RESET STORAGE INST          50323 00327  16 01555 00276
        TP    L(0)        T136A       CLEAR INST COUNTER          50324 00330  11 02047 01545
        RPB   960         L+2         TRANSFER 96 INSTRUCTIONS    50325 00331  75 31700 00333
        TP    WT          DSTORE       TO DRUM                    50326 00332  11 05710 50000
        RA    L-1         L(960)      BUMP DSTORE INSTRUCTION     50327 00333  21 00332 02074
        RA    T137        L(1)        BUMP DSTORE TALLY           50330 00334  21 01547 02054
        MJ                            EXIT                        50331 00335  45 00000 00000
T9      TJ    L(5)        RDCD        TEST FOR FIVE CARDS         50332 00336  42 02061 00041
        TP    T9B+2       T3A+4       CANCEL READER START         50333 00337  11 00357 00075
        TJ    L(6)        RDCD        TEST FOR SIX CARDS          50334 00340  42 02071 00041
        TV    T149        T8+1        YES RESET STORAGE INST      50335 00341  16 01555 00276
T9A     TP    L(5)        T136A       THIS LOOP WRITES ONE        50336 00342  11 02061 01545
        EF                WTP4         BLOCK ON THE INPUT TAPE    50337 00343  17 00000 02002
        RPV   10          L+2          FOR USE AS INPUT TO        50340 00344  75 10012 00346
        EW1               WT           PASS 2 AFTER THE DSTORE    50341 00345  77 10000 05710
        RP    10          L+2          BUFFER IS EXHAUSTED.       50342 00346  75 00012 00350
        EW1               L(0)         EACH BLOCKETTE CONTAINS    50343 00347  77 10000 02047
        RA    L-3         L(10)        TEN WORDS OF XS3 DATA      50344 00350  21 00345 02045
        IJ    T136A       T9A+2        (REPRESENTING THE FIRST    50345 00351  41 01545 00344
        TV    T149        T9A+3        60 COLUMNS OF A CARD)      50346 00352  16 01555 00345
        EF                STAPE        AND TEN WORDS OF BLANKS    50347 00353  17 00000 02004
        TP    T1+2        T3A+4       RESET READER START          50350 00354  11 00033 00075
T9B     RJ    T3A+7       T3A+4       START READER                50351 00355  37 00100 00075
        MJ                RDCD        BACK TO READ                50352 00356  45 00000 00041
        MJ                T4-1        DUMMY FOR T3A+4             50353 00357  45 00000 00101
PASS2   TP    T120        T134        STORE LAST EXECUTION ADD    50354 00360  11 01517 01542
        TP    T121        T135        STORE LAST STORAGE ADDR     50355 00361  11 01520 01543
        TP    L(10B)      T120        RESTORE EXECUTION COUNTR    50356 00362  11 02075 01517
        TP    L(10B)      T121        RESTORE STORAGE COUNTER     50357 00363  11 02075 01520
        TP    L(0)        SIND        CLEAR (SIND) INDICATOR      50360 00364  11 02047 02022
        TU    T67+1       T68+1       CHANGE EXIT FOR PASS 2      50361 00365  15 01170 01172
        TV    T69+3       T62-1       CHANGE EXIT FOR PASS 2      50362 00366  16 01200 01067
        TV    T155        T57-1       CHANGE EXIT FOR PASS 2      50363 00367  16 01563 01021
        RA    T127        T134        COMPUTE 1ST UDT ADDRESS     50364 00370  21 01531 01542
        RJ    T210A+1     SORT        SORT TAG TABLE              50365 00371  37 01764 01660
        RJ    T37         EQUALS      TRANSLATE EQLS COMMANDS     50366 00372  37 00524 00507
        RJ    T38+1       T38         TEST FOR DUPLICATE TAGS     50367 00373  37 00526 00525
T10     RJ    T27         T26         FETCH 36 INSTRUCTIONS       50370 00374  37 00506 00500
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        RPV   9           L+2          SET STORAGES W+11 - W+19    50371 00375  75 10011 00377
        TP    BLNKS       W+11          TO BLANKS                  50372 00376  11 02035 02143
        RPB   10          L+2          BRING ONE INSTRUCTION       50373 00377  75 30012 00401
T10A    TP    WT2         W+1           TO W STORAGES              50374 00400  11 07230 02131
        RA    L-1         L(1200000B)  BUMP STORE COMMAND          50375 00401  21 00400 02070
        TP    BLNKS       T138         CLEAR ERROR INDICATOR       50376 00402  11 02035 01550
        SP    T120                     STORE EXECUTION ADDRESS     50377 00403  31 01517 00000
        TP    A           W+13          IN W+13 TEST IF EQUAL      50400 00404  11 32000 02145
        EJ    T121        L+2           TO STORAGE ADDRESS IF      50401 00405  43 01520 00407
        TP    T121        W+12          NOT STORE STORAGE- W+12    50402 00406  11 01520 02144
T11     RJ    T75         T74          TEST FOR RSRV OR SETL       50403 00407  37 01225 01222
        EJ    BLNKS       T13          IF SETL OR EQLS CLEAR       50404 00410  43 02035 00420
        EJ    EQLS        T13           W+12 ON                    50405 00411  43 02015 00420
        EJ    W+2         L+3          TEST FOR NONE OF ABOVE      50406 00412  43 02132 00415
T12     RJ    T25         T21          STORE INSTRUCTION IN BUF    50407 00413  37 00477 00447
        SJ    T10         T10+1        TRANSLATE NEXT INSTRUCTN    50410 00414  46 00374 00375
        RA    T120        L(1)         BUMP LOCATION COUNTER       50411 00415  21 01517 02054
        RA    T121        L(1)         BUMP LOCATION COUNTER       50412 00416  21 01520 02054
        MJ                OFETCH       GO TO OPERATION LOOKUP      50413 00417  45 00000 00537
T13     RPV   6           T12          CLEAR W+12 TO W+17 FOR      50414 00420  75 10006 00413
        TP    BLNKS       W+12          EQLS OR SETL COMMAND       50415 00421  11 02035 02144
T18     TV    T150        T19          SECOND PASS READ ROUTINE    50416 00422  16 01556 00431
        TP    L(5)        TEMP+14      SET BLOCK COUNT             50417 00423  11 02061 02173
        EF                RDTP4        START TAPE                  50420 00424  17 00000 01777
        TP    L(5)        TEMP+15      SET BLOCKETTE COUNT         50421 00425  11 02061 02174
        RPV   20          L+2          READ BLOCKETTE              50422 00426  75 10024 00430
        ER1               W+1                                      50423 00427  76 10000 02131
        RPB   10          L+2          TRANSFER 10 WORDS TO        50424 00430  75 30012 00432
T19     TP    W+1         WT2           BUFFER                     50425 00431  11 02131 07230
        RA    L-1         L(10)        BUMP STORE                  50426 00432  21 00431 02045
        TP    W+2         A            TEST FOR END INSTRUCTION    50427 00433  11 02132 32000
        EJ    END         T19A                                     50430 00434  43 02021 00443
        IJ    TEMP+15     T18+4        TEST FOR END OF BLOCK       50431 00435  41 02174 00426
        ER0               A            IF SO TEST FOR BAD BLOCK    50432 00436  76 00000 32000
        ZJ    L+1         T20-2        IF GOOD BLOCK JUMP DOWN     50433 00437  47 00440 00444
        EF                MBCK1        IF BAD BLOCK MOVE TAPE      50434 00440  17 00000 02000
        RS    T19         L(60)         BACK RESET STORAGE ADD     50435 00441  23 00431 02076
        MJ                T18+2         RESS AND REREAD            50436 00442  45 00000 00424
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T19A    RJ    L+1          T19+4        SET TO EXIT AT BLOCK END      50437 00443  37 00444 00435
        IJ    TEMP+14      T18+3        IF GOOD BLOCK TEST FOR        50440 00444  41 02173 00425
        EF                 STAPE         SIX BLOCKS IF SO EXIT        50441 00445  17 00000 02004
T20     MJ                                                            50442 00446  45 00000 00000
T21     RPB   20           L+2          BLOCK TRANSFER ONE INSTR      50443 00447  75 30024 00451
        TP    W            WT            UCTION TO WT BUFFER          50444 00450  11 02130 05710
        RA    L-1          L(20)        BUMP STORE COMMAND            50445 00451  21 00450 02077
        RA    T139         L(1)         BUMP BLOCKETTE TALLY          50446 00452  21 01551 02054
        TJ    L(6)         T25          TEST FOR FULL BLOCK           50447 00453  42 02071 00477
T22     TP    L(0)         T139         RESET BLOCKETTE INDEX         50450 00454  11 02047 01551
        RA    T140         L(1)         BUMP BLOCK COUNT              50451 00455  21 01552 02054
        TJ    L(6)         T25          TEST FOR SIX BLOCKS           50452 00456  42 02071 00477
        TV    T149         T21+1        RESET STORE COMMAND           50453 00457  16 01555 00450
        TU    T149         T10A         RESET STORE COMMAND           50454 00460  15 01555 00400
        RS    T140         L(1)         BLOCK TALLY MINUS ONE         50455 00461  23 01552 02054
        EF                 WTP5         START OUTPUT TAPE             50456 00462  17 00000 01775
        TP    L(5)         TEMP+10      SET BLOCKETTE INDEX           50457 00463  11 02061 02167
T23     RPB   20           L+2          MOVE 20 WORDS TO W STOR       50460 00464  75 30024 00466
        TP    WT           W             AGES FOR WRITING             50461 00465  11 05710 02130
        RA    L-1          L(2400000B)  BUMP STORE COMMAND            50462 00466  21 00465 02100
        RJ    T113         XS3CON       CONVERT COMMAND TO XS-3       50463 00467  37 01516 01465
        RPV   20           L+2          WRITE ONE BLOCKETTE ON        50464 00470  75 10024 00472
        EW1                W             SYMBOLIC OUTPUT TAPE         50465 00471  77 10000 02130
T24     IJ    TEMP+10      T23          TEST FOR FULL BLOCK           50466 00472  41 02167 00464
        IJ    T140         T23-1        TEST BLOCK COUNT              50467 00473  41 01552 00463
        EF                 STAPE        STOP OUTPUT TAPE              50470 00474  17 00000 02004
        TU    T25          T23+1        RESET LOAD COMMAND            50471 00475  15 00477 00465
        SN    L                         SET A NEGATIVE                50472 00476  33 00476 00000
T25     MJ    WT                        EXIT                          50473 00477  45 05710 00000
T26     RPB   360          L+2          BRING 36 INSTRUCTIONS         50474 00500  75 30550 00502
        TP    DSTORE       WT2           FROM DRUM TO WT2 BUFFER      50475 00501  11 50000 07230
        RA    L-1          L360         BUMP FETCH                    50476 00502  21 00501 02032
        RA    T141         L(1)         BUMP TALLY                    50477 00503  21 01553 02054
        TJ    L(32)        L+2          TEST IF DRUM EMPTY            50500 00504  42 02101 00506
        TP    T151         T10          CHANGE FETCH INSTRUCTION      50501 00505  11 01557 00374
T27     MJ                                                            50502 00506  45 00000 00000
EQUALS  RS    T130         L(1)         TEST IF EQLS COMMANDS         50503 00507  23 01535 02054
        SJ    T37          L+1           ARE PRESENT  IF SO TEST      50504 00510  46 00524 00511
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T28     RA    T30          L(1)          TL TABLE FOR NEGATIVE      50505 00511  21 00522 02054
        RA    T29          L(100000B)    NUMBERS  WHEN ONE IS       50506 00512  21 00513 02052
T29     TP    TL-1         A             FOUND COMPLEMENT IT AND    50507 00513  11 04306 32000
        SJ    L+1          T28           USE THE V-ADDRESS TO       50510 00514  46 00515 00511
        SN    A            15            FETCH THE U-ADDRESS OF     50511 00515  33 32000 00017
        TU    A            L+2           THE ORIGINAL EQLS COM-     50512 00516  15 32000 00520
        RPB   2            L+2           MAND FROM ITS STORAGE-     50513 00517  75 30002 00521
        TP                 W+3           PLACE IN THE EQUALS        50514 00520  11 00000 02133
        RJ    T69          T67           BUFFER                     50515 00521  37 01175 01167
T30     TP    A            TL-1          TRANSLATE THIS U FIELD     50516 00522  11 32000 04306
        IJ    T130         T28           AND STORE IN TL TABLE      50517 00523  41 01535 00511
T37     MJ                               EXIT                       50520 00524  45 00000 00000
T38     TP    TT           A             TEST TAG TABLE FOR         50521 00525  11 02706 32000
        EJ    T1                         DUPLICATE ENTRIES          50522 00526  43 00031 00000
        EJ    TT+1         T39           STORE ALL DUPLICATES       50523 00527  43 02707 00533
T38A    TU    L-1          T38           IN DTT TABLE  BUMP         50524 00530  15 00527 00525
        RA    L-2          L(100000B)    DUPLICATE TAG LOOKUP       50525 00531  21 00527 02052
        MJ                 T38           BY ONE FOR EACH ENTRY      50526 00532  45 00000 00525
T39     TP    A            DTT           IN DTT TABLE  THIS         50527 00533  11 32000 02542
        RA    L-1          L(1)          TEST ENDS WHEN A DUMMY     50530 00534  21 00533 02054
        RA    T62A         L(100000B)    FILL ENTRY IS FOUND IN     50531 00535  21 01072 02052
        MJ                 T38A          TT TABLE                   50532 00536  45 00000 00530
OFETCH  LQ    W+2          Q+33          MASK OFF OPERATION INTO    50533 00537  55 02132 31041
        QT    OMASK        TEMP           TEMP AND ACCUMULATOR      50534 00540  51 02026 02155
        TU    OTABLE-1     T39A          RESET TJ COMMAND           50535 00541  15 00562 00545
        TJ    OTABLE+38    L+2           TEST IF GREATER THAN RA    50536 00542  42 00631 00544
        TU    L-1          T39A          YES SET TJ COMMAND         50537 00543  15 00542 00545
        RPU   61           L+2           LOOK UP MNEMONIC OPERAT    50540 00544  75 20075 00546
T39A    TJ    OTABLE       L+1            ION IN OTABLE AND STORE   50541 00545  42 00563 00546
        SN    Q            15            ITS OCTAL EQUIVALENT       50542 00546  33 31000 00017
        SA    T142                       IN W+14  IF EXACT ENTRY    50543 00547  32 01554 00000
        TU    T39A         T152          IS NOT IN TABLE STORE      50544 00550  15 00545 01560
        AT    T152         L+1           NEAREST OCTAL EQUIV-       50545 00551  35 01560 00552
        TP    OTABLE       Q             ALENT AND STORE NOP        50546 00552  11 00563 31000
        QT    OMASK        A             WARNING IN W+17  THEN      50547 00553  51 02026 32000
        SS    TEMP                       EXIT AS SPECIFIED BY       50550 00554  34 02155 00000
        ZJ    L+1          L+2           V ADDRESS OF CORRESP-      50551 00555  47 00556 00557
        TP    NOP          W+17          ONDING ENTRY IN OTABLE     50552 00556  11 02005 02151
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        TV    Q              L+3          THIS ADDRESS SPECIFIES     50553 00557  16 31000 00562
        SP    Q              21           WHICH TRANSLATION ROU-     50554 00560  31 31000 00025
        LT                   W+14         TINE IS TO BE USED         50555 00561  22 00000 02146
        MJ    OTABLE                      EXIT AS DESCRIBED ABOVE    50556 00562  45 00563 00000
OTABLE                       T41          BLANK OPERATION            50557 00563  00 00000 00665
              30300B)        T41          ZERO OPERATION             50560 00564  00 30300 00665
        01    21300B)        T40          OCTAL OPERATION            50561 00565  01 21300 00661
        02    46635B)        T41          AT                         50562 00566  02 46635 00665
        02    50000B)        T47          B- OCTAL CONSTANT          50563 00567  02 50000 00726
        02    51400B)        T47          B9 OCTAL CONST             50564 00570  02 51400 00726
        02    62437B)        T46          CALL SUBROUTINE            50565 00571  02 62437 00717
        02    62627B)        T41          CC                         50566 00572  02 62627 00665
        02    77073B)        T41          DV                         50567 00573  02 77073 00665
        03    03117B)        T41          EF                         50570 00574  03 03117 00665
        03    04443B)        T41          EJ                         50571 00575  03 04443 00665
        03    05000B)        T160         END                        50572 00576  03 05000 01565
        03    05476B)        T41          ER                         50573 00577  03 05476 00665
        03    07177B)        T41          EW                         50574 00600  03 07177 00665
        03    10000B)        T91+1        F- FLOATING DECIMAL        50575 00601  03 10000 01353
        03    12464B)        T41          FA                         50576 00602  03 12464 00665
        03    12767B)        T41          FD                         50577 00603  03 12767 00665
        03    13402B)        T41          FI                         50600 00604  03 13402 00665
        03    14766B)        T41          FM                         50601 00605  03 14766 00665
        03    15201B)        T41          FP                         50602 00606  03 15201 00665
        03    15405B)        T41          FR                         50603 00607  03 15405 00665
        03    16565B)        T41          FS                         50604 00610  03 16565 00665
        03    44441B)        T41          IJ                         50605 00611  03 44441 00665
        03    45214B)        T41          IP                         50606 00612  03 45214 00665
        04    62454B)        T41          LA                         50607 00613  04 62454 00665
        04    65355B)        T41          LQ                         50610 00614  04 65355 00665
        04    66622B)        T41          LT                         50611 00615  04 66622 00665
        04    72472B)        T41          MA                         50612 00616  04 72472 00665
        04    74445B)        T41          MJ                         50613 00617  04 74445 00665
        04    75271B)        T41          MP                         50614 00620  04 75271 00665
        04    76556B)        T41          MS                         50615 00621  04 76556 00665
        05    05204B)        T41          NP                         50616 00622  05 05204 00665
        05    25461B)        T41          PR                         50617 00623  05 25461 00665
        05    26557B)        T41          PS                         50620 00624  05 26557 00665
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          05    26763B)     T41         PU                          50621 00625  05 26763 00665
          05    32452B)     T41         QA                          50622 00626  05 32452 00665
          05    34444B)     T41         QJ                          50623 00627  05 34444 00665
          05    36553B)     T41         QS                          50624 00630  05 36553 00665
          05    36651B)     T41         QT                          50625 00631  05 36651 00665
          05    42421B)     T41         RA                          50626 00632  05 42421 00665
          05    44437B)     T41         RJ                          50627 00633  05 44437 00665
          05    45275B)     T41         RP                          50630 00634  05 45275 00665
          05    46523B)     T41         RS                          50631 00635  05 46523 00665
          06    47723B)     T41         NO OP DUMMY                 50632 00636  06 47723 00665
          06    51400B)     T99-1       STATED POINT                50633 00637  06 51400 01443
          06    52432B)     T41         SA                          50634 00640  06 52432 00665
          06    53174B)     T41         SF                          50635 00641  06 53174 00665
          06    54446B)     T41         SJ                          50636 00642  06 54446 00665
          06    55033B)     T41         SN                          50637 00643  06 55033 00665
          06    55231B)     T41         SP                          50640 00644  06 55231 00665
          06    56534B)     T41         SS                          50641 00645  06 56534 00665
          06    56636B)     T41         ST                          50642 00646  06 56636 00665
          06    64442B)     T41         TJ                          50643 00647  06 64442 00665
          06    64712B)     T41         TM                          50644 00650  06 64712 00665
          06    65013B)     T41         TN                          50645 00651  06 65013 00665
          06    65211B)     T41         TP                          50646 00652  06 65211 00665
          06    66715B)     T41         TU                          50647 00653  06 66715 00665
          06    67016B)     T41         TV                          50650 00654  06 67016 00665
          06    75203B)     T41         UP                          50651 00655  06 75203 00665
          07    26500B)     T49A        XS3                         50652 00656  07 26500 00744
          07    44447B)     T41         ZJ                          50653 00657  07 44447 00665
          07    77747B)     T41         ILLEGAL OP                  50654 00660  07 77747 00665
T40       TP    W+2         Q           CONVERT OCTAL OPERATION     50655 00661  11 02132 31000
          RJ    T81         T80+1        TO BINARY AND STORE IN     50656 00662  37 01270 01252
          TP    BLNKS       T138         W+14   CLEAR ERROR        50657 00663  11 02035 01550
          TP    A           W+14         INDICATOR                  50660 00664  11 32000 02146
T41       RJ    T69         T67         TRANSLATE U FIELD TO        50661 00665  37 01175 01167
          TP    T138        W+18         BINARY AND STORE IN W      50662 00666  11 01550 02152
          TP    BLNKS       T138         +15 STORE ERROR INDIC-     50663 00667  11 02035 01550
          TP    A           W+15         ATOR IN W+18 AND CLEAR     50664 00670  11 32000 02147
T42       RJ    L           L+1         ONE SHOT SWITCH             50665 00671  37 00671 00672
          RJ    T69         T68         TRANSLATE V FIELD AND       50666 00672  37 01175 01171
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        TP    T138          W+19          STORE IN W+16  STORE          50667 00673  11 01550 02153
        TP    A             W+16          ERROR INDICATOR IN W+19        50670 00674  11 32000 02150
T43     RJ    L             L+1         ONE SHOT SWITCH                  50671 00675  37 00675 00676
        TP    W+2           Q           TEST THIRD POSITION OF           50672 00676  11 02132 31000
        LQ    Q             18           OPERATION FIELD  IF             50673 00677  55 31000 00022
        QT    L(77B)        A            NON OCTAL  TEST FOR             50674 00700  51 02102 32000
        TJ    L(12B)        T45          FOLLOWING CHARACTERS            50675 00701  42 02045 00713
        EJ    L(54B)        T44+1        R                               50676 00702  43 02103 00711
        EJ    L(67B)        T44          U                               50677 00703  43 02104 00710
        EJ    L(70B)        T44+1        V                               50700 00704  43 02105 00711
        EJ    L(25B)        T44-1        B                               50701 00705  43 02106 00707
        MJ                  T12         JUMP TO STORE                    50702 00706  45 00000 00413
        RA    W+15          L(10000B)   BUMP U BY 10000                  50703 00707  21 02147 02107
T44     RA    W+15          L(10000B)   BUMP U BY 10000                  50704 00710  21 02147 02107
        RA    W+15          L(10000B)   BUMP U BY 10000                  50705 00711  21 02147 02107
        MJ                  T12         JUMP TO STORE                    50706 00712  45 00000 00413
T45     SS    L(3)          12          IF OCTAL SUBTRACT 3              50707 00713  34 02055 00014
        SJ    T12           L+1         IF MINUS JUMP TO STORE           50710 00714  46 00413 00715
        AT    W+15          W+15        ADD DIGIT TO HIGH U              50711 00715  35 02147 02147
        MJ                  T12         JUMP TO STORE                    50712 00716  45 00000 00413
T46     RJ    T69           T67         FOR CALL  LOOK UP U              50713 00717  37 01175 01167
        TP    A             TEMP+9      FIELD IN TAG TABLE  AND          50714 00720  11 32000 02166
        SA    L(2)                       GENERATE RJ SUBR+2               50715 00721  32 02063 00000
        RJ    T42           T41+1        SUBR  IN BINARY STORE           50716 00722  37 00671 00666
        SP    TEMP+9                     IN W+14 W+15 W+16 FOR            50717 00723  31 02166 00000
        RJ    T43           T42+2        OUTPUT                          50720 00724  37 00675 00673
        MJ                  T12         JUMP TO STORE                    50721 00725  45 00000 00413
T47     TP    W+3           Q           FOR BINARY CONSTANTS             50722 00726  11 02133 31000
        RJ    T81           T80+1        CONVERT FIRST HALF OF U         50723 00727  37 01270 01252
        TP    W+4           Q            CONVERT 2ND HALF OF U           50724 00730  11 02134 31000
        RJ    T81           T80+2        AND COMBINE WITH FIRST          50725 00731  37 01270 01253
        TP    A             TEMP+6       STORE IN TEMP+6                 50726 00732  11 32000 02163
        TP    W+2           Q           CONVERT THE SECOND AND           50727 00733  11 02132 31000
T48     LQ    Q             6            THIRD DIGITS OF THE             50730 00734  55 31000 00006
        RJ    T83           T82          OPERATION TO BINARY             50731 00735  37 01310 01271
        TV    A             L+1          AND STORE IN SHIFT INST         50732 00736  16 32000 00737
        SP    TEMP+6                     SCALE BINARY CONSTANT            50733 00737  31 02163 00000
        RJ    T87           T86          AND STORE IN W+14- W+16         50734 00740  37 01325 01322
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                TP    L(0)          W+17      CLEAR WARNING                    50735 00741  11 02047 02151
                TP    T138          W+18      STORE ERROR INDICATOR            50736 00742  11 01550 02152
T49             MJ                  T12       JUMP TO STORE                    50737 00743  45 00000 00413
T49A            SP    W+3                     FOR PSEUDO XS-3 OPERATON         50740 00744  31 02133 00000
                RJ    T87           T86        BREAK FIRST HALF OF U           50741 00745  37 01325 01322
                MJ                  T12        INTO W+14 W+15 AND W+16         50742 00746  45 00000 00413
T50             TU    T150          T53       SET UP T53   AND T54            50743 00747  15 01556 00757
                TU    L+1           T54        TO TEST IF A TAG IS             50744 00750  15 00751 00763
                MJ    L(0)          T53       1IN TAG FIELD                    50745 00751  45 02047 00757
T51             TU    T153          T53       SET UP  T53  AND  T54            50746 00752  15 01561 00757
                TU    L+1           T54        TO DETERMINE THE CONT-          50747 00753  15 00754 00763
                MJ    W+4           T53        ENTS OF U                       50750 00754  45 02134 00757
T52             TU    T154          T53       SET UP  T53  AND  T54            50751 00755  15 01562 00757
                TU    T155          T54        TO TEST V FIELD                 50752 00756  15 01563 00763
T53             TP                  Q         TEST IF FIELD CONTAINS           50753 00757  11 00000 31000
                QT    PSTOP         A          NON-NUMERIC CHARACTERS          50754 00760  51 02036 32000
                ZJ    L+1           T56        IF NOT EXIT   IF SO             50755 00761  47 00762 01011
                SP    Q             36         PLACE ENTIRE FIELD IN           50756 00762  31 31000 00044
T54             SA                              A LEFT AND A RIGHT              50757 00763  32 00000 00000
                TP    LPCT          TEMP+9    STORE LOOP COUNTER               50760 00764  11 02027 02166
                LTL   6             Q         STORE 6 DIGITS IN Q              50761 00765  22 00006 31000
                QJ    L+1           L+6       BEGIN TESTING FIELD FROM         50762 00766  44 00767 00774
                QJ    L+1           T56+1      THE LEFT UNTIL ONE OF           50763 00767  44 00770 01012
                QJ    T55           L+1        THE FOLLOWING SPECIAL           50764 00770  44 01004 00771
                QJ    T55A          L+1        CHARACTERS IS FOUND             50765 00771  44 01006 00772
                QJ    L+1           T55       + - ( ) OR BLANK THEN            50766 00772  44 00773 01004
                QJ    T56           T55       EXIT AT THIS POINT               50767 00773  44 01011 01004
                QJ    T55           L+1        THE ACCUMULATOR WILL            50770 00774  44 01004 00775
                QJ    L+4           L+1        APPEAR AS FOLLOWS (XS3)         50771 00775  44 01001 00776
                QJ    T55           L+1       +123  ABCDEF                     50772 00776  44 01004 00777
                QJ    L+1           T56       -123  ABCDEF                     50773 00777  44 01000 01011
                QJ    T55           T56       (1234B)    L                    50774 01000  44 01004 01011
                QJ    L+1           T55       (123)      L                    50775 01001  44 01002 01004
                QJ    L+1           T55       )      1234B                    50776 01002  44 01003 01004
                QJ    T57           T55       )   12345671                    50777 01003  44 01022 01004
T55             LQ    TEMP+9        1         TEST IF 12 CHARACTERS            51000 01004  55 02166 00001
                QJ    T54+2         T56        HAVE BEEN TESTED                51001 01005  44 00765 01011
T55A            QJ    T55           L+1       IF A / 64 CHARACTER IS           51002 01006  44 01004 01007
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        QJ    T55          L+1          FOUND SET INDICATOR          51003 01007  44 01004 01010
        TP    L(1)         SIND         TO ONE                       51004 01010  11 02054 02022
T56     MJ                              TEST EXIT                    51005 01011  45 00000 00000
        QJ    T55          L+1          IF ) IS THE 1ST SPECIAL      51006 01012  44 01004 01013
        QJ    T55          L+1           CHARACTER FOUND THE         51007 01013  44 01004 01014
        QJ    L+1          T55          DIGITS TO THE LEFT ARE       51010 01014  44 01015 01004
        QJ    L+1          T55          ASSUMED TO BE A DECIMAL      51011 01015  44 01016 01004
        TU    T53          L+1          NUMBER UNLESS THE ) IS       51012 01016  15 00757 01017
        SP    TEMP+10                   PRECEDED BY A B  THIS        51013 01017  31 02167 00000
        RJ    T81          T80          NUMBER IS CONVERTED TO       51014 01020  37 01270 01251
        MJ                 T56          BINARY AND LEFT IN A         51015 01021  45 00000 01011
T57     LTL   6            TEMP+5      A LEFT PARENTHESIS WAS        51016 01022  22 00006 02162
        LTR                TEMP+6       THE FIRST SPECIAL           51017 01023  22 10000 02163
        TP    BTST         Q            CHARACTER FOUND  THE        51020 01024  11 02030 31000
        QT    TEMP+5       A            INFORMATION TO THE           51021 01025  51 02162 32000
        ZJ    T58          L+1          RIGHT OF THIS CHARACTER      51022 01026  47 01036 01027
        QT    TEMP+6       A            IS ASSUMED TO BE EITHER      51023 01027  51 02163 32000
        ZJ    T58          L+1          A DECIMAL OR OCTAL           51024 01030  47 01036 01031
        TP    TEMP+5       Q            CONSTANT AND IS TO BE        51025 01031  11 02162 31000
        RJ    T83          T82          PLACED IN THE CONSTANT       51026 01032  37 01310 01271
        TP    TEMP+6       Q            POOL  IF A B IS PRESENT      51027 01033  11 02163 31000
        RJ    T83          T82+1        CONVERT AS A OCTAL           51030 01034  37 01310 01272
        MJ                 CPOOL        INTEGER IF NOT CONVERT       51031 01035  45 00000 01044
T58     TP    TEMP+5       Q            AS A DECIMAL INTEGER         51032 01036  11 02162 31000
        RJ    T81          T80+1        IN EITHER CASE LEAVE         51033 01037  37 01270 01252
        TP    TEMP+6       Q            RESULT IN THE ACCUM          51034 01040  11 02163 31000
        QJ    CPOOL        L+1          ULATOR AND THEN GO TO        51035 01041  44 01044 01042
        TP    TEMP+6       Q            CPOOL TO FIND THE LOC-       51036 01042  11 02163 31000
        RJ    T81          T80+2        ATION FOR THIS CONSTANT      51037 01043  37 01270 01253
CPOOL   TU    T122         L+1          TEST IF CONSTANT HAS         51040 01044  15 01523 01045
        RP                 L+2          ALREADY BEEN ENTERED         51041 01045  75 00000 01047
        EJ    CPT          T59          INTO THE CONSTANT POOL       51042 01046  43 02201 01062
        TU    T53          L+3          IF SO GO TO COMPUTE LOC      51043 01047  15 00757 01052
        TP    A            CPT          IF NOT STORE IN POOL         51044 01050  11 32000 02201
        RPB   2            L+2          AND STORE SYMBOLIC           51045 01051  75 30002 01053
        TP    TEMP+10      CPT+75       CONSTANT FOR LATER           51046 01052  11 02167 02314
        RA    L-3          L(1)         PRINTOUT  BUMP STORE         51047 01053  21 01050 02054
        RA    L-2          L(2)         INSTRUCTIONS AND CONS-       51050 01054  21 01052 02063
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        RA    T127            L(1)              TANT TALLY AND COUNT      51051 01055  21 01531 02054
        RA    T122A           L(1)              IF THE CONSTANT           51052 01056  21 01524 02054
        RA    T122            L(100000B)        POOL IS FILLED ALTER      51053 01057  21 01523 02052
        TJ    T123            L+2               REPEAT EXIT SO THAT ALL   51054 01060  42 01525 01062
        TV    CPOOL+2         CPOOL+1           NEW CONSTANTS WILL BE     51055 01061  16 01046 01045
T59     SP    T122                              IGNORED  COMPUTE          51056 01062  31 01523 00000
        LTL   21              A                 EXECUTION LOCATION OF     51057 01063  22 00025 32000
        SS    Q                                 CONSTANT IN QUESTION      51060 01064  34 31000 00000
        SS    L(1)                              AND LEAVE IN ACCUM-       51061 01065  34 02054 00000
        SA    T134                              ULATOR                    51062 01066  32 01542 00000
        MJ                    T56               EXIT  CHANGED FOR PASS 2  51063 01067  45 00000 01011
T62     LT                    TEMP              SAVE INCREMENT            51064 01070  22 00000 02155
        LQ    A                                 STORE ENTRY IN Q AND A    51065 01071  55 32000 00000
T62A    RPU                   L+4               TEST IF THIS TAG IS IN    51066 01072  75 20000 01076
        EJ    DTT             L+1               DUPLICATE TAG TABLE       51067 01073  43 02542 01074
        TP    A               Q                 RESTORE Q                 51070 01074  11 32000 31000
        TP    DUP             T138              STORE DUP IN ERROR IND    51071 01075  11 02011 01550
        EJ    L(46B)          T63B-3            TEST FOR L                51072 01076  43 02110 01141
        EJ    L(24B)          T63A1             TEST FOR A                51073 01077  43 02077 01135
        EJ    L(53B)          T63A1+2           TEST FOR Q                51074 01100  43 02111 01137
        EJ    L(31344646B)    T63A1-2           TEST FOR FILL             51075 01101  43 02112 01133
        TP    T63B+1          T63+2             THIS ROUTINE WILL LOOK    51076 01102  11 01145 01110
        TV    K               T63+2             UP THE TAG IN Q IN THE    51077 01103  16 01150 01110
        TU    T63B+2          T63A-2            TAG TABLE IF AN EQUAL-    51100 01104  15 01146 01113
        TU    T63A-2          T63B              ITY OCCURS THE LOCATION   51101 01105  15 01113 01144
T63     IJ    T63+2           L+1               ASSOCIATED WITH THAT      51102 01106  41 01110 01107
        TJ    T63B+1          T63A              TAG WILL BE LEFT IN THE   51103 01107  42 01145 01115
        SP    L(100000B)                        ACCUMULATOR  IF NO        51104 01110  31 02052 00000
        AT    T63B            L+2               EQUALITY OCCURS A DEF     51105 01111  35 01144 01113
        SP    Q                                 WARNING WILL BE STORED    51106 01112  31 31000 00000
        SS    TT                                IN THE ERROR INDICATOR    51107 01113  34 02706 00000
        SJ    T63             T63-1             AND CONTROL SENT TO UND   51110 01114  46 01106 01105
T63A    TU    T63B            L+2               TAG TO STORE THIS TAG     51111 01115  15 01144 01117
        TP    Q               A                 IN THE UNDEFINED TAG      51112 01116  11 31000 32000
        EJ    FILL            L+3               TABLE IF NOT ALREADY      51113 01117  43 30000 01122
        TP    DEF             T138              THERE AND ASSIGN IT AN    51114 01120  11 02010 01550
        MJ                    UNDTAG            ADDRESS INCREMENTS AND    51115 01121  45 00000 01201
        RA    T63B            T63B+3            DECREMENTS ARE IGNORED    51116 01122  21 01144 01147
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        TU   A           L+1          FOR ALL UNDEFINED TAGS      51117 01123  15 32000 01124
        TP   FILL        Q            STORE LOCATION IN Q         51120 01124  11 30000 31000
        SP   SIND                     TEST STORAGE INDICATOR      51121 01125  31 02022 00000
        ZJ   L+1         L+3           FOR ZERO                   51122 01126  47 01127 01131
        TP   L(0)        SIND         CLEAR INDICATOR             51123 01127  11 02047 02022
        LQ   Q           21           SHIFT Q 21 FOR STORAGE      51124 01130  55 31000 00025
        QT   L(77777B)   TEMP+3       STORE LOCATION IN TEMP+3    51125 01131  51 02113 02160
        MJ               T64          EXIT TO INCREMENT TEST      51126 01132  45 00000 01151
        TP   L(30000B)   TEMP+3       STORE 30000 FOR FILL        51127 01133  11 02114 02160
        MJ               T64          EXIT TO INCREMENT TEST      51130 01134  45 00000 01151
T63A1   TP   L(32000B)   TEMP+3       STORE 32000 FOR A           51131 01135  11 02115 02160
        MJ               T64          EXIT TO INCREMENT TEST      51132 01136  45 00000 01151
        TP   L(31000B)   TEMP+3       STORE 31000 FOR Q           51133 01137  11 02116 02160
        MJ               T64          EXIT TO INCREMENT TEST      51134 01140  45 00000 01151
        SP   T120                     STORE L COUNTER MINUS       51135 01141  31 01517 00000
        ST   L(1)        TEMP+3        ONE INTO TEMP +3           51136 01142  36 02054 02160
        MJ               T64          EXIT TO INCREMENT TEST      51137 01143  45 00000 01151
T63B    SS   FILL                     DUMMY TEST COMMAND          51140 01144  34 30000 00000
        SP   L(100000B)               END OF LOOKUP LOOP TEST     51141 01145  31 02052 00000
             TT                       ADDRESS OF FIRST TAG        51142 01146  00 02706 00000
             769                      CELLS BETWEEN TT AND TL     51143 01147  00 01401 00000
K       B                             TABLE LOOKUP COUNT          51144 01150  00 00000 00000
T64     TP   TEMP        Q            STORE INCREMENT IN Q        51145 01151  11 02155 31000
        SP   Q                        TEST IF NO INCREMENT        51146 01152  31 31000 00000
        ZJ   L+1         T66+1         EXISTS                     51147 01153  47 01154 01165
        LQ   Q           6            MASK OFF SIGN OF INCR-      51150 01154  55 31000 00006
        QT   L(77B)      A             EMENT INTO A               51151 01155  51 02102 32000
T65     EJ   L(64B)      L-2          IF / GET NEXT CHARACTER     51152 01156  43 02117 01154
        EJ   L(2)        L+3          TEST FOR MINUS SIGN         51153 01157  43 02063 01162
        RJ   T83         T82          CONVERT POSITIVE INCRE-     51154 01160  37 01310 01271
        MJ               T66           MENT LEAVE IN A            51155 01161  45 00000 01164
        RJ   T83         T82          CONVERT NEGATIVE INCRE-     51156 01162  37 01310 01271
        TN   A           A             MENT LEAVE IN A            51157 01163  13 32000 32000
T66     AT   TEMP+3      TEMP+3       ADD EXECUTION LOCATION      51160 01164  35 02160 02160
        SP   TEMP+3                    TO INCREMENT AND LEAVE     51161 01165  31 02160 00000
        MJ                             IN ACCUMULATOR             51162 01166  45 00000 00000
T67     RJ   T56         T51          CONVERT CONTENTS OF U       51163 01167  37 01011 00752
        MJ   L+3         L+2           THEN JUMP TO ZERO TEST     51164 01170  45 01173 01172
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T68     RJ   T56          T52        CONVERT CONTENTS OF V          51165 01171  37 01011 00755
        ZJ   T69          T69+1        IF TAG IS PRESENT            51166 01172  47 01175 01176
        RJ   T67-1        T62         LOOK UP EXECUTION LOC-        51167 01173  37 01166 01070
        SP   A                         ATION OF TAG AND LEAVE       51170 01174  31 32000 00000
T69     MJ                             IN ACCUMULATOR AND EXIT      51171 01175  45 00000 00000
        EJ   Q            T69        TEST FOR BLANK FIELD           51172 01176  43 31000 01175
        RJ   T83          T82        CONVERT DECIMAL INTEGER        51173 01177  37 01310 01271
        MJ                T69         TO BINARY  LEAVE IN A         51174 01200  45 00000 01175
UNDTAG  TU   T125         L+1        SET UP REPEAT COMMAND          51175 01201  15 01527 01202
        RP                L+2        TEST IF UNDEFINED TAG          51176 01202  75 00000 01204
T70     EJ   UT           T72         HAS BEEN STORED BEFORE        51177 01203  43 02573 01216
        TP   A            UT         STORE UNDEFINED TAG            51200 01204  11 32000 02573
        RA   L-1          L(1)       BUMP UNDEFINED TAG STORE       51201 01205  21 01204 02054
        RA   T125         L(100000B) BUMP UNDEFINED TAG TALLY       51202 01206  21 01527 02052
        TJ   T126         L+2        TEST FOR TOO MANY TAGS         51203 01207  42 01530 01211
        TV   T70          T70-1      CHANGE REPEAT EXIT             51204 01210  16 01203 01202
        SS   RPD                     COMPUTE EXECUTION              51205 01211  34 02031 00000
T71     LTL  21           A           ADDRESS OF UNDEFINED          51206 01212  22 00025 32000
        SA   T127                      TAG AND LEAVE IN ACCUM       51207 01213  32 01531 00000
        TP   DEF          T138       STORE DEF WARNING IN           51210 01214  11 02010 01550
        MJ                T67-1       ERROR INDICATOR   EXIT        51211 01215  45 00000 01166
T72     SN   Q            15         IF UNDEFINED TAG IS            51212 01216  33 31000 00017
        SA   T125                      ALREADY STORED COMPUTE       51213 01217  32 01527 00000
        SS   L(100000B)                ITS EXECUTION ADDRESS        51214 01220  34 02052 00000
        MJ                T71         AND LEAVE IN ACCUM           51215 01221  45 00000 01212
T74     TP   W+2          A          TEST OPERATION FIELD FOR       51216 01222  11 02132 32000
        EJ   RSRV         T77         RSRV OR SETL PSEUDO           51217 01223  43 02016 01244
        EJ   SETL         L+2         INSTRUCTIONS                  51220 01224  43 02017 01226
T75     MJ                             TO USE RJ T75 T74            51221 01225  45 00000 00000
        TP   W+3          A          IF SETL TEST IF U FIELD        51222 01226  11 02133 32000
        EJ   E            L+3         HAS SPECIAL TAG E             51223 01227  43 02013 01232
        RJ   T69          T67        NO TRANSLATE U FIELD           51224 01230  37 01175 01167
        ZJ   L+2          L+3         IF ZERO IGNORE  IF NOT        51225 01231  47 01233 01234
        TP   T120         A           REPLACE STORAGE LOCATN        51226 01232  11 01517 32000
        TP   A            T121        COUNTER WITH U IF SO          51227 01233  11 32000 01520
        TP   W+5          A           REPLACE WITH EXEC LCTR        51230 01234  11 02135 32000
T76     EJ   S            L+3        TEST IF V FIELD IS S           51231 01235  43 02014 01240
        RJ   T69          T68         NO TRANSLATE V AND REP        51232 01236  37 01175 01171
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      ZJ    L+2          L+3          LACE EXECUTION L COUNTR    51233 01237  47 01241 01242
      TP    T121         A            YES REPLACE WITH STOR-     51234 01240  11 01520 32000
      TP    A            T120         AGE LOCATION COUNTER       51235 01241  11 32000 01517
      TP    BLNKS        A          PUT DUMMY CODE IN A          51236 01242  11 02035 32000
      MJ                 T75          AND EXIT BACK TO T75       51237 01243  45 00000 01225
T77   RJ    T69          T67        IF RSRV ADD THE CONTENTS     51240 01244  37 01175 01167
      AT    T121         T121         OF U AND V TO THE          51241 01245  35 01520 01520
      RJ    T69          T68          STORAGE AND EXECUTION      51242 01246  37 01175 01171
      AT    T120         T120         LOCATION COUNTERS          51243 01247  35 01517 01517
      MJ                 T75        EXIT                         51244 01250  45 00000 01225
T80   TP    A            Q          THIS IS A CLOSED SUB-        51245 01251  11 32000 31000
      TP    L(0)         TEMP         ROUTINE THAT WILL CON-     51246 01252  11 02047 02155
      TP    L(5)         TEMP+1       VERT THE FIVE HI  ORDER    51247 01253  11 02061 02156
      LQ    Q            6            OCTAL XS3 CHARACTERS       51250 01254  55 31000 00006
      QT    L(77B)       A            IN A RIGHT TO BINARY       51251 01255  51 02102 32000
      ST    L(3)         TEMP+2       AND LEAVE THE RESULT       51252 01256  36 02055 02157
      SJ    T81-1        L+1          IN THE ACCUMULATOR         51253 01257  46 01267 01260
      TJ    L(8)         L+4          THE CONVERSION WILL        51254 01260  42 02075 01264
      EJ    L(22B)       T81-1        END AFTER 5 CHARACTERS     51255 01261  43 02120 01267
      TP    OCT          T138         HAVE BEEN CONVERTED OR     51256 01262  11 02007 01550
      MJ                 L+4          A NON OCTAL CHARACTER      51257 01263  45 00000 01267
      SP    TEMP         3            HAS BEEN FOUND  IF THIS    51260 01264  31 02155 00003
      AT    TEMP+2       TEMP         CHARACTER IS NOT B OR      51261 01265  35 02157 02155
      IJ    TEMP+1       T80+3        BLANK A OCT WARNING        51262 01266  41 02156 01254
      SP    TEMP                      WILL BE GIVEN              51263 01267  31 02155 00000
T81   MJ                             EXIT                       51264 01270  45 00000 00000
T82   TP    L(0)         TEMP       THIS IS A CLOSED SUB-        51265 01271  11 02047 02155
      TP    L(5)         TEMP+2       ROUTINE THAT WILL CON      51266 01272  11 02061 02157
      LQ    Q            6            VERT THE FIVE HI ORDER     51267 01273  55 31000 00006
      QT    L(77B)       A            DECIMAL XS3 CHARACTERS     51270 01274  51 02102 32000
      ST    L(3)         TEMP+1       IN Q TO BINARY AND         51271 01275  36 02055 02156
      SJ    T83-1        L+1          LEAVE THE RESULT IN THE    51272 01276  46 01307 01277
      TJ    L(10)        L+4          ACCUMULATOR  THE CON       51273 01277  42 02045 01303
      EJ    L(40B)       T83-1        VERSION WILL END AFTER     51274 01300  43 02101 01307
      TP    DEC          T138         5 CHARACTERS HAVE BEEN     51275 01301  11 02006 01550
      MJ                 T83-1        CONVERTED OR A NON DEC     51276 01302  45 00000 01307
      SP    TEMP         2            IMAL CHARACTER HAS BEEN    51277 01303  31 02155 00002
      SA    TEMP         1            FOUND  IF THIS CHARACT     51300 01304  32 02155 00001
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         AT    TEMP+1          TEMP          ER IS NOT ) OR BLANK          51301 01305  35 02156 02155
         IJ    TEMP+2          T82+2         A DEC WARNING WILL BE         51302 01306  41 02157 01273
         SP    TEMP                          GIVEN                         51303 01307  31 02155 00000
T83      MJ                                  EXIT                          51304 01310  45 00000 00000
T84      TP    L(4)            TEMP+1        THIS IS A CLOSED SUB-         51305 01311  11 02067 02156
         LTR   21              Q              ROUTINE THAT WILL CON-       51306 01312  22 10025 31000
         TP    L(0)            TEMP           VERT THE FIVE LOW            51307 01313  11 02047 02155
         LQ    Q               3              ORDER DIGITS OF A            51310 01314  55 31000 00003
         SP    TEMP            6              RIGHT TO XS-3 OCTAL          51311 01315  31 02155 00006
         QA    L(7)            TEMP           AND LEAVE THE RESULT         51312 01316  52 02121 02155
         IJ    TEMP+1          L-3            IN THE ACCUMULATOR           51313 01317  41 02156 01314
         RA    TEMP            XS3Z                                        51314 01320  21 02155 02033
T85      MJ                                  EXIT                          51315 01321  45 00000 00000
T86      LTL   6               W+14          STORE LOW 5 OCTAL DIGITS      51316 01322  22 00006 02146
         LTL   15              W+15           OF A INTO W+16 NEXT 5        51317 01323  22 00017 02147
         LTL   15              W+16           IN W+15 AND HIGH ORDER       51320 01324  22 00017 02150
T87      MJ                                   2 INTO W+14 AND EXIT         51321 01325  45 00000 00000
FLDEC    RPV   4               L+2           CLEAR FOUR TEMPORARY          51322 01326  75 10004 01330
         TP    L(0)            TEMP           CELLS  TEMP TO TEMP+3        51323 01327  11 02047 02155
         TP    L(5)            TEMP+5        SET INDEX TO 5                51324 01330  11 02061 02162
         LQ    TEMP+4          6             MASK OFF LEADING CHAR-        51325 01331  55 02161 00006
         QT    L(77B)          A              ACTER TO ACCUMULATOR         51326 01332  51 02102 32000
         EJ    L(0)            T91            TEST FOR BLANK               51327 01333  43 02047 01352
         EJ    L(22B)          T91-2          TEST FOR DECIMAL POINT       51330 01334  43 02120 01350
         EJ    L(2)            T91            TEST FOR MINUS SIGN          51331 01335  43 02063 01352
         ST    L(3)            TEMP+12        SUBTRACT 3 TO TEMP CELL      51332 01336  36 02055 02171
         TJ    L(10)           L+4            TEST FOR NON DECIMAL         51333 01337  42 02045 01343
T90      TP    L(0)            TEMP           CLEAR RESULT CELL            51334 01340  11 02047 02155
         TP    DEC             W+18           SET ERROR INDICATOR          51335 01341  11 02006 02152
         MJ                    T98+1          JUMP TO ERROR EXIT           51336 01342  45 00000 01441
         SP    TEMP            2             MULTIPLY INTEGER TO DATE      51337 01343  31 02155 00002
         SA    TEMP            1              BY 12  AND ADD IN THIS       51340 01344  32 02155 00001
         AT    TEMP+12         TEMP           DIGIT                        51341 01345  35 02171 02155
         RA    TEMP+1          TEMP+2        BUMP DECIMAL PLACE COUNT      51342 01346  21 02156 02157
         MJ                    L+2           JUMP TO INDEX                 51343 01347  45 00000 01351
         RA    TEMP+2          L(1)          SET DECIMAL PLACE ADDER       51344 01350  21 02157 02054
         IJ    TEMP+5          FLDEC+3       TEST FOR 6 DIGITS             51345 01351  41 02162 01331
T91      MJ                                  EXIT                          51346 01352  45 00000 00000
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      TP    W+3          TEMP+4      STORE 1ST 6 DIGITS OF U      51347 01353  11 02133 02161
      RJ    T91          FLDEC        IN TEMP+4 TO BE CONV-       51350 01354  37 01352 01326
      EJ    L(2)         T90          ERTED TO BINARY             51351 01355  43 02063 01340
      SP    W+4          24          STORE NEXT 4 DIGITS OF       51352 01356  31 02134 00030
      LTL                A            U INTO TEMP+4 TO BE         51353 01357  22 00000 32000
      LTR   12           TEMP+4       CONVERTED TO BINARY AND     51354 01360  22 10014 02161
      RJ    T91          FLDEC+2      ADDED TO FIRST SIX          51355 01361  37 01352 01330
      EJ    L(2)         T90         TEST FOR MINUS SIGN          51356 01362  43 02063 01340
      TP    TEMP         TEMP+7      SAVE MANTISSA                51357 01363  11 02155 02164
      TP    TEMP+1       TEMP+8      SAVE DECIMAL PLACE COUNT     51360 01364  11 02156 02165
      TP    W+5          TEMP+4      STORE EXPONENT IN TEMP+4     51361 01365  11 02135 02161
T92   RJ    T91          FLDEC       TO BE CONVERTED TO BIN-      51362 01366  37 01352 01326
      EJ    L(2)         T91-2        ARY AND STORE IN TEMP       51363 01367  43 02063 01350
      SP    TEMP+1                    AND ITS SIGN IN TEMP+1      51364 01370  31 02156 00000
      ZJ    L+1          L+2         TEST IF SIGN IS NEGATIVE     51365 01371  47 01372 01373
      TN    TEMP         TEMP        IF SO COMPLEMENT EXPON       51366 01372  13 02155 02155
      RS    TEMP         TEMP+8       ENT - DECIMAL PLACES        51367 01373  23 02155 02165
      TM    TEMP         TEMP+2      STORE ABSOLUTE VALUE OF      51370 01374  12 02155 02157
T93   TP    1S34         TEMP+4       EXPONENT IN TEMP+2          51371 01375  11 02023 02161
      SP    TEMP+2                   TEST IF EXPONENT IS TOO      51372 01376  31 02157 00000
      TJ    L(54B)       L+6          LARGE OR TOO SMALL IF       51373 01377  42 02103 01405
      MJ                 T98          SO EXIT TO ERR ROUTINE      51374 01400  45 00000 01440
      SP    TEMP+4       2           COMPUTE 10 TO THE NTH        51375 01401  31 02161 00002
      SA    TEMP+4       1            POWER WHERE N IS THE        51376 01402  32 02161 00001
T94   SF    A            TEMP+3       ABSOLUTE VALUE OF THE       51377 01403  74 32000 02160
      TP    A            TEMP+4       EXPONENT - DECIMAL PL-      51400 01404  11 32000 02161
      IJ    TEMP+2       L-4          ACES AND STORE IN TMP+4     51401 01405  41 02157 01401
      MP    TEMP         L10B2       MULT EXPONENT X LOG10B2      51402 01406  71 02155 02025
      LT    3            TEMP+6       SAVE INTEGER PART           51403 01407  22 00003 02163
      SJ    L+1          L+4         TEST FOR NEGATIVE EXPON      51404 01410  46 01411 01414
      RS    TEMP+6       L(1)        IF SO SUBTRACT ONE FROM      51405 01411  23 02163 02054
T95   SP    1S34         35           INTEGER PART AND RECIP      51406 01412  31 02023 00043
      DV    TEMP+4       TEMP+4       ROCATER EXPONENT            51407 01413  73 02161 02161
      MP    TEMP+4       TEMP+7      MULT 10 TO NTHX MANTISSA     51410 01414  71 02161 02164
      ZJ    L+1          T100-1      TEST FOR ZERO                51411 01415  47 01416 01462
      SF    A            TEMP+3      NORMALIZE ABOVE PRODUCT      51412 01416  74 32000 02160
      TP    A            TEMP+7       AND SAVE SF COUNT           51413 01417  11 32000 02164
      RA    TEMP+6       TEMP+3      ADD COUNT TO INTEGER PRT     51414 01420  21 02163 02160
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        AT    L(1)       TEMP+6     ADD ONE TO THIS SUM              51415 01421  35 02054 02163
T96     LQ    W+2        Q+6        BREAK OPERATION FIELD IN         51416 01422  55 02132 31006
        TP    Q          TEMP+4      TWO PARTS STORE BINARY          51417 01423  11 31000 02161
        LQ    Q          18          SCALE FACTOR IN TEMP+4          51420 01424  55 31000 00022
        QT    L(77B)     TEMP+9      AND SIGN IN TEMP+9              51421 01425  51 02102 02166
T97     RJ    L          L+1        ONE SHOT SWITCH                  51422 01426  37 01426 01427
        RA    TEMP+6     L(200B)    ADD 200 TO CHARACTERITIC         51423 01427  21 02163 02122
        RA    TEMP+7     L(200B)    ADD 200 TO MANTISSA              51424 01430  21 02164 02122
        EJ    A          L+3        TEST FOR CARRY                   51425 01431  43 32000 01434
        RA    TEMP+6     L(1)       ADD 1 TO CHARACTERISTIC          51426 01432  21 02163 02054
        SP    1S34                  SET MANTISSA TO 1 S 34           51427 01433  31 02023 00000
        LT    28         Q          COMBINE CHARACTERISTIC           51430 01434  22 00034 31000
        SP    TEMP+6     27          AND MANTISSA AND PUT            51431 01435  31 02163 00033
        AT    Q          Q           IN Q                            51432 01436  35 31000 31000
        EJ    A          T99A       TEST IF CHARACTERISTIC           51433 01437  43 32000 01455
T98     TP    EXP        W+18        IS TOO LARGE IF SO SET          51434 01440  11 02012 02152
        TP    L(0)       Q           TO ZERO AND GO TO ERROR         51435 01441  11 02047 31000
        MJ               T99B-1     EXIT                             51436 01442  45 00000 01460
        TP    BLNKS      W+17       CLEAR ERROR INDICATOR            51437 01443  11 02035 02151
T99     RJ    T97        T91+1      ENTRANCE FOR STATED PT           51440 01444  37 01426 01353
        RJ    T91        FLDEC      CONVERT MANTISSA                 51441 01445  37 01352 01326
        RA    TEMP+6     TEMP       CONVERT SCALING                  51442 01446  21 02163 02155
        SA    L(1)                  ADD ONE                          51443 01447  32 02054 00000
        SJ    T98        L+1        TEST FOR MINUS                   51444 01450  46 01440 01451
        TV    A          L+1        SET UP SHIFT                     51445 01451  16 32000 01452
        SP    TEMP+7                ROUND MANTISSA                   51446 01452  31 02164 00000
        SA    1S35                  AND SHIFT                        51447 01453  32 02024 00000
        LT               Q          STORE IN Q                       51450 01454  22 00000 31000
T99A    RS    TEMP+9     L(2)       TEST SIGN OF NUMBER              51451 01455  23 02166 02063
        ZJ    L+2        L+1        IF NEGATIVE COMPLEMENT Q         51452 01456  47 01460 01457
        TN    Q          Q                                           51453 01457  13 31000 31000
        SP    Q                     SPLIT OFF RESULT INTO            51454 01460  31 31000 00000
T99B    RJ    L          L+1         (ONE-SHOT SWITCH)               51455 01461  37 01461 01462
        RJ    T87        T86        W+14 W+15 W+16                   51456 01462  37 01325 01322
T100    RJ    T97        T97        RESTORE SWITCH                   51457 01463  37 01426 01426
        MJ               T12        EXIT TO STORE FOR WRITE          51460 01464  45 00000 00413
XS3CON  SP    W+1                   SHIFT TAG LEFT THREE             51461 01465  31 02131 00000
        LTL   18         W           XS-3 POSITIONS STORE IN         51462 01466  22 00022 02130
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                TP      A               W+1             W AND W+1                       51463 01467  11 32000 02131
                SP      W+12                            SAVE STORAGE ADDRESS IN         51464 01470  31 02144 00000
                TP      A               TEMP+6           TEMP+6 AND TEST IF             51465 01471  11 32000 02163
                EJ      BLNKS           L+3              BLANK DO NOT CONVERT           51466 01472  43 02035 01475
T110            RJ      T85             T84             CONVERT TO XS-3 AND             51467 01473  37 01321 01311
                TP      A               W+12             STORE IN W+12                  51470 01474  11 32000 02144
                SP      W+13                            SAVE EXECUTION ADDRESS          51471 01475  31 02145 00000
                TP      A               TEMP+7           IN TEMP+7 AND TEST IF          51472 01476  11 32000 02164
                EJ      BLNKS           T113             BLANK DO NOT CONVERT           51473 01477  43 02035 01516
                RJ      T85             T84             CONVERT TO XS-3 AND             51474 01500  37 01321 01311
                TP      A               W+13             STORE IN W+13                  51475 01501  11 32000 02145
T110A           TP      W+2             A               IF RSRV INSTRUCTION DO          51476 01502  11 02132 32000
                EJ      RSRV            T113             NOT CONVERT OP,U, OR V         51477 01503  43 02016 01516
T111            SP      W+14                            CONVERT OPERATION TO            51500 01504  31 02146 00000
                RJ      T85             T84              XS-3  SHIFT OFF TWO            51501 01505  37 01321 01311
                LQ      A               A+24             LOW ORDER CHARACTERS           51502 01506  55 32000 32030
                LTL     12              W+14             AND STORE IN W+14              51503 01507  22 00014 02146
                SP      W+15                            CONVERT U FIELD TO XS-3         51504 01510  31 02147 00000
                RJ      T85             T84              AND STORE IN W+15              51505 01511  37 01321 01311
T112            TP      A               W+15                                            51506 01512  11 32000 02147
                SP      W+16                            CONVERT V FIELD TO XS-3         51507 01513  31 02150 00000
                RJ      T85             T84              AND STORE IN W+16              51510 01514  37 01321 01311
                TP      A               W+16                                            51511 01515  11 32000 02150
T113            MJ                                      EXIT                            51512 01516  45 00000 00000
T120                                    10B)            EXECUTION LOCATION CTR          51513 01517  00 00000 00010
T121                                    10B)            STORAGE LOCATION COUNTER        51514 01520  00 00000 00010
T121A                                   10B)            SAFE STORAGE FOR                51515 01521  00 00000 00010
T121B                                   10B)             LOCATION COUNTERS              51516 01522  00 00000 00010
T122            20000B)                                 L( TYPE CONSTANT TALLY          51517 01523  00 20000 00000
T122A                                                   CONSTANT COUNT                  51520 01524  00 00000 00000
T123            20113B)                                 L( TYPE CONSTANT MAXIMUM        51521 01525  00 20113 00000
T124                                                    ADDRESS OF 1ST CONSTANT         51522 01526  00 00000 00000
T125            20000B)                                 UNDEFINED TAG TALLY             51523 01527  00 20000 00000
T126            20113B)                                 UNDEFINED TAG MAXIMUM           51524 01530  00 20113 00000
T127                                                    ADDRESS OF 1ST UNDEF TAG        51525 01531  00 00000 00000
T128            20004B)                                 TAG TALLY                       51526 01532  00 20004 00000
T128A                                                   TAG COUNT                       51527 01533  00 00000 00000
T129            21400B)                                 TAG MAXIMUM                     51530 01534  00 21400 00000
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T130                                                EQLS TALLY                      51531 01535  00 00000 00000
T130A                                               EQLS COUNT                      51532 01536  00 00000 00000
T131                                                EQLS MAXIMUM                    51533 01537  00 00000 00000
T132                                                DUPLICATE TAG TALLY             51534 01540  00 00000 00000
T133                                                DUPLICATE TAG MAXIMUM           51535 01541  00 00000 00000
T134                                                LAST EXECUTION ADDRESS          51536 01542  00 00000 00000
T135                                                LAST STORAGE ADDRESS            51537 01543  00 00000 00000
T136                                                INPUT BLOCKETTE COUNT           51540 01544  00 00000 00000
T136A                                               INSTRUCTION COUNTER             51541 01545  00 00000 00000
T136B                                               BLOCK COUNTER                   51542 01546  00 00000 00000
T137                                                DRUM STORE TALLY                51543 01547  00 00000 00000
T138                                                ERROR INDICATOR                 51544 01550  00 00000 00000
T139                                                OUTPUT BLOCKETTE TALLY          51545 01551  00 00000 00000
T140                                                OUTPUT BLOCK TALLY              51546 01552  00 00000 00000
T141                                                DRUM TO CORE TALLY              51547 01553  00 00000 00000
T142          20074B)                               OPERATION TABLE TALLY           51550 01554  00 20074 00000
T149          WT2           WT                    RESETTING CONSTANT              51551 01555  00 07230 05710
T150          W+1           WT2                   RESETTING CONSTANT              51552 01556  00 02131 07230
T151    RJ    T20           T18                   TO READ INPUT TAPE              51553 01557  37 00446 00422
T152    TP    OTABLE        Q                     FOR OPERATION LOOKUP            51554 01560  11 00563 31000
T153          W+3           W+1                   RESETTING CONSTANT              51555 01561  00 02133 02131
T154          W+5           WT2                   RESETTING CONSTANT              51556 01562  00 02135 07230
T155          W+6           T69-1                 RESETTING CONSTANT              51557 01563  00 02136 01174
T157                        EB+60                 RESETTING CONSTANT              51560 01564  00 00000 07704
T160    RPB   20            L+2                   SAVE END INSTRUCTION            51561 01565  75 30024 01567
        TP    W+1           EB+100                 IN EQLS BUFFER                 51562 01566  11 02131 07754
        RS    T122          RPD                   TEST IF L( TYPE CONSTANT        51563 01567  23 01523 02031
        SJ    T165          L+1                    HAVE BEEN USED                 51564 01570  46 01617 01571
        RPV   20            L+2                   SET STORAGES W - W+19           51565 01571  75 10024 01573
        TP    BLNKS         W                      TO BLANKS                      51566 01572  11 02035 02130
        RPB   3             L+2                   STORE THE WORDS CONSTANT        51567 01573  75 30003 01575
T161    TP    CPRINT        W+5                    POOL IN W+5 - W+7              51570 01574  11 02037 02135
        LTL   21            TEMP+5                SETUP INDEX                     51571 01575  22 00025 02162
        TP    T134          W+13                  STORE EXECUTION ADDRESS         51572 01576  11 01542 02145
        RA    T134          L(1)                  BUMP EXECUTION ADDRESS          51573 01577  21 01542 02054
        SS    T135                                TEST IF STORAGE ADDRESS         51574 01600  34 01543 00000
T162    EJ    L(1)          L+2                    EQUALS EXECUTION ADDR-         51575 01601  43 02054 01603
        TP    T135          W+12                   IF NOT STORE IN W+12           51576 01602  11 01543 02144
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        RA    T135          L(1)          BUMP STORAGE ADDRESS          51577 01603  21 01543 02054
        RJ    L             L+1           ONE SHOT SWITCH               51600 01604  37 01604 01605
T163    SP    CPT                         SPLIT BINARY CONSTANT         51601 01605  31 02201 00000
        RJ    T87           T86            AND STORE IN W+14 -W+16      51602 01606  37 01325 01322
        RA    L-2           L(100000B)    BUMP CONSTANT POOL FETCH      51603 01607  21 01605 02052
        RPB   2             L+2           STORE SYMBOLIC CONSTANT       51604 01610  75 30002 01612
        TP    CPT+75        W+9            INTO W+9 AND W+10            51605 01611  11 02314 02141
T164    RA    L-1           L(200000B)    BUMP FETCH                    51606 01612  21 01611 02123
        RJ    T25           T21           STORE IN OUTPUT BUFFER        51607 01613  37 00477 00447
        RPV   3             L+2           CLEAR STORAGES                51610 01614  75 10003 01616
        TP    L(0)          W+5            W+5 TO W+7                   51611 01615  11 02047 02135
        IJ    TEMP+5        T161+2        TEST FOR ALL CONSTANTS        51612 01616  41 02162 01576
T165    RS    T125          RPD           TEST FOR UNDEFINED TAGS       51613 01617  23 01527 02031
        SJ    T170-1        L+1            IF NOT EXIT                  51614 01620  46 01637 01621
        RPV   20            L+2           CLEAR STORAGES                51615 01621  75 10024 01623
        TP    BLNKS         W              W TO W+19                    51616 01622  11 02035 02130
        RPB   3             L+2           STORE THE WORDS UNDEFIN       51617 01623  75 30003 01625
T166    TP    UTPRNT        W+5            ED TAGS IN W+5 TO W+7        51620 01624  11 02042 02135
        LTL   21            TEMP+5        SET UP UNDEF TAG INDEX        51621 01625  22 00025 02162
        SP    L(0)                        SET OCTAL TRANSLATION TO      51622 01626  31 02047 00000
        RJ    T87           T86            ZERO FOR UNDEFINED TAGS      51623 01627  37 01325 01322
        RJ    T163-1        T161+2        STORE IN W+14 W+15 W+16       51624 01630  37 01604 01576
        TP    UT            W+9           STORE UNDFD TAG IN W+9        51625 01631  11 02573 02141
T167    RA    L-1           L(100000B)    BUMP FETCH                    51626 01632  21 01631 02052
        RJ    T25           T21           STORE IN OUTPUT BUFFER        51627 01633  37 00477 00447
        RPV   3             L+2           CLEAR STORAGES W+5 W+6        51630 01634  75 10003 01636
        TP    L(0)          W+5            AND W+7                      51631 01635  11 02047 02135
        IJ    TEMP+5        T166+2        TEST FOR ALL UNDEF TAGS       51632 01636  41 02162 01626
        RPB   20            L+2           BRING END INSTRUCTION         51633 01637  75 30024 01641
T170    TP    EB+100        W+1            IN W STORAGE                 51634 01640  11 07754 02131
        RJ    T69           T67           TRANSLATE U ADD OF END        51635 01641  37 01175 01167
        RJ    T85           T84           CONVERT TO XS-3               51636 01642  37 01321 01311
        TP    A             W+15          STORE IN W+15                 51637 01643  11 32000 02147
        RPV   3             L+2           CLEAR STORAGES                51640 01644  75 10003 01646
        TP    BLNKS         W+12           W+12 TP W+14                 51641 01645  11 02035 02144
        RJ    T25           T21           STORE IN OUTPUT BUFFER        51642 01646  37 00477 00447
        TP    PSTOP         W+2           STORE PRTR STOP IN W+2        51643 01647  11 02036 02132
        RJ    T25           T21           STORE IN OUTPUT BUFFER        51644 01650  37 00477 00447
```

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T171    SJ    L+4           L+1          IF TAPE DID NOT WRITE      51645 01651  46 01655 01652
        TP    T22+3         T22+2         GIMMICK TEST              51646 01652  11 00457 00456
        RJ    T25           T21          WRITE LAST BLOCK OF        51647 01653  37 00477 00447
        SJ    L+1           L-1           SYMBOLIC TAPE             51650 01654  46 01655 01653
        EF                  RWND4        REWIND INPUT TAPE          51651 01655  17 00000 02003
T172    EF                  RWND5        REWIND OUTPUT TAPE         51652 01656  17 00000 01776
        MS                  40014B)      FINAL STOP                 51653 01657  56 00000 40014
SORT    SP    T128                       SUBTRACT HIGH ORDER 2      51654 01660  31 01532 00000
        SS    RPD                         FROM TAG TALLY AND        51655 01661  34 02031 00000
        AT    L(100000B)    Q             LEAVE IN U PART OF Q      51656 01662  35 02052 31000
        RA    T210+1        Q            THIS IS A CLOSED SUB-      51657 01663  21 01756 31000
T200    RA    T210A         Q             ROUTINE THAT WILL SORT    51660 01664  21 01763 31000
        RA    T203          Q             THE TAG TABLE BEGINNING   51661 01665  21 01712 31000
        RA    T208+2        Q             AT THE SYMBOLIC LOCATON   51662 01666  21 01746 31000
        RA    T209          Q             TT INTO AN ASCENDING      51663 01667  21 01751 31000
        RA    T209+2        Q             SEQUENCE WHERE EACH       51664 01670  21 01753 31000
T201    RA    T210+2        Q             ENTRY IS TREATED AS A     51665 01671  21 01757 31000
        RA    T210A-2       Q             36 BIT NUMBER WITHOUT     51666 01672  21 01761 31000
        RA    T210A+1       Q             SIGN  THE LOCATIONS       51667 01673  21 01764 31000
        RA    T203-3        Q             ASSOCIATED WITH THE       51670 01674  21 01707 31000
        LQ    Q             21           ENTRIES IN THE TT TABLE    51671 01675  55 31000 00025
        RA    T212          Q            BEGIN IN THE SYMBOLIC      51672 01676  21 01770 31000
T202    RA    T210          Q            LOCATION TL  THE TL        51673 01677  21 01755 31000
        TP    L(1)          TEMP         TABLE IS 769 WORDS LONG    51674 01700  11 02054 02155
        RA    K             L(1)         AND CONTAINS STORAGE       51675 01701  21 01150 02054
        LA    TEMP          1            AND EXECUTION ADDRESSES    51676 01702  54 02155 00001
        TJ    Q             L-2          IN THE U AND V FIELDS      51677 01703  42 31000 01701
        TV    Q             T211+1       RESPECTIVELY  THE TL       51700 01704  16 31000 01767
        IJ    T211+1        L+1          TABLE IS STORED ON DRUM    51701 01705  41 01767 01706
        TP    L(1)          Q            SEVEN DURING THE SORT      51702 01706  11 02054 31000
        RPB                 L+2          OF THE TT TABLE  THEN      51703 01707  75 30000 01711
        TP    TL            TLDRUM       THE TT TABLE IS STORED     51704 01710  11 04307 76400
        SP    T211                       ON DRUM DURING THE TL      51705 01711  31 01766 00000
T203    RPV                 L+2          TABLE SORT  THE ROUTINE    51706 01712  75 10000 01714
        AT    L(100000B)    1BUF         REQUIRES 2 BUFFERS EACH    51707 01713  35 02052 05710
        TV    T211+1        T212+1       EQUAL IN LENGTH TO THE     51710 01714  16 01767 01771
        TU    T211+1        T204+3       SIZE OF THE TAG TABLE      51711 01715  15 01767 01722
        TU    T211+1        T205+1       THESE BUFFERS ARE NAMED    51712 01716  15 01767 01726
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T204    TU    T211+1        T206+1      1BUF AND 2 BUF  THE      51713 01717  15 01767 01733
        TV    T208+3        T205+1      SORTED TABLES ARE LEFT   51714 01720  16 01747 01726
        TV    T203+1        T206+1      IN THEIR ORIGINAL        51715 01721  16 01713 01733
        TU                  T205-1      BUFFERS AT THE TERMI-    51716 01722  15 00000 01724
        RA    L-1           L(100000B)  NATION OF THE SORT       51717 01723  21 01722 02052
        QT    FILL          A           THE TL TABLE IS TESTED   51720 01724  51 30000 32000
T205    ZJ    L+1           T206+1      BIT BY BIT BEGINNING     51721 01725  47 01726 01733
        TP    FILL          FILL        IN LOW ORDER POSITION    51722 01726  11 30000 30000
        RA    L-1           L(100001B)  WHEN A ZERO IS FOUND     51723 01727  21 01726 02124
        TU    A             T206+1      THE CORRESPONDING DUMMY  51724 01730  15 32000 01733
        IJ    T212+1        T204+3      TP COMMAND IS PLACED     51725 01731  41 01771 01722
T206    MJ                  T207        IN 1BUF  WHEN A ONE      51726 01732  45 00000 01737
        TP    FILL          FILL        IS FOUND THE CORRESP-    51727 01733  11 30000 30000
        RA    L-1           L(100001B)  ONDING TP DUMMY IS       51730 01734  21 01733 02124
        TU    A             T205+1      PLACED IN THE 2BUF       51731 01735  15 32000 01726
        IJ    T212+1        T204+3      WHEN ONE BIT OF EACH     51732 01736  41 01771 01722
T207    TV    T206+1        T208        ENTRY IN THE TL TABLE    51733 01737  16 01733 01744
        SP    T212                      HAS BEEN TESTED THE      51734 01740  31 01770 00000
        SS    T208          15          TP DUMMIES REPRESENTING  51735 01741  34 01744 00017
        AT    T213          L+1         ONES ARE MOVED TO THE    51736 01742  35 01772 01743
        RP                  L+2         1BUF BUFFER IMMEDIATELY  51737 01743  75 00000 01745
T208    TP    2BUF          FILL        FOLLOWING THE ZERO TP    51740 01744  11 04307 30000
        QJ    L+1           T203+2      DUMMIES  WHEN ALL 36     51741 01745  44 01746 01714
        RPB                 L+2         BITS OF EACH ENTRY HAVE  51742 01746  75 30000 01750
        TU    1BUF          2BUF        BEEN TESTED A MJ COMM-   51743 01747  15 05710 04307
        SP    T211                      AND IS STORED AFTER THE  51744 01750  31 01766 00000
T209    RPV                 L+2         LAST DUMMY TP COMMAND    51745 01751  75 10000 01753
        AT    L(1)          1BUF        THE DUMMY TP COMMANDS    51746 01752  35 02054 05710
        RPB                 L+2         ARE THEN OBEYED THESE    51747 01753  75 30000 01755
        TU    2BUF          1BUF        WILL SHUFFLE THE TABLES  51750 01754  15 04307 05710
T210    TP    T213+1        1BUF        INTO THEIR PROPER SEP-   51751 01755  11 01773 05710
        RJ    1BUF          1BUF        UENCE  THE APROXIMATE    51752 01756  37 05710 05710
        RPB                 L+2         SORTING SPEED IS 1.3     51753 01757  75 30000 01761
        TP    TLDRUM        TT          SECONDS PER 100 ENTRIES  51754 01760  11 76400 02706
        RPB                 L+2         A MAXIMUM OF 768         51755 01761  75 30000 01763
        TP    2BUF          TLDRUM      ENTRIES MAY BE SORTED    51756 01762  11 04307 76400
T210A   RJ    1BUF          1BUF        THE ENTRY POINT IS AT    51757 01763  37 05710 05710
        RPB                 FILL        THE SYMBOLIC LOCATION    51760 01764  75 30000 30000
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        TP      TLDRUM          TT              SORT                            51761 01765  11 76400 02706
T211    TP      TT-1            2BUF-1          THE EXIT POINT IS               51762 01766  11 02705 04306
                1BUF                            AT THE SYMBOLIC LOCA-           51763 01767  00 05710 00000
T212    TP      2BUF            1BUF            TION T210A + 1                  51764 01770  11 04307 05710
        B                                                                       51765 01771  00 00000 00000
T213    RPB                     T208+1                                          51766 01772  75 30000 01745
        MJ                      FILL                                            51767 01773  45 00000 30000
RDCARD  40                      5               PICK CARD READ                  51770 01774  40 00000 00005
WTP5    B       020004650000                    WRITE ON OUTPUT TAPE            51771 01775  02 00046 50000
RWND5   B       020020050000                    REWIND OUTPUT TAPE              51772 01776  02 00200 50000
RDTP4   B       020000240000                    READ INPUT TAPE                 51773 01777  02 00002 40000
MBCK1   B       020001440001                    MOVE INPUT TAPE BACK ONE        51774 02000  02 00014 40001
MBACK   B       020001440000                    MOVE INPUT TAPE BACK            51775 02001  02 00014 40000
WTP4    B       020004640000                    WRITE ON INPUT (CARD OP)        51776 02002  02 00046 40000
RWND4   B       020020040000                    REWIND INPUT TAPE               51777 02003  02 00200 40000
STAPE   B       020060040000                    STOP TAPE                       52000 02004  02 00600 40000
NOP     XS3         NOP                         ---NOP WARNING                  52001 02005  00 00005 05152
DEC     XS3         DEC                         ---DEC WARNING                  52002 02006  00 00002 73026
OCT     XS3         OCT                         ---OCT WARNING                  52003 02007  00 00005 12666
DEF     XS3         DEF                         ---DEF WARNING                  52004 02010  00 00002 73031
DUP     XS3         DUP                         ---DUP WARNING                  52005 02011  00 00002 76752
EXP     XS3         EXP                         ---EXP WARNING                  52006 02012  00 00003 07252
E       XS3     E                               E  (TEST CONSTANT)              52007 02013  30 00000 00000
S       XS3     S                               S  (TEST CONSTANT)              52010 02014  65 00000 00000
EQLS    XS3     EQLS                            EQLS (TEST CONSTANT)            52011 02015  30 53466 50000
RSRV    XS3     RSRV                            RSRV (TEST CONSTANT)            52012 02016  54 65547 00000
SETL    XS3     SETL                            SETL (TEST CONSTANT)            52013 02017  65 30664 60000
XS3     XS3     XS3                             XS3  (TEST CONSTANT)            52014 02020  72 65060 00000
END     XS3     END                             END  (TEST CONSTANT)            52015 02021  30 50270 00000
SIND                                            STORAGE INDICATOR               52016 02022  00 00000 00000
1S34    B34     1                               ONE SCALED 34                   52017 02023  20 00000 00000
1S35    B       400000000000                    ONE SCALED 35                   52020 02024  40 00000 00000
L10B2   B       324464741135                    LOG 10 BASE 2 SCALED 33         52021 02025  32 44647 41135
OMASK   B       077770000000                    OPERATION MASK                  52022 02026  07 77700 00000
LPCT    B       377737773777                    LOOP COUNTER                    52023 02027  37 77377 73777
BTST    B       202020202020                    TEST FOR LETTERS A B C D        52024 02030  20 20202 02020
RPD             20001B)                         REPEAT DUMMY                    52025 02031  00 20001 00000
L360            360                             DRUM FETCH CONSTANT             52026 02032  00 00550 00000
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XS3Z     B     000303030303                FIVE XS3 ZEROES                52027 02033  00 03030 30303
Z3S      B     030303030303                SIX XS3 ZEROES                 52030 02034  03 03030 30303
BLNKS    B     010101010101                BLANKS                         52031 02035  01 01010 10101
PSTOP    B     606060606060                PRINTER STOP                   52032 02036  60 60606 06060
CPRINT   XS3    CONST                      (CONSTANT POOL) HEADING        52033 02037  00 26515 06566
         XS3   ANT  P                        FOR SYMBOLIC OUTPUT          52034 02040  24 50660 00052
         XS3   OOL                           LISTING                      52035 02041  51 51460 00000
UTPRNT   XS3    UNDEF                      (UNDEFINED TAG) HEADING        52036 02042  00 67502 73031
         XS3   INED                          FOR SYMBOLIC OUTPUT          52037 02043  34 50302 70000
         XS3   TAGS                          LISTING                      52040 02044  66 24326 50000
                          CONSTANT  P  OOL          L(10)                 52041 02045  00 00000 00012
                                                    L(170000B)            52042 02046  00 00001 70000
                                                    L(0)                  52043 02047  00 00000 00000
                                                    L(14B)                52044 02050  00 00000 00014
                                                    L(35)                 52045 02051  00 00000 00043
                                                    L(100000B)            52046 02052  00 00001 00000
                                                    L(23)                 52047 02053  00 00000 00027
                                                    L(1)                  52050 02054  00 00000 00001
                                                    L(3)                  52051 02055  00 00000 00003
                                                    L(17B)                52052 02056  00 00000 00017
                                                    L(60B)                52053 02057  00 00000 00060
                                                    L(9)                  52054 02060  00 00000 00011
                                                    L(5)                  52055 02061  00 00000 00005
                                                    L(63B)                52056 02062  00 00000 00063
                                                    L(2)                  52057 02063  00 00000 00002
                                                    L(41B)                52060 02064  00 00000 00041
                                                    L(20B)                52061 02065  00 00000 00020
                                                    L(51B)                52062 02066  00 00000 00051
                                                    L(4)                  52063 02067  00 00000 00004
                                                    L(1200000B)           52064 02070  00 00012 00000
                                                    L(6)                  52065 02071  00 00000 00006
                                                    L(192)                52066 02072  00 00000 00300
                                                    L(96)                 52067 02073  00 00000 00140
                                                    L(960)                52070 02074  00 00000 01700
                                                    L(10B)                52071 02075  00 00000 00010
                                                    L(60)                 52072 02076  00 00000 00074
                                                    L(20)                 52073 02077  00 00000 00024
                                                    L(2400000B)           52074 02100  00 00024 00000
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L(32)	52075	02101	00	00000	00040
L(77B)	52076	02102	00	00000	00077
L(54B)	52077	02103	00	00000	00054
L(67B)	52100	02104	00	00000	00067
L(70B)	52101	02105	00	00000	00070
L(25B)	52102	02106	00	00000	00025
L(10000B)	52103	02107	00	00000	10000
L(46B)	52104	02110	00	00000	00046
L(53B)	52105	02111	00	00000	00053
L(31344646B)	52106	02112	00	00313	44646
L(77777B)	52107	02113	00	00000	77777
L(30000B)	52110	02114	00	00000	30000
L(32000B)	52111	02115	00	00000	32000
L(31000B)	52112	02116	00	00000	31000
L(64B)	52113	02117	00	00000	00064
L(22B)	52114	02120	00	00000	00022
L(7)	52115	02121	00	00000	00007
L(200B)	52116	02122	00	00000	00200
L(200000B)	52117	02123	00	00002	00000
L(100001B)	52120	02124	00	00001	00001

END

SECTION II

SERVICE LIBRARY

I. INTRODUCTION

The Service Library for the 1103AF consists of three sections: the executive routine, BOSS, and the collection of service routines. The executive routine and certain service routines operate in two modes, depending on whether or not BOSS is in control. The following sections describe the executive routine and the service routines presently available on the LMSD 1103AF.

II. MECHANICS OF OPERATION

The entire service library is located on the drum. Instructions to the executive routine can be given manually from the console or, in certain cases, under program control.

A. Manually:

1. Set specified parameters in Q and A.
2. Set PAK = proper start address.
3. Depress start.

B. Program Control:

1. Set parameters as specified in Operating Instructions.
2. RJ 40034B) DRUMST where DRUMST is the drum start of the desired service.

All service routines have a common exit at address 40034:

(40034) = 37 40034 40035
(40035) = 56 00000 40000.

A service routine used under program control does not stop at completion of the service as it would in the manual operation. Care should be used when using service routines in this manner while in the BOSS mode.

III. THE EXECUTIVE ROUTINE

The executive routine controls the use of service routines whether in or out of the BOSS mode.

The initiation of a drum start accomplishes the following sequence of events:

A. The Accumulator, Q-register, and the first 661 cells of core (0-1224) are saved on the drum (in the Drum-Core Image) and the executive routine is transferred from drum to the released core space.

B. The service routine to be executed is located and checksummed in its drum location. If the checksum is correct, A, Q, and core are restored and control is transferred to the service routine.

C. If the checksum fails, the BOSS Master Flip-Flop is checked. If BOSS is not in control an MSO stop with PAK = 00002 indicates the failure. The accumulator will contain the code number of the service routine that failed. If BOSS is in control (MFF ≠ 0), the desired service routine (and only that routine) is restored from the service library and then step B above is repeated.

IV. LIBRARY TAPE FORMAT

The service library is written and read in the variable block mode except for the first block, called the "Driver Block." The Driver Block controls the loading of the library from tape to drum.

Following the Driver Block are four variable blocks (2048 words each) which contain the entire contents of the 4 and 5 drums. The drum is restored from these blocks when A=0 on a 40000 drum start. Second core is used as a buffer during the transfer and no attempt is made to preserve either the initial content of this buffer space or the first 661 words of first core.

Following these four blocks on the tape, the service routines appear again in blocks of 500 words or less. In the case of a 40000 drum start with A equal to the Code (Code = DRUMST - 40000) of a routine, the library is moved past the 4 large blocks and the desired routine is selected from the small blocks. Since these blocks are $\leq$ 500 words, the Drum-Core Image in core may be used for the transfer buffer; hence, all of core is preserved on a selective restore.

V. OPERATION ASSIGNMENTS

A. Drum Starts.

Start	Name	Storage	(Octal) Words
40000	Cold Start		
40000	Load Library	40314-40336	23
40001	Drum F1	40001	1
40002	Manual Stop	40002	1
40003	BOSS Cold Start		
40004	BOSS Error Restart		
40005	BOSS Transfer to Next Job		
40006	BOSS Recovery Restart		
40007	SLAP	50000-52177	2200
40010	Octal Dump	40374-41275	702
40011	SLAP Symbolic Read	43220-43460	241
40012	SLAP Octal Read	43461-43761	301
40013	2-Core Binary Dump	41276-41527	232
40014	Tape Duplicate	53373-53676	304
40015	Print Binary	53677-54336	440
40016	Paper Tape Package	54337-54657	321
40017	Prepare Service Library	52200-52551	352
40020	Four Field Loader	41530-41711	162
40021	Relativizer	53011-53372	362
40022	Tag or Clear Memory	41712-41723	12
40023	Load cell from Q	41724-41732	7
40024	Read cell to Q	41733-41741	7
40025	Rewind W/EOF	41742-41767	26
40026	Card-to-Tape Simulator	52552-53010	237
40027	Tape-to-Card Simulator	53011-	
40030	Open		
40031	Open		
40032	Open		
40033	Open		

B. Miscellaneous.

Executive Routine	40000-40373	374
Drum-Core Image	41770-43217	1230
Basic BOSS	41770-43217	1230
BOSS Flip-in	43762-46761	3000

C. Abnormal Drum.

Start	Name
40000	Cold Start

```
                SETL  40000)B       40000)B       OPERATIONS PACKAGE
DRUMST          MJ                  LOAD          LOAD LIBRARY FROM TAPE          40000  45 00000 40056
                MJ                                DRUM F1                         40001  45 00000 00000
                MS                  DRUMST        UNIVERSAL STOP                  40002  56 00000 40000
                MJ                  BOSS1         BOSS COLD START                 40003  45 00000 40062
                MJ                  BOSS2         BOSS ERROR RESTART              40004  45 00000 40066
                MJ                  BOSS3         BOSS GO TO NEXT JOB             40005  45 00000 40072
                MJ                  BOSS4         BOSS RECOVERY RESTART           40006  45 00000 40076
                MJ                  SLAP          SYMBOLIC ASSEMBLY               40007  45 00000 40102
                MJ                  DUMP          FREE RUN OCTAL DUMP             40010  45 00000 40106
                MJ                  SLAPSY        READ SLAP SYMBOLIC TAPE         40011  45 00000 40112
                MJ                  SLAP8         READ SLAP OCTAL TAPE            40012  45 00000 40116
                MJ                  BINARY        TWO-CORE BINARY DUMP            40013  45 00000 40122
                MJ                  DUPE          TAPE DUPE AND/OR COMPARE        40014  45 00000 40126
                MJ                  PRINT         PRINT BINARY TAPE               40015  45 00000 40132
                MJ                  PAPER         PAPER TAPE PACKAGE              40016  45 00000 40136
                MJ                  SL            PREPARE SERVICE LIBRARY         40017  45 00000 40142
                MJ                  LOADER        4-FIELD OCTAL LOADER            40020  45 00000 40146
                MJ                  RELATE        SLAP RELATIVIZER                40021  45 00000 40152
                MJ                  TAG           TAG OR CLEAR CORE/DRUM          40022  45 00000 40156
                MJ                  LOADCL        LOAD A CELL FROM Q              40023  45 00000 40162
                MJ                  WORD2Q        DISPLAY A CELL IN Q             40024  45 00000 40166
                MJ                  FILEND        REWIND TAPES-EOF OPTION         40025  45 00000 40172
                MJ                  CTTSIM        CARD-TO-TAPE SIMULATOR          40026  45 00000 40176
                MJ                  TTC           TAPE-TO-CARD SIMULATOR          40027  45 00000 40202
                MJ                  TRACE         MACHINE LANGUAGE TRACE          40030  45 00000 40206
                MJ                  OPEN          OPEN                            40031  45 00000 40212
                MJ                  OPEN+4        OPEN                            40032  45 00000 40216
                MJ                  OPEN+8        OPEN                            40033  45 00000 40222
EXIT            RJ    L             L+1           COMMON EXIT FOR ALL             40034  37 40034 40035
                MS                  40000)B        SERVICE ROUTINES               40035  56 00000 40000
MFF                                                BOSS MASTER FLIP-FLOP           40036  00 00000 00000
SAVE            TP    CELL0         DCI+3         THIS ROUTINE SAVES A, Q,        40037  11 00000 41773
                TP    Q             DCI            F1, AND THE FIRST 660          40040  11 31000 41770
                LTL                 DCI+1          CELLS OF CORE.                 40041  22 00000 41771
                TP    A             DCI+2          A MANUAL JUMP IS SET IN        40042  11 32000 41772
                TP    DRUMST+1      CELL0          F1 TO INSURE PROPER            40043  11 40001 00000
                RPB   NDCI          DRUMST+2       EXECUTION OF ALL THE           40044  75 31224 40002
```

```
         TP    CELL1          DCI+4          SERVICE ROUTINES.                40045  11 00001 41774
RESTOR   TP    DCI            Q            THIS ROUTINE RESTORES              40046  11 41770 31000
         SP    DCI+1          36            A, Q, AND THE FIRST 66            40047  31 41771 00044
         SA    DCI+2                        CELLS OF CORE, ASSUMING           40050  32 41772 00000
         RPB   NDCI           L+2           THAT THESE HAVE BEEN              40051  75 31224 40053
         TP    DCI+4          CELL1         STORED IN DCI BY SAVE.            40052  11 41774 00001
         TV    DCI+3          CELL0         ONLY THE V-ADDRESS OF             40053  16 41773 00000
         RJ    L              L+1           F1 IS RESTORED. THE               40054  37 40054 40055
         MJ                   EXIT          COMMON EXIT IS USED.              40055  45 00000 40034
LOAD     RJ    PARAM          CALL        THE FOLLOWING SETS OF               40056  37 40230 40231
         02    READDR         READDR        WORDS (4 WORDS PER SET)           40057  02 40314 40314
               19                           ARE THE PARAMETER SETS            40060  00 00023 00000
                                            WHICH CONTROL THE                 40061  00 00000 00000
BOSS1    RJ    PARAM          DCI           SELECTION OF THE PROPER           40062  37 40230 41770
         03    DCI            DCI           SERVICE ROUTINE. THESE            40063  03 41770 41770
               1024B)                       PARAMETERS ALSO ARE               40064  00 01024 00000
                                            USED BY THE PREPARE               40065  00 00000 00000
BOSS2    RJ    PARAM          17635B)       SERVICE LIBRARY ROUTINE           40066  37 40230 17635
         04    40002B)        40002B)       WHEN PREPARING A NEW              40067  04 40002 40002
               20                           LIBRARY.                          40070  00 00024 00000
                                            THE FORMAT OF EACH FOUR           40071  00 00000 00000
BOSS3    RJ    PARAM          CALL          WORD SET IS AS FOLLOWS*           40072  37 40230 40231
         05    40002)B        40002)B       *WORD 1                           40073  05 40002 40002
               20                                                             40074  00 00024 00000
                                              IN NEARLY ALL CASES             40075  00 00000 00000
BOSS4    RJ    PARAM          CALL          THIS WORD HAS THE FORM            40076  37 40230 40231
         06    40002)B        40002)B                                         40077  06 40002 40002
               20                              RJ  PARAM  CALL               40100  00 00024 00000
                                                                              40101  00 00000 00000
SLAP     RJ    PARAM          CALL            THIS CALLING SEQUENCE         40102  37 40230 40231
         07    50000B)        50000B)       LOCATES THE PROPER              40103  07 50000 50000
               2200B)                       SERVICE ROUTINE ON              40104  00 02200 00000
                                            DRUM AND COMPUTES ITS             40105  00 00000 00000
DUMP     RJ    PARAM          CALL          CHECKSUM. IF THE SUM              40106  37 40230 40231
         10    40374B)        40374B)       IS CORRECT, CONTROL IS            40107  10 40374 40374
               702B)                        TRANSFERRED TO THE                40110  00 00702 00000
                                            SERVICE ROUTINE. IF               40111  00 00000 00000
SLAPSY   RJ    PARAM          CALL          THE SUM IS INCORRECT,             40112  37 40230 40231
```

```
         11    43220B)      43220B)
               241B)

SLAP8    RJ    PARAM        CALL
         12    43461B)      43461B)
               301B)

BINARY   RJ    PARAM        CALL
         13    41276B)      41276B)
               232B)

DUPE     RJ    PARAM        CALL
         14    53373B)      53373B)
               304B)

PRINT    RJ    PARAM        CALL
         15    53677B)      53677B)
               440B)

PAPER    RJ    PARAM        CALL
         16    54337B)      54337B)
               321B)

SL       RJ    PARAM        CALL
         17    52200B)      52200B)
               352B)

LOADER   RJ    PARAM        CALL
         20    41530B)      41530B)
               162B)

RELATE   RJ    PARAM        CALL
         21    53011B)      53011B)
               362B)

TAG      RJ    PARAM        CALL
         22    41712B)      41712B)
               12B)
```

THE BOSS MASTER FLIP-FLOP IS CHECKED. IF THE MFF IS ZERO, THE MACHINE STOPS ON AN MSO WITH PAK=00002. IF THE MFF IS NON-ZERO IT IS ASSUMED THAT THE UNISERVO NUMBER OF THE MAIN LIBRARY IS IN THE MFF (B0-B3) AND THE ROUTINE IN QUESTION IS SELECTIVELY RESTORED FROM THE MAIN LIBRARY. THE SERVICE REQUESTED IS THEN PERFORMED.

IN CERTAIN CASES WHEN BOSS ROUTINES ARE INVOLVED, CHECKSUMS ARE NOT COMPUTED BY THE CALL ROUTINE. WORD 1 MERELY TRANSFRS CONTROL TO BOSS DIRECTLY.

*WORD 2

THE FORMAT OF THIS WORD IS

```
 OP    U     V
CODE STORE START
```

WHERE CODE=DRUMSTART MINUS 40000. CODE IS USED TO SELECTIVELY RESTORE THE ROUTINE

```
40113   11 43220 43220
40114   00 00241 00000
40115   00 00000 00000
40116   37 40230 40231
40117   12 43461 43461
40120   00 00301 00000
40121   00 00000 00000
40122   37 40230 40231
40123   13 41276 41276
40124   00 00232 00000
40125   00 00000 00000
40126   37 40230 40231
40127   14 53373 53373
40130   00 00304 00000
40131   00 00000 00000
40132   37 40230 40231
40133   15 53677 53677
40134   00 00440 00000
40135   00 00000 00000
40136   37 40230 40231
40137   16 54337 54337
40140   00 00321 00000
40141   00 00000 00000
40142   37 40230 40231
40143   17 52200 52200
40144   00 00352 00000
40145   00 00000 00000
40146   37 40230 40231
40147   20 41530 41530
40150   00 00162 00000
40151   00 00000 00000
40152   37 40230 40231
40153   21 53011 53011
40154   00 00362 00000
40155   00 00000 00000
40156   37 40230 40231
40157   22 41712 41712
40160   00 00012 00000
```

LOADCL	RJ 23	PARAM 41724B) 7B)	CALL 41724B)
WORD2Q	RJ 24	PARAM 41733B) 7B)	CALL 41733B)
FILEND	RJ 25	PARAM 41742B) 26B)	CALL 41742B)
CTTSIM	RJ 26	PARAM 52552B) 237B)	CALL 52552B)
TTC	RJ 27	PARAM 40002B) 20	CALL 40002B)
TRACE	RJ	PARAM	CALL
OPEN	RJ	PARAM	CALL
	RJ	PARAM	CALL
	RJ	PARAM	CALL

FROM TAPE. STORE IS THE INITIAL DRUM STORAGE ADDRESS OF THE ROUTINE. START IS THE ADDRESS TO WHICH CONTROL IS TRANSFERRED AFTER THE CHECKSUM IS FOUND TO BE CORRECT.

*WORD 3

THE U-ADDRESS OF THIS WORD CONTAINS THE NUMBER OF WORDS TO BE CHECKSUMMED.

*WORD 4

THE COMPUTED CHECKSUM IS STORED IN THIS CELL BY THE PREPARE LIBRARY ROUTINE.

IN CERTAIN CASES CHECKSUMMING IS NOT DESIRED BECAUSE BOSS OCCUPIES THE DRUM-CORE IMAGE. IN THESE CASES, WORDS TWO, THREE, AND FOUR ARE USED BY THE PREPARE LIBRARY ROUTINE BUT NOT BY THE EXECUTIVE ROUTINE ON DRUMSTARTS.

```
40161   00 00000 00000
40162   37 40230 40231
40163   23 41724 41724
40164   00 00007 00000
40165   00 00000 00000
40166   37 40230 40231
40167   24 41733 41733
40170   00 00007 00000
40171   00 00000 00000
40172   37 40230 40231
40173   25 41742 41742
40174   00 00026 00000
40175   00 00000 00000
40176   37 40230 40231
40177   26 52552 52552
40200   00 00237 00000
40201   00 00000 00000
40202   37 40230 40231
40203   27 40002 40002
40204   00 00024 00000
40205   00 00000 00000
40206   37 40230 40231
40207   00 00000 00000
40210   00 00000 00000
40211   00 00000 00000
40212   37 40230 40231
40213   00 00000 00000
40214   00 00000 00000
40215   00 00000 00000
40216   37 40230 40231
40217   00 00000 00000
40220   00 00000 00000
40221   00 00000 00000
40222   37 40230 40231
40223   00 00000 00000
40224   00 00000 00000
40225   00 00000 00000
40226   00 00000 00000
```

```
P2
PARAM
CALL    RJ    SAVE+5        SAVE      PARAMETER                          40227  00 00000 00000
        RPB   36            CELL1      STORAGES                          40230  00 00000 00000
        TP    L+1           CELL1     THIS ROUTINE IS THE                40231  37 40044 40037
        SETL                1          BASIC PART OF THE EXEC            40232  75 30044 00001
        TP    L+1           CELL1      UTIVE ROUTINE. A,Q,F1,            40233  11 40234 00001
        SETL                1          AND PART OF CORE ARE
INCORE  SP    PARAM         15         SAVED IN DCI AND THEN      40234 00001 31 40230 00017
        TP    DRUMST+2      EXIT+1     THE ROUTINE TAKES IT-      40235 00002 11 40002 40035
        TU    A             L+2        SELF TO CORE. THEN         40236 00003 15 32000 00005
        RPB   3             L+2        3 PARAMETER WORDS          40237 00004 75 30003 00006
        TP                  LOCATE     (WORDS TWO, THREE, AND     40240 00005 11 00000 00044
        TP    LOCATE+1      Q          FOUR ABOVE) ARE BROUGHT    40241 00006 11 00045 31000
        QT    UMSK          A          DOWN FROM DRUM. THESE      40242 00007 51 00042 32000
        AT    JOF2          CKSUMR     WORDS ARE THEN USED TO     40243 00010 35 00041 00013
        TU    LOCATE        CKSUMR+1   LOCATE AND CHECKSUM THE    40244 00011 15 00044 00014
        RS    A             A          PROPER ROUTINE ON DRUM.    40245 00012 23 32000 32000
CKSUMR  RP2                 L+2        THE COMPUTED CHECKSUM      40246 00013 75 20000 00015
        SA                             IS COMPARED WITH THE       40247 00014 32 00000 00000
        TP    A             A          CONTENT OF WORD FOUR       40250 00015 11 32000 32000
        EJ    LOCATE+2      OK         (THE PREVIOUSLY COMPUT     40251 00016 43 00046 00033
        SP    LOCATE        6          ED CHECKSUM). IF THE       40252 00017 31 00044 00006
        LTL                 LOCATE     TWO COMPARE, CONTROL       40253 00020 22 00000 00044
        SP    MFF                      IS TRANSFERRED TO THE      40254 00021 31 40036 00000
        ZJ    BOSSIN        NOBOSS     ADDRESS SPECIFIED IN       40255 00022 47 00025 00023
NOBOSS  SP    LOCATE                   THE V-ADDRESS OF WORD 2    40256 00023 31 00044 00000
        MS                  2          ABOVE (AFTER RESTORING     40257 00024 56 00000 00002
BOSSIN  TP    DCI           COZY+1     A, Q, F1, AND CORE).       40260 00025 11 41770 40312
        TP    DCI+2         COZY+2     IF THE TWO DO NOT COMP     40261 00026 11 41772 40313
        TP    TPTABL+11     DCI        ARE, THE BOSS MASTER       40262 00027 11 40036 41770
        TP    LOCATE        DCI+2      FLIP-FLOP IS CHECKED.      40263 00030 11 00044 41772
        TP    PARAM         COZY       IF IT IS ZERO, THE CODE    40264 00031 11 40230 40311
        MJ                  OUTCOR     WORD IS PUT IN A AND       40265 00032 45 00000 40302
OK      TV    LOCATE        CKSOUT+1   THE ROUTINE STOPS WITH     40266 00033 16 00044 40301
        TP    DCI           Q          PAK=2. IF IT IS NON-       40267 00034 11 41770 31000
        SP    DCI+1         36         ZERO, IT IS ASSUMED        40270 00035 31 41771 00044
        SA    DCI+2                    THAT BOSS IS IN CONTROL    40271 00036 32 41772 00000
        RPB   NDCI          SETF1      AND THE SELECTIVE          40272 00037 75 31224 40277
        TP    DCI+4         CELL1      RESTORE IS USED. AFTER     40273 00040 11 41774 00001
```

```
JOF2    RP2             CKSUMR+2        THE SELECTIVE RESTORE       40274 00041  75 20000 00015
UMSK    B15  77777                      IS ACCOMPLISHED, THE        40275 00042  00 77777 00000
CR                      LOAD+1          SERVICE REQUESTED IS        40276 00043  00 00000 40057
LOCATE  RSRV            3               DONE WITHOUT STOPPING.
        SETL            S
SETF1   TP   DCI+3      CELL0                                               40277  11 41773 00000
CKSOUT  RJ   L          L+1             CORE IS PRESERVED DUR-              40300  37 40300 40301
        MJ              EXIT            ING ANY SELECTIVE RES-              40301  45 00000 40034
OUTCOR  TP   CR         PARAM           TORE, BUT NOT DURING                40302  11 00043 40230
        RJ   RESTOR+6   CALL+1          A NORMAL RESTORE.  ON A             40303  37 40054 40232
        TP   COZY       PARAM           NORMAL RESTORE SECOND               40304  11 40311 40230
        TP   COZY+1     Q               CORE IS USED AS A TRAN              40305  11 40312 31000
        SS   A                          SFER BUFFER.  NO ATTEMPT            40306  34 32000 00000
        SA   COZY+2                     IS MADE TO PRESERVE THE             40307  32 40313 00000
        MJ              CALL            INITIAL CONTENT OF THIS             40310  45 00000 40231
COZY                                    SPACE.                              40311  00 00000 00000
                                                                            40312  00 00000 00000
                                                                            40313  00 00000 00000
READDR  RJ   SAVE+5     SAVE          THIS ROUTINE READS ONE                40314  37 40044 40037
        RPB  16         170)B          BLOCK OF TAPE IN THE                 40315  75 30020 00170
        TP   L+1        170)B          FIXED BLOCK MODE FROM                40316  11 40317 00170
        SETL            170)B          THE UNISERVO SPECIFIED
        SP   Q          11             IN LOW Q.  THE BLOCK IS   40317 00170  31 31000 00013
        TV   A          UNS            READ INTO CELL ZERO       40320 00171  16 32000 00205
        LA   UNS        1              THRU 167 AND CONTROL      40321 00172  54 00205 00001
        EF              UNS            IS TRANSFERRED TO CELL    40322 00173  17 00000 00205
R       ER1             CELL0          ZERO.  IF A PARITY        40323 00174  76 10000 00000
        RA   R          LOC1           ERROR OCCURS WHILE        40324 00175  21 00174 00206
        IJ   L167       R              READING THIS BLOCK, THE   40325 00176  41 00207 00174
        ER0             A              MACHINE STOPS WITH        40326 00177  76 00000 32000
        ZJ   L+1        L+2            PAK=00001.                40327 00200  47 00201 00202
        MS              1                                        40330 00201  56 00000 00001
        SP   DCI+1      36                                       40331 00202  31 41771 00044
        SA   DCI+2                    AFTER THE FIRST BLOCK      40332 00203  32 41772 00000
        MJ              CELL0          HAS CONTROL, A PARITY     40333 00204  45 00000 00000
UNS     B    010030104000              ERROR WILL CAUSE THE      40334 00205  01 00301 04000
LOC1                    1              TAPE TO ROCK WITHOUT      40335 00206  00 00000 00001
L167                    167B)          STOPPING.                 40336 00207  00 00000 00167
```

```
TPTABL  EQLS MFF-11
RDSYMB  EQLS 46276B)
NDCI    EQLS 660
CELL0   EQLS
CELL1   EQLS 1
DCI     EQLS 41770B)
        END
```

THE LIBRARY TAPE, EXCEPT FOR THE FIRST BLOCK, IS READ IN THE VARIABLE BLOCK MODE.

NAME: LOAD LIBRARY FROM MAGNETIC TAPE.

FUNCTION: Read one block of tape (fixed mode) from a specified Uniservo and transfer control to F_1.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40000.
3. Set Q = input tape.
4. Set A = code number if selective restore desired.
   Set A = 0 if entire restore desired.
5. Depress start button.

CODE: None.

STOPS: PAK = 40000, Success stop (tape rewinds).
PAK = 00001, Parity failure on first block.
PAK = 00002, checksum failure on restore.

COMMENTS: Selective restore is not available on an abnormal drum start. On the selective restore, core is preserved; the entire restore does not preserve core.

NAME: SLAP

FUNCTION: Assembles a symbolic program from a magnetic tape prepared on the Card-to-Tape Converter. The output consists of the symbolic program with a side-by-side octal translation of the program. An octal tape is available as optional output.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40007.
3. Set Q
   a.) Q_u = input tape.
   b.) Q_v = symbolic tape.
4. Set A
   a.) A_v = octal output tape.
   b.) A = 0, no octal output.
5. Depress start button.

CODE: 07.

STOPS: PAK = 40011, Success stop.

COMMENTS: The input tape will rock without changing bias in case of parity errors.

NAME: OCTAL DUMP.

FUNCTION: Prepares an octal XS3 tape of the information stored in core or drum.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40010.
3. Depress start button.
4. At MSO stop, with (PAK) = 17030, set u and v addresses of Q with the limits of the dump.
5. Set the low order position of A with the desired uniservo number.
6. Depress start button.

CODE: 10.

STOPS: PAK = 17030, Console entry stop.

PAK = 40000, Success stop.

COMMENTS: The dump is sequential from u through v. The u and v limits may be core or drum addresses, but not a combination of the two. Any lines of output that are all zero are omitted; if the memory to be dumped is all zero, the words ALL ZERO are written on the output tape. If A = 0, uniservo #5 is used. If v of Q equals zero, the dump is from the address specified in u of Q to the end of that band.

No printer stop is written and the output tape is not rewound at completion of a dump. Core is preserved.

```
          SETL  40374B)       40374B)      OCTAL DUMP
DMPENT    LT                  DCI          SAVE                                40374  22 00000 41770
          LT1                 DCI+1         ACCUMULATOR                        40375  22 10000 41771
          TP    Q             DCI+2         Q-REGISTER                         40376  11 31000 41772
          TP    F1            DCI+3         AND F1                             40377  11 00000 41773
          RS    Q             Q            CLEAR A AND Q                       40400  23 31000 31000
          RPB   640           L+2          PRESERVE CORE IN                    40401  75 31200 40403
          TP    BUF           DCI+24        DRUM CORE IMAGE                    40402  11 16600 42020
          RPB   503           CORE-4       BRING PROGRAM FROM                  40403  75 30767 17011
          TP    L+1           CORE-4        DRUM INTO CORE                     40404  11 40405 17011
          SETL                17011B)
          TP    MFF           A            TEST PROGRAM CONTROLLED    40405 17011  11 40036 32000
          ZJ    OCTDMP        CORE          DUMP OR NOT               40406 17012  47 17013 17015
OCTDMP    RJ    CORE+3        CORE         RJ FOR NO-STOP DUMP        40407 17013  37 17020 17015
          MJ                  LIMTAB-3     GO DUMP                    40410 17014  45 00000 17032
CORE      MJ1                 L+5          TEST IF ANY                40411 17015  45 10000 17022
          MJ2                 L+6           MJ SWITCHES               40412 17016  45 20000 17024
          MJ3                 L+7           ARE ON                    40413 17017  45 30000 17026
          RJ    L             L+1          DUMMY FOR NO STOP DUMP     40414 17020  37 17020 17021
          MS                  L+7          STOP FOR LIMIT AND SERVO   40415 17021  56 00000 17030
          TP    ON            ONOFF          MJ1 ON                   40416 17022  11 17502 17477
          MJ                  CORE+1                                  40417 17023  45 00000 17016
          TP    ON            ONOFF+1        MJ2 ON                   40420 17024  11 17502 17500
          MJ                  CORE+2                                  40421 17025  45 00000 17017
          TP    ON            ONOFF+2        MJ3 ON                   40422 17026  11 17502 17501
          MJ                  CORE+3                                  40423 17027  45 00000 17020
          TP    A             PARAM        SAVE                       40424 17030  11 32000 40226
          TP    Q             PARAM+1       LIMITS AND UNISERVO       40425 17031  11 31000 40227
          TP    PARAM         A            TEST UNISERVO              40426 17032  11 40226 32000
          ZJ    L+2           L+1           SELECTION IN A            40427 17033  47 17035 17034
          TP    L(5)          A            SET UNISERVO 5             40430 17034  11 17671 32000
LIMTAB    LA    A             12            IF ACCUMULATOR = 0        40431 17035  54 32000 00014
          AT    EF            EF           FORM EF WRITE FREE RUN     40432 17036  35 17601 17601
          TP    PARAM+1       LIM          SAVE DUMP LIMITS           40433 17037  11 40227 17660
          RPV   34            L+2          CLEAR CHARACTER,           40434 17040  75 10042 17042
SKIN      TP    L(0)          CHAR          LIMIT, AND FLAG TABLES    40435 17041  11 17672 17000
          TP    L(0)          LCT          FORM                       40436 17042  11 17672 17670
          TU    LIM           LCT           BXXXX-00000               40437 17043  15 17660 17670
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        RJ    FIND        B7777      FIND B7777                    40440 17044   37 17075 17071
STRLIM  TP    A           LIMTAB     STORE 1ST LIMIT               40441 17045   11 32000 17035
        TJ    LIM         BMPBND     IS IT TOO BIG ,NO-BUMP        40442 17046   42 17660 17076
        TV    L-2         L+8        YES,TOO LARGE SO              40443 17047   16 17045 17057
        TP    L(7777B)    Q           ASSUME LAST LIMIT            40444 17050   11 17673 31000
        RA    Q           7MASKS+7   FORM V MASK IN Q              40445 17051   21 31000 17611
        QT    LIM         A          TEST V OF LIMIT               40446 17052   51 17660 32000
        ZJ    L+4         L+1         EQUAL TO ZERO                40447 17053   47 17057 17054
        RA    LIM         L(7777B)   YES, ADD 07777                40450 17054   21 17660 17673
        TP    7MASKS+7    Q          INSERT BAND NUMBER,LIMIT      40451 17055   11 17611 31000
        QS    LIMTAB      LIM         NOW EQUALS BXXXX-B7777       40452 17056   53 17035 17660
        TP    LIM         FILL       STORE LAST LIMIT              40453 17057   11 17660 30000
DOLIM   TP    LIMTAB      A          PROCESS LIMITS IN TABLE       40454 17060   11 17035 32000
        ZJ    L+1         OFF+2      TEST LAST LIMIT =0            40455 17061   47 17062 17571
        RJ    L           L+4        1-SHOT BYPASS SWITCH          40456 17062   37 17062 17066
        TJ    CORE2+1     L+2        DONT RESWAP 1ST CORE          40457 17063   42 17630 17065
        RJ    EXSWAP      SWAP       RESWAP DRUM                   40460 17064   37 17560 17525
        TP    SKIPHD      HEADER     SET SKIP HEADER NEXT LIM      40461 17065   11 17136 17416
        TP    LIMTAB      LIM        SET LIMIT FOR THIS PASS       40462 17066   11 17035 17660
        RPB   4           1STWD       AND MOVE NEXT LIMIT          40463 17067   75 30004 17102
        TP    LIMTAB+1    LIMTAB      INTO POSITION                40464 17070   11 17036 17035
B7777   LQ    LCT         A+21       SUBROUTINE TO FORM            40465 17071   55 17670 32025
        TP    7MASKS+7    Q           BXXXX-B7777 FROM             40466 17072   11 17611 31000
        QS    A           LCT         INPUT BXXXX-00000            40467 17073   53 32000 17670
        RA    LCT         L(7777B)    RESULT LEFT IN A             40470 17074   21 17670 17673
FIND    MJ                FILL        AND CELL LCT                 40471 17075   45 00000 30000
BMPBND  SA    ONEV        15         ADVANCE LIMIT                 40472 17076   32 17620 00017
        TU    A           LIM         TO NEXT BAND                 40473 17077   15 32000 17660
        RA    STRLIM      ONEV        AS IN 47777                  40474 17100   21 17045 17620
        MJ                STRLIM-3    TO 50000                     40475 17101   45 00000 17042
1STWD   TP    7MASKS+2    Q          SAVE THE FIRST                40476 17102   11 17604 31000
        QS    LIM         L+1         WORD OF THE BAND             40477 17103   53 17660 17104
        TP    FILL        1STWOR      FOR HEADER OUTPUT            40500 17104   11 30000 17664
        QT    LIM         A          TEST IF SWAP                  40501 17105   51 17660 32000
        EJ    CORE2       SWAP2       IS NECESSARY TO DUMP         40502 17106   43 17627 17122
        ZJ    L+1         FORM        DESIRED MEMORY               40503 17107   47 17110 17137
        TP    LIM         SWAPLM     SET SWAP LIMITS               40504 17110   11 17660 17662
        SP    A           27         FORM                          40505 17111   31 32000 00033
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                LT0             A               DUMMIED XS3 OF          40506 17112  22 00000 32000
                AT      SWPXS3  PRLOCX          PRLOC TO PRINT NUMBER   40507 17113  35 17622 17665
                TP      LIM     Q               OF DRUM OR 2ND CORE     40510 17114  11 17660 31000
                QT      UVM     LIM           SET CORE LIMITS           40511 17115  51 17621 17660
                RJ      L       L+1            FOR DUMP AFTER SWAP      40512 17116  37 17116 17117
                RJ      EXSWAP  SWAP          SWAP DRUM TO CORE         40513 17117  37 17560 17525
                TV      OFF     OFF+2         SET RESWAP SWITCH         40514 17120  16 17567 17571
                MJ              FORM          GO SETUP AND DUMP         40515 17121  45 00000 17137
SWAP2           RJ      1STWD+12 1STWD+6      SWAP SETUP FOR 2ND CORE   40516 17122  37 17116 17110
                TP      L(26)   CHAR          SWAP PART OF 2ND CORE     40517 17123  11 17674 17000
                RJ      EXSWAP  SWAP+1         WITH FIRST CORE          40520 17124  37 17560 17526
                TU      OFF+4   MOVE+3       PRESET                    40521 17125  15 17573 17550
                TV      DMPENT+6 MOVE+5        DRUM CORE IMAGE          40522 17126  16 40402 17552
                TP      L(4)    CHAR           SWAP                     40523 17127  11 17675 17000
                RJ      EXSWAP  MOVE          SWAP DRUM CORE IMAGE      40524 17130  37 17560 17545
                RJ      L       L+2           1-SHOT BYPASS FOR SWAP    40525 17131  37 17131 17133
                MJ              OFF+3         EXIT ON RESWAP            40526 17132  45 00000 17572
                TV      L+2     OFF+2         SET SWAP 2 RESWAP         40527 17133  16 17135 17571
                MJ              FORM          GO FORM FLAGS WHICH WILL  40530 17134  45 00000 17137
                                SWAP2+1        SPECIFY ZERO SUPPRESS    40531 17135  00 00000 17123
SKIPHD          MJ              EXHED         SKIP HEADER PRESETTER     40532 17136  45 00000 17465
FORM            TP      RST+4   RSTWF         THIS PORTION FORMS        40533 17137  11 17377 17343
                RPV     17      L+2            A TABLE OF FLAGS WHICH   40534 17140  75 10021 17142
                TP      L(0)    FLAG           SPECIFIES THE LINE       40535 17141  11 17672 17014
                TV      RST+3   PICFLG+5       SUPPRESSION OF COMPLETE  40536 17142  16 17376 17317
                TP      ONEV    SKIN           LINES OF ZERO OUTPUT     40537 17143  11 17620 17041
                TP      L(5)    LINECT        THE FLAG FORMAT IS        40540 17144  11 17671 17661
                RJ      EXCH    CONHED         4 BITS- ADDRESS IDENT    40541 17145  37 17415 17400
                SP      LIM                    32 BITS,1 PER LINE OF    40542 17146  31 17660 00000
                SA      ONEV    15             OUTPUT,IF ANY LINE IS    40543 17147  32 17620 00017
                TU      A       LASTCK         ALL ZERO THE BIT IS      40544 17150  15 32000 17235
                TP      LIM     Q              ZERO,IF NOT THE BIT      40545 17151  11 17660 31000
                QT      MASK1   A              IS ONE                   40546 17152  51 17634 32000
                LT1     9       LOC           THE FLAG WORDS ARE EXAM   40547 17153  22 10011 17666
                QT      MASK2   A              INED AFTER TAPE STARTS   40550 17154  51 17635 32000
                TU      A       CKZER+2       SET 1ST ADDRESS MOD 8     40551 17155  15 32000 17217
                LA      A       9             SETUP LEADING             40552 17156  54 32000 00011
                SS      LOC                    ZERO BITS IN FLAG        40553 17157  34 17666 00000
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         SN    A           45          WORD AS SPECIFIED          40554 17160  33 32000 00055
         AT    L(31)       CHAR        BY LIMIT. FLAG WORDS       40555 17161  35 17676 17000
         TP    L(0)        Q           START AT 00000 AND         40556 17162  11 17672 31000
         TV    PICFLG+1    CKZER+9     INCREMENT BY 256 DEC       40557 17163  16 17313 17226
         MJ                CKZER       WORDS = 400 OCTAL          40560 17164  45 00000 17215
BMPBY8   RA    CKZER+2     8U        UP ADDRESS BY 8              40561 17165  21 17217 17641
         TJ    LASTCK      CKZER     IS IT ABOVE LIMITS           40562 17166  42 17235 17215
         TP    CHAR        A         PLACE INDEX IN A             40563 17167  11 17000 32000
         EF                EF        START TAPE                   40564 17170  17 00000 17601
         TP    Q           CHAR+1    SAVE UNFINISHED FLAG         40565 17171  11 31000 17001
         EJ    L(31)       L+3       TEST INDEX FOR TOTAL FLG     40566 17172  43 17676 17175
         TP    CHAR+1      A         TEST LAST FLAG               40567 17173  11 17001 32000
         ZJ    FIN         L+1        EQUAL TO ZERO               40570 17174  47 17204 17175
         TP    FLAG        A         TEST IF ALL FLAGS            40571 17175  11 17014 32000
         ZJ    HEADER      ALZERO     EQUAL ZERO                  40572 17176  47 17416 17177
ALZERO   RJ    EXHED       HEADER    WRITE HEADER                 40573 17177  37 17465 17416
         EW1               ALL       WRITE-ALL- ZERO-             40574 17200  77 10000 17636
         EW1               ZERO       IF DESIRED DUMP             40575 17201  77 10000 17637
         RP    118         DUMWRT+2   DOES CONTAIN ONLY           40576 17202  75 00166 17240
         EW1               L(0)       ZERO. THEN EXIT             40577 17203  77 10000 17672
FIN      RJ    EXHED       HEADER    WRITE HEADER                 40600 17204  37 17465 17416
         SP    CHAR+1                FILL                         40601 17205  31 17001 00000
         TV    CHAR        L+1        LAST FLAG WITH              40602 17206  16 17000 17207
         LA    A           FILL       ZERO TO COMPLETE IT         40603 17207  54 32000 30000
         TP    CKZER+9     L+2       SET STORE LAST FLAG          40604 17210  11 17226 17212
         SA    LOC                   ADD ADDRESS IDENT BITS       40605 17211  32 17666 00000
ERASE          FILL        FILL      STORE LAST FLAG              40606 17212  00 30000 30000
         TU    PICFLG-3    PICFLG    PRESET START AT FLAG 1       40607 17213  15 17307 17312
         MJ                PICFLG    MAKE PASS SETTING UP         40610 17214  45 00000 17312
CKZER    SP    L(0)                   1ST LINE OF OUTPUT          40611 17215  31 17672 00000
         RPU   8           L+2       CHECK                        40612 17216  75 20010 17220
         SA    FILL                    8 CELLS ZERO               40613 17217  32 30000 00000
         ZJ    L+1         L+2        IF THEY ARE                 40614 17220  47 17221 17222
         RA    Q           ONEV       NOT ZERO ADD A BIT          40615 17221  21 31000 17620
         IJ    CHAR        SHFTQ     32 BITS PER FLAG             40616 17222  41 17000 17234
         SP    Q                     NEW FORMED FLAG TO A         40617 17223  31 31000 00000
         ZJ    L+1         L+4       TEST FLAG ZERO               40620 17224  47 17225 17230
         SA    LOC                   IF NOT ZERO ADD IDENT        40621 17225  32 17666 00000
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         LT1                FILL      STORE FLAG AND BUMP          40622 17226  22 10000 30000
         RA    L-1          ONEV       STORE FOR NEXT FLAG         40623 17227  21 17226 17620
         RA    LOC          LOCUP     BUMP ADDRESS IDENTIFICT      40624 17230  21 17666 17640
         TP    L(0)         Q          TO START OF NEXT FLAG       40625 17231  11 17672 31000
         TP    L(31)        CHAR       E.G. 00400 TO 01000         40626 17232  11 17676 17000
         MJ                 BMPBY8    DO NEXT FLAG                 40627 17233  45 00000 17165
SHFTQ    QJ    BMPBY8       BMPBY8    SHIFT FLAG ONE PLACE         40630 17234  44 17165 17165
LASTCK   SA                            CHECKER FOR COMPLETION      40631 17235  32 00000 00000
DUMWRT   RP    FILL         L+2       DUMMY                        40632 17236  75 30000 17240
         EW1                L(0)       WRITES TO FILL LAST BLK     40633 17237  77 10000 17672
         EF                 STOPTP    STOP TAPE                    40634 17240  17 00000 17645
         MJ                 DOLIM     GO TO EXAMINE NEXT LIMIT     40635 17241  45 00000 17060
         SP    LOC          18        SETUP                        40636 17242  31 17666 00022
         TU    A            PICKUP     THE LOCATION OF THE         40637 17243  15 32000 17246
         TV    DOMOR+8      STORE      NEXT LINE BY EXAMINING      40640 17244  16 17276 17255
         TV    DOMOR+14     STORE+1    THE LOCATION  BITS          40641 17245  16 17304 17256
PICKUP   TP    FILL         Q         E.G. LOCATION BITS FOR       40642 17246  11 30000 31000
         RPB   12           L+2        01400 ARE 001100000.        40643 17247  75 30014 17251
         QT    7MASKS       CHAR      FORM THE XS3                 40644 17250  51 17602 17000
         SP    XS31                    TRANSLATION OF              40645 17251  31 17631 00000
         RPU   11           L+2        8 WORDS EQUALS              40646 17252  75 20013 17254
         SA    CHAR         3          ONE LINE OF OUTPUT          40647 17253  32 17000 00003
         SA    CHAR+11                 THE LOCATION OF THE         40650 17254  32 17013 00000
STORE    LT                 FILL       FIRST WORD IS SPECIFIED     40651 17255  22 00000 30000
         AT    XS32         FILL       BY THE LOCATION BITS        40652 17256  35 17632 30000
         RA    PICKUP       ONEU      THE LOCATION BITS ARE        40653 17257  21 17246 17616
         RA    STORE        L(2)       FORMED FROM THE IDENT       40654 17260  21 17255 17677
         AT    DUMMY        STORE+1    BITS AND THE POSITION       40655 17261  35 17646 17256
         TJ    DUMTST       PICKUP     OF ONES AND ZEROS IN        40656 17262  42 17647 17246
         LQ    PRLOC        6          THE FLAG WORDS              40657 17263  55 17667 00006
         EW1                Q         WRITE LOCATION OF OUTPUT     40660 17264  77 10000 31000
         TP    L(3)         I1        SET INDEX TO 3               40661 17265  11 17700 17670
DOMOR    LQ    BUF          24        BUILD UP FORMAT              40662 17266  55 16600 00030
         QT    MA           A          OF OUTPUT BETWEEN           40663 17267  51 17650 32000
         LQ    BUF+1        24         SUCCESSIVE EXTERNAL         40664 17270  55 16601 00030
         LQ    BUF+2        12         WRITES. IN SOME             40665 17271  55 16602 00014
         LQ    BUF+3        12         CASES MAX TIMES ARE USE     40666 17272  55 16603 00014
         EW1                A         416-MICROSECONDS             40667 17273  77 10000 32000
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         QT    MB              ERASE       THE CONVERSION OF          40670 17274  51 17651 17212
         TP    MA              Q            ALL EIGHT WORDS           40671 17275  11 17650 31000
         QS    BUF+1           BUF          FROM BINARY TO XS3        40672 17276  53 16601 16600
         TP    MB              Q            IS ACCOMPLISHED           40673 17277  11 17651 31000
         QS    BUF+2           BUF+3        BETWEEN BLOCKETTES        40674 17300  53 16602 16603
         TP    MC              Q           THE CONVERSION LOOP        40675 17301  11 17652 31000
         QT    BUF+1           A            IS APPROXIMATELY          40676 17302  51 16601 32000
         TP    MD              Q            NINE AND A HALF           40677 17303  11 17653 31000
         QA    BUF+2           BUF+1        MILLESECONDS              40700 17304  52 16602 16601
         EW1                   BUF         422-MICROSECONDS           40701 17305  77 10000 16600
         IJ    I1              RSTWF+3     INDEX TO LOOP FORMAT       40702 17306  41 17670 17346
         SP    FLAG                        TEST IF REST OF            40703 17307  31 17014 00000
         ZJ    PICFLG+9        L+1          FLAG IS ZERO, IF SO       40704 17310  47 17323 17311
         RA    L+1             ONEU         ADVANCE TO NEXT FLAG      40705 17311  21 17312 17616
PICFLG   TP    FILL            Q           MASK OUT NEW ZERO          40706 17312  11 30000 31000
         QT    ME              FLAG         AND ONE BITS              40707 17313  51 17654 17014
         ZJ    L+1             LST3        TEST FOR LAST FLAG         40710 17314  47 17315 17365
         LQ    Q               9            THAT IS , ALL BITS        40711 17315  55 31000 00011
         QT    MG              LOC          ARE ZERO                  40712 17316  51 17656 17666
         RJ    L               L+2         SKIP 1ST WRITE FOR SETUP   40713 17317  37 17317 17321
         EW1                   BUF+1       410- MICROSECONDS          40714 17320  77 10000 16601
         RS    LOC             L(3)        FORM NEW LOCATION          40715 17321  23 17666 17700
         MJ                    L+2         SKIP WRITE OF              40716 17322  45 00000 17324
         EW1                   BUF+1        OTHER PATH                40717 17323  77 10000 16601
         TP    MF              Q           BIT MASK TO Q              40720 17324  11 17655 31000
         SF    FLAG            CNT         POSITION AND               40721 17325  74 17014 17663
         QT    A               FLAG         REMOVE PRESENT BIT        40722 17326  51 32000 17014
         IJ    SKIN            L+2         SKIP 1ST WRITE FOR SETUP   40723 17327  41 17041 17331
         EW1                   BUF+3       406-MICROSECONDS           40724 17330  77 10000 16603
         RA    LOC             L(72)       LOCATION BITS PLUS 72      40725 17331  21 17666 17701
         ST    CNT             LOC          MINUS SF COUNT EQUALS     40726 17332  36 17663 17666
         TP    A               Q            THE NEW LOCATION          40727 17333  11 32000 31000
         QT    7MASKS+10       CHAR         BITS, FOR EXAMPLE         40730 17334  51 17614 17000
         QT    7MASKS+11       CHAR+1       IF PRESENT LOC BITS =     40731 17335  51 17615 17001
         QT    7MASKS+9        A            140 AND THERE IS A LEAD   40732 17336  51 17613 32000
         SP    A               3            ZERO ON ZERO-ONE BITS     40733 17337  31 32000 00003
         SA    CHAR            3            THEN NEW LOC BITS = 142   40734 17340  32 17000 00003
         SA    CHAR+1                       THE WORD IDENTIFIED BY    40735 17341  32 17001 00000
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        AT    PRLOCX      PRLOC      LOCATION BITS = 01420      40736 17342   35 17665 17667
RSTWF   MJ                BANDWD     FIRST WORD OF BAND FLOW    40737 17343   45 00000 17505
        EW1               ERASE      NORMAL FLOW AFTER 1ST      40740 17344   77 10000 17212
        MJ                DUMWRT+4    WORD OF BAND OUTPUT       40741 17345   45 00000 17242
        EW1               BUF+1      WORD 3 WRITE               40742 17346   77 10000 16601
        EW1               BUF+3      WORD 4 WRITE               40743 17347   77 10000 16603
        IJ    I1          L+8        8 WORD FORMAT LOOP         40744 17350   41 17670 17360
        IJ    LINECT      L+2        COUNT LINES MOD6           40745 17351   41 17661 17353
        TP    L(5)        LINECT     RESTORE LINE COUNT TO 5    40746 17352   11 17671 17661
        EW1               ERASE      WORD 5 WRITE               40747 17353   77 10000 17212
        EW1               BUF+4      WORD 6 WRITE               40750 17354   77 10000 16604
        EW1               BUF+5      WORD 7 WRITE               40751 17355   77 10000 16605
        RPB   4           DOMOR      LAST 2 WORDS OF OUTPUT     40752 17356   75 30004 17266
        TP    BUF+12      BUF         TO WORKING POSITION       40753 17357   11 16614 16600
        EW1               ERASE      WORD 5 WRITE               40754 17360   77 10000 17212
        EW1               BUF+4      WORD 6 WRITE               40755 17361   77 10000 16604
        EW1               BUF+5      WORD 7 WRITE               40756 17362   77 10000 16605
        RPB   6           DOMOR      FETCH 2ND THREE WORDS      40757 17363   75 30006 17266
        TP    BUF+6       BUF         OF OUTPUT TO WORK ON      40760 17364   11 16606 16600
LST3    EW1               BUF+1      LAST THREE WRITES          40761 17365   77 10000 16601
        EW1               BUF+3       BEFORE GOING TO           40762 17366   77 10000 16603
        EW1               ERASE       FILLING LAST BLOCK        40763 17367   77 10000 17212
        MP    LINECT      20U        LINE COUNT X 20            40764 17370   71 17661 17657
        TU    A           DUMWRT     SET RP-EW TO               40765 17371   15 32000 17236
        MJ                DUMWRT      FILLUP LAST BLOCK         40766 17372   45 00000 17236
RST     TV    L+2         RSTWF      RESTORE NORMAL FLOW        40767 17373   16 17375 17343
        MJ                DUMWRT+4    AFTER 1ST WORD OF BAND    40770 17374   45 00000 17242
                          RSTWF+1    RESET                      40771 17375   00 00000 17344
                          PICFLG+7    CONSTANTS FOR             40772 17376   00 00000 17321
        MJ                BANDWD      NORMAL FLOW               40773 17377   45 00000 17505
CONHED  TP    DCI         Q          CONVERT THE                40774 17400   11 41770 31000
        RPB   12          L+2         ACCUMULATOR,F1 AND        40775 17401   75 30014 17403
        QT    7MASKS      CHAR        Q-REGISTER TO XS3         40776 17402   51 17602 17000
        SP    XS31                    THE CELLS WHICH           40777 17403   31 17631 00000
        RPU   11          L+2         CONTAIN THE A,Q,F1        41000 17404   75 20013 17406
        SA    CHAR        3           IN BINARY MUST BE         41001 17405   32 17000 00003
        SA    CHAR+11                 DCI, DCI+1, DCI+2 AND     41002 17406   32 17013 00000
        LT0               BUF         DCI+3                     41003 17407   22 00000 16600
        AT    XS32        BUF+1      THE CALLING                41004 17410   35 17632 16601
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                RA    CONHED      ONEU      SEQUENCE IS                41005 17411   21 17400 17616
                RA    L-3         L(2)      RJ EXCH CONHED             41006 17412   21 17407 17677
                RA    L-3         L(2)    THE XS3 TRANSLATION          41007 17413   21 17410 17677
                IJ    INHED       CONHED    IS STORED IN THE           41010 17414   41 17633 17400
EXCH            MJ                FILL      FIRST 8 CELLS OF BUF       41011 17415   45 00000 30000
HEADER          EW1               FF1     THE CONTENTS OF THE          41012 17416   77 10000 17467
                EW1               L(0)      ACCUMULATOR ,Q-REGISTER    41013 17417   77 10000 17672
                EW1               L(0)      AND F1 AND THE STATUS      41014 17420   77 10000 17672
                EW1               ACCUMU    OF THE MJ SWITCHES ARE     41015 17421   77 10000 17470
                EW1               LATOR     WRITTEN IN THE HEADER      41016 17422   77 10000 17471
                EW1               L(0)    THE HEADER OCCUPIES          41017 17423   77 10000 17672
                EW1               L(0)      6 LINES (ONE BLOCK)        41020 17424   77 10000 17672
                EW1               QREG    THE CALLING                  41021 17425   77 10000 17472
                EW1               ISTER     SEQUENCE IS                41022 17426   77 10000 17473
                RP    8           L+2       RJ EXHED HEADER            41023 17427   75 00010 17431
                EW1               L(0)    THE HEADER IS                41024 17430   77 10000 17672
                RPV   3           L+2       WRITTEN ONLY               41025 17431   75 10003 17433
                EW1               MJS       ONCE FOR EACH              41026 17432   77 10000 17474
                EW1               L(0)      DUMP NO MATTER             41027 17433   77 10000 17672
                SP    BUF         6         HOW MANY BANDS             41030 17434   31 16600 00006
                LT                Q         THE DUMP MAY               41031 17435   22 00000 31000
                EW1               Q         COVER                      41032 17436   77 10000 31000
                SP    A           30      THE FIRST WORD OF            41033 17437   31 32000 00036
                SA    BUF+1       6         BAND LINE IS               41034 17440   32 16601 00006
                LT                Q         WRITTEN FOR EACH           41035 17441   22 00000 31000
                EW1               Q         BAND OR PORTION            41036 17442   77 10000 31000
                EW1               A         OF A BAND THAT IS          41037 17443   77 10000 32000
                EW1               BUF+2     REQUESTED                  41040 17444   77 10000 16602
                EW1               BUF+3   THE TRUE CONTENT             41041 17445   77 10000 16603
                EW1               L(0)      OF F1,CELL 00000,          41042 17446   77 10000 17672
                EW1               BUF+4     APPEARS ONLY               41043 17447   77 10000 16604
                EW1               BUF+5     IN THE HEADER              41044 17450   77 10000 16605
                RP    8           L+2     THE FIRST WORD               41045 17451   75 00010 17453
                EW1               L(0)      OF BAND FOR                41046 17452   77 10000 17672
                RPV   3           L+2       1ST CORE IS CELL           41047 17453   75 10003 17455
                EW1               ONOFF     ZERO BUT APPEARS           41050 17454   77 10000 17477
                RP    29          L+2       ALWAYS THE SAME            41051 17455   75 00035 17457
                EW1               L(0)      AND NOT F1                 41052 17456   77 10000 17672
                EW1               FONE    THE FIRST WORD ON            41053 17457   77 10000 17503
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        EW1                 COREX       THE LINE OF OUTPUT          41054 17460  77 10000 17504
        EW1                 BUF+6       WITH ADDRESS 00000          41055 17461  77 10000 16606
        EW1                 BUF+7       IS AGAIN NOT THE            41056 17462  77 10000 16607
        RP    47            L+2         TRUE VALUE                  41057 17463  75 00057 17465
        EW1                 L(0)        OF F1                       41060 17464  77 10000 17672
EXHED   RJ    L             L+1       DUMMY EXIT                    41061 17465  37 17465 17466
        MJ                  CKZER-2   NORMAL FLOW EXIT              41062 17466  45 00000 17213
FF1     B30   37                      XS3 CONSTANTS                 41063 17467  37 00000 00000
ACCUMU  B     242626674767            FOR HEADER                    41064 17470  24 26266 74767
LATOR   B     462466515401            AND FIRST WORD                41065 17471  46 24665 15401
QREG    B     015302543032            OF BAND LINES                 41066 17472  01 53025 43032
ISTER   B     346566305401          ISTER                           41067 17473  34 65663 05401
MJS     B     014744040101          MJ1                             41070 17474  01 47440 40101
        B     014744050101          MJ2                             41071 17475  01 47440 50101
        B     014744060101          MJ3                             41072 17476  01 47440 60101
ONOFF   B     010151313101          OFF                             41073 17477  01 01513 13101
        B     010151313101          OFF                             41074 17500  01 01513 13101
        B     010151313101          OFF                             41075 17501  01 01513 13101
ON      B     010151500101          ON                              41076 17502  01 01515 00101
FONE    B     310402265154          F1-COR                          41077 17503  31 04022 65154
COREX   B     300101010101          E-----                          41100 17504  30 01010 10101
BANDWD  TP    1STWOR        Q       CONVERT THE FIRST WORD          41101 17505  11 17664 31000
        RPB   12            L+2      OF A BAND AND WRITE IT         41102 17506  75 30014 17510
        QT    7MASKS        CHAR     OUT ON ONE LINE                41103 17507  51 17602 17000
        SP    XS31                  THE REASON THAT THE 1ST         41104 17510  31 17631 00000
        RPU   11            L+2      WORD OF THE BAND IS            41105 17511  75 20013 17513
        SA    CHAR          3        SAVED IS DUE TO THE            41106 17512  32 17000 00003
        SA    CHAR+11                FACT THAT THE PROGRAM          41107 17513  32 17013 00000
        LT                  CHAR     ALWAYS DUMPS OUT OF            41110 17514  22 00000 17000
        AT    XS32          CHAR+1   FIRST CORE. SINCE F1           41111 17515  35 17632 17001
        RPV   3             L+2      IS THE FIRST WORD OF           41112 17516  75 10003 17520
        EW1                 FIRST    CORE, THE FIRST  WORD          41113 17517  77 10000 17642
        EW1                 L(0)     OF EACH BAND  IS ALWAYS        41114 17520  77 10000 17672
        RPV   2             L+2      WRONG AS  IT APPEARS           41115 17521  75 10002 17523
        EW1                 CHAR     ON THE FIRST LINE OF           41116 17522  77 10000 17000
        RP    14            RST      OUTPUT. THE CONTENT            41117 17523  75 00016 17373
        EW1                 L(0)     OF F1 APPEARS INSTEAD          41120 17524  77 10000 17672
SWAP    TP    L(31)         CHAR    SWAP ANY COMPLETE DRUM          41121 17525  11 17676 17000
        TV    EXSWAP+6      EXSWAP-2 OR 2ND CORE WITH THE           41122 17526  16 17566 17556
```

```
        TP    EF-2          MOVE+3      FIRST CORE. 128 WORD      41123 17527  11 17577 17550
        TV    ONEB          MOVE+3      BATCHES ARE MOVED IN      41124 17530  16 17617 17550
        TU    ONEB          MOVE+1      THE SWAP THROUGH A        41125 17531  15 17617 17546
        TP    SWAPLM        Q           BUFFER TO CORE OR DRUM    41126 17532  11 17662 31000
        QT    HI7S          A         FOR A SECOND CORE SWAP,     41127 17533  51 17623 32000
        SA    ONEB                       CELLS 10001 THRU 15777   41130 17534  32 17617 00000
        TU    A             MOVE+3      ARE SWAPPED BETWEEN       41131 17535  15 32000 17550
        TV    A             MOVE+5      CORES AND 16000 THRU      41132 17536  16 32000 17552
        TU    DOMOR         MOVE+5      17777 ARE SWAPPED FROM    41133 17537  15 17266 17552
        RPB   3             L+2         THE DRUM CORE IMAGE       41134 17540  75 30003 17542
        RS    128S          ONEU      127 WORD SWAP 1ST BATCH     41135 17541  23 17624 17616
        RS    MOVE          ONEU        IS TO PRESERVE F1         41136 17542  23 17545 17616
        RS    MOVE+2        ONEU      THE SAME ROUTINE            41137 17543  23 17547 17616
        RS    MOVE+4        ONEU        IS USED TO RESWAP         41140 17544  23 17551 17616
MOVE    RPB   128           L+2         2ND CORE OR A DRUM        41141 17545  75 30200 17547
        TP    F1            BUF         AFTER  DUMPING            41142 17546  11 00000 16600
        RPB   128           L+2       SWAP THIRTY-TWO             41143 17547  75 30200 17551
        TP    FILL          F1          ONE HUNDRED AND           41144 17550  11 30000 00000
        RPB   128           L+2         TWENTY-EIGHT              41145 17551  75 30200 17553
        TP    BUF           FILL        WORD BATCHES              41146 17552  11 16600 30000
        RA    MOVE+1        128S        REQUIRED TO               41147 17553  21 17546 17624
        RA    MOVE+3        128S+1      COMPLETELY SWAP           41150 17554  21 17550 17625
        RA    MOVE+5        128S+2      ONE DRUM                  41151 17555  21 17552 17626
        RJ    L             EXSWAP+1  SWITCH TO RESET TO 128      41152 17556  37 17556 17561
        IJ    CHAR          MOVE      32 BATCHES EQUAL ONE BND    41153 17557  41 17000 17545
EXSWAP  MJ                  FILL      EXIT                        41154 17560  45 00000 30000
        RA    MOVE          ONEU      RESET BUMPS                 41155 17561  21 17545 17616
        RA    MOVE+2        ONEU        TO 128 BUMPS              41156 17562  21 17547 17616
        RA    MOVE+4        ONEU        AFTER FIRST BATCH         41157 17563  21 17551 17616
        RPB   3             L-5       FORM                        41160 17564  75 30003 17557
        RA    128S          ONEU        128 BUMPS                 41161 17565  21 17624 17616
                            EXSWAP+1  RESET CONSTANT              41162 17566  00 00000 17561
OFF                         L+1       EXIT FLOW RESETTER          41163 17567  00 00000 17570
        RJ    EXSWAP        SWAP      RESWAP, THEN GO EXIT        41164 17570  37 17560 17525
        RJ    L             L+1       RESWAP SWITCH               41165 17571  37 17571 17572
        RPB   640           DMPENT+380  RESTORE                   41166 17572  75 31200 41170
        TP    DCI+24        BUF         THE                       41167 17573  11 42020 16600
        SP    DCI           36          MACHINE                   41170 17574  31 41770 00044
        SA    DCI+1                     ACCUMULATOR               41171 17575  32 41771 00000
```

```
         TP    DCI+2          Q
         TP    DCI+3          F1
         MJ                   40034B1
EF       B     020004600000
7MASKS   B33   7
         B30   7
         B27   7
         B24   7
         B21   7
         B18   7
         B15   7
         B12   7
         B9    7
         B6    7
         B3    7
         B     7
ONEU     B15   1
ONEB     B     000000100001
ONEV     B     1
UVM      B     000777707777
SWPXS3   B     035703030303
HI7S     B     007000070000
128S     B15   200
         B     000020000200
         B     200
CORE2    B     001000000000
         B     002000000000
XS31     B     303030303030
XS32     B     030303030303
INHED    B     3
MASK1    B     000740000000
MASK2    B     000777000000
ALL      B     012446460101
ZERO     B     017430544501
LOCUP    B30   4
8U       B15   10
FIRST    B     313454656602
         B     715154270251
```

```
 Q-REGISTER                    41172 17576  11 41772 31000
 AND F1                        41173 17577  11 41773 00000
GO TO EXIT ON DRUM             41174 17600  45 00000 40034
EF WRITE FREE RUN              41175 17601  02 00046 00000
CONVERSION MASKS               41176 17602  70 00000 00000
                               41177 17603  07 00000 00000
                               41200 17604  00 70000 00000
                               41201 17605  00 07000 00000
                               41202 17606  00 00700 00000
                               41203 17607  00 00070 00000
                               41204 17610  00 00007 00000
                               41205 17611  00 00000 70000
                               41206 17612  00 00000 07000
                               41207 17613  00 00000 00700
                               41210 17614  00 00000 00070
                               41211 17615  00 00000 00007
U ADVANCER                     41212 17616  00 00001 00000
U AND V ADVANCER               41213 17617  00 00001 00001
V ADVANCE                      41214 17620  00 00000 00001
LOW 4 U AND V MASK             41215 17621  00 07777 07777
PRLOC XS3 FOR SWAPS            41216 17622  03 57030 30303
HIGH U-V SEVENS                41217 17623  00 70000 70000
U ADVANCE 128                  41220 17624  00 00200 00000
U-V ADVANCE 128                41221 17625  00 00200 00200
V ADVANCE 128                  41222 17626  00 00000 00200
2ND CORE TESTER                41223 17627  00 10000 00000
MAX CORE LIM TESTER            41224 17630  00 20000 00000
XS3 FOR XS3                    41225 17631  30 30303 03030
 TRANSLATION                   41226 17632  03 03030 30303
INDEX TO CONVERT HEADER        41227 17633  00 00000 00003
PICKUP                         41230 17634  00 07400 00000
 MASKS                         41231 17635  00 07770 00000
XS3 FOR -ALL-ZERO-             41232 17636  01 24464 60101
 DUMP OF MEMORY                41233 17637  01 74305 44501
ADDRESS IDENT ADVANCER         41234 17640  04 00000 00000
U ADVANCE 8                    41235 17641  00 00010 00000
FIRST                          41236 17642  31 34546 56602
 WORD                          41237 17643  71 51542 70251
```

```
        B     310225245027                    OF BAND IN XS3                41240 17644  31 02252 45027
STOPTP  B     020060000000                    STOP TAPE EF                  41241 17645  02 00600 00000
DUMMY   TN    XS32          1B)               DUMMY MODIFIER                41242 17646  13 17632 00001
DUMTST  AT    XS32          BUF+16            DUMMY TESTER                  41243 17647  35 17632 16620
MA      B     000077777777                    MASKA                         41244 17650  00 00777 77777
MB      B     777777770000                        B                         41245 17651  77 77777 70000
MC      B     777700000000                        C                         41246 17652  77 77000 00000
MD      B     7777                                D                         41247 17653  00 00000 07777
ME      B     037777777777                        E                         41250 17654  03 77777 77777
MF      B     177777777777                        F                         41251 17655  17 77777 77777
MG      B     740                                 G                         41252 17656  00 00000 00740
20U     B15   24                              U ADVANCE 20                  41253 17657  00 00024 00000
LIM     B                                     DUMP LIMITS                   41254 17660  00 00000 00000
LINECT  B     5                               LINE CT PRESET TO 5           41255 17661  00 00000 00005
SWAPLM  B                                     SWAP LIMIT STORE              41256 17662  00 00000 00000
CNT                                           SCALE FACTOR COUNT            41257 17663  00 00000 00000
1STWOR  B                                     STORE FOR 1ST BAND WORD       41260 17664  00 00000 00000
PRLOCX  B     035701030303                    XS3 FOR LOCATION              41261 17665  03 57010 30303
LOC     B                                     LOCATION BITS                 41262 17666  00 00000 00000
PRLOC   B                                     XS3 OF LOCATION               41263 17667  00 00000 00000
I1      B                                     INDEX                         41264 17670  00 00000 00000
FLAG    EQLS  CORE-1                          FLAG CELLS FOR DUMP
CHAR    EQLS  CORE-13                         CHARACTERS FOR XS3 CONV
F1      EQLS  00000B)                         FIRST CELL OF CORE
BUF     EQLS  16600B)                         SWAP BUFFER DEFINED
DCI     EQLS  41770B)                         DRUM CORE IMAGE
LCT     EQLS  I1                              LCT IS A TEMP
PARAM   EQLS  40226B)                         PARAMETER LOCATIONS
MFF     EQLS  40036B)                         PROGRAM CONTROLLED INDIC
                      CONSTANT  P  OOL   L(5)                             41265 17671  00 00000 00005
                                         L(0)                             41266 17672  00 00000 00000
                                         L(7777B)                         41267 17673  00 00000 07777
                                         L(26)                            41270 17674  00 00000 00032
                                         L(4)                             41271 17675  00 00000 00004
                                         L(31)                            41272 17676  00 00000 00037
                                         L(2)                             41273 17677  00 00000 00002
                                         L(3)                             41274 17700  00 00000 00003
                                         L(72)                            41275 17701  00 00000 00110

        END
```

NAME: READ SLAP SYMBOLIC TAPE.

FUNCTION: Loads a program into memory from a SLAP symbolic tape.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40011.
3. Set Q_3-Q_0 equal to uniservo number of input tape.
4. Depress start button.

CODE: 11.

STOPS: PAK = u address of END instruction, Success stop.

COMMENTS: In case of a parity error, the tape will rock on all biases without stopping.

This routine will not give the proper loading if any of the program being loaded is to be stored in DCI.

There are no checks made for assembly errors on the symbolic tape. The storage address is loaded with the octal translation of the instruction as it appears on the listing. All illegal storage addresses are ignored and nothing from that line is loaded.

```
         SETL  1             1
T        RSRV  5             5
TT       RSRV  6             6
B        RSRV  20            20
BB       RSRV  470           470
         SETL  43220B)       43220B)
RDSYMB   RJ    SAVE+5        SAVE
         RPB   159           CORE
         TP    L+1           CORE
         SETL                766B)
CORE     SP    Q             12
         RPB   3             L+2
         AT    E             E
JMPSET   TP    DRUMST+1      BACKEN+2
         EF                  NORMAL
SETUPS   TP    L(2)          IB
         TV    CONVRT        LAST
         TV    SEQ           BREAKS
         EF                  E
         TV    JMPSET        STORE
         TP    J3NO          TR1
         TP    L(455)        SIZE
         TV    BBV           TP
TRASH    TP    LAST          TT
         TP    TP            TT+1
         TP    SIZE          TT+2
         TP    STORE         TT+3
         TP    TR1           TT+4
         TP    TR1+1         TT+5
SET4     TP    L(4)          FOUR
READ     RPV   20            L+2
         ER1                 B
         SP    B+2
         EJ    ENDOP         END
CONVRT   TP    B+12          A
         EJ    C01           EXEC
BOX      RJ    X+9           X
         TJ    L(20000B)     CORADD
```

THIS ROUTINE LOADS A PROGRAM INTO MEMORY FROM A SLAP SYMBOLIC OUTPUT TAPE. SINCE SLAP WRITES THE SYMBOLIC TAPE IN THE FIXED BLOCK MODE, THIS ROUTINE READS IT IN THE FIXED BLOCK MODE BECAUSE OF THE BAD SPOT DETECTION INCOMPATIBILITIES BETWEEN FIXED BLOCK AND VARIABLE BLOCK MODES.

THE CONSOLE REGISTERS AND CORE ARE PRESERVED BY USING THE SAVE ROUTINE AND DRUM-CORE IMAGE. WHILE OPERATING FROM CORE, THE ROUTINE AND ITS BUFFER OCCUPY CELLS 0 TO 1224. ANY DRUM ADDRESS TO BE LOADED IS STORED IN THE CORE BUFFER UNTIL THAT BUFFER IS FILLED. WHEN THE BUFFER IS FULL, THE INPUT TAPE IS STOPPED AND THE CORE BUFFER IS UNLOADED. ALL CORE ADDRESSES ARE LOADED DIRECTLY UNLESS THEY ARE BETWEEN 0 AND 1224. IN THAT CASE, THEY ARE TREATED AS DRUM ADDRESSES AND STORED IN THE CORE BUFFER. WHEN THE CORE BUFFER IS UN-

```
                    00001
                    00006
                    00014
                    00040
                    43220  37 40044 40037
                    43221  75 30237 00766
                    43222  11 43223 00766
43223 00766         31 31000 00014
43224 00767         75 30003 00771
43225 00770         35 01173 01173
43226 00771         11 40001 00765
43227 00772         17 00000 01177
43230 00773         11 01213 00770
43231 00774         16 01016 01205
43232 00775         16 01212 01071
43233 00776         17 00000 01173
43234 00777         16 00771 01075
43235 01000         11 01201 01066
43236 01001         11 01214 00767
43237 01002         16 01210 01031
43240 01003         11 01205 00006
43241 01004         11 01031 00007
43242 01005         11 00767 00010
43243 01006         11 01075 00011
43244 01007         11 01066 00012
43245 01010         11 01067 00013
43246 01011         11 01215 00766
43247 01012         75 10024 01014
43250 01013         76 10000 00014
43251 01014         31 00016 00000
43252 01015         43 01202 01104
43253 01016         11 00030 32000
43254 01017         43 01203 01063
43255 01020         37 01152 01141
43256 01021         42 01216 01054
```

```
          TJ    L(40000B)     TEST        LOADED, THE CONTENTS OF     43257 01022   42 01217 01035
INSERT    TP    A             LAST+1      THE ADDRESSES 0 TO 1224     43260 01023   11 32000 01206
          SS    L(1)                      ARE STORED IN DCI.          43261 01024   34 01220 00000
          EJ    LAST          L+2         WHEN DCI GOES TO CORE       43262 01025   43 01205 01027
          MJ                  BREAKS      AT THE COMPLETION OF        43263 01026   45 00000 01071
          TP    LAST+1        LAST        THE LOADING, THE CONT-      43264 01027   11 01206 01205
          RJ    X+25          X+10        ENTS OF CELLS 0-1224        43265 01030   37 01172 01153
TP        TP    A             BB          ARE THEN IN PLACE.          43266 01031   11 32000 00040
          RA    TP            L(1)                                    43267 01032   21 01031 01220
          RA    TR1           L(100000B)  LOADING OF THE TAPE IS      43270 01033   21 01066 01221
          RS    SIZE          L(1)        TERMINATED BY THE END       43271 01034   23 00767 01220
TEST      RJ    L             L+1         INSTRUCTION ON TAPE.        43272 01035   37 01035 01036
          IJ    FOUR          READ        THE IS KEPT MOVING AS       43273 01036   41 00766 01012
          RPV   20            L+2         LONG AS THE BUFFER IS       43274 01037   75 10024 01041
          ER1                 B           NOT FULL OR END NOT         43275 01040   76 10000 00014
          ER                  A           FOUND. HENCE, PROGRAMS      43276 01041   76 00000 32000
          ZJ    PARITY        L+1         WITH CORE STORAGE ADD-      43277 01042   47 01120 01043
          SP    B+2                       RESSES WILL LOAD FREE       43300 01043   31 00016 00000
          EJ    ENDOP         END+5       RUN. THE PROGRAM LOADED     43301 01044   43 01202 01111
          TP    SIZE          A           IS A TRANSLATION TO         43302 01045   11 00767 32000
          SJ    L+1           LLINE       BINARY OF THE OCTAL         43303 01046   46 01047 01052
          EF                  STOPTP      TRANSLATION ON THE SLAP     43304 01047   17 00000 01176
          RJ    TEST          CONVRT      TAPE. THE STORAGE ADD-      43305 01050   37 01035 01016
          MJ                  DUMP        RESS IS USED UNLESS THE     43306 01051   45 00000 01136
LLINE     RJ    TEST          CONVRT      STORAGE AND EXECUTION       43307 01052   37 01035 01016
          MJ                  TRASH       ARE THE SAME. BLANK         43310 01053   45 00000 01003
CORADD    TJ    LAP           ADJUST      LINES AND ILLEGAL STOR-     43311 01054   42 01204 01061
          TV    A             CORADD+3    AGE ADDRESSES ARE SKIP-     43312 01055   16 32000 01057
          RJ    X+25          X+10        PED.  THE U-ADDRESS OF      43313 01056   37 01172 01153
          TP    A             FILL        THE END INSTRUCTION IS      43314 01057   11 32000 30000
          MJ                  TEST        ASSUMED TO BE THE START     43315 01060   45 00000 01035
ADJUST    SA    LAPCON                    ADDRESS OF THE PROGRAM      43316 01061   32 01207 00000
          MJ                  INSERT      BEING LOADED AND WILL       43317 01062   45 00000 01023
EXEC      TP    B+13          A           APPEAR IN PAK UPON          43320 01063   11 00031 32000
          EJ    C01           TEST        COMPLETION OF LOADING.      43321 01064   43 01203 01035
          MJ                  BOX         THE TAPE REWINDS AT         43322 01065   45 00000 01020
TR1       RPB                 L+2         THIS TIME.                  43323 01066   75 30000 01070
          TP    FILL          FILL                                    43324 01067   11 30000 30000
```

```
         MJ                FILL          EACH LINE (BLOCKETTE) OF     43325 01070  45 00000 30000
BREAKS   RJ    L            SEQUIN         SYMBOLIC TAPE IS PROC-       43326 01071  37 01071 01077
         TV    STORE        TR1            ESSED AND STORED AS IT       43327 01072  16 01075 01066
         RS    STORE        L(2)           IS READ. HENCE, SINCE        43330 01073  23 01075 01213
         RPB   2            L+2            A PARITY ERROR IS NOT        43331 01074  75 30002 01076
STORE    TP    TR1          BACKEN+2       DETECTED UNTIL THE END       43332 01075  11 01066 00765
         RS    SIZE         L(2)           OF A BLOCK, ENOUGH           43333 01076  23 00767 01213
SEQUIN   TV    LAST+1       TR1+1          INFORMATION MUST BE          43334 01077  16 01206 01067
         LQ    TP           A+15           SAVED SO THAT A RECOV-       43335 01100  55 01031 32017
         TU    Q            TR1+1          ERY MAY BE MADE IF A         43336 01101  15 31000 01067
         TP    J3NO         TR1            PARITY ERROR OCCURS.         43337 01102  11 01201 01066
         MJ                 INSERT+4       THIS INFORMATION IS          43340 01103  45 00000 01027
END      RPO   20           L+2            SAVED IN THE TT BUFFER       43341 01104  75 00024 01106
         ER1                A              AT THE BEGINNING OF          43342 01105  76 10000 32000
         IJ    FOUR         L-2            EVERY BLOCK.  A PARITY       43343 01106  41 00766 01104
         ER                 A              ERROR WILL CAUSE THE         43344 01107  76 00000 32000
         ZJ    PARITY       L+1            TAPE TO ROCK ON ALL          43345 01110  47 01120 01111
         EF                 STOPTP         BIASES INDEFINITELY.         43346 01111  17 00000 01176
         EF                 E+2                                         43347 01112  17 00000 01175
         SP    B+15                        IN ORDER TO SPEED UP THE     43350 01113  31 00033 00000
         RJ    X+9          X              UNLOADING OF THE CORE        43351 01114  37 01152 01141
         TV    A            EXIT+1         BUFFER TO DRUM, THE          43352 01115  16 32000 40035
         RJ    DUMP+2       DUMP           BUFFER IS SET UP IN THE      43353 01116  37 01140 01136
         MJ                 RESTOR         FOLLOWING MANNER=            43354 01117  45 00000 40046
PARITY   IJ    IB           L+2             AS LONG AS THE CELLS        43355 01120  41 00770 01122
         TP    L(2)         IB              TO BE LOADED ARE IN         43356 01121  11 01213 00770
         LA    A            12              SEQUENCE, THEY ARE          43357 01122  54 32000 00014
         AT    LOWBIS       T               STORED SEQUENTIALLY         43360 01123  35 01200 00001
         EF                 T               FROM THE BEGINNING OF       43361 01124  17 00000 00001
         EF                 E+1             THE BUFFER. ONE SET OF      43362 01125  17 00000 01174
         TP    TT           LAST            TRANSFER COMMANDS IS        43363 01126  11 00006 01205
         TP    TT+1         TP              GENERATED FOR EACH          43364 01127  11 00007 01031
         TP    TT+2         SIZE            SEQUENCE. THE 2 TRANS-      43365 01130  11 00010 00767
         TP    TT+3         STORE           FER COMMANDS ARE STOR-      43366 01131  11 00011 01075
         TP    TT+4         TR1             ED AT THE BACKEND OF        43367 01132  11 00012 01066
         TP    TT+5         TR1+1           THE BUFFER. EACH BREAK      43370 01133  11 00013 01067
         EF                 E               IN SEQUENCE CREATES A       43371 01134  17 00000 01173
         MJ                 SET4            NEW PAIR OF TRANSFER        43372 01135  45 00000 01011
```

```
DUMP    TV    STORE          TR1+2
        RJ    BACKEN+2       TR1
        MJ                   SETUPS
X       TP    L(4)           T+1
        ST    C03            Q
        RS    T              T
        LQ    Q              6
        LQ    Q              6
        SP    T              3
        QA    L(7)           T
        IJ    T+1            X+4
        SP    T
        MJ
        TP    B+14           A
        ST    L(303B)        Q
        LQ    Q              18
        TP    L(1)           T+1
        RJ    X+9            X+2
        TP    A              T+2
        TP    B+15           A
        RJ    X+9            X
        TP    A              T+3
        TP    B+16           A
        RJ    X+9            X
        TP    A              T+4
        SP    T+2            15
        SA    T+3            15
        SA    T+4
        MJ
E       B     020000200000
        B     000001200001
        B     000016377777
STOPTP  B     020060000000
NORMAL  B     020000150000
LOWBIS  B     020000160000
J3NO    RPB                  TR1+2
ENDOP   B18   305027
C01     B     010101010101
```

COMMANDS. WHEN THE INFORMATION TO BE LOADED AND THE TRANSFER COMMANDS MEET, THE TAPE IS STOPPED AND CONTROL IS TRANSFERRED TO THE STRING OF TRANSFER COMMANDS. THIS EMPTIES THE BUFFER AND LOADING IS RESUMED. TREATING THE BUFFER IN THIS WAY MAKES IT POSSIBLE TO TAKE MAXIMUM ADVANTAGE OF THE SIZE OF THE BUFFER AND ALSO UNLOAD IT WITH THE FEWEST NUMBER OF DRUM REFERENCES.

THE CONVERSION ROUTINE USED TO CONVERT FROM XS3 OCTAL TO BINARY STARTS AT TAG X. THE ROUTINE FROM X TO X+9 CONVERTS THE XS3 OCTAL NUMBER IN A-RIGHT TO BINARY AND LEAVES IT IN A-RIGHT. IF THE ROUTINE IS USED FROM X+10 TO X+25 THE OP-U-V OF THE WORD TO BE LOADED IS TRANSLATED FROM OCTAL XS3 TO BINARY AND PACKED INTO ONE WORD. THE ASSEMBLED BINARY WORD IS LEFT IN A-RT.

THE SLAP SYMBOLIC TAPE

```
43373 01136  16 01075 01070
43374 01137  37 00765 01066
43375 01140  45 00000 00773
43376 01141  11 01215 00002
43377 01142  36 01211 31000
43400 01143  23 00001 00001
43401 01144  55 31000 00006
43402 01145  55 31000 00006
43403 01146  31 00001 00003
43404 01147  52 01222 00001
43405 01150  41 00002 01145
43406 01151  31 00001 00000
43407 01152  45 00000 00000
43410 01153  11 00032 32000
43411 01154  36 01223 31000
43412 01155  55 31000 00022
43413 01156  11 01220 00002
43414 01157  37 01152 01143
43415 01160  11 32000 00003
43416 01161  11 00033 32000
43417 01162  37 01152 01141
43420 01163  11 32000 00004
43421 01164  11 00034 32000
43422 01165  37 01152 01141
43423 01166  11 32000 00005
43424 01167  31 00003 00017
43425 01170  32 00004 00017
43426 01171  32 00005 00000
43427 01172  45 00000 00000
43430 01173  02 00002 00000
43431 01174  00 00012 00001
43432 01175  00 00163 77777
43433 01176  02 00600 00000
43434 01177  02 00001 50000
43435 01200  02 00001 60000
43436 01201  75 30000 01070
43437 01202  30 50270 00000
43440 01203  01 01010 10101
```

```
LAP                          1225B)        MAY BE READ FROM ANY       43441 01204  00 00000 01225
LAST                         FILL          UNISERVO BY SETTING THE    43442 01205  00 00000 30000
                             FILL          DESIRED NUMBER IN THE      43443 01206  00 00000 30000
LAPCON                       DCI+3         LOW-ORDER OF THE Q         43444 01207  00 00000 41773
BBV                          BB            REGISTER. A LEGAL          43445 01210  00 00000 00040
C03      B    0303030303                   UNISERVO NUMBER MUST       43446 01211  00 03030 30303
SEQ                          SEQUIN        BE SPECIFIED.              43447 01212  00 00000 01077
SIZE     EQLS CORE+1
FOUR     EQLS CORE                        WHEN REUSING OR RESTART-
DRUMST   EQLS 40000B)                      ING THIS ROUTINE, THE
DCI      EQLS 41770B)                      DRUMSTART SHOULD BE
BACKEN   EQLS CORE-3                       USED SO THAT THE ROUT-
SAVE     EQLS 40037B)                      INE WILL BE BROUGHT
RESTOR   EQLS 40046B)                      FROM DRUM TO CORE BE-
EXIT     EQLS 40034B)                      FORE EACH USE. THIS IS
IB       EQLS CORE+2                       NECESSARY BECAUSE PARTS
                          CONSTANT  P OOL          L(2)       43450 01213  00 00000 00002
                                                   L(455)     43451 01214  00 00000 00707
                                                   L(4)       43452 01215  00 00000 00004
                                                   L(20000B)  43453 01216  00 00000 20000
                                                   L(40000B)  43454 01217  00 00000 40000
                                                   L(1)       43455 01220  00 00000 00001
                                                   L(100000B) 43456 01221  00 00001 00000
                                                   L(7)       43457 01222  00 00000 00007
                                                   L(303B)    43460 01223  00 00000 00303
END                                       OF THE PROGRAM ARE USED
```

NAME: BINARY DUMP (2-Core).

FUNCTION: Prepares a self-loading binary tape of the entire memory on a designated uniservo.

OPERATING INSTRUCTIONS:

1. To dump:

   a. Clear console.
   b. Set PAK = 40013.
   c. Set Q_3-Q_0 = output uniservo number.
   d. Depress start button.

2. To read:

   a. Clear console.
   b. Set PAK = 40000.
   c. Set Q = 00 DDDDD 000TT,
      where D = dump number desired and
            T = uniservo number.
   d. Depress start button.

CODE: 13.

STOPS: PAK = 40000, Success stop for read or write.

PAK = 00002, Checksum failure on read.

COMMENTS: The Cold Start procedure may be used to read a binary dump if desired. In case of parity errors, the tape will rock on all biases. A dump number of 0 indicates the first dump. The binary dump may be used under program control as follows:

1. With BOSS:

```
TP  Tape Unit 40226
RJ  40034  40013.
```

2. Without BOSS:

```
TP  Tape Unit Q
RJ  40034  40013.
```

```
        SETL  41276B)       41276B)       2 CORE BINARY DUMP
MFF     EQLS  40036B)
DCI     EQLS  41770B)
BINDMP  TP    MFF           A              TEST BOSS MASTER FLIP-          41276  11 40036 32000
        ZJ    L+2           L+1           FLOP. IF MFF IS 0 THE            41277  47 41301 41300
        TP    Q             PARA          PARAMETER IS IN Q, IF            41300  11 31000 40226
        MJ                  SETUP         MFF NOT 0 IT IS IN PARA.         41301  45 00000 41302
SETUP   TP    F1            DCI            SAVE CONTENTS OF CELLS          41302  11 00000 41770
        RPB   660           L+2           0 THRU 1224B IN DCI (THE         41303  75 31224 41305
        TP    1             DCI+4         DRUM IMAGE OF CORE).             41304  11 00001 41774
        RPB   145           CORBIN         TRANSFER BINARY DUMP            41305  75 30221 00003
        TP    L+1           CORBIN        ROUTINE TO CORE.                 41306  11 41307 00003
        SETL                3
CORBIN  LTL                 DCI+1          SAVE AL, AR AND Q IN     41307 00003  22 00000 41771
        LTR                 DCI+2         DCI.                      41310 00004  22 10000 41772
        TP    Q             DCI+3         Q                         41311 00005  11 31000 41773
        TV    GULP          GULP           SET INDEX FOR 27 GULPS   41312 00006  16 00063 00063
        TU    L+4           STDUMP+1      SET TO TRANSFER FR 4000   41313 00007  15 00013 00020
        SP    PARA          12             EXTRACT UNISERVO NR FR   41314 00010  31 40226 00014
        AT    EFWRIT        EFWRIT        PARAMETER, SET WRITE EF.  41315 00011  35 00060 00060
        ST    A             CKSUM          CLEAR CHECKSUM CELL.     41316 00012  36 32000 00064
        EF    40000B)       EFWRIT         WRITE THE BINARY DUMP    41317 00013  17 40000 00060
        RPV   120           L+2           DRIVER (1ST BLOCK ON THE  41320 00014  75 10170 00016
        EW1                 DRIVER        DUMP TAPE) AND STOP.      41321 00015  77 10000 00066
        RS    EFWRIT        STOPCD         REMOVE STOP CODE FR EF.  41322 00016  23 00060 00062
STDUMP  RPB   600           L+2            TRANSFER 5 BLOCKS OF     41323 00017  75 31130 00021
        TP                  DRIVER        INFORMATION TO CORE.      41324 00020  11 00000 00066
        EF                  EFWRIT         START FREE RUN WRITE.    41325 00021  17 00000 00060
        RA    STDUMP+1      UBUMP         BUMP TRANSFER ADDRESS.    41326 00022  21 00020 00065
        RPV   600           L+2            WRITE 5 BLOCKS OF IN-    41327 00023  75 11130 00025
        EW1                 DRIVER        FORMATION ON TAPE.        41330 00024  77 10000 00066
        EF                  EFSTOP         STOP THE TAPE UNIT.      41331 00025  17 00000 00061
        SP    CKSUM                        LOAD PREVIOUS CHECKSUM   41332 00026  31 00064 00000
        RPU   600           L+2           IN A AND ADD CHECKSUM     41333 00027  75 21130 00031
        SA    DRIVER                      FOR BLOCKS JUST WRITTEN.  41334 00030  32 00066 00000
        LTR                 CKSUM          STORE PARTIAL CHECKSUM.  41335 00031  22 10000 00064
        IJ    GULP          STDUMP        TEST-27 GULPS DUMPED.     41336 00032  41 00063 00017
        RPB   270B)         L+2            TRANSFER LAST 270B WDS   41337 00033  75 30270 00035
```

```
          TP    77510B)       735B)          OF DRUM TO CORE.          41340 00034  11 77510 00735
          SP    CKSUM                         LOAD PREVIOUS CHECKSUM    41341 00035  31 00064 00000
          RPU   7044B)        L+2            AND ADD THE CHECKSUM OF   41342 00036  75 27044 00040
          SA    735B)                        CELLS 735B THRU 10000B.   41343 00037  32 00735 00000
          RPU   7777B)        L+2            CHECKSUM REMAINDER OF     41344 00040  75 27777 00042
          SA    10001B)                      CORE,10001B THRU 17777B.  41345 00041  32 10001 00000
          EF                  EFWRIT         START FREE RUN WRITE      41346 00042  17 00000 00060
          RPV   7400B)        L+2            AND WRITE THE CONTENTS    41347 00043  75 17400 00045
          EW1                 611B)          OF CELLS 611B THRU 1021   41350 00044  77 10000 00611
          RPV   7567B)        L+2            WRITE THE CONTENTS OF     41351 00045  75 17567 00047
          EW1                 10211B)        CELLS 10211B THRU 17777.  41352 00046  77 10000 10211
          EW1                 A              WRITE TOTAL CHECKSUM.     41353 00047  77 10000 32000
          EF                  EFSTOP         STOP THE TAPE UNIT.       41354 00050  17 00000 00061
          SP    DCI+1         36             RESTORE AL, AR, Q AND     41355 00051  31 41771 00044
          SA    DCI+2                        CELLS 1B THRU 1224B FROM  41356 00052  32 41772 00000
          TP    DCI+3         Q              THE DCI, THEN TRANSFER    41357 00053  11 41773 31000
          RPB   660           BINDMP+52      TO DRUM AND RESTORE F1    41360 00054  75 31224 41362
          TP    DCI+4         1              (CELL 0) FROM THE DCI.    41361 00055  11 41774 00001
          TP    DCI                          JUMP TO THE COMMON        41362 00056  11 41770 00000
          MJ                  40034B)        SERVICE ROUTINE EXIT.     41363 00057  45 00000 40034
EFWRIT    B     020060600000                 EF CODE FOR TAPE WRITE.   41364 00060  02 00606 00000
EFSTOP    B     020060000000                 EF CODE FOR STOP TAPE.    41365 00061  02 00600 00000
STOPCD    B     000060000000                 EF STOP CODE MASK.        41366 00062  00 00600 00000
GULP      B     32                           NR OF 5 BLOCK GULPS -1.   41367 00063  00 00000 00032
CKSUM                                        CHECKSUM CELL             41370 00064  00 00000 00000
UBUMP           1130B)                       1130B EQUALS 600(DEC)     41371 00065  00 01130 00000
DRIVER    MJ                  READ           BINARY DUMP DRIVER RTN    41372 00066  45 00000 00001
          SETL                1
READ      TU    Q             BNEW           SAVE DUMP NUMBER          41373 00001  15 31000 00120
          IJ    Q             L+2            TEST PARAMETER FOR NON    41374 00002  41 31000 00004
          MS                  READ           ENTRY OF UNISERVO NR.     41375 00003  56 00000 00001
          TV    A             NBLKS          SAVE SERVO NR LESS 1,     41376 00004  16 32000 00117
          SP    NBLKS         12             AND ADD THIS NR TO EF     41377 00005  31 00117 00014
          RPB   3             L+2            CODES WHICH WERE PRESET   41400 00006  75 30003 00010
          AT    EFREAD        EFREAD         TO INDICATE UNISERVO 1.   41401 00007  35 00125 00125
          LQ    BNEW          A+21           TEST DUMP NUMBER (DN),    41402 00010  55 00120 32025
          SS    TWO                          IF DN EQ 0 OR 1,SET TO    41403 00011  34 00121 00000
          SJ    SETIND        L+1            READ 1ST DUMP ON TAPE,    41404 00012  46 00015 00013
```

```
                EF                      MOVFWD          IF DN GTR THN 1 SET TO          41405 00013   17 00000 00126
                IJ      A               L-1             READ DN(TH) DUMP ON TAPE        41406 00014   41 32000 00013
SETIND          TP      27IND           NBLKS            SET FOR 27 BLOCK GULPS.        41407 00015   11 00130 00117
                RJ      RETURN          RD27BK           SUBRTN-READ 27 BLOCKS          41410 00016   37 00105 00061
STORE           RPB     3240            L+2              STORE 3240 WORDS (27           41411 00017   75 36250 00021
                TP      145B)           40000B)         BLOCKS) ON DRUM.                41412 00020   11 00145 40000
                SP      CKS                              LOAD PREVIOUS CHECKSUM         41413 00021   31 00135 00000
                RPU     3240            L+2             AND ADD TO IT THE CHECK         41414 00022   75 26250 00024
                SA      145B)                           SUM OF THE 3240 WORDS           41415 00023   32 00145 00000
                TP      A               CKS             JUST STORED.                    41416 00024   11 32000 00135
                RA      STORE+1         3240V            BUMP STORE ADDRESS.            41417 00025   21 00020 00134
                IJ      PASSES          SETIND           TEST-5 GULPS DONE              41420 00026   41 00132 00015
                TV      611V            RD27BK+5         RESET READ SUBROUTINE          41421 00027   16 00124 00066
                TP      63IND           NBLKS           AND READ 64 BLOCKS INTO         41422 00030   11 00131 00117
                RJ      RETURN          RD27BK+1        CORE, CELLS 611B-17610B.        41423 00031   37 00105 00062
                TP      119RD           RD27BK+4         RESET READ SUBRTN, READ        41424 00032   11 00133 00065
                MJ                      RD27BK+1        167B WDS,17611B-17777B.         41425 00033   45 00000 00062
LASTBK          ER1                     Q                READ CHKSUM COMPUTED AS        41426 00034   76 10000 31000
                ER                      A               DUMP WAS MADE, READ IOA.        41427 00035   76 00000 32000
                ZJ      BINDEX          L+1              TEST PARITY                    41430 00036   47 00071 00037
                EF                      STOPTP           STOP TAPE UNIT                 41431 00037   17 00000 00113
                SP      CKS                              LOAD PREVIOUS CHECKSUM         41432 00040   31 00135 00000
                RPU     7044B)          L+2             AND FINISH CHECKSUM OF          41433 00041   75 27044 00043
                SA      735B)                           DRUM AND ADD TO CHECKSUM        41434 00042   32 00735 00000
                RPU     7777B)          L+2             OF CORE, THEN COMPARE           41435 00043   75 27777 00045
                SA      10001B)                         THIS CHECKSUM WITH THE          41436 00044   32 10001 00000
                RS      A               Q               ONE COMPUTED WHEN THE           41437 00045   23 32000 31000
                ZJ      L+1             L+2             DUMP WAS MADE.                  41440 00046   47 00047 00050
                MS                      00002B)          CHECKSUM FAILURE EXIT.         41441 00047   56 00000 00002
                RPB     270B)           L+2              RESTORE LAST 270 WORDS         41442 00050   75 30270 00052
                TP      735B)           77510B)         AT END OF DRUM.                 41443 00051   11 00735 77510
                SP      DCI+1           36               RESTORE AL, AR, Q, AND         41444 00052   31 41771 00044
                SA      DCI+2                           RESTORE CELLS 1 THRU            41445 00053   32 41772 00000
                TP      DCI+3           Q               1224B FROM THE DCI.             41446 00054   11 41773 31000
                RPB     660             BINDMP+107                                      41447 00055   75 31224 41451
                TP      DCI+4           1                                               41450 00056   11 41774 00001
                TP      DCI                              RESTORE F1 FROM DCI.           41451 00057   11 41770 00000
                MS                      40000B)          SUCCESS EXIT                   41452 00060   56 00000 40000
```

```
RD27BK  TV    RDADDR        RD27BK+5    SET READ ADDRESS                41453 00061  16 00122 00066
        EF                  BNORM       SET NORMAL BIAS                 41454 00062  17 00000 00114
        TP    TWO           BIASIN      SET BIAS CHANGE INDEX           41455 00063  11 00121 00116
        EF                  EFREAD      START FREE RUN READ             41456 00064  17 00000 00125
        RPV   120           L+2         READ ONE BLOCK OF IN-           41457 00065  75 10170 00067
        ER1                            FORMATION INTO CORE.            41460 00066  76 10000 00000
        ER                  A           READ IOA                        41461 00067  76 00000 32000
        ZJ    BINDEX        BSWITH      TEST PARITY                     41462 00070  47 00071 00101
BINDEX  IJ    BIASIN        L+2         DETECTION OF A PARITY           41463 00071  41 00116 00073
        TP    TWO           BIASIN     ERROR WILL CAUSE THIS            41464 00072  11 00121 00116
        LA    A             12         ROUTINE TO CONTINUE TO           41465 00073  54 32000 00014
        AT    BLOW          BNEW       ATTEMPT TO READ THE BAD          41466 00074  35 00115 00120
        EF                  MOVBAK     BLOCK ON ALL 3 BIAS LEV          41467 00075  17 00000 00127
        EF                  BNEW       ELS UNTIL PARITY TEST IS         41470 00076  17 00000 00120
        TV    RETURN+1      BSWITH     SUCCESSFUL, OR THE COM-          41471 00077  16 00106 00101
        MJ                  RD27BK+3   PUTER IS FORCE STOPPED.          41472 00100  45 00000 00064
BSWITH  RJ    L             L+1         DUMMY BIAS RESET SWICH          41473 00101  37 00101 00102
        RA    RD27BK+5      BLK         BUMP READ ADDRESS               41474 00102  21 00066 00123
        IJ    NBLKS         RD27BK+4    TEST-REQUIRED NUMBER OF         41475 00103  41 00117 00065
        EF                  STOPTP     BLKS READ, SO STOP TAPE.         41476 00104  17 00000 00113
RETURN  MJ                  FILL        READ SUBROUTINE EXIT            41477 00105  45 00000 30000
                            L+1                                         41500 00106  00 00000 00107
        EF                  STOPTP      STOP TAPE                       41501 00107  17 00000 00113
        RA    RD27BK+5      BLK         BUMP READ ADDRESS               41502 00110  21 00066 00123
        IJ    NBLKS         RD27BK+1    TEST REQUIRED NUMBER OF         41503 00111  41 00117 00062
        MJ                  RETURN     BLOCKS SO EXIT.                  41504 00112  45 00000 00105

F1      EQLS
STOPTP  B     020060000000              EF STOP CODE                    41505 00113  02 00600 00000
BNORM   B     020000150000              EF NORMAL BIAS CODE             41506 00114  02 00001 50000
BLOW    B     020000160000              EF LOW BIAS CODE                41507 00115  02 00001 60000
BIASIN                                                                  41510 00116  00 00000 00000
NBLKS                                                                   41511 00117  00 00000 00000
BNEW                                                                    41512 00120  00 00000 00000
TWO     B     2                                                         41513 00121  00 00000 00002
RDADDR  B     145                                                       41514 00122  00 00000 00145
BLK     B     170                                                       41515 00123  00 00000 00170
611V    B     611                                                       41516 00124  00 00000 00611
EFREAD  B     020000210000              EF READ FWD FREE RUN            41517 00125  02 00002 10000
```

```
MOVFWD   B     000000200311                    EF MOVE FWD 311B BLOCKS     41520 00126  00 00002 00311
MOVBAK   B     000000777470                    EF MOVE BACK 1 BLOCK        41521 00127  00 00007 77470
27IND    B     32                          27 BLK INDEX                  41522 00130  00 00000 00032
63IND    B     77                          64 BLOCK INDEX                41523 00131  00 00000 00077
PASSES   B     4                           5GULPS                        41524 00132  00 00000 00004
119RD    RPV   119           LASTBK                                       41525 00133  75 10167 00034
3240V    B     6250                        3240                          41526 00134  00 00000 06250
CKS                                                                      41527 00135  00 00000 00000
PARA     EQLS  40226B)
         END
```

NAME: MAGNETIC TAPE DUPLICATE AND/OR COMPARE.

FUNCTION: To duplicate a fixed block magnetic tape with the option of a comparison check; or to compare two previously prepared magnetic tapes.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40014.
3. MJ1 ON for duplicate with no compare.

   MJ2 ON for compare only.
4. Set Q = MO 000BB 000CC

   BB = Input tape.

   CC = Output tape or second input tape.

   M = 0, duplicate or compare tape including every occurrence of an end of file.

   M = 4, duplicate tape omitting all end of file blocks from the duplicate tape.

   M = 2, duplicate tape omitting all end of file blocks from the duplicate tape and adding an end of file block at the end of the duplicate tape.
5. Set A = 00 0000N 0000K.

   If N=0, K=number of sequential blocks of information to be duplicated and/or compared, starting with the first block.

   If N≠0, K=number of sequential files of information to be duplicated and/or compared, starting with the N^{th} file.

MAGNETIC TAPE DUPLICATE AND/OR COMPARE (Cont'd)

CODE: 14.

STOPS: PAK = 40000, Success stop.

PAK = 00073, Block Mode error (see Comments).

PAK = 00131, Tapes do not compare.

PAK = 00001, Tape fails all biases.

COMMENTS: A File is n blocks of information followed by one block of printer stop code (end of file). If, while in the Block Mode (N=0), and end of file block is detected, the routine stops with PAK=00073. Depressing the start button will:

1. MJ1 ON, rewind tapes and exit.
2. MJ1 OFF, compare the blocks of information that have been duplicated.

To duplicate additional blocks, restart the routine with the number of additional blocks in A and Q=MO 000AA 000CC, M=0 or 2.

```
         SETL  53373B)       53373B)      TAPE DUPLICATE/COMPARE
TPDUPL   RJ    SAVE+5        SAVE         SAVE REGS AND 1ST 1224          53373  37 40044 40037
         RPB   200           CORE         LOAD PROGAM                     53374  75 30310 00004
         TP    TPDUPL        CORE-3        INTO CORE                      53375  11 53373 00001
         SETL                4            PROGRAM STARTS AT LOC. 4
CORE     TJ    UADV          BLKMOD       TEST-BLOCK OR FILE MODE  53376 00004  42 00273 00025
FILMOD   SS    L(1)                       NO. OF FILES IN SEQ.-1   53377 00005  34 00274 00000
         TV    A             SEQ          STORE NO. OF FILES       53400 00006  16 32000 00240
         LTL   21            A            FILE NO TO AR            53401 00007  22 00025 32000
         ST    L(1)          FILECT       SET FILE NUMBER INDEX    53402 00010  36 00274 00237
         TP    UADV          BLKCT        OVERLOAD BLK COUNT INDEX 53403 00011  11 00273 00241
         TP    Q             A            SAVE Q                   53404 00012  11 31000 32000
CODTST   QJ    NOEOF         L+1          TEST-NO EOF AT ALL       53405 00013  44 00031 00014
         QJ    ONEEOF        L+1          TEST-EOF AT END ONLY     53406 00014  44 00030 00015
SETEFS   LQ    A             Q+12         MORE THAN ONE EOF        53407 00015  55 32000 31014
         QT    L(170000B)    GULP         ACTUAL NUMBER OF FILES   53410 00016  51 00275 00244
         RPU   5             L+2          FORM WRITE EFS           53411 00017  75 20005 00021
         RA    WRTONV        GULP          FOR SERVO IN U OF Q     53412 00020  21 00252 00244
         LQ    Q             21           REPEAT FOR               53413 00021  55 31000 00025
         QT    L(170000B)    GULP          READ FILES              53414 00022  51 00275 00244
         RPU   5             STDUP        FORM READ EFS            53415 00023  75 20005 00034
         RA    RDFFRU        GULP          FOR SERVO IN U OF Q     53416 00024  21 00257 00244
BLKMOD   ST    L(1)          BLKCT        SET BLOCK COUNT INDEX    53417 00025  36 00274 00241
         TV    BLKSTP        TOCKFL       SET FOR  STOP ON EOF     53420 00026  16 00250 00140
         MJ                  CODTST-1     RETURN TO EOF STOP       53421 00027  45 00000 00012
ONEEOF   TV    VWREOF        SKPCMP-1     SET-ADD EOF AT END       53422 00030  16 00270 00072
NOEOF    TV    TSTPAR+3      CHKFIL+1     SET-NO EOF BETWEEN FILES 53423 00031  16 00046 00064
         TV    8V            COMPAR+4     SET COMPARE TO IGNOR EOF 53424 00032  16 00271 00100
         MJ                  SETEFS       RETURN TO SET EOFS       53425 00033  45 00000 00015
STDUP    EF                  RDFFRU       START READ TAPE FROM U   53426 00034  17 00000 00257
         TP    L(0)          BLOCKS       CLEAR BLOCK COUNTER      53427 00035  11 00276 00242
SETRD    TV    VBUFR         READ+1       PRESET READ ADDRESS      53430 00036  16 00247 00041
         TP    L(29)         GULP         SET GULP INDEX-30 BLOCKS 53431 00037  11 00277 00244
READ     RPV   120           L+2          READ                     53432 00040  75 10170 00042
         ER1                 FILL          120 WORDS               53433 00041  76 10000 30000
         ER0                 A            READ IOA                 53434 00042  76 00000 32000
TSTPAR   ZJ    BIASCK        L+1          TEST PARITY              53435 00043  47 00210 00044
         SP    READ+1        15           FORM                     53436 00044  31 00041 00017
```

```
                TU      A               L+2             EOF TEST QUANTITY               53437 00045   15 32000 00047
                RA      BLOCKS          L(1)            BUMP BLOCK COUNTER              53440 00046   21 00242 00274
PRELIM          TP      FILL            A               INITIAL TEST                    53441 00047   11 00000 32000
EOFCHK          EJ      PRSTOP          CHKEOF          TEST FOR                        53442 00050   43 00245 00135
                RA      READ+1          L(120)           END OF FILE                    53443 00051   21 00041 00300
                IJ      BLKCT           L+2             TEST-ALREADY READ IN            53444 00052   41 00241 00054
                MJ                      CHKFIL+2         RIGHT NUMBER OF BLOCKS         53445 00053   45 00000 00065
                IJ      GULP            READ            TEST-READ IN 30 BLOCKS          53446 00054   41 00244 00040
CE              TP      FILECT          A               TEST-IF IN                      53447 00055   11 00237 32000
                ZJ      SETRD-1         L+1              REQUESTED FILE                 53450 00056   47 00035 00057
                TV      IJSSEQ          DUMJMP          YES-SET FOR READ AFT DUP        53451 00057   16 00071 00070
                MJ                      CHKFIL+2        STOP READ AND GO TO WRIT        53452 00060   45 00000 00065
                RS      BLOCKS          L(1)            DONT COUNT BLK OF EOF           53453 00061   23 00242 00274
                MJ                      READ            READ NEXT BLOCK                 53454 00062   45 00000 00040
CHKFIL          IJ      FILECT          SETRD-1          INTO SAME ADDRESS              53455 00063   41 00237 00035
                RS      BLOCKS          L(0)            STOP TAPE                       53456 00064   23 00242 00276
                EF                      STOPTP          TOTAL NUMBER OF BLOCKS          53457 00065   17 00000 00264
                RA      TOTAL           BLOCKS          GO TO DUPL ROUTINE              53460 00066   21 00243 00242
                RJ      WRTXIT          DUPL            DUMMY JUMP L L+1                53461 00067   37 00155 00150
DUMJMP          RJ      L               L+1             TEST-DONE 5 FILES IN SEQ        53462 00070   37 00070 00071
IJSSEQ          IJ      SEQ             STDUP           SET V FOR FINAL EOF             53463 00071   41 00240 00034
                MJ                      L+1             LEAVE IN OR DELETE EOF          53464 00072   45 00000 00073
SKPCMP          MJ1                     STPDUP          SKIP COMPARE IF MJ1 ON          53465 00073   45 10000 00145
COMPAR          TP      RDBFRU          RDFFRU          SET READ BACKWRDS FROM U        53466 00074   11 00260 00257
                TP      CP              CE              SET TO BYPASS FILE TEST         53467 00075   11 00103 00055
                TP      MOVFDU          MOVBKU          SET BIASCK FR READ BKWDS        53470 00076   11 00262 00261
                TV      LOADA+2         TOCKFL          SET BYPASS CHKFIL               53471 00077   16 00141 00140
                RA      TOCKFL          L(0)            SET TO BYPASS EOFS ON U         53472 00100   21 00140 00276
                TP      UADV            BLKCT           OVERLOAD BLK COUNT INDEX        53473 00101   11 00273 00241
                MJ                      TAPCHK          CHECK TAPE                      53474 00102   45 00000 00122
CP              MJ                      CP+1            DUMMY JUMP                      53475 00103   45 00000 00104
                EF                      STOPTP          STOP AND RD BKWDS FROM U        53476 00104   17 00000 00264
                TP      L(29)           GULP            RESET BLOCK COUNTER             53477 00105   11 00277 00244
                EF                      RDBFRV          SET READ BKWDS FROM U           53500 00106   17 00000 00253
                TU      VBUFR           1TO1            SET COMPARE TEST                53501 00107   15 00247 00112
BK              TP      L(119)          3               SET INDEX                       53502 00110   11 00301 00003
                ER1                     A               ER TO READ EACH WORD            53503 00111   76 10000 32000
1TO1            EJ      FILL            L+2             COMPARISON TEST                 53504 00112   43 30000 00114
```

```
          TV    SNAFU+3     PARTST    DOES NOT COMP SET ALTER      53505 00113  16 00134 00117
          RA    1T01        UADV      INCREASE COMPARISON WORD     53506 00114  21 00112 00273
          IJ    3           BK+1      TEST 4 WDS AT A TIME         53507 00115  41 00003 00111
          ER                A         READ IOA                     53510 00116  76 00000 32000
PARTST    ZJ    BKBCHK      L+1       BIAS TEST                    53511 00117  47 00170 00120
          IJ    GULP        BK        NO ERROR. RETURN             53512 00120  41 00244 00110
          EF                STOPTP    STOP  READ BKWD FROM U       53513 00121  17 00000 00264
TAPCHK    RS    TOTAL       L(30)     TAPE CHECK ROUTINE           53514 00122  23 00243 00302
          SJ    L+1         STDUP                                  53515 00123  46 00124 00034
          RA    TOTAL       L(29)                                  53516 00124  21 00243 00277
          TP    TOTAL       L(29)                                  53517 00125  11 00243 00277
          TU    L+1         L-3                                    53520 00126  15 00127 00123
          MJ    L+1         STDUP                                  53521 00127  45 00130 00034
          MJ                STPDUP                                 53522 00130  45 00000 00145
SNAFU     EF                STOPTP    TAPE COMPARE ERROR           53523 00131  17 00000 00264
          EF                REWNDU     ROUTINE                     53524 00132  17 00000 00263
          EF                REWNDV                                 53525 00133  17 00000 00255
          MS                SNAFU                                  53526 00134  56 00000 00131
CHKEOF    RA    PRELIM      L(3100000B)                            53527 00135  21 00047 00303
          TP    A           L+1                                    53530 00136  11 32000 00137
LOADA                                                              53531 00137  00 00000 00000
TOCKFL    EJ    PRSTOP      CHKFIL                                 53532 00140  43 00245 00063
          MJ                EOFCHK+1                               53533 00141  45 00000 00051
STPBLK    RJ    DUMJMP      CHKFIL+1  STOP READ, START WRITE       53534 00142  37 00070 00064
          TP    TOTAL       A         (A) EQUALS TOTAL BLOCKS      53535 00143  11 00243 32000
          MS                SKPCMP    STOP-SET FR CMP OR RWND      53536 00144  56 00000 00073
STPDUP    EF                REWNDU                                 53537 00145  17 00000 00263
          EF                REWNDV                                 53540 00146  17 00000 00255
          MJ                RESTOR    RESTORE CORE AND STOP        53541 00147  45 00000 40046
DUPL      MJ2               SETMOV                                 53542 00150  45 20000 00231
          TV    VBUFR       WRITE                                  53543 00151  16 00247 00157
          EF                WRTONV                                 53544 00152  17 00000 00252
          IJ    BLOCKS      L+3       TEST-REQUIRED NUMBER OF      53545 00153  41 00242 00156
          EF                STOPTP     BLOCKS WRITTEN              53546 00154  17 00000 00264
WRTXIT    MJ                FILL                                   53547 00155  45 00000 30000
          RPV   120         L+2       WRITE 120 WORDS              53550 00156  75 10170 00160
WRITE     EW1               FILL                                   53551 00157  77 10000 30000
          RA    WRITE       L(120)    BUMP WRITE LOCATION          53552 00160  21 00157 00300
```

```
                MJ                DUPL+3                                    53553 00161   45 00000 00153
WRTEOF          EF                WRTONV      WRITE END OF FILE             53554 00162   17 00000 00252
                RP      120       L+2          AND MOVE BACK                53555 00163   75 00170 00165
                EW1               PRSTOP       ONE BLOCK SO                 53556 00164   77 10000 00245
                EF                STOPTP       THAT TAPE IS                 53557 00165   17 00000 00264
                EF                MOVBKV       READY FOR COMPARE            53560 00166   17 00000 00256
                MJ                SKPCMP       ROUTINE.                     53561 00167   45 00000 00073
BKBCHK          EF                MOVFDV      MOVE V TAPE FWD ONE BLK       53562 00170   17 00000 00254
                IJ      BIASIN    BKBCHG      CHECK BIAS                    53563 00171   41 00251 00174
                EF                BIASNO      SET BIAS NORMAL               53564 00172   17 00000 00265
                MS                FAIL                                      53565 00173   56 00000 00001
BKBCHG          SP      A         12          DETERMINE                     53566 00174   31 32000 00014
                AT      BIASLO    BIASHL       HIGH BIAS                    53567 00175   35 00267 00266
                EF                BIASHL       AND RESET                    53570 00176   17 00000 00266
                TV      BKBRST+6  PARTST                                    53571 00177   16 00207 00117
                MJ                BK-1                                      53572 00200   45 00000 00107
BKBRST          TV      BKBRST+5  PARTST                                    53573 00201   16 00206 00117
                EF                STOPTP      STOP TAPE                     53574 00202   17 00000 00264
                EF                BIASNO      SET NORMAL BIAS               53575 00203   17 00000 00265
                EF                RDBFRV      SET BACKWARD READ             53576 00204   17 00000 00253
                TP      TWO       BIASIN                                    53577 00205   11 00246 00251
                MJ                PARTST+1                                  53600 00206   45 00000 00120
                                  BKBRST                                    53601 00207   00 00000 00201
BIASCK          EF      5         MOVBKU      MOVE TAPE BACK 1 BLOCK        53602 00210   17 00000 00261
                IJ      BIASIN    CHGBIS      TEST-NUMBER OF BIAS CHGS      53603 00211   41 00251 00214
                EF                BIASNO                                    53604 00212   17 00000 00265
                MS                FAIL        BIAS FAILURE STOP             53605 00213   56 00000 00001
CHGBIS          SP      A         12          SHIFT A TO SET CHNG BIAS      53606 00214   31 32000 00014
                AT      BIASLO    BIASHL      CHANGE BIAS EF                53607 00215   35 00267 00266
                EF                BIASHL      SET TO LOW OR HIGH BIAS       53610 00216   17 00000 00266
                TV      BRESET+6  TSTPAR                                    53611 00217   16 00230 00043
                EF                RDFFRU      START READ FORWARD FR U       53612 00220   17 00000 00257
                MJ                READ        GO TO READ IN SAME BLOCK      53613 00221   45 00000 00040
BRESET          TV      BRESET+5  TSTPAR                                    53614 00222   16 00227 00043
                EF                STOPTP                                    53615 00223   17 00000 00264
                EF                BIASNO      CHANGE BACK TO NORM BIAS      53616 00224   17 00000 00265
                EF                RDFFRU      START READ FWD FROM U         53617 00225   17 00000 00257
                TP      TWO       BIASIN                                    53620 00226   11 00246 00251
```

```
         MJ                  TSTPAR+1                                    53621 00227  45 00000 00044
                             BRESET                                      53622 00230  00 00000 00222
SETMOV   TP   WRTEOF+5       WRTEOF    BYPASS ADD EOF AT END             53623 00231  11 00167 00162
         SP   MOVFDV                                                     53624 00232  31 00254 00000
         AT   BLOCKS         2                                           53625 00233  35 00242 00002
         IJ   2              L+1                                         53626 00234  41 00002 00235
         EF                  2         MOVE FORWARD BY THIS              53627 00235  17 00000 00002
         MJ2                 WRTXIT     NUMBER OF BLOCKS                 53630 00236  45 20000 00155
FILECT                                                                   53631 00237  00 00000 00000
SEQ                                                                      53632 00240  00 00000 00000
BLKCT                                                                    53633 00241  00 00000 00000
BLOCKS                                                                   53634 00242  00 00000 00000
TOTAL                                                                    53635 00243  00 00000 00000
GULP                                                                     53636 00244  00 00000 00000
PRSTOP   B    606060606060                                               53637 00245  60 60606 06060
TWO      B    2                                                          53640 00246  00 00000 00002
VBUFR         BUFFER              BUFFER                                 53641 00247  00 00310 00310
BLKSTP                            STPBLK                                 53642 00250  00 00000 00142
BIASIN   B    2                                                          53643 00251  00 00000 00002
WRTONV   B    020004600000                WRITE FORWARD ON V             53644 00252  02 00046 00000
RDBFRV   B    020001200000                READ BACKWARD FROM V           53645 00253  02 00012 00000
MOVFDV   B    020000400001                MOVE TAPE ON V FWD 1 BLK       53646 00254  02 00004 00001
REWNDV   B    020020000000                TAPE REWIND                    53647 00255  02 00200 00000
MOVBKV   B    020001400001                MOVE BACK A BLOCK              53650 00256  02 00014 00001
RDFFRU   B    020000200000                READ FORWARD FROM U            53651 00257  02 00002 00000
RDBFRU   B    020001200000                READ BACKWARD FROM U           53652 00260  02 00012 00000
MOVBKU   B    020001400001                MOVE TAPE ON U BKD 1 BLK       53653 00261  02 00014 00001
MOVFDU   B    020000400001                MOVE TAPE ON U FWD 1 BLK       53654 00262  02 00004 00001
REWNDU   B    020020000000                REWIND                         53655 00263  02 00200 00000
STOPTP   B    020060000000                STOP                           53656 00264  02 00600 00000
BIASNO   B    020000150000                NORMAL BIAS                    53657 00265  02 00001 50000
BIASHL   B                                HIGH BIAS                      53660 00266  00 00000 00000
BIASLO   B    020000160000                LOW BIAS                       53661 00267  02 00001 60000
VWREOF                            WRTEOF                                 53662 00270  00 00000 00162
8V                                L(8)                                   53663 00271  00 00000 00304
120IND                                                                   53664 00272  00 00000 00000
UADV          1                                                          53665 00273  00 00001 00000
BUFFER   EQLS 310B)
```

```
FAIL    EQLS 1
DCI     EQLS 41770B)
RESTOR  EQLS 40046B)
SAVE    EQLS 40037B)
        SETL                274B)
                             CONSTANT  P  OOL        L(1)              53666 00274  00 00000 00001
                                                     L(170000B)        53667 00275  00 00001 70000
                                                     L(0)              53670 00276  00 00000 00000
                                                     L(29)             53671 00277  00 00000 00035
                                                     L(120)            53672 00300  00 00000 00170
                                                     L(119)            53673 00301  00 00000 00167
                                                     L(30)             53674 00302  00 00000 00036
                                                     L(3100000B)       53675 00303  00 00031 00000
                                                     L(8)              53676 00304  00 00000 00010
        END
```

NAME: PRINT BINARY TAPE.

FUNCTION: Prepare an octal listing tape for the High Speed Printer by converting the information contained on any fixed block binary tape.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40015.
3. Block Mode:
   a. Set Q = 40 00AA 00BB
      where AA = input tape
            BB = output tape.
   b. Set A = number of blocks.
4. File Mode:
   a. Set Q = NN 00AA 00BB
      where $NN \leq 37_8$, the number of files
            AA = input tape
            BB = output tape.
5. Depress start button.

CODE: 15.

STOPS: PAK = 40000, Success stop.

COMMENTS: In the Block Mode this routine recognizes a block of printer stops (60's) as a termination indicator. The number of files on a tape equals the number of blocks of printer stops.

PRINT BINARY TAPE (Cont'd)

This routine may be used under program control as follows:

1. Without BOSS:

   a. TP PARAM Q

   b. TP Number Blocks A

   c. RJ 40034 40015

   where PARAM is the proper parameter for the desired mode.

2. With BOSS:

   Same as above except the uniservos indicated in PARAM must be mnemonic (W, X, Y, Z).

```
        SETL                                PRINT BINARY TAPE
CORE    RSRV 3600           3600            INPUT BUFFER ON CORE
OUTPUT  RSRV 20             20              OUTPUT BUFFER
        SETL 53677B)        53677B)         ROUTINE STORED AT 53677B
BEGIN   MJ                  BEGIN+3         TRANSFER TO OBTAIN PROG.        53677  45 00000 53702
        TP   ZERO           SFF             CLEAR SERVICE FLIP-FLOP         53700  11 07476 17777
        MJ                  SVCXIT          TRNSFR TO SERVICE EXIT          53701  45 00000 40034
        RPB  445B)          COREST          TRANSFER PRINT BINARY           53702  75 30445 07065
        TP   BEGIN          COREST-5         PROGRAM TO CORE                53703  11 53677 07060
        SETL                7065B)          ROUTINE EXECUTED AT 7065
COREST  LTR                 BETA            SAVE (AR)-BLOCK COUNT     53704 07065  22 10000 07471
        TP   Q              ALPHA           SAVE PARAMETER WORD       53705 07066  11 31000 07470
        SP   MFF                            TEST MASTER FLIP-FLOP     53706 07067  31 40036 00000
        ZJ   L+1            SETUP           IF MFF=1, SET SFF         53707 07070  47 07071 07105
        TP   ONE            SFF             PROGRAM UNDER CONTROL OF  53710 07071  11 07477 17777
        TV   KONST+14       END+5            BOSS. SET SFF=1          53711 07072  16 07451 07333
        SP   Q                              TRANSLATE PARAMETER       53712 07073  31 31000 00000
        SS   71U71V                          WORD                     53713 07074  34 07515 00000
        AT   KONST+3        KONST+3         OP TPTABL+XX TP+ABL+XX     53714 07075  35 07436 07436
        TU   KONST+3        L+1             STORE BINARY TAPE NO.     53715 07076  15 07436 07077
        SP                  15               OF BINARY TAPE           53716 07077  31 00000 00017
        TU   A              KONST+4         EXTRACT READ SERVO NO.    53717 07100  15 32000 07437
        SP   KONST+3        15              EXTRACT                   53720 07101  31 07436 00017
        TU   A              L+1              WRITE                    53721 07102  15 32000 07103
        TV                  KONST+4           UNISERVO NUMBER        53722 07103  16 00000 07437
        TP   KONST+4        Q               TRNSLTD U V OF PARAM WD   53723 07104  11 07437 31000
SETUP   QT   17V            A               V OF Q TO A               53724 07105  51 07504 32000
        LTR  12             DELTA           SAVE WRITE SERVO NO.      53725 07106  22 10014 07475
        AT   WRITE          WRITE           SET EF FOR TAPE WRITE     53726 07107  35 07465 07465
        RA   REWNDW         DELTA           SET EF REWIND WRITESERVO  53727 07110  21 07466 07475
        LQ   Q              33              POSITION TAPE NO.         53730 07111  55 31000 00041
        QT   SRVMSK         DELTA           SAVE READ SERVO NO.       53731 07112  51 07514 07475
        RPU  3              L+2             SET UP EFS FOR RD SERVO   53732 07113  75 20003 07115
        RA   READ           DELTA           READ-MOVBAK-REWND RD TP   53733 07114  21 07460 07475
        TP   ALPHA          A               TEST FOR BLK OR FILE      53734 07115  11 07470 32000
        SJ   L+1            L+8             BLOCK COUNT OR FILE CT    53735 07116  46 07117 07126
        TP   ZERO           ENDFIL          END-OF-FILE INDEX TO 0    53736 07117  11 07476 07467
        SP   BETA                           SET (AR) TO BLOCK COUNT   53737 07120  31 07471 00000
```

```
                DV    THIRTY      GROUPS    GROUPS NO OF 30-BLK GRPS     53740 07121  73 07506 07472
                ZJ    L+2         L+1       TEST ON ZERO FOR NUMBER      53741 07122  47 07124 07123
                TV    NOBLKS      ORIG+3     OF XS3 BLKS OVER  MOD3      53742 07123  16 07361 07136
                ST    ONE         BLOCKS    BLKS (NO. EXCESS-1)          53743 07124  36 07477 07473
                MJ                L+5       TRNSFR TO ORIG-1             53744 07125  45 00000 07132
                TP    SRVMSK      GROUPS    OVERLOAD GRP COUNT INDEX     53745 07126  11 07514 07472
                SP    A           6         SET UP END OF FILE INDEX     53746 07127  31 32000 00006
                LTL               A          IN AR                       53747 07130  22 00000 32000
                ST    ONE         ENDFIL    NO OF FILES MINUS 1          53750 07131  36 07477 07467
                TP    ENDFIL      CONST+7   NO OF FILES MINUS 1          53751 07132  11 07467 07373
ORIG            TP    TWO         CONST+6   RESET BIAS CHANGE INDEX      53752 07133  11 07500 07372
                EF                BIASNO    SET NORMAL BIAS              53753 07134  17 00000 07457
                IJ    GROUPS      JUMP      TEST-NO OF 30 BLCK GRPS      53754 07135  41 07472 07334
                MJ                L+1       SET UP                       53755 07136  45 00000 07137
                TP    BLOCKS      CONST+1    REMAINDER INDEX             53756 07137  11 07473 07365
                TP    BLOCKS      KONST+12  SET NO OF XS3 BLKS-1          53757 07140  11 07473 07447
READIN          EF                READ      START READ                   53760 07141  17 00000 07460
                RPV   120         L+2       READ IOB REPEATED            53761 07142  75 10170 07144
                ER1               CORE       TO OBTAIN BLOCK             53762 07143  76 10000 00010
                ER0               A         READ IOA                     53763 07144  76 00000 32000
TSTPAR          ZJ    BIASCK      L+1       TEST BIAS                    53764 07145  47 07172 07146
                TP    CORE        A         LOAD FIRST WORD OF BLOCK     53765 07146  11 00010 32000
                EJ    CONST       EOFTST    PRELIM TEST-EOF (60S)        53766 07147  43 07364 07157
NOEOF           RA    L-2         BLKADV    ADVANCE FOR NEXT BLOCK       53767 07150  21 07146 07517
                RA    READIN+2    12CV      ADVANCE FOR NEXT BLOCK       53770 07151  21 07143 07511
                IJ    CONST+1     READIN+1  TEST-READ REQRD NO BLKS       53771 07152  41 07365 07142
                TV    CONST+2     READIN+2  RESET FOR NEXT GROUP          53772 07153  16 07366 07143
                TU    CONST+2     READIN+5  RESET FOR NEXT GROUP          53773 07154  15 07366 07146
                EF                STOP      STOP READ TAPE               53774 07155  17 00000 07463
                MJ                CNVERT    TO XS3 CONVERSION ROUTNE     53775 07156  45 00000 07212
EOFTST          EF                STOP      TEST FOR EOF BLOCK           53776 07157  17 00000 07463
                TP    119V        CONST+3   STOP READ AND SET TO          53777 07160  11 07510 07367
                TU    READIN+5    EOFTST+3   PICK UP FIRST WORD           54000 07161  15 07146 07162
                TP                A         LOAD WORD INTO A             54001 07162  11 00000 32000
                EJ    CONST       EOFTST+7  TEST FOR 606060606060        54002 07163  43 07364 07166
                EF                READ      NOT EOF. START READ,         54003 07164  17 00000 07460
                MJ                NOEOF      CONTINUING PROCESS          54004 07165  45 00000 07150
                RA    EOFTST+3    UADV      SET FOR NEXT CELL            54005 07166  21 07162 07512
```

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        IJ    CONST+3      EOFTST+3    TEST-WHOLE BLK OF 60S          54006 07167  41 07367 07162
        IJ    ENDFIL       EOFTST+5    TEST-LAST END OF FILE          54007 07170  41 07467 07164
        MJ                 CNVERT      TO XS3 CONVERSION              54010 07171  45 00000 07212
BIASCK  EF                 MOVBAK      MOVE TAPE BACK 1 BLOCK         54011 07172  17 00000 07461
        IJ    CONST+6      CHGBIS      TEST BIAS                      54012 07173  41 07372 07176
        EF                 BIASNO      BIAS FAILURE STOP              54013 07174  17 00000 07457
        MS                 FAIL        SHIFT A TO SET BIAS CHNG       54014 07175  56 00000 00001
CHGBIS  SP    A            12          CHANGE EF FOR BIAS SET         54015 07176  31 32000 00014
        AT    BIASLO       BIASHL      CHANGE TO LO OR HI BIAS        54016 07177  35 07464 07474
        EF                 BIASHL      SET PARITY TEST                54017 07200  17 00000 07474
        TV    BRESET+6     TSTPAR      GO TO READ IN SAME BLOCK       54020 07201  16 07211 07145
        MJ                 READIN      RESET PARITY TEST              54021 07202  45 00000 07141
BRESET  TV    BRESET+5     TSTPAR      STOP READ TAPE                 54022 07203  16 07210 07145
        EF                 STOP        SET NORMAL BIAS                54023 07204  17 00000 07463
        EF                 BIASNO      CHANGE BACK TO NORM BIAS       54024 07205  17 00000 07457
        EF                 READ        RESTART READ                   54025 07206  17 00000 07460
        TP    TWO          CONST+6     RESET BIAS CHECK INDEX         54026 07207  11 07500 07372
        MJ                 TSTPAR+1    TRNSFER TO PARITY TEST         54027 07210  45 00000 07146
                           BRESET      BIAS CHANGE DUMMY              54030 07211  00 00000 07203
CNVERT  EF                 WRITE       XS3 CONVERSION ROUTINE         54031 07212  17 00000 07465
        TP    CORE         A           LOAD BINARY WORD               54032 07213  11 00010 32000
        EJ    CONST        TSTEOF      PRELIM TEST-END OF FILE        54033 07214  43 07364 07336
        TP    CORE         Q           LOAD ODD BINARY WORD           54034 07215  11 00010 31000
        RPB   12           L+2         MASK OUT AND STORE             54035 07216  75 30014 07220
        QT    7MASKS       DIGIT        OCTAL DIGITS                  54036 07217  51 07403 07417
        SP    KONST                    AR=303030303030                54037 07220  31 07433 00000
        RPU   11           L+2         FORM 1ST HALF                  54040 07221  75 20013 07223
        SA    DIGIT        3            OF XS3 REPRESENTATION         54041 07222  32 07417 00003
        SA    DIGIT+11                  IN AL                         54042 07223  32 07432 00000
        LTL                OUTPUT      STORE AL-1ST HALF XS3 WD       54043 07224  22 00000 07030
        AT    KONST+1      OUTPUT+1    STORE AR-2D HALF XS3 REP       54044 07225  35 07434 07031
        TP    CORE+1       Q           LOAD BINARY WORD               54045 07226  11 00011 31000
        RPB   12           L+2         MASK OUT AND STORE             54046 07227  75 30014 07231
        QT    7MASKS       DIGIT        OCTAL DIGITS                  54047 07230  51 07403 07417
        SP    KONST                    AR=303030303030                54050 07231  31 07433 00000
        RPU   3            L+2         FORM 3 SPACES AND 1ST 3        54051 07232  75 20003 07234
        SA    DIGIT        3            DIGITS OF XS3 REP             54052 07233  32 07417 00003
        LTL   6            OUTPUT+2     AND STORE                     54053 07234  22 00006 07032
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```
         SP    CONST+4                AR=000303030303                54054 07235  31 07370 00000
         RPU   9          L+2        FORM LAST 9 DIGITS OF          54055 07236  75 20011 07240
         SA    DIGIT+3    3           XS3 REPRESENTATION AND        54056 07237  32 07422 00003
         SA    CONST+5    15          THE 3 SPACES THAT FOLOW       54057 07240  32 07371 00017
         LTL              OUTPUT+3    AND                           54060 07241  22 00000 07033
         LTR              OUTPUT+4    STORE                         54061 07242  22 10000 07034
         RA    CNVERT+3   2U         RESETS                         54062 07243  21 07215 07513
         RA    CNVERT+12  2U          THE                           54063 07244  21 07226 07513
         RA    CNVERT+10  FIVE        CONVERT                       54064 07245  21 07224 07502
         RA    CNVERT+11  FIVE        ROUTINE                       54065 07246  21 07225 07502
         RA    CNVERT+18  FIVE        FOR THE                       54066 07247  21 07234 07502
         RA    CNVERT+23  FIVE        NEXT                          54067 07250  21 07241 07502
         RA    CNVERT+24  FIVE        TWO WORDS                     54070 07251  21 07242 07502
         IJ    KONST+2    CNVERT+3   TEST-CONVERTED ONE LINE        54071 07252  41 07435 07215
         TP    THREE      KONST+2    RESET INDEX                   54072 07253  11 07501 07435
         RPV   20         L+2        WRITE ONE LINE                54073 07254  75 10024 07256
         EW1              OUTPUT                                   54074 07255  77 10000 07030
         TV    KONST+6    CNVERT+10  RESET                         54075 07256  16 07441 07224
         TV    KONST+7    CNVERT+11   OUTPUT                       54076 07257  16 07442 07225
         TV    KONST+8    CNVERT+18   BUFFER                       54077 07260  16 07443 07234
         TV    KONST+9    CNVERT+23  STORAGE ADDRESS               54100 07261  16 07444 07241
         TV    KONST+10   CNVERT+24   FOR NEXT LINE                54101 07262  16 07445 07242
         IJ    KONST+13   CNVERT+3   TEST-15 LINES WRITTEN         54102 07263  41 07450 07215
         TP    14V        KONST+13    (A FULL BLOCK)               54103 07264  11 07503 07450
         RPO   60         L+2        FILL END OF THIRD             54104 07265  75 00074 07267
         EW1              ZERO        BLOCK WITH ZEROS             54105 07266  77 10000 07476
         RA    CNVERT+1   BLKADV     ADV EOF TEST WORD             54106 07267  21 07213 07517
         IJ    KONST+12   L+2        TEST-NO OF BLKS CNVRTED       54107 07270  41 07447 07272
         MJ               END        TO REWIND AND EXIT            54110 07271  45 00000 07326
         IJ    KONST+11   CNVERT+1   TEST-30 BLOCKS CONVERTED      54111 07272  41 07446 07213
         TU    CONST+2    CNVERT+1   RESET CONVERT                 54112 07273  15 07366 07213
         TU    CONST+2    CNVERT+3    ROUTINE FOR                  54113 07274  15 07366 07215
         TU    KONST+14   CNVERT+12   NEXT GROUP                   54114 07275  15 07451 07226
         TP    THIRTY     KONST+12    OF                           54115 07276  11 07506 07447
         TP    29V        KONST+11    30 BLOCKS                    54116 07277  11 07505 07446
         EF               STOP       STOP TAPE                     54117 07300  17 00000 07463
TAPFUL   IJ    MORE       ORIG       TEST-                         54120 07301  41 07454 07133
         TP    34V        MORE        IS WRITE                     54121 07302  11 07507 07454
```

```
                EF              WRITE     TAPE FULL                          54122 07303  17 00000 07465
                RP0   120       L+2       WRITE                              54123 07304  75 00170 07306
                EW1             CONST      **END OF FILE**                   54124 07305  77 10000 07364
                EF              STOP      STOP TAPE                          54125 07306  17 00000 07463
                EF              REWNDW     AND REWIND                        54126 07307  17 00000 07466
                LQ    MORE+2    6         PRINT ON FLEXIWRITER               54127 07310  55 07456 00006
                PR              MORE+2     THE LETTERS **TPFL**,             54130 07311  61 00000 07456
                IJ    MORE+1    L-2        MEANING WRITE                     54131 07312  41 07455 07310
                TP    FIVE      MORE+1    LEAVE WRITE                        54132 07313  11 07502 07455
                TP    SRVMSK    Q          UNISERVO NO                       54133 07314  11 07514 31000
                QT    WRITE     A          IN Q                              54134 07315  51 07465 32000
                LTL   24        Q         STOP AND CHANGE TAPES              54135 07316  22 00030 31000
                MS              L+1       POSN WRITE USRVO NO IN A           54136 07317  56 00000 07320
                SP    Q         12        TEST-Q=0, USE SAME SERVO           54137 07320  31 31000 00014
                ZJ    L+1       ORIG      Q NOT CLEARED                      54140 07321  47 07322 07133
                TP    SRVMSK    Q         RESET WRITE SERVO EFS              54141 07322  11 07514 31000
                QS    A         WRITE      ALSO REWIND EF                    54142 07323  53 32000 07465
                AT    132U      REWNDW    RE-ENTER                           54143 07324  35 07516 07466
                MJ              ORIG      EOF WRITE ROUTINE                  54144 07325  45 00000 07133
END             RP    120       L+2        WRITE   END-OF-FILE               54145 07326  75 00170 07330
                EW1             CONST      ON WRITE TAPE                     54146 07327  77 10000 07364
                EF              STOP      STOP, REWIND                       54147 07330  17 00000 07463
                EF              REWNDR     READ AND WRITE TAPES              54150 07331  17 00000 07462
                EF              REWNDW    TO SERVICE ROUTINE EXIT            54151 07332  17 00000 07466
                MJ              BEGIN+2   RESET AND                          54152 07333  45 00000 53701
JUMP            TP    29V       CONST+1    TRANSFER TO READ IN               54153 07334  11 07505 07365
                MJ              READIN    END OF FILE TEST                   54154 07335  45 00000 07141
TSTEOF          EF              STOP      TAPE FULL                          54155 07336  17 00000 07463
                TU    CNVERT+1  L+1       SET WD ADDR FOR TEST               54156 07337  15 07213 07340
                TP              A         TEST-                              54157 07340  11 00000 32000
                EJ    CONST     L+3        END OF FILE                       54160 07341  43 07364 07344
                EF              WRITE                                        54161 07342  17 00000 07465
                MJ              CNVERT+3  FAIL TEST                          54162 07343  45 00000 07215
                RA    TSTEOF+2  UADV      ADVANCE LOAD ADDRESS               54163 07344  21 07340 07512
                IJ    CONST+3   TSTEOF+2  TEST-WHOLE BLOCK OF 60S            54164 07345  41 07367 07340
                TP    119V      CONST+3   RESET INDEX                        54165 07346  11 07510 07367
                EF              WRITE     WRITE                              54166 07347  17 00000 07465
                RPV   2         L+2        XS3 CODE                          54167 07350  75 10002 07352
```

```
                EW1             EOF         FOR THE WORDS                54170 07351   77 10000 07452
                RP0   118       L+2         **END OF FILE**              54171 07352   75 00166 07354
                EW1             ZERO        ON WRITE TAPE                54172 07353   77 10000 07476
                IJ    CONST+7   L+2       TEST-LAST END OF FILE          54173 07354   41 07373 07356
                MJ              END       TO SERVICE ROUTINE EXIT        54174 07355   45 00000 07326
                RA    CNVERT+3  BLKADV    BUMP BINARY                  54175 07356   21 07215 07517
                RA    CNVERT+12 BLKADV     WORD ADDRESS                54176 07357   21 07226 07517
                MJ              CNVERT+45                              54177 07360   45 00000 07267
NOBLKS                          NOBLKS+1  NO BLOCKS                    54200 07361   00 00000 07362
                EF              WRITE     TO SERVICE ROUTINE           54201 07362   17 00000 07465
                MJ              END        EXIT                        54202 07363   45 00000 07326
CONST           B     606060606060        END OF FILE FILLER           54203 07364   60 60606 06060
                B     000000000035        NO BLOCKS MINUS 1            54204 07365   00 00000 00035
                      CORE        CORE    BUFFER                       54205 07366   00 00010 00010
                B     167                 119 IN BINARY                54206 07367   00 00000 00167
                B     000303030303        XS3 CONVERSION               54207 07370   00 03030 30303
                B     000030303030         CONSTANTS                   54210 07371   00 00303 03030
                B     2                   2                            54211 07372   00 00000 00002
                B                         NO OF FILES MINUS ONE        54212 07373   00 00000 00000
                B     2645                B   F                        54213 07374   00 00000 02645
                B     3047                 I   A                       54214 07375   00 00000 03047
                B     1423                  A   I                      54215 07376   00 00000 01423
                B     1114                   S   L                     54216 07377   00 00000 01114
                B     3430                       U                    54217 07400   00 00000 03430
                B     1224                        R                   54220 07401   00 00000 01224
                B     2004                         E                  54221 07402   00 00000 02004
7MASKS          B     700000000000        7 MASKS TO OBTAIN            54222 07403   70 00000 00000
                B     070000000000         XS3 CHARACTERS              54223 07404   07 00000 00000
                B     007000000000                                    54224 07405   00 70000 00000
                B     000700000000                                    54225 07406   00 07000 00000
                B     000070000000                                    54226 07407   00 00700 00000
                B     000007000000                                    54227 07410   00 00070 00000
                B     000000700000                                    54230 07411   00 00007 00000
                B     000000070000                                    54231 07412   00 00000 70000
                B     000000007000                                    54232 07413   00 00000 07000
                B     000000000700                                    54233 07414   00 00000 00700
                B     000000000070                                    54234 07415   00 00000 00070
                B     000000000007                                    54235 07416   00 00000 00007
```

```
DIGIT   RSRV 12              12
KONST   B    303030303030
        B    030303030303
        B    3
             TPTABL          TPTABL
        B
        B    3
                             OUTPUT
                             OUTPUT+1
                             OUTPUT+2
                             OUTPUT+3
                             OUTPUT+4
        B    35
        B    36
        B    16
             CORE+1          BEGIN+1
EOF     B    013050270151
        B    310131344630
MORE    B    42
        B    5
        B    450401152611
BIASNO  B    020000150000
READ    B    020000200000
MOVBAK  B    020001400001
REWNDR  B    020020000000
STOP    B    020060000000
BIASLO  B    020000160000
WRITE   B    020004600000
REWNDW  B    020020000000
ENDFIL  B
ALPHA   B
BETA    B
GROUPS  B
BLOCKS  B
BIASHL  B
DELTA   B
ZERO    B
ONE     B    1
```

```
XS3 CONVERTED LINE
XS3                                54252 07433  30 30303 03030
 ADDERS                            54253 07434  03 03030 30303
3                                  54254 07435  00 00000 00003
BOSS UNISERVO NUMBER               54255 07436  00 17700 17700
 CONVERSION CONSTANT               54256 07437  00 00000 00000
3                                  54257 07440  00 00000 00003
COVERSION                          54260 07441  00 00000 07030
 ROUTINE                           54261 07442  00 00000 07031
 RESTORE                           54262 07443  00 00000 07032
 LOCATIONS                         54263 07444  00 00000 07033
                                   54264 07445  00 00000 07034
29                                 54265 07446  00 00000 00035
30                                 54266 07447  00 00000 00036
14                                 54267 07450  00 00000 00016
                                   54270 07451  00 00011 53700
END OF FILE                        54271 07452  01 30502 70151
 IN XS3                            54272 07453  31 01313 44630
34                                 54273 07454  00 00000 00042
5                                  54274 07455  00 00000 00005
TPFL IN FLEX CODE                  54275 07456  45 04011 52611
EF NORMAL BIAS                     54276 07457  02 00001 50000
EF PRESET T                        54277 07460  02 00002 00000
EF ONE BLOCK                       54300 07461  02 00014 00001
EF PRESET T                        54301 07462  02 00200 00000
EF STOP                            54302 07463  02 00600 00000
EF LOW BIAS                        54303 07464  02 00001 60000
EF PRESET T                        54304 07465  02 00046 00000
EF PRESET T                        54305 07466  02 00200 00000
END OF FILE INDEX                  54306 07467  00 00000 00000
(U) READ SERV (V) WR SER           54307 07470  00 00000 00000
                                   54310 07471  00 00000 00000
NO OF GRPS OF 30 BLOCKS            54311 07472  00 00000 00000
                                   54312 07473  00 00000 00000
                                   54313 07474  00 00000 00000
                                   54314 07475  00 00000 00000
                                   54315 07476  00 00000 00000
                                   54316 07477  00 00000 00001
```

```
TWO      B     2                    54317 07500   00 00000 00002
THREE    B     3                    54320 07501   00 00000 00003
FIVE     B     5                    54321 07502   00 00000 00005
14V      B     16                   54322 07503   00 00000 00016
17V      B     17                   54323 07504   00 00000 00017
29V      B     35                   54324 07505   00 00000 00035
THIRTY   B     36                   54325 07506   00 00000 00036
34V      B     42                   54326 07507   00 00000 00042
119V     B     167                  54327 07510   00 00000 00167
120V     B     170                  54330 07511   00 00000 00170
UADV     B     100000               54331 07512   00 00001 00000
2U       B     200000               54332 07513   00 00002 00000
SRVMSK   B     170000               54333 07514   00 00001 70000
71U71V   B     7100071              54334 07515   00 00071 00071
132U     B     000013200000         54335 07516   00 00132 00000
BLKADV   B     17000000             54336 07517   00 00170 00000
FAIL     EQLS  1
MFF      EQLS  40036B)
SVCXIT   EQLS  40034B)
SFF      EQLS  17777B)
         SETL  E
TPTABL   EQLS  17700B)
         END
```

NAME: PAPER TAPE PACKAGE

FUNCTION: To read, punch, or duplicate paper tape.

OPERATING INSTRUCTIONS:

1. Clear console
2. Set PAK = 40016
3. To read:
   a. Paper tape in Ferranti, reader ON.
   b. Clear Q
   c. Set A:
      1). Zero for normal DCI.
      2). 00 00000 NNNNN for DCI using cells NNNNN thru NNNNN + 122_8.
4. To punch:
   a. Turn on Punch
   b. Set Q = 00 AAAAA BBBBB
      AAAAA = Address of first word to be punched.
      BBBBB = Number of words to be punched (octal).
   c. Set A as in 3c for DCI selection.
   d. Set MJ1 for no end code.
5. To duplicate:
   a. Paper tape in Ferranti, reader ON.
   b. Punch ON.
   c. Set Q = 1
   d. Set A as in 3c for DCI selection.
6. Depress start button.

PAPER TAPE PACKAGE (cont.)

CODE: 16.

STOPS: PAK = 40000, Success stop.

PAK = 00004, illegal address error.

PAK = 30000, check address error on read.

COMMENTS: The read and punch routines are based on the standard Remington Rand bioctal format with 7th level control configurations. The duplicate routine will duplicate 7 level paper tapes not necessarily in Remington Rand format, but it does recognize any two consecutive seventh level punches as a stop code. All routines except duplicate preserve core.

Addresses 20000 thru 37777 are illegal addresses (this includes A and Q).

Any drum-core image may be specified by entering the location of the first word in the V of A. The specified DCI may be any 1224 (octal) consecutive cells in core or drum.

To restore core after an error, set PAK equal to 54356 and depress start button.

The punch routine gives 100 frames of leader prior to punching the insert address.

To continue reading a tape after a check address error (PAK=30000 set PAK=00010 and start.

```
                SETL  54337B)       54337B)      PAPER TAPE PACKAGE
DCI             EQLS  41770B)
                ZJ    L+1           SAVEF1       TEST-(A) EQ 0,NORMAL DCI          54337  47 54340 54347
                TV    A             SAVEF1        (A) NOT EQUAL TO ZERO,           54340  16 32000 54347
                SA    ONE                         LOCATE DCI (DRUM IMAGE           54341  32 54363 00000
                TV    A             DDCIV         OF CELLS 0 THRU 1224             54342  16 32000 54351
                SP    A             15            (OCTAL)) AS INDICATED            54343  31 32000 00017
                TU    A             DDCIU         BY THE V ADDRESS OF AR.          54344  15 32000 54357
                SP    SAVEF1        15            (F1) ARE SAVED IN DCI+3          54345  31 54347 00017
                TU    A             RESTF1        DCI-DCI+2 ARE NOT USED.          54346  15 32000 54360
SAVEF1          TP    F1            DCI+3        (F1) TO DCI+3                     54347  11 00000 41773
SAVE            RPB   1224B)        L+2           SAVE THE CONTENTS OF             54350  75 31224 54352
DDCIV           TP    1             DCI+4        CELLS 1 THRU 1224 IN DCI          54351  11 00001 41774
                TP    Q             A            SELECT PAPER TAPE ROUTN           54352  11 31000 32000
                EJ    ZERO          PAPERD       READ PAPER TAPE                   54353  43 54362 54364
                EJ    ONE           PPRDUP       DUPLICATE PAPER TAPE              54354  43 54363 54510
                MJ                  PPRPCH       PUNCH PAPER TAPE                  54355  45 00000 54572
RESTOR          RPB   1224B)        L+2           RESTORE CELLS 1 THRU             54356  75 31224 54360
DDCIU           TP    DCI+4         1            1224 FROM THE DCI                 54357  11 41774 00001
RESTF1          TP    DCI+3         F1           RESTORE F1 FROM THE DCI           54360  11 41773 00000
                MJ                  40034B)       EXIT                             54361  45 00000 40034
F1              EQLS
ZERO                                                                              54362  00 00000 00000
ONE             B     1                                                           54363  00 00000 00001
PAPERD          MJ                  L+3          READ PAPER TAPE ROUTINE           54364  45 00000 54367
                MS                  ERROR        CHECK ADDR ERROR STOP             54365  56 00000 30000
                MJ                  RESTOR       NORMAL EXIT                       54366  45 00000 54356
LDPROG          RPB   84            STREAD-1      TRANSFER PAPER TAPE              54367  75 30124 00006
                TP    PAPERD        STREAD-6     READ ROUTINE TO CORE              54370  11 54364 00001
                SETL                6
                TV    SAVEF1        DCIADR       SET DCI LOCATION         54371 00006  16 54347 00124
STREAD          EF                  RDPAPR       READ ONE FRAME           54372 00007  17 00000 00100
1FRAME          ER                  Q             OF PAPER TAPE INTO Q    54373 00010  76 00000 31000
                SP    WRDASS        6            ADD DATA LEVELS TO        54374 00011  31 00101 00006
                QA    DATMSK        WRDASS        WORD ASSEMBLY            54375 00012  52 00102 00101
                SP    7LCODE        1            ADD SEVENTH LEVEL TO      54376 00013  31 00103 00001
                QA    7LMASK        Q             INSTR CODE ASSEMBLY      54377 00014  52 00104 31000
                QT    7LMASK        7LCODE       ISOLATE 6 BIT INSTR CODE  54400 00015  51 00104 00103
```

```
         EJ    INSERT        STADDR
         EJ    DATA          STORE+1
         EJ    CHECK         CKADDR
         QT    ENDCOD        A
         EJ    ENDCOD        STPRDR
         MJ                  1FRAME
STADDR   TV    WRDASS        STORE
         MJ                  1FRAME
CKADDR   RJ    DRUM+3        LOAD-1
         TP    WRDASS        A
         EJ    STORE         1FRAME+1
         RJ    EFSTOP+2      EFSTOP
         MJ                  PAPERD+1
STPRDR   RJ    EFSTOP+2      EFSTOP
         MJ                  PAPERD+2
ADRERR   MS                  4
STORE                        FILL
         SP    STORE
         TJ    LSTBUF        L+2
         MJ                  ILEGAL
         SA    DCIADR
ILEGAL   TJ    20K           CORADR
ADRTST   TJ    40K           ADRERR
SETDRM   TV    DRMSAV        TRNSMT
         TV    A             DRUM
         TU    DRMSAV        LOAD
         TP    RSTDBI        DBINDX
         TP    BYPASS        SETDRM
BUMPRP   RA    LOAD          UADV
         IJ    DBINDX        TRNSMT
         TP    TRNSMT        L+1
         TP    WRDASS        FILL
         RJ    DRUM+3        LOAD-1
         RA    STORE         VADV
         MJ                  1FRAME+1
TRNSMT   TP    WRDASS        FILL
         RA    TRNSMT        VADV
         RA    STORE         VADV
```

```
      TEST              111    54401 00016   43 00105 00024
      7TH               101    54402 00017   43 00106 00037
      LEVEL             105    54403 00020   43 00107 00026
      CODE                     54404 00021   51 00115 32000
   INSTR ASSEMBLY       003    54405 00022   43 00115 00033
TO READ NEXT FRAME             54406 00023   45 00000 00010
 SET INITIAL STORE ADDR        54407 00024   16 00101 00036
AND THEN READ NEXT FRAME       54410 00025   45 00000 00010
INTERROGATE DRUM BUFFER        54411 00026   37 00072 00065
CHECK ADDRESS TO A             54412 00027   11 00101 32000
TEST-CHECK ADDRESS OK          54413 00030   43 00036 00011
 NOT OK, SO GO TO STOP         54414 00031   37 00077 00075
 READER AND ERROR EXIT         54415 00032   45 00000 54365
 END CODE DETECTED,SO          54416 00033   37 00077 00075
STOP READER AND EXIT           54417 00034   45 00000 54366
ILLEGAL ADDR ERROR STOP        54420 00035   56 00000 00004
S EQ UNBIASED STORE ADDR       54421 00036   00 00000 30000
 IF 1225B GTR THN S,THEN       54422 00037   31 00036 00000
STORE DATA WORD CORRES-        54423 00040   42 00112 00042
PONDING TO S IN LOCATION       54424 00041   45 00000 00043
GIVEN BY S + DCI+3             54425 00042   32 00124 00000
TEST-IS 20000B GTR THN S       54426 00043   42 00113 00073
TEST-IS 40000B GTR THN S       54427 00044   42 00114 00035
SET FOR TRNSMT TO DRMBUF       54430 00045   16 00116 00061
SET DRM ADDR F BLK TNSFR       54431 00046   16 32000 00067
SET NR OF REPEATS TO 0         54432 00047   15 00116 00066
SET IND-NR WDS IN DRMBUF       54433 00050   11 00122 00121
BYPASS SETUP BLK TNSFR         54434 00051   11 00117 00045
ADD 1 TO NR OF REPEATS         54435 00052   21 00066 00120
TEST-DRM STOR BUFFR FULL       54436 00053   41 00121 00061
SET STOR CMD FOR LAST WD       54437 00054   11 00061 00055
TRNSMT 608TH WORD              54440 00055   11 00101 30000
TRNSMT 607 WORDS TO DRUM       54441 00056   37 00072 00065
  BUMP UNBIASED STOR ADR       54442 00057   21 00036 00110
GET NEXT WORD                  54443 00060   45 00000 00011
STORE 6 FRAME DATA WORD        54444 00061   11 00101 30000
  BUMP BIASED STOR ADDR        54445 00062   21 00061 00110
  BUMP UNBIASED STOR ADR       54446 00063   21 00036 00110
```

```
                MJ                      1FRAME      GET NEXT WORD                    54447 00064  45 00000 00010
                RJ      EFSTOP+2        EFSTOP      GO TO STOP READER                54450 00065  37 00077 00075
LOAD            RPB                     L+2         TRANSFR DATA WORDS TO            54451 00066  75 30000 00070
DRUM            TP      DRMBUF          FILL         UNBIASED DRUM STOR ADRS         54452 00067  11 00125 30000
                EF                      RDPAPR       START READER AND RESET          54453 00070  17 00000 00100
                TP      RESET           SETDRM      BLK TNSFR ENTRY SO THAT          54454 00071  11 00123 00045
                MJ                      FILL        DRMBUF CAN BE REFILLED           54455 00072  45 00000 30000
CORADR          TV      A               TRNSMT       SET TRNSMT CMD TO STORE         54456 00073  16 32000 00061
                MJ                      TRNSMT      DATA WORD IN CORE                54457 00074  45 00000 00061
EFSTOP          EF                      STOP        STOP PAPER TAPE READER           54460 00075  17 00000 00111
RDIOA           ER                      Q           AND READ IOA                     54461 00076  76 00000 31000
                MJ                      FILL                                         54462 00077  45 00000 30000
ERROR           EQLS    30000B)
DRMBUF          EQLS    125B)                       1ST ADDR OF 576 WD BUFFR
RDPAPR          B       100000200000                READ PAPER TAPE-FREE RUN         54463 00100  10 00002 00000
WRDASS                                              WORD ASSEMBLY                    54464 00101  00 00000 00000
DATMSK          B       000000000077                DATA LEVELS MASK                 54465 00102  00 00000 00077
7LCODE                                              INSTRUCTION CODE                 54466 00103  00 00000 00000
7LMASK          B       000000017700                7TH LEVEL MASK                   54467 00104  00 00000 17700
INSERT          B       000000011100                INSERT ADDRESS CODE              54470 00105  00 00000 11100
DATA            B       000000010100                DATA ADDRESS CODE                54471 00106  00 00000 10100
CHECK           B       000000010500                CHECK ADDRESS CODE               54472 00107  00 00000 10500
VADV            B       1                                                            54473 00110  00 00000 00001
STOP            B       100000100000                PAPER TAPE STOP EF               54474 00111  10 00001 00000
LSTBUF          B       1225                                                         54475 00112  00 00000 01225
20K             B       20000                                                        54476 00113  00 00000 20000
40K             B       40000                                                        54477 00114  00 00000 40000
ENDCOD          B       000000000300                                                 54500 00115  00 00000 00300
DRMSAV                  30000B)         DRMBUF                                       54501 00116  00 30000 00125
BYPASS          MJ                      BUMPRP                                       54502 00117  45 00000 00052
UADV            B15     1                                                            54503 00120  00 00001 00000
DBINDX          B       1077                                                         54504 00121  00 00000 01077
RSTDBI          B       1077                                                         54505 00122  00 00000 01077
RESET           TV      DRMSAV          TRNSMT                                       54506 00123  16 00116 00061
DCIADR                                  FILL        F1 EQ 46553B OR AS SPECI         54507 00124  00 00000 30000
                SETL                    S
PPRDUP          MJ                      L+3         PAPER TAPE DUPLICATE RTN               54510  45 00000 54513
                MS                      MISTAK      DUMMY ERROR EXIT                       54511  56 00000 00004
```

```
                MJ              RESTOR      NORMAL EXIT                                  54512  45 00000 54356
PROGLD          RPB     50      PUNCHA       TRANSFER PAPER TAPE DU                      54513  75 30062 00006
                TP      PPRDUP  PUNCHA-5    PLICATE ROUTINE TO CORE                     54514  11 54510 00001
                SETL            6
PUNCHA          RP      100     L+2          PUNCH 100 FRAMES OF                54515 00006  75 00144 00010
LEADER          PU              STPCTR      LEADER ON DUPLICATE TAPE           54516 00007  63 00000 00060
SETSTR          TV      VBUFR   STOR        PRESET STOR COMD                   54517 00010  16 00062 00013
                EF              RDPPR       START PAPER TAPE READER            54520 00011  17 00000 00052
READ            ER              Q           READ 1 FRAME                       54521 00012  76 00000 31000
STOR            TP      Q       BUFFER      STORE 1 FRAME                      54522 00013  11 31000 00067
                RA      STOR    VADVDP      ADVANCE STORE ADDRESS              54523 00014  21 00013 00053
                QT      7LMSK   A           TEST FOR                           54524 00015  51 00057 32000
                ZJ      L+3     L+1         7TH LEVEL PUNCH                    54525 00016  47 00021 00017
                LTR             STPCTR       CLEAR STOP COUNTER AND            54526 00017  22 10000 00060
                MJ              FRMCTR      GO TO TEST FRAME COUNTER           54527 00020  45 00000 00024
                SP      STPCTR               TEST STOP COUNTER FOR             54530 00021  31 00060 00000
                ZJ      STOPRD  L+1         7TH LEVEL PUNCH IN PRE-            54531 00022  47 00025 00023
                TP      VADVDP  STPCTR      VIOUS FRAME                        54532 00023  11 00053 00060
FRMCTR          IJ      INDEX   READ        TEST-NR OF FRAMES READ             54533 00024  41 00055 00012
STOPRD          EF      BUFFER  TPSTOP      STOP PAPER TAPE READER             54534 00025  17 00067 00061
                ER              Q            AND CLEAR IOA                     54535 00026  76 00000 31000
                TP      RSTIND  INDEX        RESET FRAME COUNT INDEX           54536 00027  11 00056 00055
                RS      STPCTR  STPCTR      AND CLEAR A AND STPCTR             54537 00030  23 00060 00060
                TU      STOPRD  LOADQ       SET LOADQ CMD FOR PUNCH            54540 00031  15 00025 00032
LOADQ           TP      BUFFER  Q           LOAD Q WITH 1 FRAME                54541 00032  11 00067 31000
                RA      LOADQ   UADVDP      ADV LOAD ADDRESS                   54542 00033  21 00032 00054
                QT      7LMSK   A           TEST FOR                           54543 00034  51 00057 32000
                ZJ      L+4     L+1         7TH LEVEL PUNCH                    54544 00035  47 00041 00036
                LTR             STPCTR       NO 7TH LEVEL PUNCH SO             54545 00036  22 10000 00060
                PU              Q           CLEAR STPCTR, PUNCH Q6-            54546 00037  63 00000 31000
                MJ              CTRFRM      Q0 AND TEST FRAME COUNTR           54547 00040  45 00000 00045
                PU1             Q            PUNCH 7TH LEVEL AND Q6            54550 00041  63 10000 31000
                SP      STPCTR              Q0 AND TEST STPCTR FOR 2           54551 00042  31 00060 00000
                ZJ      STOPCH  L+1         CONSECUTIVE 7TH LEVEL              54552 00043  47 00050 00044
                TP      VADVDP  STPCTR      PUNCHES                            54553 00044  11 00053 00060
CTRFRM          IJ      INDEX   LOADQ       TEST-NR OF FRAMES PUNCHD           54554 00045  41 00055 00032
                TP      RSTIND  INDEX        RESET INDEX AND GO TO             54555 00046  11 00056 00055
                MJ              SETSTR      READ MORE PAPER TAPE.              54556 00047  45 00000 00010
```

```
STOPCH  RP    60            PPRDUP+2    MOVE TAPE PAST PUNCH          54557 00050  75 00074 54512
        PU                  READ        HEAD AND EXIT                 54560 00051  63 00000 00012
MISTAK  EQLS  4
BUFFER  EQLS  67B)
RDPPR   B     100000200000                                            54561 00052  10 00002 00000
VADVDP  B     1                                                       54562 00053  00 00000 00001
UADVDP  B15   1                                                       54563 00054  00 00001 00000
INDEX   B     7700          4032 DEC-DIV BY 6 EQ 672                  54564 00055  00 00000 07700
RSTIND  B     7700                                                    54565 00056  00 00000 07700
7LMSK   B     000000000100                                            54566 00057  00 00000 00100
STPCTR                                                                54567 00060  00 00000 00000
TPSTOP  B     100000100000                                            54570 00061  10 00001 00000
VBUFR                       BUFFER                                    54571 00062  00 00000 00067
        SETL                S
PPRPCH  MJ                  L+3         ENTRY-PAPER TAPE PUNCH                54572  45 00000 54575
        MJ                  GOOF        ERROR EXIT                            54573  45 00000 00004
        MJ                  RESTOR      NORMAL EXIT                           54574  45 00000 54356
        RPB   54            SETDCI       TRANSFER PAPER TAPE                  54575  75 30066 00006
        TP    PPRPCH        SETDCI-5    PUNCH ROUTINE TO CORE                 54576  11 54572 00001
        SETL                6
SETDCI  TU    RESTF1        DRCRIM      SET (DRCRIM) EQ DCI+3     54577 00006  15 54360 00063
        TU    Q             ADDR        EXTRACT FIRST WORD ADDR   54600 00007  15 31000 00057
        IJ    Q             L+1         EXTRACT NR WDS TO BE      54601 00010  41 31000 00011
        TV    Q             PCHIND       PUNCHED AND SET INDEX    54602 00011  16 31000 00056
        RPU   101           L+2               PUNCH 100 FRAMES     54603 00012  75 20145 00014
        PU    47634B)       BLANK             OF LEADER AND 1 7L   54604 00013  63 47634 00024
        RPU   3             L+2               PCH FRMS 1 2 3(7L)   54605 00014  75 20003 00016
        PU    47776B)       BLANK             OF INSERT ADDRESS    54606 00015  63 47776 00024
        LQ    ADDR          A+9                                    54607 00016  55 00057 32011
        PU                  Q                 PUNCH FRAME 4        54610 00017  63 00000 31000
        LQ    Q             6                                      54611 00020  55 31000 00006
        PU                  Q                 PUNCH FRAME 5        54612 00021  63 00000 31000
        LQ    Q             6                                      54613 00022  55 31000 00006
        PU1                 Q                 PUNCH FRAME 6   7L   54614 00023  63 10000 31000
TSTADR  SP    ADDR                          ADDR TO U OF AR        54615 00024  31 00057 00000
        TJ    ENDCOR        L+2         20000 GT ADDR-YES-CORE    54616 00025  42 00061 00027
        TJ    BEGDRM        PPRPCH+1    40000 GT ADDR-YES-ILLEGL  54617 00026  42 00062 54573
        TJ    ENDCI         ADBIAS      1225 GT ADDR-YES-ADD DCI  54620 00027  42 00060 00054
```

```
SETADR  TU    A              L+1
        LQ    FILL           Q+6
        TP    RSTFRI         FRMIND
        PU                   Q
        LQ    Q              6
        IJ    FRMIND         L-2
        PU1                  Q
        RA    ADDR           1U
        IJ    PCHIND         TSTADR
        RP    3              L+2
        PU                   BLANK
        LQ    ADDR           Q+9
        PU1                  Q
        LQ    Q              6
        PU                   Q
        LQ    Q              6
        PU1                  Q
        MJ1                  PPRPCH+2
        RPU   8              PPRPCH+2
        PU    47772B)        BLANK
ADBIAS  SA    DRCRIM
        MJ                   SETADR
GOOF    EQLS  4B)
PCHIND                       FILL
BLANK   EQLS  TSTADR
ADDR          FILL
ENDCI         1225B)
ENDCOR        20000B)
BEGDRM        40000B)
DRCRIM        DCI+3
FRMIND  B     4
RSTFRI  B     4
1U            1
        END
```

```
 TRANSFER DATA WORD CO-
RRESPONDING TO ADDR TO
Q AND PRESET FRMIND
       PUNCH FRAMES 1-5
        OF DATA WORD

       PCH FR 6 OF DATAWD
ADV ADDR BY 1
TEST-PUNCHD REQD NR WDS
C      PUNCH 1ST 3
 H     FRAMES OF CHK ADDR
  E
   C   PUNCH FRAME 4 (7L)
A   K
 D     PUNCH FRAME 5
  D
   R   PUNCH FRAME 6 (7L)
OPTION-OMIT STOP CODE
       PUNCH 6 BLANK FRMS
       AND END CODE 2(7L)
ADDR + LOC F1 IN DCI




LST COR ADDR OF DCI + 1
LST LEGAL CORE ADDR + 1
1ST LEGAL DRUM ADDR
/R AS SPEC IN (A) I
```

```
54621 00030  15 32000 00031
54622 00031  55 30000 31006
54623 00032  11 00065 00064
54624 00033  63 00000 31000
54625 00034  55 31000 00006
54626 00035  41 00064 00033
54627 00036  63 10000 31000
54630 00037  21 00057 00066
54631 00040  41 00056 00024
54632 00041  75 00003 00043
54633 00042  63 00000 00024
54634 00043  55 00057 31011
54635 00044  63 10000 31000
54636 00045  55 31000 00006
54637 00046  63 00000 31000
54640 00047  55 31000 00006
54641 00050  63 10000 31000
54642 00051  45 10000 54574
54643 00052  75 20010 54574
54644 00053  63 47772 00024
54645 00054  32 00063 00000
54646 00055  45 00000 00030

54647 00056  00 00000 30000

54650 00057  00 30000 00000
54651 00060  00 01225 00000
54652 00061  00 20000 00000
54653 00062  00 40000 00000
54654 00063  00 41773 00000
54655 00064  00 00000 00004
54656 00065  00 00000 00004
54657 00066  00 00001 00000
```

NAME: PREPARE SERVICE LIBRARY

FUNCTION: Prepare a service library on designated uniservo.

OPERATING INSTRUCTION:

1. Load all required service routines.
2. Set PAK = 40017.
3. Set $Q_3 - Q_0$ = uniservo number of output tape.
4. Depress start button.

CODE: 17.

STOPS: PAK = 40000, Success stop.

COMMENTS: As many libraries may be made as desired by repeating steps 2, 3, and 4.

```
        SETL  52200B)      52200B)     THE PREPARE SERVICE
MAKE    RPB   300          CELL1        LIBRARY ROUTINE WILL          52200  75 30454 00001
        TP    L+1          CELL1        PREPARE A LIBRARY ON          52201  11 52202 00001
        SETL               1            ANY UNISERVO SPECIFIED
        SP    Q            12           IN THE LOW ORDER POSI-  52202 00001  31 31000 00014
        AT    WRITE        WRITE        TION OF THE Q-REGISTER. 52203 00002  35 00160 00160
        AT    REWIND       REWIND                               52204 00003  35 00161 00161
TP      TP    UMASK        Q           THIS SECTION COMPUTES    52205 00004  11 00176 31000
QT      QT    LOAD+2       NN1          THE CHECKSUM OF EACH    52206 00005  51 40060 06000
        ZJ    NONZED       BUMP         ROUTINE TO BE WRITTEN   52207 00006  47 00012 00007
BUMP    RA    QT           FOURU        ON THE LIBRARY. TO DO   52210 00007  21 00005 00206
        IJ    INDEX1       TP           THIS IT USES THE PARA-  52211 00010  41 00166 00004
        MJ                 DRIVER       METER WORDS DESCRIBED   52212 00011  45 00000 00041
NONZED  AT    DUMMY        SUM          IN THE OPERATIONS PACK  52213 00012  35 00172 00035
        SP    NN1                       AGE. AFTER EACH CHECK-  52214 00013  31 06000 00000
        DV    MOST         Q            SUM IS COMPUTED, IT IS  52215 00014  73 00170 31000
        ZJ    L+1          L+2          STORED BACK IN WORD 4   52216 00015  47 00016 00017
        SP    LL1                       OF THE PARAMETER SET.   52217 00016  31 00164 00000
        AT    Q            NN2          TO MAKE THE SELECTIVE   52220 00017  35 31000 06001
        SP    A            30           RESTORE FUNCTION, THIS  52221 00020  31 32000 00036
        AT    NN1          NN1          ROUTINE COMPUTES A MOVE 52222 00021  35 06000 06000
        TV    MV           NN1          COUNT WHICH IS STORED   52223 00022  16 00171 06000
        RA    MV           NN2          IN PARAMETER WORD 3 OF  52224 00023  21 00171 06001
        LQ    QT           A+21         EACH PARAMETER SET.     52225 00024  55 00005 32025
        TV    A            L+1          THIS MOVE COUNT (IN OP  52226 00025  16 32000 00026
        TP    NN1                       OF WORD 3) TELLS THE    52227 00026  11 06000 00000
        SA    LL1                       EXECUTIVE ROUTINE HOW   52230 00027  32 00164 00000
        TV    A            SUM+2        MANY BLOCKS TO MOVE THE 52231 00030  16 32000 00037
        SS    LL2          15           LIBRARY TO POSITION THE 52232 00031  34 00165 00017
        TU    A            L+1          DESIRED ROUTINE FOR     52233 00032  15 32000 00033
        TU                 SUM+1        READING.                52234 00033  15 00000 00036
        RS    A            A            THIS ROUTINE SKIPS ALL  52235 00034  23 32000 32000
SUM     RPU                SUM+2        DRUMSTARTS WHICH HAS    52236 00035  75 20000 00037
        SA                              A WORD 3 OF ZERO. THIS  52237 00036  32 00000 00000
        TP    A                         INDICATES THAT THERE    52240 00037  11 32000 00000
        MJ                 BUMP         ARE ZERO WORDS TO BE    52241 00040  45 00000 00007
DRIVER  EF                 WRITE        CHECKSUMMED.            52242 00041  17 00000 00160
        RPV   120          L+2            THIS ROUTINE WRITES   52243 00042  75 10170 00044
```

```
                EW1             BUFFER      THE DRIVER BLOCK ON THE     52244 00043  77 10000 00210
                EF              STOP        NEW LIBRARY.                52245 00044  17 00000 00162
ENTIRE          RPB   4095      L+2           THIS ROUTINE WRITES       52246 00045  75 37777 00047
                TP    DRUMST    CORE2       THE ENTIRE CONTENTS OF      52247 00046  11 40000 10000
                TP    47777B)   17777B)      DRUMS FOUR (4) AND FIVE     52250 00047  11 47777 17777
                RS    A         A           (5) ON THE LIBRARY          52251 00050  23 32000 32000
                RPU   2048      L+2         TAPE.  THIS IS ACCOMPL      52252 00051  75 24000 00053
SA              SA    CORE2                 ISHED BY BRINGING DRUM      52253 00052  32 10000 00000
                EF              WRITE       FOUR INTO SECOND CORE       52254 00053  17 00000 00160
                EW1             OPS         AND THEN RECORDING TWO      52255 00054  77 10000 00173
                EW1             OPS+1       VARIABLE BLOCKS OF 2048     52256 00055  77 10000 00174
                EW1             A           WORDS EACH. THE PROCESS     52257 00056  77 10000 32000
                LQ    SA        A+21        IS THEN REPEATED FOR        52260 00057  55 00052 32025
                TV    A         L+2         DRUM FIVE.  EACH BLOCK      52261 00060  16 32000 00062
                RPV   2048      L+2         IS PRECEDED BY THREE        52262 00061  75 14000 00063
                EW1             FILL        CONTROL WORDS. THESE        52263 00062  77 10000 30000
                EF              STOP        ARE*                        52264 00063  17 00000 00162
                RA    SA        OPS+1           1 INSERT ADDRESS.       52265 00064  21 00052 00174
                RA    OPS       OPS+1                                   52266 00065  21 00173 00174
                IJ    I2        SA-2            2 NUMBER OF WORDS.      52267 00066  41 00175 00050
DRJ             RJ    L         L+1                                     52270 00067  37 00067 00070
                RA    ENTIRE+1  JOF1            3 CHECKSUM OF THE       52271 00070  21 00046 00204
                RA    ENTIRE+2  JOF1              BLOCK.                52272 00071  21 00047 00204
                TU    ADD+1     SA                                      52273 00072  15 00146 00052
                TP    LL1       I2                                      52274 00073  11 00164 00175
                RJ    DRJ       ENTIRE                                  52275 00074  37 00067 00045
NEXT            RPB   3         L+2         THIS ROUTINE OPERATES ON    52276 00075  75 30003 00077
P               TP    LOAD+1    Z           EACH SERVICE ROUTINE IN     52277 00076  11 40057 06002
                TU    C2500     BUMP4-3     TURN.  EACH ONE IS          52300 00077  15 00163 00123
                TP    Z         A           WRITTEN ON THE LIBRARY      52301 00100  11 06002 32000
                ZJ    L+1       BUMP4       TAPE IN A SEQUENCE OF       52302 00101  47 00102 00126
                TU    A         FETCH+1     500 WORD BLOCKS (VAR-       52303 00102  15 32000 00107
                TP    Z+1       Q           IABLE BLOCK MODE). THIS     52304 00103  11 06003 31000
                QT    UMASK     NN1         PERMITS CORE TO BE PRE      52305 00104  51 00176 06000
                AT    D1        FETCH       SERVED DURING A SELEC-      52306 00105  35 00177 00106
FETCH           RPB             L+2         TIVE RESTORE, SINCE         52307 00106  75 30000 00110
                TP    FILL      CORE2       THERE IS A 500 WORD         52310 00107  11 30000 10000
SP              SP    NN1                   BUFFER AVAILABLE IN THE     52311 00110  31 06000 00000
```

```
         TJ    501U          TST       DRUM-CORE IMAGE ON          52312 00111   42 00202 00136
         ST    500U          NN1       DRUM.                       52313 00112   36 00201 06000
         RA    Z+1           H           AS MENTIONED ABOVE,       52314 00113   21 06003 00205
         SP    500U                    EACH BLOCK IS PRECEDED      52315 00114   31 00201 00000
         TU    A             Z+1       BY THREE CONTROL WORDS      52316 00115   15 32000 06003
         RJ    EX            1BLOCK    WHICH INSTRUCT THE EXE      52317 00116   37 00156 00141
         RS    Z+1           H         CUTIVE ROUTINE HOW TO       52320 00117   23 06003 00205
         RA    Z             500U      LOAD THE SERVICE ROUT-      52321 00120   21 06002 00201
         TU    NN1           Z+1       INE.  IF THE SECOND         52322 00121   15 06000 06003
         RPB   500           L+2       CONTROL WORD IS NEGA-       52323 00122   75 30764 00124
         TP    CORE2+500     CORE2     TIVE, THIS INDICATES        52324 00123   11 10764 10000
         RA    L-1           500U      THERE IS AT LEAST ONE       52325 00124   21 00123 00201
         MJ                  SP        MORE BLOCK TO BE LOADED     52326 00125   45 00000 00110
BUMP4    RA    P             FOURU     BEFORE THE ROUTINE IN       52327 00126   21 00076 00206
         IJ    INDEX2        NEXT      QUESTION IS COMPLETELY      52330 00127   41 00167 00075
         EF                  WRITE     LOADED.  TO AVOID POSS      52331 00130   17 00000 00160
         RP    120           L+2       IBLE TAPE TROUBLE, NO       52332 00131   75 00170 00133
         EW1                 EOF       BLOCKS SMALLER THAN 20      52333 00132   77 10000 00207
         EF                  STOP      WORDS ARE WRITTEN.          52334 00133   17 00000 00162
         EF                  REWIND    ALTHOUGH ALL 20 WORDS       52335 00134   17 00000 00161
         MJ                  40034)B   ARE CHECKSUMMED FOR THE     52336 00135   45 00000 40034
TST      TJ    20U           L+2       READ TEST, ONLY THE         52337 00136   42 00203 00140
         MJ                  1BLOCK    EXACT NUMBER OF WORDS       52340 00137   45 00000 00141
         SP    20U                     THAT BELONG TO THE          52341 00140   31 00203 00000
1BLOCK   AT    D2            OUT       SERVICE ROUTINE ARE         52342 00141   35 00200 00153
         SA    JOF1                    TRANSFERRED TO DRUM.        52343 00142   32 00204 00000
         TU    A             ADD        WHEN ALL SERVICE         52344 00143   15 32000 00145
         RS    A             A         ROUTINES HAVE BEEN          52345 00144   23 32000 32000
ADD      RPU                 ADD+2     WRITTEN ON THE TAPE,        52346 00145   75 20000 00147
         SA    CORE2                   A BLOCK (120 WORDS) OF      52347 00146   32 10000 00000
         EF                  WRITE     PRINTER STOPS (60 IN        52350 00147   17 00000 00160
         EW1                 Z         XS3) IS WRITTEN ON THE      52351 00150   77 10000 06002
         EW1                 Z+1       TAPE. IT IS THEN RE-        52352 00151   77 10000 06003
         EW1                 A         WOUND AND THE SUCCESS       52353 00152   77 10000 32000
OUT      RPV                 OUT+2     STOP IS AN MSO WITH         52354 00153   75 10000 00155
         EW1                 CORE2     PAK EQUAL TO 40000.         52355 00154   77 10000 10000
         EF                  STOP                                  52356 00155   17 00000 00162
EX       RJ    L             L+1     SINCE SPACE LIMITATIONS       52357 00156   37 00156 00157
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         MJ                  BUMP4       REQUIRE THAT THE AUTO-      52360 00157  45 00000 00126
WRITE    B     020006600000              MONITOR (BOSS) OCCUPY       52361 00160  02 00066 00000
REWIND   B     000011200000              DCI (DRUM-CORE IMAGE),      52362 00161  00 00112 00000
STOP     B     020060000000              THE PREPARE LIBRARY         52363 00162  02 00600 00000
C2500          CORE2+500                 ROUTINE IS NOT CHECK-       52364 00163  00 10764 00000
LL1                        1             SUMMED BY THE EXECUTIVE     52365 00164  00 00000 00001
LL2                        2             ROUTINE. THEREFORE, TO      52366 00165  00 00000 00002
INDEX1                     25            PREPARE A NEW LIBRARY,      52367 00166  00 00000 00031
INDEX2                     25            THE CURRENT LIBRARY         52370 00167  00 00000 00031
MOST           500                       SHOULD BE READ INTO         52371 00170  00 00764 00000
MV                         4             MEMORY, ANY CHANGES         52372 00171  00 00000 00004
DUMMY    RPU               SUM+2         KEYED IN, THEN THE          52373 00172  75 20000 00037
OPS            DRUMST      DRUMST        40017 DRUMSTART USED.       52374 00173  00 40000 40000
               2048                      IF CHANGES ARE READ IN      52375 00174  00 04000 00000
I2                         1             BY USING OCTAL CARDS        52376 00175  00 00000 00001
UMASK    B15   77777                     (40020) OR SLAP TAPES       52377 00176  00 77777 00000
D1       RPB               FETCH+2       (40011), BOSS MUST BE       52400 00177  75 30000 00110
D2       RPV               OUT+2         RESTORED BEFORE USING       52401 00200  75 10000 00155
500U           500                       THE 40017 DRUMSTART. IF     52402 00201  00 00764 00000
501U           501                       BOSS IS NOT DESIRED,        52403 00202  00 00765 00000
20U            20                        THIS PRECAUTION NEED        52404 00203  00 00024 00000
JOF1     B     001000000000              NOT BE TAKEN.               52405 00204  00 10000 00000
H        B33   4                                                     52406 00205  40 00000 00000
FOURU          4                                                     52407 00206  00 00004 00000
EOF      B     606060606060            THE REST OF THE CODING        52410 00207  60 60606 06060
ZERO     MJ                  CELL1      THAT FOLLOWS IS THE         52411 00210  45 00000 00001
         SETL                1          DRIVER BLOCK THAT IS
         TP    Q             TEMP       WRITTEN AT THE BEGIN-       52412 00001  11 31000 00143
         ZJ    L+1           ALL        NING OF EACH NEW LIB-       52413 00002  47 00003 00065
         SS    L2                       RARY.  IT IS COMPLETELY     52414 00003  34 00117 00000
         MP    A             L4         SELF-CONTAINED AND          52415 00004  71 32000 00121
         SA    K2            15         MAKES ALL TESTS TO DE-      52416 00005  32 00134 00017
         TU    A             L+1        CIDE WHETHER A NORMAL       52417 00006  15 32000 00007
         TP                  Q          OR SELECTIVE RESTORE        52420 00007  11 00000 31000
         QT    VMASK         A          IS REQUIRED.  THE SEL-      52421 00010  51 00122 32000
         AT    EFMOVE        EFMOVE     ECTIVE RESTORE, HOW-        52422 00011  35 00125 00125
XX       SP    TEMP          12         EVER, ASSUMES THAT THE      52423 00012  31 00143 00014
         ZJ    L+2           L+1        OPERATIONS PACKAGE IS       52424 00013  47 00015 00014
```

```
                SP    L1          12          INTACT ON THE 4 DRUM.      52425 00014  31 00116 00014
                TP    MASKMT      Q           THIS IS NECESSARY, OF      52426 00015  11 00124 31000
                RPV   4           L+2         COURSE, BECAUSE THE        52427 00016  75 10004 00020
                QS    A           EFMOVE      MOVE COUNT IS STORED IN    52430 00017  53 32000 00125
                EF                EFMOVE      THE PARAMETER SETS         52431 00020  17 00000 00125
SET             TP    L2          TWO         STORED THERE.  THE NOR     52432 00021  11 00117 00142
                EF                NORMAL      MAL RESTORE MAKES NO       52433 00022  17 00000 00132
                TV    1           ER1         SUCH ASSUMPTION.  IT       52434 00023  16 00001 00032
                EF                READ        MERELY RESTORES THE        52435 00024  17 00000 00126
IOA             ER                A           ENTIRE FOUR AND FIVE       52436 00025  76 00000 32000
                EJ    L1          PARITY      DRUMS, MAKING NO ATT-      52437 00026  43 00116 00103
                EJ    L2          ENDBLK      EMPT TO PRESERVE CORE.     52440 00027  43 00117 00035
                EJ    L3          MOD6                                   52441 00030  43 00120 00114
                EJ    L4          ENDBLK+1    ALL READING IS DONE IN     52442 00031  43 00121 00036
ER1             ER1               TEMP        THE VARIABLE BLOCK         52443 00032  76 10000 00143
                RA    L-1         L1          MODE.  IN CASE OF A PAR    52444 00033  21 00032 00116
                MJ                IOA         ITY ERROR, THE BLOCK IN    52445 00034  45 00000 00025
ENDBLK          EF                HALT        WHICH THE ERROR OCCUR-     52446 00035  17 00000 00131
SJ              RJ    L           L+1         ED IS COMPLETELY READ      52447 00036  37 00036 00037
                LQ    TEMP        A+21        BEFORE THE TAPE IS         52450 00037  55 00143 32025
                TV    Q           TODRUM+1    BACKSPACED FOR REREAD-     52451 00040  16 31000 00060
                TP    TEMP+1      Q           ING.  THIS IS A NECESS-    52452 00041  11 00144 31000
                QT    MASKU       TEMP        ARY PRECAUTION SINCE       52453 00042  51 00123 00143
                AT    RPT         TODRUM      THE COMBINATION OF AN      52454 00043  35 00135 00057
                SP    TEMP                    END OF BLOCK GAP AND       52455 00044  31 00143 00000
                TJ    C20U        L+2         A LINE COUNT OF THREE      52456 00045  42 00137 00047
                MJ                ATA         GIVES A FALSE BAD SPOT     52457 00046  45 00000 00050
                SP    C20U                    INDICATION.  ONCE THE      52460 00047  31 00137 00000
ATA             AT    ADDER       TOTAL       TAPE IS BACKSPACED, IT     52461 00050  35 00136 00052
                RS    A           A           IS REREAD WITH HIGH        52462 00051  23 32000 32000
TOTAL           RPU               L+2         BIAS.  IF THE PARITY       52463 00052  75 20000 00054
                SA    TEMP+3                  CONTINUES TO FAIL, BIAS    52464 00053  32 00146 00000
                TP    A           A           IS CHANGED TO LOW, THEN    52465 00054  11 32000 32000
                EJ    TEMP+2      L+2         NORMAL, THEN HIGH AGAIN    52466 00055  43 00145 00057
                MS                2           AND SO ON INDEFINITELY.    52467 00056  56 00000 00002
TODRUM          RPB               L+2         A MOD6 ERROR IS HANDLED    52470 00057  75 30000 00061
                TP    TEMP+3      FILL        EXACTLY THE SAME AS A      52471 00060  11 00146 30000
SS              RJ    L           L+1         PARITY ERROR, EXCEPT       52472 00061  37 00061 00062
```

```
                QJ    SET             L+1             THAT READING THE REST       52473 00062   44 00021 00063
                EF                    REWND           OF THE BLOCK IS UNNEC-      52474 00063   17 00000 00130
                MJ                    RESTOR          ESSARY SINCE A MOD6         52475 00064   45 00000 40046
ALL             TV    K3              CELL1           ERROR CAN ONLY OCCUR AT     52476 00065   16 00140 00001
                TU    K3              TODRUM+1        THE END OF A BLOCK. AN      52477 00066   15 00140 00060
                TU    K3              TOTAL+1         END OF TAPE SIGNAL IS       52500 00067   15 00140 00053
                TP    L2              ONE             TREATED THE SAME AS AN      52501 00070   11 00117 00141
                RJ    SJ              XX              END OF BLOCK SIGNAL,        52502 00071   37 00036 00012
V               RPB   3               L+2             EXCEPT THAT THE STOP        52503 00072   75 30003 00074
                TP    CORE2           TEMP            TAPE EF IS SKIPPED.         52504 00073   11 10000 00143
DU              RJ    L               L+1                                         52505 00074   37 00074 00075
                RJ    SS              SJ+1            AS MENTIONED BEFORE,        52506 00075   37 00061 00037
                RJ    SJ              SET             EACH BLOCK ON THE TAPE      52507 00076   37 00036 00021
                RJ    DU              V               HAS ITS OWN CHECKSUM.       52510 00077   37 00074 00072
                RJ    SS              SJ+1            AFTER EACH BLOCK IS         52511 00100   37 00061 00037
                IJ    ONE             L-3             READ INTO CORE, ITS SUM     52512 00101   41 00141 00076
                MJ                    SS+2            IS RECOMPUTED AND COM-      52513 00102   45 00000 00063
PARITY          ER1                   A               PARED TO THE SUM ON         52514 00103   76 10000 32000
                EF                    HALT            TAPE. IF THEY COMPARE,      52515 00104   17 00000 00131
                IJ    TWO             L+2             THE CORE TO DRUM TRANS      52516 00105   41 00142 00107
                TP    L2              TWO             FER TAKES PLACE. IF THE     52517 00106   11 00117 00142
                LA    A               12              TWO SUMS DO NOT COMPARE     52520 00107   54 32000 00014
                AT    EFL             TEMP            THE ROUTINE COMES TO AN     52521 00110   35 00133 00143
                EF                    TEMP            MSO STOP WITH PAK EQUAL     52522 00111   17 00000 00143
                EF                    BACK            TO 00002.  THE ONLY         52523 00112   17 00000 00127
                MJ                    IOA-2           RECOVERY IS TO REWIND       52524 00113   45 00000 00023
MOD6            EF                    HALT            THE TAPE AND ATTEMPT A      52525 00114   17 00000 00131
                MJ                    PARITY+2        REREADING.                  52526 00115   45 00000 00105
L1                                    1                                           52527 00116   00 00000 00001
L2                                    2               THE NORMAL EXIT OF THIS     52530 00117   00 00000 00002
L3                                    3               ROUTINE IS THROUGH THE      52531 00120   00 00000 00003
L4                                    4               RESTORE ROUTINE IN THE      52532 00121   00 00000 00004
VMASK           B     77777                           OPERATIONS PACKAGE.         52533 00122   00 00000 77777
MASKU           B15   77777                           THIS ACCOMPLISHES NOTH      52534 00123   00 77777 00000
MASKMT          B12   17                              ING IF AN ABNORMAL DRUM     52535 00124   00 00001 70000
EFMOVE          B     020006400000                    COLD START IS USED.         52536 00125   02 00064 00000
READ            B     020006200000                    HOWEVER, IF THE NORMAL      52537 00126   02 00062 00000
BACK            B     020007400001                    DRUM 40000 START IS         52540 00127   02 00074 00001
```

```
REWND   B     020020000000
HALT    B     020060000000
NORMAL  B     020000150000
EFL     B     020000160000
K2                         LOAD+2
RPT     RPB                TODRUM+2
ADDER   RPU                TOTAL+2
C20U          20
K3            CORE2+3      CORE2
ONE     RSRV               1
TWO     RSRV               1
TEMP    RSRV               400
        SETL  06000)B      06000)B
NN1     RSRV               1
NN2     RSRV               1
Z       RSRV               3
CORE2   EQLS  10000)B
DCI     EQLS  41770B)
BUFFER  EQLS  EOF+1
CELL1   EQLS  1
CELL0   EQLS
LOAD    EQLS  40056B)
DRUMST  EQLS  40000B)
RESTOR  EQLS  40046B)
        END
```

USED, A,Q, F1, AND THE FIRST 660 CELLS OF CORE ARE SAVED IN THE DRUM-CORE IMAGE. THEREFORE, EXITING THRU THE RESTORE ROUTINE IN EFF ECT RESTORES CORE. THIS IS HOW THE SELECTIVE RESTORE ACCOMPLISHES PRESERVING CORE.

IN ORDER FOR THIS ROUTINE TO TAKE CONTROL IT IS ONLY NECESSARY TO READ 120 WORDS INTO CONSECUTIVE CELLS STARTING AT CELL ZERO-THEN TRANSFER CONTROL TO CELL ZERO. THE Q-REGISTER SHOULD CONTAIN THE NUMBER OF THE DES-IRED UNISERVO BEFORE CONTROL IS TRANSFERRED TO CELL ZERO.

```
52541 00130  02 00200 00000
52542 00131  02 00600 00000
52543 00132  02 00001 50000
52544 00133  02 00001 60000
52545 00134  00 00000 40060
52546 00135  75 30000 00061
52547 00136  75 20000 00054
52550 00137  00 00024 00000
52551 00140  00 10003 10000
```

NAME: FOUR FIELD OCTAL CARD LOADER.

FUNCTION: To load information into memory as specified on octal cards (format described below).

OPERATING INSTRUCTIONS:

1. Clear Console.
2. Set PAK = 40020.
3. Put cards in read hopper, cycle 1 card.
4. Depress start button.

CODE: 20.

STOPS: PAK = 40000, Success stop.

COMMENTS: The card format is as follows:

Columns	1-5	Location of Word 1
	6-17	Word 1
	18-22	Location of Word 2
	23-34	Word 2
	35-39	Location of Word 3
	40-51	Word 3
	52-56	Location of Word 4
	57-68	Word 4

Loading is terminated by a 12(+) punch in column 80 of the last card to be read. A location of 00000 is ignored. Blank columns are read as zeros. Core is preserved. Cards can be read under program control as follows:

1. Cards positioned in read hopper.
2. RJ 40034 40020.

```
         SETL  41530B)      41530B)
         RPB   127          L+2
         TP    1            DCI+1
         RPB   127          START
         TP    L+1          1
         SETL               1
START    EF                 RDCARD
         RPV   4            L+2
         TV    QV           C1
         RPV   6            L+2
         TP    L0           T
         TP    L12          X4
         TU    QV           SAD
READ     ER                 T+6
         ER1                T+7
         ER1                T+8
         TU    TRES         TAG+2
         TU    TRES         TAG+5
         TP    T+7          T+6
SAD      TP    L9           T+9
         RJ    TAGE         TAG
         TP    T+8          T+6
         RJ    TAGE         TAG
         RA    SAD          B15
         IJ    X4           READ
CONV     SP    T            15
         TP    A            Q
         LT                 A
         ZJ    L+1          R
         TJ    200BB        L+2
         MJ                 L+2
         SA    DCIADD
         TV    A            C1
R        SP    Q            21
         SA    T+1          15
         LT                 T+10
         SP    A            15
         TP    A            Q
```

THIS ROUTINE ACCEPTS

OCTAL CARDS PUNCHED IN

THE FOLLOWING FORMAT

COLS 1-5 ADDRESS OF WORD

COLS 6-17 WORD

COLS 18-22 ADDRESS OF WD

COLS 23-34 WORD

COLS 35-39 ADDRESS OF WD

COLS 40-51 WORD

COLS 52-56 ADDRESS OF WD

COLS 57-68 WORD

ADDRESSES MAY BE EITHER

DRUM OR CORE EXCEPT

41770 TO 43770 INCL.

WORDS HAVING A BLANK OR

ZERO ADDRESS WILL BE

IGNORED

A 12 PUNCH IN COL 80

INDICATES THE LAST CARD

```
41530  75 30177 41532
41531  11 00001 41771
41532  75 30177 00001
41533  11 41534 00001
41534 00001  17 00000 00154
41535 00002  75 10004 00004
41536 00003  16 00153 00105
41537 00004  75 10006 00006
41540 00005  11 00146 00157
41541 00006  11 00152 00175
41542 00007  15 00153 00016
41543 00010  76 00000 00165
41544 00011  76 10000 00166
41545 00012  76 10000 00167
41546 00013  15 00155 00122
41547 00014  15 00155 00125
41550 00015  11 00166 00165
41551 00016  11 00136 00170
41552 00017  37 00133 00120
41553 00020  11 00167 00165
41554 00021  37 00133 00120
41555 00022  21 00016 00156
41556 00023  41 00175 00010
41557 00024  31 00157 00017
41560 00025  11 32000 31000
41561 00026  22 00000 32000
41562 00027  47 00030 00034
41563 00030  42 00150 00032
41564 00031  45 00000 00033
41565 00032  32 00151 00000
41566 00033  16 32000 00105
41567 00034  31 31000 00025
41570 00035  32 00160 00017
41571 00036  22 00000 00171
41572 00037  31 32000 00017
41573 00040  11 32000 31000
```

```
        LT              A
        ZJ      L+1     R1
        TJ      200BB   L+2
        MJ              L+2
        SA      DCIADD
        TV      A       C2
R1      SP      Q       6
        SA      T+2     30
        LT              T+11
        SP      A       6
        SA      T+3     9
        TP      A       Q
        LT              A
        ZJ      L+1     R2
        TJ      200BB   L+2
        MJ              L+2
        SA      DCIADD
        TV      A       C3
R2      SP      Q       27
        SA      T+4     9
        LT              T+12
        SP      A       15
        TP      A       Q
        LT              A
        ZJ      L+1     R3
        TJ      200BB   L+2
        MJ              L+2
        SA      DCIADD
        TV      A       C4
        SP      Q       12
        SA      T+5     24
        LT              T+13
R3      ER              A
        ER1             Q
        ER1             Q
        ZJ      STOP    AGIN
C1      TP      T+10    Q
C2      TP      T+11    Q
```

OF THE DECK TO BE LOADED
AFTER THE LAST CARD IS
LOADED CONTROL IS SENT
TO 40034 WHICH CONTAINS
A RJ L L+1 40035 CON-
TAINS A MSO 40000
EXCEPT FOR COL 80 ALL
ZONE PUNCHES AND COLS
69-79 WILL BE IGNORED
THIS ROUTINE FIRST
STORES CORE STORAGES
00001-00177 INCLUSIVE
INTO THE DCI (DRUM CORE
IMAGE) BUFFER LOCATED
AT 41771-43770 INCL.
THEN BOOTSTRAPS ITSELF
INTO CORE STORAGE
00001-00170 FOR EXEC-
UTION. ALL WORDS TO

```
41574 00041   22 00000 32000
41575 00042   47 00043 00047
41576 00043   42 00150 00045
41577 00044   45 00000 00046
41600 00045   32 00151 00000
41601 00046   16 32000 00106
41602 00047   31 31000 00006
41603 00050   32 00161 00036
41604 00051   22 00000 00172
41605 00052   31 32000 00006
41606 00053   32 00162 00011
41607 00054   11 32000 31000
41610 00055   22 00000 32000
41611 00056   47 00057 00063
41612 00057   42 00150 00061
41613 00060   45 00000 00062
41614 00061   32 00151 00000
41615 00062   16 32000 00107
41616 00063   31 31000 00033
41617 00064   32 00163 00011
41620 00065   22 00000 00173
41621 00066   31 32000 00017
41622 00067   11 32000 31000
41623 00070   22 00000 32000
41624 00071   47 00072 00101
41625 00072   42 00150 00074
41626 00073   45 00000 00075
41627 00074   32 00151 00000
41630 00075   16 32000 00110
41631 00076   31 31000 00014
41632 00077   32 00164 00030
41633 00100   22 00000 00174
41634 00101   76 00000 32000
41635 00102   76 10000 31000
41636 00103   76 10000 31000
41637 00104   47 00115 00112
41640 00105   11 00171 31000
41641 00106   11 00172 31000
```

```
C3      TP    T+12            Q
C4      TP    T+13            Q
C5      MJ
AGIN    EF                    RDCARD
        RJ    C5              C1
        MJ                    START+1
STOP    RJ    C5              C1
        RPB   127             40034B)
        TP    DCI+1           1
TAG     TP    L2              X2
        TP    L13             X3
        LQ    T               3
        TP    T+6             Q
        QJ    L+1             L+2
        RA    T               T+9
        TP    Q               T+6
        IJ    X3              TAG+2
        RA    TAG+2           B15
        RA    TAG+5           B15
        IJ    X2              TAG+1
TAGE    MJ
L13     B     13
L9      B
L8      B
L7      B     7
L6      B     6
L5      B     5
L4      B     4
L3      B     3
L2      B     2
L1      B     1
L0      B
LX      B
200BB   B     200
DCIADD                        DCI
L12     B     12
QV            L9              Q
RDCARD  B     400000000005
```

BE STORED WITHIN THESE LIMITS WILL BE TEMP- ORARILY STORED IN THE DCI BUFFER WHEN LOADING HAS TERMINATED THE DCI BUFFER IS SENT TO CORE ALL CONVERSION AND SET- UP OF STORE INSTRUCTIONS IS COMPLETED BEFORE ROW TWELVE HAS BEEN READ IF THE CARD READ DOES NOT CONTAIN A Y (TWELVE) PUNCH IN COL.80 A PICK AND READ EF CODE (40000 000005) IS GIVEN IMMED- IATELY AFTER ROW 12 HAS BEEN READ HENCE FULL CARD READ SPEED IS ATT- AINED DESPITE 4 POSS-

```
41642 00107  11 00173 31000
41643 00110  11 00174 31000
41644 00111  45 00000 00000
41645 00112  17 00000 00154
41646 00113  37 00111 00105
41647 00114  45 00000 00002
41650 00115  37 00111 00105
41651 00116  75 30177 40034
41652 00117  11 41771 00001
41653 00120  11 00144 00176
41654 00121  11 00134 00177
41655 00122  55 00157 00003
41656 00123  11 00165 31000
41657 00124  44 00125 00126
41660 00125  21 00157 00170
41661 00126  11 31000 00165
41662 00127  41 00177 00122
41663 00130  21 00122 00156
41664 00131  21 00125 00156
41665 00132  41 00176 00121
41666 00133  45 00000 00000
41667 00134  00 00000 00013
41670 00135  00 00000 00000
41671 00136  00 00000 00000
41672 00137  00 00000 00007
41673 00140  00 00000 00006
41674 00141  00 00000 00005
41675 00142  00 00000 00004
41676 00143  00 00000 00003
41677 00144  00 00000 00002
41700 00145  00 00000 00001
41701 00146  00 00000 00000
41702 00147  00 00000 00000
41703 00150  00 00000 00200
41704 00151  00 00000 41770
41705 00152  00 00000 00012
41706 00153  00 00135 31000
41707 00154  40 00000 00005
```

```
TRES        T                          IBLE DRUM STORES. THIS      41710 00155  00 00157 00000
B15     B15 1                                                      41711 00156  00 00001 00000
T       RSRV                14         ROUTINES READS THREE
        SETL E
DCI     EQLS 41770B)                   FIELDS (ALL 80 COLUMNS).
                             UNDEFINED  TAGS            X4                175  00 00000 00000
                                                        X2                176  00 00000 00000
                                                        X3                177  00 00000 00000

        END
```

NAME: RELATIVIZER

FUNCTION: To convert a SLAP output (symbolic) tape into a relativized SLAP symbolic output tape.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40021.
3. Set Q = 00 000AA 000BB

   where AA = input tape

   BB = output tape.
4. Set A_r = XS3 representation of exceptional tag.
5. Depress start button.

CODE: 21.

STOPS: PAK = 40000, Success stop.

COMMENTS: All of core is used by this routine. For general restrictions see comments of coding.

```
        SETL  1           1
BUFF    RSRV  20          20
BUFFER  RSRV  3720        3720
        SETL  53011B)     53011B)
        RPB   360)B       Z
        TP    L+1         Z
        SETL              7414)B
Z       TP    A           TBL+4
        TP    Q           TAGS
        LQ    Q           A+12
        TP    L(170000B)  Q
        QS    A           GOWRT
        QS    A           RWND4
        LA    TAGS        69
        RPV   3           L+2
        QS    A           GORD
READ    TP    DMMY1       SWITCH
        TP    L(0)        TAGS
        MJ0               START
        TN    L(1)        BLOCKS
        EF                BIAS
        EF                GORD
        MP    BLOCKS      L(120)
        AT    SETUP       STORE
        TP    L(0)-       LOC+8
        TP    L(5)        BKCTR
        ER1               BUFF
        SP    BUFF        18
        ER1               BUFF+1
        LQ    BUFF+1      Q+18
        SA    Q
        EJ    SPACES      SWITCH+5
SWITCH  RJ    L           FILL
        SP    SPACES
        LT0   18          BUFF
        TP    A           BUFF+1
        RA    LOC+8       L(1)
        ER1               BUFF+2
```

THIS PROGRAM CONVERTS A SLAP (SYMBOLIC) OUTPUT TAPE INTO A RELATIVIZED SLAP SYMBOLIC OUTPUT TAPE. A PASS OF THIS TAPE THROUGH THE TAPE TO CARD CONVERTER WITH OFFSET PUNCHING WILL PRODUCE A DETAGGED PROGRAM DECK.

ALL TAGS IN THE TAG FIELD, EXCEPT THE FIRST ONE ENCOUNTERED, ARE RESET TO BLANKS. TAGS IN THE U AND V FIELD ARE RELATIVIZED, THAT IS CHANGED TO THE FORM L+N OR L-N, WHERE N IS A DECIMAL INTEGER.

HOWEVER, THE FOLLOWING TAGS (OR WORDS) ARE NOT RELATIVIZED, DECIMAL NUMBERS, OCTAL NUMBERS, L(N) NUMBERS, A, Q, L+N OR L-N AND FILL.

IN ADDITION THE PROGRAM MER IS ALLOWED A CHOICE OF ONE UNDEFINED SYMBOL. THIS SYMBOL IS PLACED IN XS3 IN THE LOW ORDER OF THE ACC- UMULATOR BEFORE HITTING

```
                53011  75 30360 07414
                53012  11 53013 07414
53013 07414     11 32000 07652
53014 07415     11 31000 07771
53015 07416     55 31000 32014
53016 07417     11 07757 31000
53017 07420     53 32000 07612
53020 07421     53 32000 07613
53021 07422     54 07771 00105
53022 07423     75 10003 07425
53023 07424     53 32000 07607
53024 07425     11 07514 07445
53025 07426     11 07760 07771
53026 07427     45 00000 07501
53027 07430     13 07761 07772
53030 07431     17 00000 07574
53031 07432     17 00000 07607
53032 07433     71 07772 07762
53033 07434     35 07515 07462
53034 07435     11 07760 07744
53035 07436     11 07763 07773
53036 07437     76 10000 00001
53037 07440     31 00001 00022
53040 07441     76 10000 00002
53041 07442     55 00002 31022
53042 07443     32 31000 00000
53043 07444     43 07603 07452
53044 07445     37 07445 30000
53045 07446     31 07603 00000
53046 07447     22 00022 00001
53047 07450     11 32000 00002
53050 07451     21 07744 07761
53051 07452     76 10000 00003
```

```
        SP    BUFF+2        18          THE START BUTTON. FOR       53052 07453  31 00003 00022
        LT0                 A           EXAMPLE,IF A SUBROUTINE     53053 07454  22 00000 32000
        EJ    TSTWD         LAST        IS TO BE RELATIVIZED,       53054 07455  43 07606 07564
        RP1   17            STORE+1     AND THE TAG -TEMPS-         53055 07456  75 10021 07463
        ER1                 BUFF+3      IS TO BE USED FOR A         53056 07457  76 10000 00004
        RA    STORE         L(20)       TEMPORARY POOL,SETTING      53057 07460  21 07462 07764
        RP3   20            READ+10      006630475265 INTO Q        53060 07461  75 30024 07437
STORE   TP    FILL          FILL        WILL CAUSE THIS TAG TO      53061 07462  11 30000 30000
        IJ    BKCTR         STORE-2     BE UNRELATIVIZED WHEN       53062 07463  41 07773 07460
        ER0                 A           IT APPEARS IN THE U OR      53063 07464  76 00000 32000
        ZJ    L+1           L+8         V FIELDS.(HOWEVER,IT        53064 07465  47 07466 07475
        EF                  BACK        WILL NOT APPEAR IN THE      53065 07466  17 00000 07611
        TP    TAGS          A           TAG FIELD UNLESS IT IS      53066 07467  11 07771 32000
        ZJ    L+2           L+1         THE FIRST TAG DEFINED       53067 07470  47 07472 07471
        TP    DMMY1         SWITCH      IN THE PROGRAM.)            53070 07471  11 07514 07445
        TP    BIAS          BIAS+3                                  53071 07472  11 07574 07577
        RP3   3             READ+4                                  53072 07473  75 30003 07431
        TP    BIAS+1        BIAS      EXCEPTIONAL CASES*            53073 07474  11 07575 07574
        RA    TAGS          LOC+8                                   53074 07475  21 07771 07744
        RA    BLOCKS        L(1)                                    53075 07476  21 07772 07761
        EJ    L(30)         L+8       *1. EQLS                      53076 07477  43 07765 07507
        MJ0                 FILL        THE EQUALS OPERATIONS       53077 07500  45 00000 30000
START   RJ    L-1           READ+3      BECOME MEANINGLESS IN       53100 07501  37 07500 07430
        RA    STORE         L(20)       THE RELATIVIZED             53101 07502  21 07462 07764
        TP    A             L+2         PROGRAM SINCE, IN           53102 07503  11 32000 07505
        RP3   20            READ+6      GENERAL, THERE IS NO        53103 07504  75 30024 07433
        TP    FILL          FILL        TAG IN THE TAG FIELD.       53104 07505  11 30000 30000
        RJ    START-1       STORE-4     HOWEVER,IF THE ORIGIN       53105 07506  37 07500 07456
        EF                  STOP        AL PROGRAM LINE WAS OF      53106 07507  17 00000 07605
        RA    STORE         L(20)       THE FORM                    53107 07510  21 07462 07764
        TP    A             L+2           TAG1  EQLS  TAG2+-N,      53110 07511  11 32000 07513
        RP3   20            WRITE       THE RELATIVIZATION          53111 07512  75 30024 07516
        TP    FILL          FILL        PROCESS HAS ALREADY         53112 07513  11 30000 30000
DMMY1   RJ    SWITCH        SWITCH+2    TAKEN THIS SYNONYMITY       53113 07514  37 07445 07447
SETUP   TP    BUFF          BUFFER+100  INTO ACCOUNT. IF IT         53114 07515  11 00001 00171
WRITE   RP3   3             L+2         WAS OF THE FORM             53115 07516  75 30003 07520
        TP    BIAS+4        BIAS         TAG1 EQLS N WHERE N        53116 07517  11 07600 07574
        EF    BUFFER+20     BIAS        IS A DECIMAL (OR            53117 07520  17 00051 07574
```

```
          TU    WRITE+2     CIRC+3      OCTAL ) NUMBER, THEN      53120 07521  15 07520 07553
          EF                GOWRT       TAG1 IS NOT PROPERLY      53121 07522  17 00000 07612
          RP3   20          L+2         RELATIVIZED. IT SHOULD    53122 07523  75 30024 07525
          TP    BUFFER      BUFF        BE POINTED OUT THAT       53123 07524  11 00025 00001
ALSO      TP    L(5)        BKCTR       THE LATTER USUAGE OF      53124 07525  11 07763 07773
          TV    L-2         CIRC+1      EQLS IS INCONSISTENT      53125 07526  16 07524 07551
          TP    BUFF+13     A           WITH A RELATIVIZED        53126 07527  11 00016 32000
          EJ    SPACES      L+2         PROGRAM. IF TAG1 IS TO    53127 07530  43 07603 07532
          TP    A           LOC         BE A (KNOWN) CONSTANT     53130 07531  11 32000 07734
          SP    BUFF+3                  IT MUST BE INSERTED       53131 07532  31 00004 00000
          RJ    OUT         LOOP        INTO THE BODY OF THE      53132 07533  37 07645 07614
          ZJ    L+1         L+5         PROGRAM WHEREVER IT       53133 07534  47 07535 07541
          TP    BUFF+15     LOC+1       OCCOURS IN THE U OR V     53134 07535  11 00020 07735
          RJ    CVERT       FIELD       FIELDS.                   53135 07536  37 07731 07653
          TP    A           BUFF+3                                53136 07537  11 32000 00004
          TP    LOC+8       BUFF+4                                53137 07540  11 07744 00005
          SP    BUFF+5                  *2.SETL                   53140 07541  31 00006 00000
          RJ    OUT         LOOP          IF A TAG OCCOURS IN     53141 07542  37 07645 07614
          ZJ    L+1         L+5           A SETL, THIS TAG IS     53142 07543  47 07544 07550
          TP    BUFF+16     LOC+1         RELATIVIZED ACCORDING   53143 07544  11 00021 07735
          RJ    CVERT       FIELD         TO THE PREVIOUS SET-    53144 07545  37 07731 07653
          TP    A           BUFF+5        TING OF THE LOCATION    53145 07546  11 32000 00006
          TP    LOC+8       BUFF+6        COUNTER, BUT NO         53146 07547  11 07744 00007
CIRC      TP    L(19)       LOC+8         ATTEMPT IS MADE TO      53147 07550  11 07766 07744
          EW1               FILL          KEEP TRACK OF ANY RSRV  53150 07551  77 10000 30000
          TV    L-1         L+1           CONSEQUENTLY, IF A      53151 07552  16 07551 07553
          TP    FILL        FILL          SETL IS IMMEDIATELY     53152 07553  11 30000 30000
          RA    CIRC+1      L(1)          PRECEDED BY A RESERVE,  53153 07554  21 07551 07761
          RA    L-2         UADV          TAGS IN THE U AND V     53154 07555  21 07553 07604
          IJ    LOC+8       CIRC+1        FIELD WILL BE IM-       53155 07556  41 07744 07551
          IJ    BKCTR       ALSO+1        PROPERLY  RELATIVIZED.  53156 07557  41 07773 07526
          IJ    BLOCKS      ALSO                                  53157 07560  41 07772 07525
          RJ    L           L+1                                   53160 07561  37 07561 07562
          EF                STOP        *3.OCTAL ADDRESSES IN     53161 07562  17 00000 07605
          MJ0               READ+3       U OR V.                  53162 07563  45 00000 07430
LAST      TP    DMMY1       SWITCH        IF THE NUMBER IN U OR   53163 07564  11 07514 07445
          RJ    LAST-3      START+5       V HAS SIX (OR MORE)     53164 07565  37 07561 07506
          RP    120         L+2           CHARACTERS PRECEDING    53165 07566  75 00170 07570
```

```
                EW1             SIXOHS      THE RIGHT PARENTHESIS,      53166 07567  77 10000 07756
                EF              STOP        IT WILL BE ASSUMMED         53167 07570  17 00000 07605
                EF              RWND4       TO BE A TAG AND NOT         53170 07571  17 00000 07613
                EF              RWND5       AN OCTAL ADDRESS.           53171 07572  17 00000 07610
                MJ              40034B)     ALL DECIMAL ADDRESSES,      53172 07573  45 00000 40034
BIAS            B   020000150000            AND OCTAL ADDRESSES         53173 07574  02 00001 50000
                B   020000160000            WITH LESS THAN SIX          53174 07575  02 00001 60000
                B   020000170000.           CHARACTERS BEFORE THE       53175 07576  02 00001 70000
                B                           RIGHT PARENTHESIS, ARE      53176 07577  00 00000 00000
                B   020000150000            NOT AFFECTED. THUS,         53177 07600  02 00001 50000
                B   020000160000            THE U (OR V) FIELDS         53200 07601  02 00001 60000
                B   020000170000             240B),                     53201 07602  02 00001 70000
SPACES          B   010101010101             46000)B,ETC,               53202 07603  01 01010 10101
UADV            B15 1                       WILL BE TREATED AS          53203 07604  00 00001 00000
STOP            B   020060000000            OCTAL, BUT                  53204 07605  02 00600 00000
TSTWD           B   305027                   46000B)                    53205 07606  00 00003 05027
GORD            B   020000240000            WILL BE ASSUMED TO BE       53206 07607  02 00002 40000
RWND5           B   020020050000            THE TAG                     53207 07610  02 00200 50000
BACK            B   020061440001            .46000B                     53210 07611  02 00614 40001
GOWRT           B   020004650000            AND WILL BE RELATIVIZ       53211 07612  02 00046 50000
RWND4           B   020020040000            ED. THUS, FIVE DIGIT        53212 07613  02 00200 40000
LOOP            LT1 6           Q           OCTAL ADDRESSES SHOULD      53213 07614  22 10006 31000
                QJ  L+9         L+1         ALWAYS BE WRITTEN           53214 07615  44 07626 07616
                QJ  LOOP        L+1          DDDDD)B                    53215 07616  44 07614 07617
                QJ  L+4         L+1         IF THE ROUTINE IS TO        53216 07617  44 07623 07620
                QJ  LOOP        L+1         BE RELATIVIZED.             53217 07620  44 07614 07621
                QJ  L+1         DEC                                     53220 07621  44 07622 07636
                QJ  LOOP        DEC                                     53221 07622  44 07614 07636
                QJ  L+1         LOOP                                    53222 07623  44 07624 07614
                QJ  L+1         LOOP        THE MOST FREQUENT USE       53223 07624  44 07625 07614
                QJ  DEC         LOOP         OF THIS ROUTINE SHOULD     53224 07625  44 07636 07614
                QJ  L+1         L+4          BE RELATIVIZATION OF       53225 07626  44 07627 07632
                QJ  LOOP        L+1          SUBROUTINES SUCH THAT      53226 07627  44 07614 07630
                QJ  LOOP        L+1          ANY PROGRAMMER MAY USE     53227 07630  44 07614 07631
                QJ  L-4         LOOP         THE ROUTINE AND LIMIT      53230 07631  44 07625 07614
                QJ  LOOP        L+1          ONLY THE FIRST TAG OF      53231 07632  44 07614 07633
                QJ  LOOP        L+1          THE SUBROUTINE FROM        53232 07633  44 07614 07634
                QJ  L+1         LOOP         HIS PROGRAM.               53233 07634  44 07635 07614
```

```
        QJ    OUT-1          LOOP
DEC     LTO                  Q
        QT    SIXOHS         A
        ZJ    L+1            OUT
        TP    Q              A
        RP2   5              OUT
        EJ    TBL            L+1
        TP    L(0)           A
OUT     MJO                  FILL
TBL     B     24
        B     46
        B     53
        B     31344646
        B
FIELD   TP    L(62B)         LOC+3
        SP    LOC+1
        ST    LOC            Q
        SJ    L+1            L+4
        TP    L(1)           LOC+3
        SP    LOC
        ST    LOC+1          Q
        RP3   5              L+2
        QT    MASKS          LOC+4
        SS    A
        RP2   5              L+2
        SA    LOC+4          3
        LTO   21             A
        TJ    TEN4           L+6
        RP3   4              L+2
        DV    TEN4           LOC+4
        SA    L(2)           30
        AT    SPACES         LOC+8
        MJO                  XS3
        TP    SPACES         LOC+8
        TJ    TENS           L+6
        DV    TENS           LOC+4
        DV    TENS+1         LOC+5
        DV    TENS+2         LOC+6
```

THE FEATURE OF BEING ABLE TO LEAVE ONE ADDED TAG NOT RELATIVIZED ALLOWS THE PROGRAMMER TO HAVE A COMMON TEMPORARY POOL FOR ALL SUBROUTINES HE USES, AS WELL AS THE TEMPORARIES HIS PROGRAM MAY REQUIRE.

THE ROUTINE IS A ONE-PASS ROUTINE READING FREE RUN FOR THIRTY-TWO BLOCKS THEN OUTPUTS FREE RUN FOR THE SAME NUMBER OF BLOCKS.

THE OCTAL TRANSLATION OF THE PROGRAM IS DELETED ON THE OUTPUT TAPE.

IF THERE IS NO TAPE-TO-CARD CONVERTER AVAILABLE, THE TAPE TO CARD SIMULATOR PROVIDED IN THE SERVICE LIBRARY

```
53234 07635  44 07644 07614
53235 07636  22 00000 31000
53236 07637  51 07756 32000
53237 07640  47 07641 07645
53240 07641  11 31000 32000
53241 07642  75 20005 07645
53242 07643  43 07646 07644
53243 07644  11 07760 32000
53244 07645  45 00000 30000
53245 07646  00 00000 00024
53246 07647  00 00000 00046
53247 07650  00 00000 00053
53250 07651  00 00313 44646
53251 07652  00 00000 00000
53252 07653  11 07767 07737
53253 07654  31 07735 00000
53254 07655  36 07734 31000
53255 07656  46 07657 07662
53256 07657  11 07761 07737
53257 07660  31 07734 00000
53260 07661  36 07735 31000
53261 07662  75 30005 07664
53262 07663  51 07745 07740
53263 07664  34 32000 00000
53264 07665  75 20005 07667
53265 07666  32 07740 00003
53266 07667  22 00025 32000
53267 07670  42 07752 07676
53270 07671  75 30004 07673
53271 07672  73 07752 07740
53272 07673  32 07770 00036
53273 07674  35 07603 07744
53274 07675  45 00000 07723
53275 07676  11 07603 07744
53276 07677  42 07753 07705
53277 07700  73 07753 07740
53300 07701  73 07754 07741
53301 07702  73 07755 07742
```

```
         TP    A              LOC+7
         MJ0                  XS3
         TN    L(1)           LOC+7
         TJ    TENS+1         L+5
         DV    TENS+1         LOC+4
         DV    TENS+2         LOC+5
         TP    A              LOC+6
         MJ0                  XS3
         TN    L(1)           LOC+6
         TJ    TENS+2         L+4
         DV    TENS+2         LOC+4
         TP    A              LOC+5
         MJ0                  XS3
         ZJ    L+1            XS3+5
         TN    L(1)           LOC+5
         TP    A              LOC+4
XS3      SS    A
         RP2   4              L+2
         SA    LOC+3          6
         SA    LOC+7
         SA    TWOS
         SA    HELLS
CVERT    MJ0                  FILL
TWOS     B     000002020202
HELLS    B     460101010101
LOC      RSRV  9              9
MASKS    B     7
         B6    7
         B12   7
         B18   7
         B24   7
TEN4     B     23420
TENS     B     1750
         B     144
         B     12
SIXOHS   B     606060606060
```

WILL PRODUCE A DECK THAT CAN BE OFFSET REPRODUCED ON A REPRODUCER.

THE REASON OFFSET REPRODUCING IS NECESSARY IS THAT AN ASSEMBLED PROGRAM HAS CERTAIN FIELDS SHIFTED TO THE RIGHT.

THE OFFSET TAPE-TO-CARD CONVERTER BOARD OR THE REPRODUCER OFFSET BOARD WILL PRODUCE A DECK THAT CAN BE ASSEMBLED AGAIN AS A DETAGGED ROUTINE.

```
53302 07703  11 32000 07743
53303 07704  45 00000 07723
53304 07705  13 07761 07743
53305 07706  42 07754 07713
53306 07707  73 07754 07740
53307 07710  73 07755 07741
53310 07711  11 32000 07742
53311 07712  45 00000 07723
53312 07713  13 07761 07742
53313 07714  42 07755 07720
53314 07715  73 07755 07740
53315 07716  11 32000 07741
53316 07717  45 00000 07723
53317 07720  47 07721 07730
53320 07721  13 07761 07741
53321 07722  11 32000 07740
53322 07723  34 32000 00000
53323 07724  75 20004 07726
53324 07725  32 07737 00006
53325 07726  32 07743 00000
53326 07727  32 07732 00000
53327 07730  32 07733 00000
53330 07731  45 00000 30000
53331 07732  00 00020 20202
53332 07733  46 01010 10101

53344 07745  00 00000 00007
53345 07746  00 00000 00700
53346 07747  00 00000 70000
53347 07750  00 00070 00000
53350 07751  00 07000 00000
53351 07752  00 00000 23420
53352 07753  00 00000 01750
53353 07754  00 00000 00144
53354 07755  00 00000 00012
53355 07756  60 60606 06060
53356 07757  00 00001 70000
53357 07760  00 00000 00000
```

CONSTANT P OOL L(170000B)
L(0)

			L(1)	53360	07761	00 00000 00001
			L(120)	53361	07762	00 00000 00170
			L(5)	53362	07763	00 00000 00005
			L(20)	53363	07764	00 00000 00024
			L(30)	53364	07765	00 00000 00036
			L(19)	53365	07766	00 00000 00023
			L(62B)	53366	07767	00 00000 00062
			L(2)	53367	07770	00 00000 00002
	UNDEFINED	TAGS	TAGS	53370	07771	00 00000 00000
			BLOCKS	53371	07772	00 00000 00000
			BKCTR	53372	07773	00 00000 00000

END

NAME: TAG OR CLEAR CORE/DRUM

FUNCTION: To tag or clear core and/or drum.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40022.
3. Set Q
   a) Q = 0, clear memory band.
   b) Q = 1, tag memory band.
4. Set A_V = first word of band to be cleared or tagged.
5. Depress start button.

CODE: 22.

STOPS: PAK = 40000, Success stop.

COMMENTS: The first word of the band is <u>not</u> tagged or cleared. This routine tags or clears 4095 consecutive cells starting at Y+1, where Y is the address in A.

NAME: LOAD MEMORY CELL FROM Q.

FUNCTION: To load a memory cell from the console.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40023.
3. Set A_V = Cell to be loaded.
4. Set Q = Information to be loaded into cell.
5. Depress start button.

CODE: 23.

STOPS: PAK = 41724, Success stop.

COMMENTS: The address in A is bumped by one each time so that consecutive loading may be accomplished. After the initial load, start at 41724 for subsequent loading.

NAME: DISPLAY CONTENT OF MEMORY CELL.

FUNCTION: To display in Q the content of any specified memory cell.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40024.
3. Set A = desired memory cell.
4. Depress start button.

CODE: 24.

STOPS: PAK = 41733, Success stop.

COMMENTS: The address in A is bumped by one after execution. This permits successive read-outs.

NAME: REWIND WITH END-OF-FILE OPTION.

FUNCTION: Rewind specified tape units, writing End-of-File if desired.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40025.
3. Set bits in Q corresponding to tapes to be rewound. Set Q_{35} = 1 if EOF desired.
4. Depress start button.

CODE: 25.

STOPS: PAK = 40000, Success Stop.

COMMENTS: If the EOF option is specified, one fixed block of printer stops is written before the rewind is executed.

```
          SETL  41724B)      41724B)     STORE 36 BIT WORD IN
G         TV    A            L+1          Q INTO ADDRESS SPECI-
          TP    Q            Q            FIED IN V ADDRESS OF
          SA    G+6                       ACCUMULATOR  BUMP THIS
          LT                 Q            STORAGE ADDRESS BY ONE
          TV    L-1          G+1          AND STOP (MSO) WITH
          MS                 G            PAK EQUAL TO STARTING
          B     1                         ADDRESS OF THIS ROUTINE
          SETL  41733B)      41733B)     STORE 36 BIT WORD INTO
H         LA    A            15           Q FROM AN ADDRESS SPEC
          TU    A            L+1          FIED IN THE V ADRESS
          TP    A            Q            OF THE ACCUMULATOR BUMP
          SA    L+3          71B)         THIS ADDRESS BY ONE AND
          TU    H+1          H+2          STOP (MSO) WITH PAK
          MS                 H            EQUAL TO THE STARTING
          B15   1                         ADDRESS OF THIS ROUTINE
          SETL  41712B)      41712B)     SET 4095 CONSECUTIVE
W         AT    W1           L+6          CELLS TO EITHER ZERO
          SS    W1                        OR ASCENDING VALUES
          LQ    Q            35           BEGINNING WITH THE
          QJ    L+2          L+1          NON ZERO VALUE APPEAR-
          RS    A            A            ING IN THE Q REGISTER
          RP1   7777B)       L+2          THE FIRST CELL TO BE
          AT    Q            L+1          SET IS SPECIFIED IN
          TV    L-2          L-1          THE V ADDRESS OF A
          MJ                 40034B)      A MSO WITH PAK EQUAL
W1        AT    Q            1            TO 40000 WILL OCCUR
          SETL  41742B)      41742B)     REWIND WITH END OF FILE
RW        RPB   20           RW1          OPTION   THIS ROUTINE
          TP    L+1          RW1          WILL REWIND THE UNIS-
          SETL               10B)         ERVO SPECIFIED IN THE
RW1       QJ    L+2          L+1          V ADDRESS OF Q AND
          TV    P-4          QJ+5         COME TO AN MSO STOP
          LQ    Q            24           WITH PAK EQUAL TO 4000
          RJ    QJ+4         L+2          AS ITS SUCCESS STOP
QJ        QJ    L+1          L-1          IF A HIGH ORDER BIT IS
          RS    P            P+3          PLACED IN THE Q REGIS-
          RS    P+1          P+3          TER IN ADDITION TO THE
```

```
          41724   16 32000 41725
          41725   11 31000 31000
          41726   32 41732 00000
          41727   22 00000 31000
          41730   16 41727 41725
          41731   56 00000 41724
          41732   00 00000 00001
          41733   54 32000 00017
          41734   15 32000 41735
          41735   11 32000 31000
          41736   32 41741 00071
          41737   15 41734 41735
          41740   56 00000 41733
          41741   00 00001 00000
          41712   35 41723 41720
          41713   34 41723 00000
          41714   55 31000 00043
          41715   44 41717 41716
          41716   23 32000 32000
          41717   75 17777 41721
          41720   35 31000 41721
          41721   16 41717 41720
          41722   45 00000 40034
          41723   35 31000 00001
          41742   75 30024 00010
          41743   11 41744 00010
41744 00010   44 00012 00011
41745 00011   16 00023 00021
41746 00012   55 31000 00030
41747 00013   37 00020 00015
41750 00014   44 00015 00013
41751 00015   23 00027 00032
41752 00016   23 00030 00032
```

```
      EJ    P+2           40034B)     UNISERVO NUMBER A FIXED    41753 00017  43 00031 40034
      RJ    L             L+1         BLOCK  (120 WORDS OF       41754 00020  37 00020 00021
      MJ                  L+1       606060606060) WILL BE        41755 00021  45 00000 00022
      EF                  P           WRITTEN ON THE SPEC-       41756 00022  17 00000 00027
      RP    120           L+2         IFIED UNISERVO PRIOR       41757 00023  75 00170 00025
      EW1                 P1          TO REWINDING               41760 00024  77 10000 00033
      EF                  P+1         THE ABOVE FOUR ROUTINES    41761 00025  17 00000 00030
      MJ                  QJ          MAY BE SELECTIVELY         41762 00026  45 00000 00014
P     B     020064740000              RESTORED FROM THE          41763 00027  02 00647 40000
      B     020020140000              LIBRARY TAPE IF THEY       41764 00030  02 00201 40000
      B     020020000000              SHOULD BE DESTROYED BY     41765 00031  02 00200 00000
      B12   1                         PLACING THE CODE WORD      41766 00032  00 00000 10000
P1    B     606060606060              IN A AND PAK TO 40000      41767 00033  60 60606 06060
      END
```

NAME: CARD-TO-TAPE SIMULATOR

FUNCTION: To simulate Card-to-Tape equipment.

OPERATING INSTRUCTIONS:

1. Clear console.
2. Set PAK = 40026.
3. Set $Q_3 - Q_0$ = output tape unit.
4. Place cards in Bull read hopper, cycle 1 card.
5. Depress start button.

CODE: 26.

STOPS: PAK = 40007, Success stop.

COMMENTS: This routine is an 80-80 simulation of the Card-to-Tape Converter. It translates all card punch combinations into the same XS3 codes as the Card-to-Tape. In case of a mispick during simulation, reposition the mispicked card and start at 00014 for recovery.

```
                SETL    250B)           TWO CORE MACHINE
SAVER           RSRV    240B)   240B)                       00010 00250
BIN             RSRV    84      84                          00250 00510
RAUS            RSRV    20      20                          00374 00634
BUF             RSRV    2       2                           00420 00660
AUS             RSRV    3360    3360                        00422 00662
                SETL    52552B) 52552B)         C-T-T SIMULATOR
DST             RPB     200     SUSN                                52552  75 30310 00010
                TP      L+1     SUSN                                52553  11 52554 00010
                SETL            00010B)
SUSN            LQ      Q       12              PICK UP             52554 00010  55 31000 00014
                RA      C8      Q                 UNISERVO          52555 00011  21 00153 31000
                RA      C8A     Q                  NUMBER           52556 00012  21 00154 31000
                MJ              EF                                  52557 00013  45 00000 00016
                RPB     240B)   L+2             EF FOR CARD READ    52560 00014  75 30240 00016
                TP      SAVER   EF               SET UP RETURN EXIT 52561 00015  11 00250 00016
EF              EF              C1              CLEAR WORKING       52562 00016  17 00000 00144
                RJ      FINI    L+1              STORAGE            52563 00017  37 00114 00020
                RPV     104     L+2             THESE               52564 00020  75 10150 00022
                TP      L(0)    BIN              COMMANDS           52565 00021  11 00231 00510
                TP      CO+1    IX12              RESTORE THE       52566 00022  11 00160 00226
                TV      C5      QJT1               CARD READ        52567 00023  16 00150 00037
                TU      C5      EQT                 AND STORAGE SETUP 52570 00024 15 00150 00073
                TU      C6      C4                   FOR THE NEXT   52571 00025  15 00151 00147
                TU      EJT     STOR1                  CARD         52572 00026  15 00075 00102
                TU      C7      STOR2           SAVE COLS. 73-80    52573 00027  15 00152 00104
                TU      EJT     QJT1            COLS. 1-36 TO Q     52574 00030  15 00075 00037
ER              ER              BUF+1           COLS. 37-72 SAVE    52575 00031  76 00000 00661
                ER1             Q               SET EXIT FOR RETURN 52576 00032  76 10000 31000
                ER1             BUF             SET TO TEST 36 BITS 52577 00033  76 10000 00660
                RJ      RJ2     IXSET           TEST FOR BIT        52600 00034  37 00043 00035
IXSET           TP      L(35)   IX36            IF YES ADD ROW VALUE 52601 00035  11 00232 00227
QJT             QJ      L+1     L+2             AND IN EITHER CASE BUMP 52602 00036 44 00037 00040
QJT1            RA      BIN     CO              STORAGE ADDRESS BY 1 52603 00037  21 00510 00157
                RA      QJT1    L(100000B)      RETURN AND PROCESS COLS. 52604 00040 21 00037 00233
IXJ             IJ      IX36    QJT             37-72               52605 00041  41 00227 00036
                TP      BUF     Q               PREPARE TO PROCESS  52606 00042  11 00660 31000
RJ2             RJ      RJ2     IXSET            COLS.              52607 00043  37 00043 00035
```

```
                TP    CO+5          IX36                 73-80                          52610 00044   11 00164 00227
                LQ    BUF+1         28                BUMP ROW VALUE                    52611 00045   55 00661 00034
RJ3             RJ    RJ2           QJT               AND PROCESS NEXT ROW              52612 00046   37 00043 00036
                RA    QJT1          L(1)              TALLY FOR EACH CARD               52613 00047   21 00037 00234
                IJ    IX12          ER-1              TEST                              52614 00050   41 00226 00030
                RA    XN            L(1)               TO DETERMINE                     52615 00051   21 00225 00234
ZTST            SP    BIN+6         6      5           IF THE LAST CARD                 52616 00052   31 00516 00006
                SA    BIN+7         6                  TEST FOR FULL BUFFER             52617 00053   32 00517 00006
                SA    BIN+8                            IF IT IS EITHER SET              52620 00054   32 00520 00000
                EJ    ZTST1         ISEQ               PROPER EXIT AND SET              52621 00055   43 00156 00065
                IJ    IX500         NEQU               EXIT FOR OUTPUT                  52622 00056   41 00230 00063
                TP    L(503)        IX500              IF                               52623 00057   11 00235 00230
                TV    C7            FINI                NOT                             52624 00060   16 00152 00114
                RJ    WRIT          EQTF                 CONTINUE                       52625 00061   37 00143 00072
                MJ                  EF                     TO                           52626 00062   45 00000 00016
NEQU            EF                  C1                       PROCESS                    52627 00063   17 00000 00144
                MJ                  EQTF                      CARDS                     52630 00064   45 00000 00072
ISEQ            TV    C7            FINI               MAXIMUM                          52631 00065   16 00152 00114
                RJ    WRIT          EQTF               NUMBER OF CARDS IN               52632 00066   37 00143 00072
                EF                  C8A                BUFFER EQUALS 500                52633 00067   17 00000 00154
                RS    Q             Q                                                   52634 00070   23 31000 31000
                MS                  40007B)            TEST                             52635 00071   56 00000 40007
EQTF            TP    CO+1          IX12                EACH INPUT CONFIGURATIO         52636 00072   11 00160 00226
EQT             SP    EQ                                FOR A SPECIAL CHARACTER         52637 00073   31 00173 00000
                RPU   80            EQSU               AND IF THERE IS ONE              52640 00074   75 20120 00076
EJT             EJ    BIN           EQS                SUBSTITUTE THE PROPER            52641 00075   43 00510 00115
EQSU            RA    EQT           L(100000B)         CODE                             52642 00076   21 00073 00233
                RA    C4            L(100000B)         EACH CHARACTER IS IN A           52643 00077   21 00147 00233
                IJ    IX12          EQT                 SEPARATE CELL AT THIS           52644 00100   41 00226 00073
                TP    L(13)         IX36                TIME.                           52645 00101   11 00236 00227
STOR1           SP    BIN           6                   THIS                            52646 00102   31 00510 00006
                RPU   5             STOR3              SECTION COMBINES                 52647 00103   75 20005 00105
STOR2           SA    BIN+1         6                   6 CHARACTERS                    52650 00104   32 00511 00006
STOR3           LT    30            AUS                 IN EACH CELL READY              52651 00105   22 00036 00662
                RA    STOR1         L(600000B)          FOR OUTPUT ON TAPE              52652 00106   21 00102 00237
                RA    STOR2         L(600000B)         TRANSFER ENTIRE                  52653 00107   21 00104 00237
                RA    STOR3         L(1)                ROUTINE TO A BUFFER SO          52654 00110   21 00105 00234
                IJ    IX36          STOR1               IT MAYBE RESTARTED              52655 00111   41 00227 00102
```

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                RPB   240B)          L+2          SUBSTITUTE PROPER          52656 00112   75 30240 00114
                TP    EF             SAVER         SPECIAL C.ARACTER         52657 00113   11 00016 00250
FINI            MJ                                 CODE                      52660 00114   45 00000 00000
EQS             SP    C3                                                     52661 00115   31 00146 00000
                SS    Q                                                      52662 00116   34 31000 00000
                AT    C4             TCMP          TAPE OUTPUT SECTION       52663 00117   35 00147 00120
TCMP                                               DETERMINE                 52664 00120   00 00000 00000
                MJ                   EQT           NUMBER OF WORDS TO BE     52665 00121   45 00000 00073
WRITE           SP    XN                           WRITTEN, MUST BE          52666 00122   31 00225 00000
                DV    L(6)           Q             MULTIPLES                 52667 00123   73 00240 31000
                ZJ    L+1            L+4           OF SIX                    52670 00124   47 00125 00130
                TN    A              A             THEN                      52671 00125   13 32000 32000
                SA    XN                           TRANSFER                  52672 00126   32 00225 00000
                AT    L(6)           XN            14 WORDS                  52673 00127   35 00240 00225
                IJ    XN             L+1           TO OUTPUT                 52674 00130   41 00225 00131
                EF                   C8            BLOCKETTE                 52675 00131   17 00000 00153
                RPB   14             L+2           AND SETUP                 52676 00132   75 30016 00134
PIUP            TP    AUS            RAUS          WRITE                     52677 00133   11 00662 00634
                RPV   20             L+2           ROUTINE                   52700 00134   75 10024 00136
WR              EW1                  RAUS          FOR NEXT                  52701 00135   77 10000 00634
                RA    PIUP           L(1600000B)   WRITE                     52702 00136   21 00133 00241
                IJ    XN             PIUP-1                                  52703 00137   41 00225 00132
                TV    C2             STOR3                                   52704 00140   16 00145 00105
                TU    C2             PIUP          READS 80                  52705 00141   15 00145 00133
                EF                   C9             COLUMNS OF               52706 00142   17 00000 00155
WRIT            MJ                   EF+1            ALPHABETIC,             52707 00143   45 00000 00017
C1              B     400000000005                    NUMERIC INFORMATION     52710 00144   40 00000 00005
C2                    AUS            AUS               PLUS SPECIAL          52711 00145   00 00662 00662
C3              B     20117                              CHARACTERS AS       52712 00146   00 00000 20117
C4              TP    EQSUB          BIN                  DESIGNATED BY THE 52713 00147   11 00207 00510
C5                    EQ             CO                    SLAP ASSEMBLY    52714 00150   00 00173 00157
C6                    EQSUB          RAUS                   PROGRAM AND     52715 00151   00 00207 00634
C7                    BIN+1          WRITE                   CREATES AN      52716 00152   00 00511 00122
C8              B     020004600000                             80-80 XS-3    52717 00153   02 00046 00000
C8A             B     020020000000                              TAPE ON A    52720 00154   02 00200 00000
C9              B     020060000000                               DESIGNATED  52721 00155   02 00600 00000
UAD             EQLS  L(10000B)                                   UNISERVO
ZTST1           B     305027         BLANKS                                  52722 00156   00 00003 05027
```

```
CO      B     14          ARE                          52723 00157   00 00000 00014
        B     13           READ                        52724 00160   00 00000 00013
        B     12            AS                         52725 00161   00 00000 00012
        B     11             ZEROS                     52726 00162   00 00000 00011
        B     10          MISPICK, RESTART AT          52727 00163   00 00000 00010
        B     7            CELL 14                     52730 00164   00 00000 00007
        B     6                                        52731 00165   00 00000 00006
        B     5                                        52732 00166   00 00000 00005
        B     4                                        52733 00167   00 00000 00004
        B     60                                       52734 00170   00 00000 00060
        B     40                                       52735 00171   00 00000 00040
        B     20                                       52736 00172   00 00000 00020
EQ      B     20                                       52737 00173   00 00000 00020
        B     40                                       52740 00174   00 00000 00040
        B     60                                       52741 00175   00 00000 00060
        B     102                                      52742 00176   00 00000 00102
        B     62                                       52743 00177   00 00000 00062
        B     21                                       52744 00200   00 00000 00021
        B     101                                      52745 00201   00 00000 00101
        B     41                                       52746 00202   00 00000 00041
        B     100                                      52747 00203   00 00000 00100
        B     42                                       52750 00204   00 00000 00042
        B     61                                       52751 00205   00 00000 00061
        B     120                                      52752 00206   00 00000 00120
EQSUB   B     63                                       52753 00207   00 00000 00063
        B     02                                       52754 00210   00 00000 00002
        B     03                                       52755 00211   00 00000 00003
        B     17                                       52756 00212   00 00000 00017
        B     56                                       52757 00213   00 00000 00056
        B     62                                       52760 00214   00 00000 00062
        B     21                                       52761 00215   00 00000 00021
        B     22                                       52762 00216   00 00000 00022
        B     23                                       52763 00217   00 00000 00023
        B     43                                       52764 00220   00 00000 00043
        B     55                                       52765 00221   00 00000 00055
        B     43                                       52766 00222   00 00000 00043
RECO1                                                  52767 00223   00 00000 00000
RECO2                                                  52770 00224   00 00000 00000
```

```
XN
IX12
IX36
IX500    S     503
                          CONSTANT   P   OOL
```

	52771	00225	00	00000 00000
	52772	00226	00	00000 00000
	52773	00227	00	00000 00000
	52774	00230	00	00000 00767
L(0)	52775	00231	00	00000 00000
L(35)	52776	00232	00	00000 00043
L(100000B)	52777	00233	00	00001 00000
L(1)	53000	00234	00	00000 00001
L(503)	53001	00235	00	00000 00767
L(13)	53002	00236	00	00000 00015
L(600000B)	53003	00237	00	00006 00000
L(6)	53004	00240	00	00000 00006
L(1600000B)	53005	00241	00	00016 00000
L(10000B)	53006	00242	00	00000 10000

```
         END
```

NAME: TRACE ROUTINE

FUNCTION: To trace a machine language program.

OPERATING INSTRUCTIONS:

1. Load program to be traced.
2. Place trace control card in Bull and cycle once.
3. Set PAK = 40030.
4. Depress start.

CODE: 30.

STOPS: None.

COMMENTS: Core cells 15500-16100 and drum cells 53011-53410 are used by this routine.

```
         SETL  55150B)      55150B)
         RPB   300          CRDRED                          55150  75 30454 55152
         TP    L+1          CRDRED                          55151  11 55152 15537
         SETL               15500B)
BUF      RSRV               20          INPUT-OUTPUT BUFFER
BEGIN    RSRV               1           PROGRAM START ADDRESS
ST       RSRV               1           TRACE
ST1      RSRV               1             START
ST2      RSRV               1               ADDRESSES
ST3      RSRV               1
ST4      RSRV               1
ENDOUT   RSRV               5           TRACE STOP ADDRESSES
CRDRED   EF                 EFA         READ TRACE CONTROL CARD     55152 15537  17 00000 16100
         RPV   20           L+2         CLEAR INPUT-OUTPUT          55153 15540  75 10024 15542
         TP    L(0)         BUF           BUFFER REGION             55154 15541  11 16122 15500
         TP    L(9)         BUF+12      INDEX TO READ TEN ROWS      55155 15542  11 16123 15514
         TP    L(4)         BUF+13      INDEX FOR STORING CARD      55156 15543  11 16124 15515
         TP    L(1)         BUF+17      INDEX FOR ROW 11 AND 12     55157 15544  11 16125 15521
LOOP     ER                 Q           DISCARD COLUMNS 73 TO 8     55160 15545  76 00000 31000
         ER1                BUF+18      READ COLUMNS 1 THRU 36      55161 15546  76 10000 15522
         ER1                BUF+19      READ COLUMNS 37 THRU 72     55162 15547  76 10000 15523
         TU    CBUF         LOOPA       SET ADDER LOOP              55163 15550  15 16116 15557
         TU    CBUF         LOOPB         FOR FIRST WORD            55164 15551  15 16116 15561
         TP    L(1)         BUF+16                                  55165 15552  11 16125 15520
ALOOP    TP    L(2)         BUF+15      3 FIELDS FOR EACH SIDE      55166 15553  11 16126 15517
         TP    L(11)        BUF+14      12 DIGITS EACH FIELD        55167 15554  11 16127 15516
BLOOP    TP    BUF+18       Q           ROW IMAGE TO Q              55170 15555  11 15522 31000
         QJ    L+1          L+2         TEST FOR BIT IN IMAGE       55171 15556  44 15557 15560
LOOPA    RA    BUF          COST        IF BIT ADD ROW VALUE        55172 15557  21 15500 16104
         TP    Q            BUF+18      IN EITHER CASE SAVE Q       55173 15560  11 31000 15522
LOOPB    LQ    BUF          3             AND SHIFT WORD            55174 15561  55 15500 00003
         IJ    BUF+14       BLOOP       DO TWELVE DIGITS            55175 15562  41 15516 15555
         RA    LOOPA        L(100000B)  BUMP ADDER LOOP FOR         55176 15563  21 15557 16130
         RA    LOOPB        L(100000B)    NEXT WORD                 55177 15564  21 15561 16130
         IJ    BUF+15       BLOOP-1     GO BACK FOR WORDS 2 AN 3    55200 15565  41 15517 15554
         TP    BUF+19       BUF+18      SETUP FOR IMAGE OF 37-72    55201 15566  11 15523 15522
         IJ    BUF+16       ALOOP       GO BACK FOR WDS.4,5,6       55202 15567  41 15520 15553
         RA    LOOPA        L(1)        BUMP ROW VALUE FOR NEXT     55203 15570  21 15557 16125
         IJ    BUF+12       LOOP          ROW AND PROCESS IT        55204 15571  41 15514 15545
```

```
         ER                  Q                DISCARD                          55205 15572   76 00000 31000
         ER1                 Q                  ROWS                           55206 15573   76 10000 31000
         ER1                 Q                    ELEVEN                       55207 15574   76 10000 31000
         IJ    BUF+17        L-3                    AND TWELVE                 55210 15575   41 15521 15572
         TP    BUF           Q                PICKUP                           55211 15576   11 15500 31000
         QT    L(77777B)     BEGIN              PROGRAM START ADDRESS          55212 15577   51 16131 15524
         LQ    BUF           A+18             PICKUP                           55213 15600   55 15500 32022
         TP    L(170000B)    Q                 UNISERVO                        55214 15601   11 16132 31000
         QS    A             WRT/               NUMBER                         55215 15602   53 32000 55505
SETUP    TP    BUF+1         Q                PICKUP                           55216 15603   11 15501 31000
SETUPA   QT    L(77777B)     ENDOUT            TRACE                           55217 15604   51 16131 15532
         LQ    Q             21                 CONTROL                        55220 15605   55 31000 00025
SETUPB   QT    L(77777B)     ST                  START                         55221 15606   51 16131 15525
         RA    SETUP         L(100000B)          AND                           55222 15607   21 15603 16130
         RA    SETUPA        L(1)                 STOP                         55223 15610   21 15604 16125
         RA    SETUPB        L(1)                  ADDRESSESS                  55224 15611   21 15606 16125
         IJ    BUF+13        SETUP                                             55225 15612   41 15515 15603
START    TP    CU            BUF+4            SETUP                            55226 15613   11 16060 15504
         TP    CV            BUF+7             INDICATIVE                      55227 15614   11 16061 15507
         TP    CAL           BUF+10             INFORMATION                    55230 15615   11 16062 15512
         TP    CAR           BUF+13              IN                            55231 15616   11 16063 15515
         TP    CAQ           BUF+16               OUTPUT BUFFER                55232 15617   11 16064 15520
         TP    L(0)          BUF+19           CLEAR BUF+19                     55233 15620   11 16122 15523
STA      RJ    RESTX         REST             SAVE Q AND A                     55234 15621   37 15734 15731
         TV    BEGIN         STAX             SET EXIT TO PROGRAM              55235 15622   16 15524 15640
         TP    L(4)          IND              THIS                             55236 15623   11 16124 16120
         TP    ST            Q                SUBROUTINE                       55237 15624   11 15525 31000
         SP    Q             15                SUBSTITUTES A                   55240 15625   31 31000 00017
         ZJ    L+1           STAX-1             RETURN JUMP                    55241 15626   47 15627 15637
         TU    A             L+1                 IN EACH                       55242 15627   15 32000 15630
         TP    FILL          ST                   START                        55243 15630   11 30000 15525
         TV    Q             L+1                   ADDRESS                    55244 15631   16 31000 15632
         TP    RJC           FILL                   AND                       55245 15632   11 16066 30000
         RA    STA+3         L(100000B)              SAVES                    55246 15633   21 15624 16130
         RA    RJC           L(2)                     THE                     55247 15634   21 16066 16126
         RA    L-5           L(1)                      ORIGINAL               55250 15635   21 15630 16125
         IJ    IND           STA+3                      COMMANDS              55251 15636   41 16120 15624
         RJ    OBEYX         OBEY             RESTORE Q AND A                  55252 15637   37 15726 15723
STAX     MJ                                   EXIT TO PROGRAM                  55253 15640   45 00000 00000
```

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TRANS   LQ    LCTR          Q+15        SETUP PICKUP                    55254 15641   55 16067 31017
        TU    Q             L+1          FOR NEXT INSTRUCTION           55255 15642   15 31000 15643
        TP                  EXEC          TO BE TRACED                  55256 15643   11 00000 15730
EXIT    SP    LCTR          21          TEST                            55257 15644   31 16067 00025
        LQ    A             15           FOR                            55260 15645   55 32000 00017
        RPU   5             L+4           STOP TRACE                    55261 15646   75 20005 15652
        EJ    ENDOUT        L+1            CONTROL                      55262 15647   43 15532 15650
        RJ    OBEYX         OBEY        RESTORE Q AND A                 55263 15650   37 15726 15723
        MJ                  LCTR        EXIT IF STOP COMMAND            55264 15651   45 00000 16067
        TP    EXEC          Q           SETUP COMMAND TO                55265 15652   11 15730 31000
        TP    EXEC          TEMPA         PRINT OUT                     55266 15653   11 15730 16121
        TU    Q             UP            STORE CONTENTS OF U           55267 15654   15 31000 15735
        LQ    Q             15          SETUP COMMAND TO                55270 15655   55 31000 00017
        TU    Q             VP            STORE CONTENTS OF V           55271 15656   15 31000 15736
OPT     SP    EXEC                      TEST OP FOR SPECIAL             55272 15657   31 15730 00000
        LT    6             A             HANDLING                      55273 15660   22 00006 32000
        EJ    L(17B)        EXIT+4      IF EF EXIT FROM TRACE           55274 15661   43 16133 15650
        EJ    L(14B)        EXIT+4      IF IP EXIT FROM TRACE           55275 15662   43 16134 15650
        EJ    L(37B)        RJ          IF RJ GO TO RJ SETUP            55276 15663   43 16135 15677
        EJ    L(75B)        RP          IF RP GO TO RP SETUP            55277 15664   43 16136 15712
        TP    EXEC          Q           THIS                            55300 15665   11 15730 31000
        QJ    L+1           OBEY         SECTION                        55301 15666   44 15667 15723
        QJ    OBEY          L+1           TESTS                         55302 15667   44 15723 15670
        QJ    L+5           L+1            FOR                          55303 15670   44 15675 15671
        TV    VJ            EXEC            ONE                         55304 15671   16 16077 15730
        QJ    L+1           OBEY             AND                        55305 15672   44 15673 15723
        QJ    UVJMP         L+1               TWO                       55306 15673   44 15717 15674
        QJ    MJMS          UVJMP              WAY                      55307 15674   44 15721 15717
        QJ    L+1           OBEY                JUMPS                   55310 15675   44 15676 15723
        QJ    MJMS          OBEY                                        55311 15676   44 15721 15723
RJ      TV    VJ            EXEC        IF RJ SET V EXIT                55312 15677   16 16077 15730
        SP    EXEC          21            AND TEST FOR                  55313 15700   31 15730 00025
        LT                  A              BLOCKING COMMAND             55314 15701   22 00000 32000
        EJ    BLKTST        EXIT+4          IF IT IS EXECUTE IT         55315 15702   43 16103 15650
        LQ    EXEC          Q+21        IF NOT                          55316 15703   55 15730 31025
        TV    Q             L+3           PICKOFF LINECOUNTER           55317 15704   16 31000 15707
        SP    LCTR                        BUMP BY 1                     55320 15705   31 16067 00000
        SA    L(1)                        AND SET V                     55321 15706   32 16125 00000
        TV    A             FILL           OF EXIT                      55322 15707   16 32000 30000
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                TU    L(0)          EXEC      SET EXEC TO ZERO                  55323 15710   15 16122 15730
                MJ                  OBEY      JUMP TO EXECUTE COMMAND           55324 15711   45 00000 15723
RP              TP    EXEC          EXEC-1    IF AN RP MOVE EXEC TO             55325 15712   11 15730 15727
                TU    VP            RPU        DUMMY, SAVE V EXIT               55326 15713   15 15736 16065
                TV    LZERO         EXEC-1    GIMMICK V ADDRESS                 55327 15714   16 16102 15727
                TU    LZERO         UP        BLANK OUT U PICKUP                55330 15715   15 16102 15735
                MJ                  UP        BYPASS EXECUTION                  55331 15716   45 00000 15735
UVJMP           TU    VJ            EXEC      SET U EXIT                        55332 15717   15 16077 15730
                MJ                  OBEY       JUMP TO EXECUTE COMMAND          55333 15720   45 00000 15723
MJMS            TV    VJ            EXEC      ON MS OR MJ SET                   55334 15721   16 16077 15730
                TU    LZERO         UP        U PICKUP TO ZERO                  55335 15722   15 16102 15735
OBEY            SP    SVAL          36        RESTORE AL                        55336 15723   31 16074 00044
                SA    SVAR                    AR                                55337 15724   32 16141 00000
                TP    SVQ           Q         AND Q                             55340 15725   11 16142 31000
OBEYX           RJ    L             L+1                                         55341 15726   37 15726 15727
                TP    SVQ           Q         DUMMY CELL FOR RP,S               55342 15727   11 16142 31000
EXEC                                          EXECUTION ADDRESS                 55343 15730   00 00000 00000
REST            TP    Q             SVQ       SAVE Q                            55344 15731   11 31000 16142
                LTL                 SVAL      SAVE AL                           55345 15732   22 00000 16074
                TP    A             SVAR      SAVE AR                           55346 15733   11 32000 16141
RESTX           RJ    L             L+1                                         55347 15734   37 15734 15735
UP              TP                  SVU       SAVE CONTENTS OF U                55350 15735   11 00000 16075
VP              TP                  SVV       SAVE CONTENTS OF V                55351 15736   11 00000 16076
                MJ                  WTP       JUMP TO TAPE WRITE                55352 15737   45 00000 15747
VJUMP           TU    VP            TP        SAVE V EXIT OF ANY JUMP           55353 15740   15 15736 16101
                TV    TP            JSW       BUMP JUMP SWITCH                  55354 15741   16 16101 15754
                TP    OBEYX-1       OBEYX+1   RESTORE RP DUMMY                  55355 15742   11 15725 15727
                MJ                  EXEC+1                                      55356 15743   45 00000 15731
UJUMP           TU    UP            TP        SAVE U EXIT OF 2 WAY JMP          55357 15744   15 15735 16101
                TV    TP            JSW       BUMP JUMP SWITCH                  55360 15745   16 16101 15754
                MJ                  EXEC+1                                      55361 15746   45 00000 15731
WTP             RJ    XSE           XS        CONVERT TO XS-3                   55362 15747   37 16030 15762
                EF                  WRT       WRITE ONE                         55363 15750   17 00000 16072
                RP1   20            L+2        BLOCKETTE OF                     55364 15751   75 10024 15753
                EW1                 BUF         OUTPUT TAPE                     55365 15752   77 10000 15500
                EF                  STAPE     STOP TAPE                         55366 15753   17 00000 16073
JSW             RJ    L             L+1                                         55367 15754   37 15754 15755
                RA    LCTR          L(1)      BUMP LCTR                         55370 15755   21 16067 16125
                MJ                  TRANS     NEXT WORD                         55371 15756   45 00000 15641
```

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J2      LQ    TP          Q+21        SETUP EXIT                    55372 15757  55 16101 31025
        TV    Q           LCTR        FROM JUMP                     55373 15760  16 31000 16067
        MJ                TRANS       COMMANDS                      55374 15761  45 00000 15641
XS      LA    LCTR        A+15        SET UP LCTR FOR               55375 15762  54 16067 32017
        TU    A           TEMP        OUTPUT                        55376 15763  15 32000 16070
        RA    TEMP        DBLSP       AND ADD DB1 SPACE             55377 15764  21 16070 16117
        RJ    CNVE        CNV          THIS COMMAND TO              55400 15765  37 16037 16031
        LTL   6           BUF         CONVERT                       55401 15766  22 00006 15500
        TP    TEMPA       TEMP        THIS COMMAND                  55402 15767  11 16121 16070
        RJ    CNVE        CNV          TO XS-3 AND STORE            55403 15770  37 16037 16031
        LTR   12          BUF+1         OP INTO BUF+1              55404 15771  22 10014 15501
        LTR   30          BUF+2         U FIELD INTO BUF+2         55405 15772  22 10036 15502
        LTR   30          BUF+3         V FIELD INTO BUF+3         55406 15773  22 10036 15503
        LQ    BUF         A+6         SPLIT OFF HIGH DIGIT          55407 15774  55 15500 32006
        LTL   30          BUF          OF LOCATION                  55410 15775  22 00036 15500
        LQ    BUF+1       A+24        SPLIT OFF HIGH 4 DIGITS       55411 15776  55 15501 32030
        LTL   12          BUF+1        OF OPERATION                 55412 15777  22 00014 15501
        LQ    BUF+2       A+6         SPLIT OFF HIGH DIGIT          55413 16000  55 15502 32006
        LTL   30          BUF+2        OF U FIELD                   55414 16001  22 00036 15502
        LQ    BUF+3       A+6         SPLIT OFF HIGH DIGIT          55415 16002  55 15503 32006
        LTL   30          BUF+3        OF V FIELD                   55416 16003  22 00036 15503
        TP    SVU         TEMP        CONVERT                       55417 16004  11 16075 16070
        RJ    CNVE        CNV           CONTENTS OF U               55420 16005  37 16037 16031
        LTL               BUF+5           TO XS3                    55421 16006  22 00000 15505
        TP    A           BUF+6             STORE IN BUF+5,6        55422 16007  11 32000 15506
        TP    SVV         TEMP        CONVERT                       55423 16010  11 16076 16070
        RJ    CNVE        CNV           CONTENTS OF V               55424 16011  37 16037 16031
        LTL               BUF+8           TO XS3                    55425 16012  22 00000 15510
        TP    A           BUF+9             STORE IN BUF+8,9        55426 16013  11 32000 15511
        TP    SVAL        TEMP        CONVERT                       55427 16014  11 16074 16070
        RJ    CNVE        CNV           CONTENTS OF AL              55430 16015  37 16037 16031
        LTL               BUF+11          TO XS3                    55431 16016  22 00000 15513
        TP    A           BUF+12            STORE IN BUF+11,12      55432 16017  11 32000 15514
        TP    SVAR        TEMP        CONVERT                       55433 16020  11 16141 16070
        RJ    CNVE        CNV           CONTENTS OF AR              55434 16021  37 16037 16031
        LTL               BUF+14          TO XS3                    55435 16022  22 00000 15516
        TP    A           BUF+15            STORE IN BUF+14,15      55436 16023  11 32000 15517
        TP    SVQ         TEMP        CONVERT                       55437 16024  11 16142 16070
        RJ    CNVE        CNV           CONTENTS OF Q               55440 16025  37 16037 16031
```

```
         LTL                BUF+17          TO XS3                          55441 16026  22 00000 15521
         TP    A            BUF+18            STORE IN BUF+17,18            55442 16027  11 32000 15522
XSE      MJ                                                                 55443 16030  45 00000 00000
CNV      SP    L(0)                       CONVERT 12 DIGIT                  55444 16031  31 16122 00000
         LA    A            6              NUMBER IN TEMP CELL              55445 16032  54 32000 00006
         LQ    TEMP         3               TO XS-3 AND                     55446 16033  55 16070 00003
         QA    L(7)         A                LEAVE IN                       55447 16034  52 16137 32000
         SA    L(3)                           ACCUMMULATOR                  55450 16035  32 16140 00000
         LQ    TST          1                                              55451 16036  55 16071 00001
CNVE     QJ    CNV+1                                                       55452 16037  44 16032 00000
BLK1     TP    ST           EXEC          THESE BLOCKING                   55453 16040  11 15525 15730
         MJ                 BLKOUT        COMMANDS PLACE                   55454 16041  45 00000 16051
BLK2     TP    ST1          EXEC          THE ORIGINAL COMMAND             55455 16042  11 15526 15730
         MJ                 BLKOUT        IN EXEC WHEN A                   55456 16043  45 00000 16051
BLK3     TP    ST2          EXEC          DUMMY RJ APPEARS                 55457 16044  11 15527 15730
         MJ                 BLKOUT        IN A                             55460 16045  45 00000 16051
BLK4     TP    ST3          EXEC          SEQUENCE                         55461 16046  11 15530 15730
         MJ                 BLKOUT        OF COMMANDS                      55462 16047  45 00000 16051
BLK5     TP    ST4          EXEC          TO BE TRACED                     55463 16050  11 15531 15730
BLKOUT   RJ    RESTX        REST                                           55464 16051  37 15734 15731
         RS    LCTR         L(1)                                           55465 16052  23 16067 16125
         MJ                 EXIT+6                                         55466 16053  45 00000 15652
RPJ      TU    RPU          TP            THIS SEQUENCE                    55467 16054  15 16065 16101
         TV    TP           JSW           SETS UP THE                      55470 16055  16 16101 15754
         TP    OBEYX-1      OBEYX+1       V JUMP OF A                      55471 16056  11 15725 15727
         MJ                 EXEC+1        REPEAT INSTRUCTION               55472 16057  45 00000 15731
CU       XS3     (U)                      INDICATIVE                       55473 16060  00 00176 74300
CV       XS3     (V)                      INDICATIVE                       55474 16061  00 00177 04300
CAL      XS3    (AL)                      INDICATIVE                       55475 16062  00 17244 64300
CAR      XS3    (AR)                      INDICATIVE                       55476 16063  00 17245 44300
CAQ      XS3     (Q)                      INDICATIVE                       55477 16064  00 00175 34300
RPU      B                                                                 55500 16065  00 00000 00000
RJC      RJ    LCTR         BLK1                                           55501 16066  37 16067 16040
LCTR     MJ                                                              55502 16067  45 00000 00000
TEMP     B                                                               55503 16070  00 00000 00000
TST      B     377737773777               LOOP TESTER                      55504 16071  37 77377 73777
WRT      B     020006650000               WRITE OUTPUT TAPE                55505 16072  02 00066 50000
STAPE    B     020060000000               STOP TAPE                        55506 16073  02 00600 00000
SVAL                                      THIS ROUTINE                     55507 16074  00 00000 00000
```

```
SVU                                                AND IS CALLED          55510 16075  00 00000 00000
SVV                                                 INTO CORE             55511 16076  00 00000 00000
VJ          UJUMP          VJUMP                     WHEN USED            55512 16077  00 15744 15740
EFA     B   400000000005                          THE PROGRAMMER           55513 16100  40 00000 00005
TP                         J2                      CANNOT USE             55514 16101  00 00000 15757
LZERO       L(0)           RPJ                       THE CORE             55515 16102  00 16122 16054
BLKTST      37B)           LCTR                       AREA                55516 16103  00 00037 16067
COST                                                   WHERE              55517 16104  00 00000 00000
                                                        THIS              55520 16105  00 00000 00000
        B   700000000000                                 ROUTINE          55521 16106  70 00000 00000
        B   600000000000                                  WILL            55522 16107  60 00000 00000
        B   500000000000                                   WORK           55523 16110  50 00000 00000
        B   400000000000                              ALL                 55524 16111  40 00000 00000
        B   300000000000                               OUTPUT             55525 16112  30 00000 00000
        B   200000000000                                FROM              55526 16113  20 00000 00000
        B   100000000000                                 THE              55527 16114  10 00000 00000
        B                                                 TRACE           55530 16115  00 00000 00000
CBUF        BUF                                            IS            55531 16116  00 15500 00000
DBLSP   B   370000000000                                    IN           55532 16117  37 00000 00000
IND                                                          OCTAL       55533 16120  00 00000 00000
TEMPA                                                         NOTATION.  55534 16121  00 00000 00000
                           CONSTANT  P  OOL                     L(0)     55535 16122  00 00000 00000
                                                                L(9)     55536 16123  00 00000 00011
                                                                L(4)     55537 16124  00 00000 00004
                                                                L(1)     55540 16125  00 00000 00001
                                                                L(2)     55541 16126  00 00000 00002
                                                                L(11)    55542 16127  00 00000 00013
                                                                L(100000B) 55543 16130  00 00001 00000
                                                                L(77777B) 55544 16131  00 00000 77777
                                                                L(170000B) 55545 16132  00 00001 70000
                                                                L(17B)   55546 16133  00 00000 00017
                                                                L(14B)   55547 16134  00 00000 00014
                                                                L(37B)   55550 16135  00 00000 00037
                                                                L(75B)   55551 16136  00 00000 00075
                                                                L(7)     55552 16137  00 00000 00007
                                                                L(3)     55553 16140  00 00000 00003
                           UNDEFINED     TAGS                   SVAR     55554 16141  00 00000 00000
                                                                 SVQ     55555 16142  00 00000 00000
END
```

SECTION III

ARITHMETIC SUBROUTINES

(F.P.)= Floating Point
(S.P.)= Stated Point

1103AF SUBR	DESCRIPTION	TAG	AUTHOR	DETAGGED	STORAGE	COMMENTS
00001S	STANDARDIZATION OF SUBROUTINES		Systems Dev.			
00002S	Sine (F.P.) Cosine (F.P.)	SINE COSINE	Systems Dev. Systems Dev.	x	78	One common deck
00003S	Square Root (F.P.)	SQROOT	Systems Dev.	x	61	
00004S	Exponential Function (F.P.)	EXP	Systems Dev.	x	69	
00005S	Natural Logarithm (F.P.)	LNX	Systems Dev.	x	77	
00006S	Arctangent (F.P.)	ARCTAN	Systems Dev.	x	87	
00007S	Arcsine (F.P.)	ARCSIN	D. L. Richards	x	68	Needs SSQRT
00008S	Arcosine (F.P.)	ARCOS	D. L. Richards	x	69	Needs SSQRT
00009S	Sine (S.P.)	SSIN	D. L. Richards	x	47	
00010S	Cosine (S.P.)	SCOS	D. L. Richards	x	49	
00011S	Square Root (S.P.)	SSQRT	D. L. Richards	x	48	
00012S	Exponential Function (S.P.)	SEXP	D. L. Richards	x	45	
00013S	Natural Logarithm (S.P.)	SLNX	D. L. Richards	x	52	
00014S	Arcsine (S.P.)	SARCSN	D. L. Richards	x	77	
00015S	Arcosine (S.P.)	SARCOS	D. L. Richards	x	79	
00016S	Arctangent (S.P.)	SARCTN	D. L. Richards	x	49	
00017P	Print Edit	PREDIT	A. Podvin	x	520	
00018S	Variable Field Card Read	VARAB	Systems Dev.	x	393	
00019S	Variable Field Card Read (Tape Mode)	VARCAR	Systems Dev.	x	377	
00020S	Read Floating Decimal Tape	RDFLDC	Systems Dev.	x	234	
00021S	Write Floating Decimal Tape	WFLDEC	Systems Dev.	x	326	

1103AF SUBR	DESCRIPTION	TAG	AUTHOR	DETAGGED	STORAGE	COMMENTS
00022S	Read Binary Cards	RDBIN	Systems Dev.	x	68	
00023S	Punch Binary Cards	PCHBIN	Systems Dev.	x	215	
00024P	Complex Arithmetic Package	CMPLX	D. N. Williams		146	May need SINE, COSINE, SQROOT, ARCTAN
00025P	Determinant Evaluator (Complex Floating Point)	CPXDET	M. J. Antchagno		198	
00026P	Matrix Card Read	MATRDC	F. P. Brown M. J. Antchagno		260	
00027P	Determinant Evaluator (F.P.)	RLDET	M. J. Antchagno		122	
00028P	Linear Matrix Equation Solver and Matrix Inverter (F.P.)	SIMEQN INVERT	M. J. Antchagno		174	
00029P	Complex Matrix Multiply	MATMPC	M. J. Antchagno		117	
00030P						
00031P	Polynomial Multiply	PØLMUL	T. Griffen		57	
00032P	Complex Polynomial Multiply	PØLCML	T. Griffen		106	Includes F2

All error terms refer only to the error due to the numerical method used in the subroutine.

1. IDENTIFICATION

FLOATING POINT SINE, COSINE
Identification Tag: SINE, COSINE

2. DESCRIPTION

This routine computes the sine (cosine) of a floating point number placed in Q. The answer is left in Q.

3. CALLING SEQUENCE

TP	L(x)	Q
CALL	SINE	(COSINE)

4. CODING INFORMATION

This routine requires 78 cells, including one temporary and 17 constants. Fixed point arithmetic is used.

5. RESTRICTIONS

Inputs greater than 2^{26} give zero for an answer; if this occurs Q is cleared and AR = XS3 code for SINE

Accuracy: $|E| < 5 \times 10^{-8}$

6. ERROR PROCEDURES

None

```
COSINE  RJ    L+14          L+3
        TP    L+61          Q
        MJO                 FILL
        TV    L-1           L+6
        TP    L+60          L+22
        TM    Q             Q
        MJO                 L+6
SINE    MJO                 L+3
        MSO                 L+1
        MJO                 FILL
        TP    L+40          L+16
        TV    L-3           L+3
        TP    Q             L+48
        TM    Q             A
        TJ    L+51          FILL
        TJ    L+51          L+4
        RS    Q             Q
        SP    L+50
        MJO                 L-10
        LT1   9             Q
        LTO                 A
        SS    L+47
        AT    L+47          L+3
        LQ    Q             35
        MP    Q             L+46
        SS    FILL
        AT    FILL          FILL
        QT    L+44          L-2
        QJ    L+1           L+2
        TN    L+31          L+31
        QJ    L+1           L+3
        SP    L+32
        ST    L-7           L-7
        MP    L-8           L-8
        LTO   2             Q
        MP    Q             L+37
        LTO   1             A
        AT    L+36          L-11
        MP    Q             L-12
```

IDENTIFICATION

FLOATING POINT SINE COSINE

IDENTIFICATION TAGS

SINE, COSINE

DESCRIPTION

THIS ROUTINE COMPUTES THE SINE(COSINE) OF A FOATING POINT ARGUMENT PLACED IN Q. THE ARGUMENT MUST BE EXPRESSED IN RADIANS. THE ANSWER IS LEFT IN Q.

CALLING SEQUENCE

```
TP   L(X)      Q
CALL SINE

        OR

TP    L(X)     Q
CALL  COSINE
```

CODING INFORMATION

THIS ROUTINE REQUIRES 78 CELLS, INCLUDING ONE TEMPORARY STORAGE AND 17 CONSTANTS. FIXED POINT ARITHMETIC IS USED

```
LTO   1              A
AT    L+34           L-14
MP    Q              L-15
LTO   2              A
AT    L+32           L-17
MP    Q              L-18
LTO   1              A
AT    L+30           L-20
MP    L-22           L-21
ZJ    L+1            L+11
SF    A              L+12
TP    A              Q
LA    Q              28
LTO                  Q
TP    L+8            A
SA    L+23           27
AT    Q              Q
TP    L+4            A
SJ    L+1            L+2
TN    Q              Q
MJO                  L-50
B
B
B     201400000000
B     200000000000
AT    L-1            Q
B     160400000000
B     233400000000
B     653450300101
B     201
SS    A              37
B     242763015562
B     177777777777
B     000117327564
B     775466631633
B     024315053663
B     532504175124
B     311037552202
B     137
```

INTERNALLY.

RESTRICTIONS

ARGUMENTS PLACED IN Q MUST BE LESS THAN 2 RAISED TO THE 26TH POWER IN ABSOLUTE MAGNITUDE.

ACCURACY

THE ABSOLUTE VALUE OF THE ERROR IN THE RESULT IS LESS THAN 5 TIMES 10 RAISED TO THE POWER -8 IN ALL CASES.

ERROR PROCEDURES

AN ARGUMENT GREATER THAN 2 RAISED TO THE 26TH POWER WILL YIELD A ZERO RESULT IN Q AND CAUSE THE COMPUTER TO STOP (MSO STOP) LEAVING THE UNIVAC CODE,

653450300101-(SINE)

IN AR. DEPRESSING THE START BUTTON WILL RESULT IN A NORMAL EXIT FROM THE ROUTINE.

1. IDENTIFICATION

FLOATING POINT SQUARE ROOT
Identification Tag: SQROOT

2. DESCRIPTION

This routine computes the square root of a floating point number placed in Q. The answer is left in Q.

3. CALLING SEQUENCE

```
TP      L(x)        Q

CALL    SQROOT
```

4. CODING INFORMATION

This routine occupies 61 cells. Fixed point arithmetic is used.

5. RESTRICTIONS

Input and output are non-negative floating point numbers.

Accuracy: $|E| < 5 \times 10^{-9}$

6. ERROR PROCEDURES

If the input is negative, the code word 655354515166 is placed in A, Q is cleared and the routine goes to the error exit. Depressing the start button will give a normal exit from the routine.

```
SQROOT  MJ0              L+3
        MS0              L+1
        MJ0              FILL
        TP   Q           A
        LT0  9           L+34
        ZJ   L+1         L-3
        SJ   L+1         L+4
        RS   Q           Q
        SP   L+52
        MJ0              L-8
        LQ   A           34
        TP   Q           L+28
        LT0  7           A
        SP   A           15
        AT   L+27        L+1
        MP   FILL        FILL
        LT0              A
        LQ   Q           17
        AT   Q           L-3
        SP   L+20        33
        DV   L-5         A
        AT   L-6         L-6
        LA   L+16        35
        TP   A           Q
        LT0              A
        AT   L+15        L+13
        QJ   L+7         L+1
        MP   L-12        L+31
        LT   1           L-13
        LT   1           Q
        QJ   L+3         L+1
        LT0              L-16
        RS   L+6         L+27
        TP   L-18        A
        LT0  28          A
        LQ   L+3         27
```

IDENTIFICATION

FLOATING POINT SQUARE ROOT

IDENTIFICATION TAG

SQROOT

DESCRIPTION

THIS ROUTINE COMPUTES THE SQUARE ROOT OF A FLOATING POINT NUMBER PLACED IN Q. THE ANSWER IS LEFT IN Q.

CALLING SEQUENCE

```
TP      L(X)      Q

CALL    SQROOT
```

CODING INFORMATION

THIS ROUTINE OCCUPIES 61 CELLS. FIXED POINT ARITHMETIC IS USED INTERNALLY.

RESTRICTIONS

```
AT    Q              Q
MJO                  L-35
MJO                  FILL
MJO                  FILL
B     101
MP    L-15           L-2
B     374076100764
B     364636102726
B     356062104635
B     347722106511
B     342134110335
B     334666112133
B     327710113705
B     323176115434
B     316710117140
B     312626120623
B     306734122267
B     303216123714
B     277644125322
B     274426126713
B     271332130267
B     266352131626
B     265011714640
B     1
B     655354515166
```

```
 INPUT AND OUTPUT ARE      37SQ
NON-NEGATIVE FLOATING      38SQ
POINT NUMBERS.             39SQ
                           40SQ
                           41SQ
       ACCURACY            42SQ
                           43SQ
 THE ABSOLUTE VALUE OF     44SQ
THE ERROR IN THE RESULT    45SQ
IS LESS THAN 5 TIMES 10    46SQ
RAISED TO THE POWER -9     47SQ
IN ALL CASES.              48SQ
                           49SQ
                           50SQ
   ERROR PROCEDURES        51SQ
                           52SQ
 IF THE INPUT IS NEGA-     53SQ
TIVE THE UNIVAC CODE       54SQ
 655354515166-(SQROOT)     55SQ
IS PLACED IN AR, Q IS      56SQ
CLEARED AND THE COMPUTER   57SQ
IS STOPPED. DEPRESSING     58SQ
THE START BUTTON WILL      59SQ
RESULT IN A NORMAL EXIT    60SQ
FROM THE ROUTINE.          61SQ
```

1. IDENTIFICATION

FLOATING POINT EXPONENTIAL
Identification Tag: EXP

2. DESCRIPTION

This routine computes e^x where x is a floating point number placed in Q. The answer is left in Q.

3. CALLING SEQUENCE

```
TP    L(X)    Q
CALL  EXP
```

4. CODING INFORMATION

This routine occupies 69 cells. Fixed point arithmetic is used.

5. RESTRICTIONS

Input range: $-87 < X < +87$.

Accuracy: $|E| < 5 \times 10^{-9}$.

6. ERROR PROCEDURES

Underflow gives an answer of zero and takes the normal exit. Overflow places the code word 307252010101 in A and 377777777770 in Q and stops at the error exit. Depressing the start will give a normal exit.

```
EXP     MJO             L+3
        MSO             L+1
        MJO             FILL
        TP    Q         L+43
        RS    Q         Q
        TP    L+41      A
        TJ    L+41      L-4
        TJ    L+41      L+4
        SP    L+41
        LQ    L+41      Q+3
        MJO             L-9
        TM    A         A
        TP    L+39      Q
        TJ    L+39      L-11
        LTO   9         A
        ST    L+38      Q
        SA    L+38      15
        TU    A         L+9
        TN    Q         A
        AT    L+36      L+5
        LA    L+26      9
        LQ    A         35
        MP    Q         L+35
        LTO   1         Q
        SP    FILL
        AT    Q         A
        LTO             A
        LTO   9         L+19
        LQ    A         35
        LTO   4         A
        AT    L+28      L+11
        QT    L+19      Q
        MP    Q         L+35
        LTO             A
        AT    L+34      L-10
        MP    Q         L-11
```

IDENTIFICATION

FLOATING POINT EXPONENTIAL

IDENTIFICATION TAG

EXP

DESCRIPTION

THIS ROUTINE COMPUTES THE VALUE OF E RAISED TO THE POWER X WHERE X IS A FLOATING POINT NUMBER PLACED IN Q. THE ANSWER IS LEFT IN Q.

CALLING SEQUENCE

```
TP    L(X)      Q

CALL  EXP
```

CODING INFORMATION

THIS ROUTINE OCCUPIES 69 CELLS OF COMPUTER STORAGE. FIXED POINT ARITHMETIC IS USED INTERNALLY.

```
LT0                 A
AT    L+20          L-13
SP    Q             33
DV    L-15          A
AT    L+19          Q
MP    FILL          FILL
SS    A             30
LQ    L+3           27
AT    Q             Q
MJ0                 L-43
B
B     570232254037
B     207540074635
B     307252010101
B     037777777777
B     201400000000
B     145400000000
B     200
B     35
SP    L+1           7
B     201000000000
B     270524354513
MP    Q             L+1
B     200000000000
B     213453407440
B     230157701214
B     245775532516
B     265011714640
B     305316250212
B     327211763126
B     352601433477
B     035440262675
B     600000171150
```

RESTRICTIONS

RANGE OF ACCEPTABLE INPUT VALUES IS GIVEN BY THE FOLLOWING STATEMENT. X MUST BE GREATER THAN -87 AND LESS THAN +87.

THE ACCURACY OF THE ROUTINE IS SUCH THAT THE ERROR IN THE RESULT IS ALWAYS LESS THAN 5 TIMES 10 RAISED TO THE POWER -9 IN ABSOLUTE VALUE.

ERROR PROCEDURES

UNDERFLOW (X EQUAL TO OR LESS THAN -87) GIVES AN ANSWER OF ZERO AND TAKES THE NORMAL EXIT.
OVERFLOW (X EQUAL TO OR GREATER THAN +87) CAUSES THE UNIVAC CODE

3072520101-(EXP)

TO BE ENTERED IN AR, AND 377777777777 IN Q, AND STOPS THE COMPUTER. DEPRESSING THE START BUTTON WILL GIVE A NORMAL EXIT WITH 377777777777 AS THE ANSWER.

1. IDENTIFICATION

FLOATING POINT NATURAL LOGARITHM
Identification Tag: LNX

2. DESCRIPTION

This routine computes the natural logarithm of x, where x is a floating point number placed in Q. The answer is left in Q.

3. CALLING SEQUENCE

```
TP      L(x)      Q

CALL    LNX
```

4. CODING INFORMATION

This routine occupies 77 cells. Fixed point arithmetic is used.

5. RESTRICTIONS

Input: any floating point number greater than zero.

Accuracy: $|E| < 5 \times 10^{-9}$

6. ERROR PROCEDURES

If the input is less than or equal to zero, the error exit is used. A will contain the code word 465072010101 and Q will be zero. Depressing the start button will give a normal exit.

```
LNX     MJO             L+3
        MSO             L+1
        MJO             FILL
        TP    Q         A
        SJ    L+2       L+1
        ZJ    L+4       L+1
        RS    Q         Q
        SP    L+50
        MJO             L-7
        LTO   9         L+45
        LQ    A         35
        TP    Q         L+44
        RP2   7         L+2
        TJ    L+46      L+2
        TP    L+52      Q
        SP    L+52
        ST    Q         Q
        SA    L+51      15
        TU    A         L+4
        TP    L+35      A
        SS    L+49      3
        AT    Q         L+33
        TP    FILL      Q
        SP    Q
        SA    L+31      35
        LTO             L+31
        SP    L+29
        SS    Q         37
        DV    L+28      L+28
        MP    Q         Q
        SS    A         31
        MP    A         L+40
        LT    1         A
        AT    L+39      L+22
        MP    Q         L+21
        LTO             A
        AT    L+22      Q
        MP    Q         L+19
        LTO   3         A
```

IDENTIFICATION

FLOATING POINT NATURAL LOGARITHM

IDENTIFICATION TAG

LNX

DESCRIPTION

THIS ROUTINE COMPUTES THE NATURAL LOGARITHM OF X, WHERE X IS A FLOATING POINT NUMBER PLACED IN Q. THE ANSWER IS LEFT IN Q.

CALLING SEQUENCE

```
TP    L(X)    Q
CALL  LNX
```

CODING INFORMATION

THIS ROUTINE OCCUPIES 77 CELLS OF COMPUTER STORAGE. FIXED POINT ARITHMETIC IS USED INTERNALLY.

RESTRICTIONS

RANGE OF ACCEPTABLE IN

```
MA    L+15          L+34
TP    A             Q
ZJ    L+1           L-39
SF    A             L+28
LT0   28            Q
TP    L+26          A
TJ    L+29          L+2
SS    L+29
AT    L+29          L+7
TP    Q             A
SJ    L+1           L+2
TN    L+4           L+4
LQ    L+3           27
AT    Q             Q
MJ0                 L-51
B
TM    FILL          FILL
TM    FILL          FILL
B     465072010101
B     200000000000
B     213453407440
B     230157701214
B     245775532516
B     265011714640
B     305316250212
B     327211763126
B     352601433477
B     17777
B     20006
                    L-10
B     201
B
B     063146314632
B     125252525253
B     261344137700
B     44
B     110
B     175
```

PUT VALUES IS GIVEN BY THE FOLLOWING STATEMENT. X MUST BE GREATER THAN ZERO.

THE ACCURACY OF THE ROUTINE IS SUCH THAT THE ERROR IN THE RESULT IS ALWAYS LESS THAN 5 TIMES 10 RAISED TO THE POWER -9 IN ABSOLUTE VALUE.

ERROR PROCEDURES

IF X IS LESS THAN OR EQUAL TO ZERO THE COMPUTER WILL STOP LEAVING THE UNIVAC CODE

465072010101-(LNX)

IN AR AND ZERO IN Q. DE PRESSING THE START BUTTON WILL GIVE A NORMAL EXIT WITH ZERO AS THE ANSWER.

1. IDENTIFICATION

FLOATING POINT ARCTANGENT

Identification Tag: ARCTAN

2. DESCRIPTION

This routine computes the arctangent of x, where x is a floating point number placed in Q. The answer, expressed in radians, is left in Q.

3. CALLING SEQUENCE

RP	L(X)	Q
CALL	ARCTAN	

4. CODING INFORMATION

This routine occupies 87 cells. Fixed point arithmetic is used.

5. RESTRICTIONS

The routine gives a 1st quadrant angle for positive arguments and a 4th quadrant angle for negative arguments.

Accuracy: $|E| < 5 \times 10^{-9}$

6. ERROR PROCEDURES

None

FLOATING POINT ARCTANGENT

```
ARCTAN  MJO                 L+3
        TN    Q             Q
        MJO                 FILL
        TP    Q             L+57
        TM    Q             A
        TJ    L+61          L-3
        TJ    L+61          L+4
        TP    L+61          Q
        TP    L+52          A
        SJ    L-8           L-7
        LT    9             L+52
        LQ    A             35
        RS    L+50          L+57
        TN    L+57          L+48
        TJ    L+47          L+8
        TP    L+55          L+46
        TJ    L+45          L+2
        MJO                 L+5
        TP    A             L+43
        TP    Q             A
        TJ    L+45          L+2
        RA    L+40          L+43
        LA    L+39          A+15
        AT    L+48          L+28
        TP    L+37          A
        ST    L+37          A
        AT    L+53          L+11
        RA    L+35          L+34
        SJ    L+2           L+1
        TN    L+35          A
        AT    L+50          L+5
        ST    L+30          L+7
        TN    L+30          A
        AT    L+48          L+1
        SP    FILL
        SA    FILL
```

IDENTIFICATION

FLOATING POINT ARCTANGENT.

IDENTIFICATION TAG

ARCTAN

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCTANGENT OF X, WHERE X IS A FLOATING POINT NUMBER PLACED IN Q. THE ANSWER IS EXPRESSED IN RADIANS AND IS LEFT IN Q.

CALLING SEQUENCE

```
TP    L(X)    Q

CALL  ARCTAN
```

CODING INFORMATION

THIS ROUTINE OCCUPIES 87 CELLS. FIXED POINT ARITHMETIC IS USED WITH IN THE ROUTINE.

```
LTO   2              L+25
SN    FILL
SA    FILL
DV    L+22           L+22
MP    Q              Q
LTO   4              Q
MP    Q              L+40
LTO                  A
AT    L+39           L+18
MP    Q              L+17
LTO                  A
AT    L+37           L+15
MP    Q              L+14
LTO                  A
AT    L+35           Q
SP    FILL           34
MA    Q              L+9
SF    A              L+10
SP    A              28
LTO                  Q
TP    L+7            A
SA    L+29           27
AT    Q              Q
MJO                  L-51
B
B
B
B
B     1
B     261463146315
B     160400000000
B     236400000000
B     201622077325
B     201
B     3
SP    L+4            34
```

RESTRICTIONS

IF THE ARGUMENT (X) IS POSITIVE, THE ANSWER GIVEN IS A FIRST QUADRANT ANGLE (0 TO PI/2). IF THE ARGUMENT (X) IS NEGATIVE, THE ANSWER GIVEN IS A FOURTH QUADRANT ANGLE (0 TO -PI/2).

THE ACCURACY IS SUCH THAT THE ABSOLUTE VALUE OF THE ERROR IS LESS THAN 5 TIMES 10 RAISED TO THE POWER -9 IN ALL CASES.

ERROR PROCEDURES

NONE

```
      B     017725565152                       73AT
      B     037266727711                       74AT
      B     073261470126                       75AT
      B     144417665211                       76AT
      B     215556062273                       77AT
      B     251550622510                       78AT
      B     271111765246                       79AT
      SN    L-15          34                   80AT
      SA    Q             34                   81AT
      SP    L-17          34                   82AT
      B     756516101356                       83AT
      B     031450345451                       84AT
      B     725252603356                       85AT
      B     177777777773                       86AT
      B     137                                87AT
```

1. IDENTIFICATION

FLOATING POINT ARCSINE
D. L. Richards
Identification Tag: ARCSIN

2. DESCRIPTION

This routine computes the arcsine of a floating point argument x. The Rand polynomial $P(x) = \sum_{a=0}^{7} A_i/x/^i$ is evaluated for input x. Also $R(x) = \sqrt{1-/x/}$ is evaluated using the SSQRT subroutine. Then if x is positive, arcsine $x = \pi/2 - P(x)R(x)$; if x is negative, arcsine $x = -\pi/2 + P(x)R(x)$.

The output is an angle from quadrant I or quadrant IV expressed in radians and is left in Q.

3. CALLING SEQUENCE

TP	L(x)	Q
CALL	ARCSIN	

4. CODING INFORMATION

Routine required 68 decimal or 104 octal cells. In addition, the stated point square root subroutine SSQRT is called upon and must be included with this routine.

5. RESTRICTIONS

Form: Input and output are in packed floating point form

Accuracy: $/E/ < 2^{-26} < 2 \times 10^{-8}$

Range of input: $-1 \leq x \leq 1$

6. ERROR PROCEDURES

For input out of range, machine stops.

FLOATING POINT ARCSINE

```
ARCSIN  MJ                      L+3
        MS
        MJ
        TP      Q               L+59
        TM      Q               A
        TP      L+52            L+58
        ST      L+48            Q
        TJ      L+52            L+29
        TJ      L+52            L+2
        MJ                      L-8
        QT      L+46            L+53
        SP      Q               45
        TV      A               L+1
        LA      L+50
        SP      L+39
        ST      L+48            A
        ZJ      L+1             L+13
        SJ      L-16            L+1
        CALL    SSQRT
        LT                      L+45
        LT1                     L+45
        TU      L+40            L+4
        TP      L+22            Q
        MP      Q               L+40
        LT      1               A
        AT      L+20            Q
        RA      L-1             L+32
        TJ      L+14            L-4
        MP      Q               L+37
        LT      5               L+34
        TP      L+32            Q
        QJ      L+1             L+3
        SP      L+23            1
        ST      L+30            L+30
        SP      L+21
        ST      L+28            L+28
```

IDENTIFICATION

FLOATING POINT ARCSINE

IDENTIFICATION TAG

ARCSIN

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCSINE OF X, WHERE X IS A FLOATING POINT NUMBER PLACED IN Q. THE ANSWER, EXPRESED IN RADIANS, IS LEFT IN Q.

CALLING SEQUENCE

```
TP      L(X)        Q
CALL    ARCSIN
```

CODING INFORMATION

THIS ROUTINE OCCUPIES 68 CELLS. FIXED (STATED) POINT ARITHMETIC IS USED WITHIN THE ROUTINE. IN ADDITION, THE STATED POINT SQUARE ROOT SUBROUTINE (SSQRT) IS USED AND MUST BE ASSEMBLED WITH THIS ROUTINE.

```
SF    L+27          L+25
ZJ    L+1           L+29
LA    A             64
TP    A             L+24
SP    L+21          27
AT    L+11          Q
CC    Q             L+21
MJ                  L-41
S43-  1.2624911     -3
S41   6.6700901     -3
S39-  1.70881256    -2
S37   3.0891881     -2
S35-  5.01743046    -2
S33   8.89789874    -2
S31-  2.145988016   -1
S29   1.570796305
B     74000000000
B     100000000000
B     62000000000
S31   1.5707963268
B     400777777777
B
B     100000
B     44000000000
B     117400000001
MS    L-16
B
B
B
B
TP    L-9           Q
MJ                  L-24
```

RESTRICTIONS

IF THE ARGUMENT (X) IS POSITIVE, THE ANSWER GIVEN IS A FIRST QUADRANT ANGLE (0 TO PI/2). FOR A NEGATIVE X THE ANSWER IS A 4TH QUADRANT ANGLE (0 TO -PI/2).

RANGE OF INPUT. X MUST BE GREATER THAN OR EQUAL TO -1 AND LESS THAN OR EQUAL TO +1.

THE ABSOLUTE VALUE OF THE ERROR IN THE RESULT IS LESS THAN 2 TIMES 10 RAISED TO THE POWER -8.

ERROR PROCEDURES

FOR INPUT NOT IN RANGE, THE COMPUTER STOPS. DEPRESSING START KEY WILL NOT GIVE A NORMAL EXIT. THE CONTENTS OF A AND Q ARE MEANINGLESS.

1. IDENTIFICATION

FLOATING POINT ARCOSINE
D. L. Richards
Identification Tag: ARCOS

2. DESCRIPTION

This routine computes the arcosine of a floating point argument x. The Rand polynomial $P(x) = \sum_{i=0}^{7} A_i/x/^i$ is evaluated for input x. Also $R(x) = \sqrt{1-/x/}$ is evaluated using the SSQRT subroutine. Then if x is positive, arcosine $x = P(x)R(x)$; if x is negative, arcosine $x = \pi - P(x)R(x)$.

The output is an angle from quadrant I or quadrant II expressed in radians and is left in Q.

3. CALLING SEQUENCE

```
TP      L(x)      Q
CALL    ARCOS
```

4. CODING INFORMATION

Routine requires 69 decimal or 105 octal cells. In addition, the stated point square root subroutine SSQRT is called upon and must be included with this routine.

5. RESTRICTIONS

Form: Input and output are in packed floating point form

Accuracy: $/E/ < 2^{-26} < 2 \times 10^{-8}$

Range of input: $-1 \leq x \leq 1$

6. ERROR PROCEDURES

For input out of range, machine stops.

FLOATING POINT ARCCOSINE

```
ARCOS   MJ                  L+3
        MS
        MJ
        TP      Q           L+64
        TM      Q           A
        TP      L+53        L+59
        ST      L+49        Q
        TJ      L+54        L+6
        TJ      L+54        L+2
        MJ                  L-8
        QT      L+47        L+54
        SP      Q           45
        TV      A           L+1
        LA      L+51
        SP      L+40
        ST      L+49        A
        ZJ      L+1         L+16
        SJ      L-16        L+1
        CALL    SSQRT
        LT                  L+46
        LT1     ------      L+46
        TU      L+42        L+4
        TP      L+23        Q
        MP      Q           L+41
        LA      A           37
        AT      L+21        Q
        RA      L-1         L+33
        TJ      L+15        L-4
        TP      Q           L+40
        SP      L+36        36
        SA      L+36
        MP      A           L+37
        LT      5           L+32
        TP      L+34        Q
        QJ      L+1         L+3
        SP      L+21        1
```

IDENTIFICATION

FLOATING POINT ARCCOSINE

IDENTIFICATION TAG. ARCOS

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCCOSINE OF X, WHERE X IS A FLOATING POINT WORD PLACED IN Q. THE ANSWER, IN RADIANS IS LEFT IN Q.

CALLING SEQUENCE

```
TP      L(X)        Q
CALL    ARCOS
```

CODING INFORMATION

THE ROUTINE OCCUPIES 69 CELLS. STATED POINT ARITHMETIC IS USED WITH IN THE ROUTINE.

IN ADDITION, THE STATED POINT SQUARE ROOT SUB-ROUTINE IS USED AND MUST BE ASSEMBLED WITH THIS ROUTINE.

```
ST    L+28          L+28
SF    L+27          L+26
ZJ    L+1           L+6
LA    A             64
TP    A             L+24
SP    L+22          27
AT    L+11          Q
CC    Q             L+21
MJ                  L-42
S43-  1.2624911     -3
S41   6.6700901     -3
S39-  1.70881256    -2
S37   3.0891881     -2
S35-  5.01743046    -2
S33   8.89789874    -2
S31-  2.145988016   -1
S29   1.570796505
B     74000000000
B     100000000000
B     62000000000
S31   1.5707963268
B     400777777777
B
B     100000
B     1
B     44000000000
B     117400000001
MS    L-17
RSRV  5             5
```

RESTRICTIONS

FOR POSITIVE X, THE RESULT IS A FIRST QUADRANT ANGLE (0 TO PI/2), IF X IS NEGATIVE THE RESULT IS A QUADRANT II ANGLE.

THE ABSOLUTE VALUE OF THE ERROR IN THE RESULT IS LESS THAN 2 TIMES 10 RAISED TO THE POWER -8.

THE ACCEPTABLE VALUES OF X RANGE FROM -1 TO 1.

ERROR PROCEDURES

FOR INPUT NOT IN THE RANGE -1 THRU +1, THE COMPUTER WILL STOP. DEPRESSING THE START KEY WILL NOT GIVE A NORMAL EXIT. THE CONTENTS OF A AND Q ARE MEANINGLESS.

1. IDENTIFICATION

STATED POINT SINE
D. L. Richards
Identification Tag: SSIN

2. DESCRIPTION

This routine computes the sine of an angle. Input is reduced to a positive angle in quadrant I, II, III, or IV; the sign is assigned accordingly and the angle transformed to one whose absolute value does not exceed $\pi/2$. The following polynomial (of Rand type) is then applied:

$$\sin x = \sum_{i=1}^{5} A_{2i-1}\, x^{2i-1}$$

3. CALLING SEQUENCE

TP	L(x)	A
CALL	SSIN	

4. SPACE REQUIRED

47 decimal or 57 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 32 in A.

Accuracy: $/ E / \leq 6 \times 10^{-9}$

Range of input: $-2\pi \leq x \leq 2\pi$ (radians)

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SSIN    MJ                      L+3
        MS
        MJ
        TP      L+39            Q
        TJ      L+29            L+8
        QJ      L+1             L+3
        DV      L+27            Q
        SJ      L+4             L+8
        ST      L+25            A
        SJ      L+2             L-4
        QJ      L-4             L+1
        AT      L+22            A
        SJ      L-2             L+3
        TN      A               A
        MJ                      L+5
        TJ      L+26            L+4
        ST      L+19            A
        TJ      L+24            L-4
        ST      L+17            A
        TP      A               L+28
        MP      L+27            Q
        SA      L+13            41
        TP      A               L+24
        TP      L+13            Q
        TU      L+19            L+3
        MP      Q               L+21
        LT      1               A
        AT      L+10            Q
        RA      L-1             L+17
        TJ      L+15            L-4
        MP      Q               L+17
        LT      1               A
        MJ                      L-30
        B       311037552421
        B       10000000000
        B       144417665210
```

IDENTIFICATION

STATED POINT SINE

IDENTIFICATION TAG

SSIN

DESCRIPTION

THIS ROUTINE COMPUTES THE SINE OF X, WHERE X IS AN ANGLE EXPRESSED IN RADIANS IN A-RIGHT. THE RESULT IS LEFT IN A-RIGHT.

CALLING SEQUENCE

```
TP    L(X)    A
CALL  SSIN
```

CODING INFORMATION

ROUTINE USES 48 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 32 IN A.

ACCURACY. ABSOLUTE VALUE OF ERROR IS AT MOST 6 TIMES 10 TO THE -9TH POWER.

```
      B     311037552421
      B     10000000000
      B     144417665210
      B     127234047
      B     774602336021
      B     42103475514
      B     525252560054
      B     377777777511
      B     62207732504
      B     7000000000
      MS    L-6
      B     100000
      B
      B
```

```
RANGE OF INPUT. ABSO-                    37CO
LUTE VALUE OF X MUST NOT                 38CO
EXCEED 2 PI RADIANS.                     39CO
                                         40CO
    ERROR PROCEDURES                     41CO
                                         42CO
 FOR INPUT OUT OF RANGE,                 43CO
THE COMPUTER STOPS.                      44CO
                                         45CO
                                         46CO
                                         47CO
                                         48CO
                                         49CO
                                         50CO
```

1. IDENTIFICATION

STATED POINT COSINE
D. L. Richards
Identification Tag: SCOS

2. DESCRIPTION

This routine computes the cosine of an angle. If input is negative, $\pi/2$ is added; if it is positive, $-3\pi/2$ is added. The result is reduced to a positive angle in quadrant I, II, III, or IV; the sign is assigned accordingly and the angle transformed to one whose absolute value does not exceed $\pi/2$. The following polynomial (of Rand type) is then applied to produce the cosine of the original input:

$$\sin x = \sum_{i=1}^{5} A_{2i-1}\, x^{2i-1}$$

3. CALLING SEQUENCE

TP	L(x)	A
CALL	SCOS	

4. SPACE REQUIRED

49 decimal or 61 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 32 in A.

Accuracy: $/ E /$ $\leq 6 \times 10^{-9}$

Range of input: $-2\pi \leq x \leq 2$

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SCOS     MJ                L+3
         MS
         MJ
         SJ      L+2       L+1
         ST      L+32      A
         AT      L+39      Q
         TP      L+39      Q
         TJ      L+29      L+8
         QJ      L+1       L+3
         DV      L+27      Q
         SJ      L+4       L+8
         ST      L+25      A
         SJ      L+2       L-4
         QJ      L-4       L+1
         AT      L+22      A
         SJ      L-2       L+3
         TN      A         A
         MJ                L+5
         TJ      L+26      L+4
         ST      L+19      A
         TJ      L+24      L-4
         ST      L+17      A
         TP      A         L+27
         MP      L+26      Q
         SA      L+13      41
         TP      A         L+23
         TP      L+13      Q
         TU      L+19      L+3
         MP      Q         L+20
         LT      1         A
         AT      L+10      Q
         RA      L-1       L+16
         TJ      L-27      L-4
         MP      Q         L+16
         LT      1         A
         MJ                L-33
```

IDENTIFICATION

STATED POINT COSINE

IDENTIFICATION TAG

SCOS

DESCRIPTION

THIS ROUTINE COMPUTES THE COSINE OF X, WHERE X IS AN ANGLE EXPRESSED IN RADIANS IN A-RIGHT. THE RESULT IS LEFT IN A-RIGHT.

CALLING SEQUENCE

```
TP    L(X)    A
CALL  SCOS
```

CODING INFORMATION

ROUTINE USES 50 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 32 IN A.

ACCURACY. THE ABSOLUTE VALUE OF THE ERROR IS AT MOST 6 TIMES 10 TO THE -9TH POWER.

```
      B     127234047                  RANGE OF INPUT. ABSO-      37SI
      B     774602336021               LUTE VALUE OF X MUST NOT   38SI
      B     42103475514                EXCEED 2 PI RADIANS.       39SI
      B     525252560054                                          40SI
      B     377777777511                  ERROR PROCEDURES        41SI
      B     062207732504                                          42SI
      B     7000000000                  FOR INPUT OUT OF RANGE,   43SI
      MS    L-6                        THE COMPUTER STOPS.        44SI
      AT    L-3           Q                                       45SI
      B     100000                                                46SI
      B                                                           47SI
      B                                                           48SI
```

1. IDENTIFICATION

STATED POINT SQUARE ROOT
D. L. Richards
Identification Tag: SSQRT

2. DESCRIPTION

This routine computes the square root of the argument. A first approximation of the form $C_1(x + C_4) + C_2 - (C_3/x + C_4)$ is computed and the Newton-Raphson formula is applied for one iteration.

3. CALLING SEQUENCE

SP	$L(x_L)$	36
SA	$L(x_R)$	
CALL	SSQRT	

4. SPACE REQUIRED

48 decimal or 60 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 33 in A.

Accuracy: $/ E / < 4x8^{-11}$

Range of input: $0 \leq x \leq 2^{38}$

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SSQRT   MJ                  L+3
        MS
        MJ
        SJ      L-2         L+1
        ZJ      L+1         L-2
        SF      A           L+39
        TP      A           A
        TP      A           L+38
        SA      L+26        54
        TP      A           L+37
        MP      L+25        L+36
        AT      L+25        L+36
        SN      L+25        15
        DV      L+33        A
        AT      L+33        L+32
        SP      L+30        32
        SS      L+30
        DV      L+29        A
        AT      L+28        L+28
        LQ      L+25        35
        QT      L+23        A
        TV      A           L+8
        TP      L+10        L+8
        TJ      L+15        L+2
        TP      L+9         L+6
        QJ      L+4         L+1
        MP      L+13        L+20
        SA      L+13        37
        TP      A           L+18
        SP      L+17
        MS
        TP      A           A
        MJ                  L-30
        SA      L+9         36
        B       264767031361
        B       65324
```

```
          IDENTIFICATION                1SR
 STATED POINT SQUARE                    2SR
ROOT                                    3SR
                                        4SR
    IDENTIFICATION TAG                  5SR
 SSQRT                                  6SR
                                        7SR
         DESCRIPTION                    8SR
 THIS ROUTINE COMPUTES                  9SR
THE SQUARE ROOT OF X,                   10SR
WHERE X IS A 72 BIT WORD                11SR
IN A. THE ANSWER IS LEFT                12SR
IN A.                                   13SR
                                        14SR
      CALLING SEQUENCE                  15SR
 SP     L(XL)    36                     16SR
 SP     L(XR)                           17SR
 CALL   SSQRT                           18SR
                                        19SR
 XL - LEFT 36 BITS OF X                 20SR
 XR - RIGHT 36 BITS OF X                21SR
                                        22SR
    CODING INFORMATION                  23SR
 ROUTINE USES 48 CELLS.                 24SR
                                        25SR
         RESTRICTIONS                   26SR
 SCALING. INPUT AND OUT                 27SR
PUT ARE SCALED 33 IN A.                 28SR
                                        29SR
 ACCURACY. ABSOLUTE                     30SR
VALUE OF ERROR IS LESS                  31SR
THAN 4 TIMES 8 TO THE                   32SR
-11TH POWER.                            33SR
                                        34SR
 RANGE OF INPUT. X MUST                 35SR
BE GREATER THAN OR EQUAL                36SR
```

```
      B     114534644516
      B     330657140273
      B     23
      B     265011714640
      B     200000000000
      B     243512563704
      B     377777777777
      B     77
      RSRV  4              4
```

TO ZERO AND LESS THAN 2 37SR
TO THE 38TH POWER. 38SR
39SR
ERROR PROCEDURES 40SR
FOR NEGATIVE INPUT, THE 41SR
COMPUTER STOPS. 42SR
43SR
44SR
45SR

1. IDENTIFICATION

STATED POINT EXPONENTIAL
D. L. Richards
Identification Tag: SEXP

2. DESCRIPTION

This routine computes e^x for argument x. Numbers q and r are found such that $x = q(\text{LN } 2) + r$ and $/r/ \leq (\text{LN } 2)/ 2$. Then $e^x = 2^{q+1} (e^r/2)$. $e^r/2$ is evaluated by seventh order polynomial and shifted left q+1 places to produce the result.

3. CALLING SEQUENCE

SP	$L(x_L)$	36
SA	$L(x_R)$	
CALL	SEXP	

4. SPACE REQUIRED

45 decimal or 55 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 35 in A.

Accuracy: $/ E / < (11.3 + .7 /x/) 2^{-35} e^x + 2^{-35}$

Range of input: $-(\text{LN } 2) (2^{35} + 2^{-1}) < x < 34.5 (\text{LN } 2)$

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SEXP    MJ                  L+3
        MS
        MJ
        AT      L+38        A
        DV      L+27        L+39
        ST      L+36        L+39
        TP      L+26        Q
        TU      L+21        L+3
        MP      Q           L+36
        LA      A           37
        AT                  Q
        RA      L-1         L+30
        TJ      L+15        L-4
        RA      L+30        L+29
        SJ      L+1         L+8
        TV      L+15        L+4
        AT      L+13        A
        TJ      L+13        L+2
        TV      A           L+1
        LA      Q
        TP      A           A
        MJ                  L-19
        TJ      L+8         L+2
        MJ                  L-22
        TV      A           L+1
        LA      Q
        MJ                  L-24
        AT      L+13        Q
        MS      L+5
        B       110
        B       44
        B       261344137677
        B       15035404
        B       133323520
        B       1042101327
        B       5252506225
```

IDENTIFICATION

STATED POINT EXPONENTIAL

IDENTIFICATION TAG

SEXP

DESCRIPTION

THIS ROUTINE COMPUTES E TO THE XTH POWER, WHERE X IS A 72 BIT NUMBER IN A. THE RESULT IS LEFT IN A.

CALLING SEQUENCE

```
SP    L(XL)   36
SA    L(XR)
CALL  SEXP
```

XL - LEFT 36 BITS OF X

XR - RIGHT 36 BITS OF X

CODING INFORMATION

ROUTINE USES 45 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 35 IN A.

ACCURACY. ABSOLUTE VALUE OF ERROR IS AT MOST (11.3+.7/X/) TIMES 2 TO THE -35TH POWER TIMES E TO THE XTH POWER

RANGE OF INPUT. X MUST

```
      B     25252525342
      B     100000000000
      B     177777777777
      B     177777777777
      B     130562057737
      B     100000
      B     1
      B
      B
```

EXCEED -LN 2 TIMES 2 TO 37SX
THE 35TH POWER AND BE 38SX
LESS THAN 34.5(LN 2). 39SX
40SX
ERROR PROCEDURES 41SX
FOR INPUT OUT OF RANGE, 42SX
THE COMPUTER STOPS. 43SX
44SX
45SX

1. IDENTIFICATION

STATED POINT NATURAL LOGARITHM
D. L. Richards
Identification Tag: SLNX

2. DESCRIPTION

The routine computes LN(x) for argument x. Numbers s, u, and v are found such that $x = 2^s u = 2^s(3/4)(v+1)$ and $/v/ \leq 1/3$. Then $LN\ x = x(LN\ 2) + LN\ (3/4) + LN(v+1)$. LN(v+1) is obtained by polynomial evaluation.

3. CALLING SEQUENCE

SP	$L(x_L)$	36
SA	$L(x_R)$	
CALL	SLNX	

4. SPACE REQUIRED

52 decimal or 64 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 35 in A.

Accuracy: For $x \geq 10^{-1}$, $/E/ \leq (.72/LN\ x/ + 8.6)\ 2^{-35}$.

For $x < 10^{-1}$, $/E/ < x^{-1}.2^{-35}$

Range of input: $0 < x < 2^{35}$

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SLNX    MJ                  L+3
        MS
        MJ
        TJ      L+29        L-2
        SF      A           L+41
        ST      L+19        L+41
        LA      A           35
        MA      L+39        L+18
        LT      1           L+38
        TP      L+24        Q
        TU      L+21        L+3
        MP      Q           L+35
        LT      1           A
        AT                  Q
        RA      L-1         L+15
        TJ      L+13        L-4
        TP      Q           L+31
        TP      L+28        A
        TJ      L+8         L+2
        ST      L+11        A
        MP      A           L+7
        AT      L+25        A
        AT      L+25        A
        MJ                  L-21
        B       300000000000
        B       125252525253
        B       45
        B       261344137700
        AT      L+17        Q
        B       100000
        B       110
        MS      L+3
        B       1
        B       040652163741
        B       735622203763
        B       032714524356
```

IDENTIFICATION

STATED POINT NATURAL LOGARITHM

IDENTIFICATION TAG

SLNX

DESCRIPTION

THIS ROUTINE COMPUTES THE NATURAL LOGARITHM OF X, WHERE X IS A 72 BIT NUMBER IN A. THE RESULT IS LEFT IN A.

CALLING SEQUENCE

```
SP    L(XL)   36
SA    L(XR)
CALL  SLNX
```

XL - LEFT 36 BITS OF X
XR - RIGHT 36 BITS OF X

CODING INFORMATION

ROUTINE USES 48 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 35 IN A.

ACCURACY. WHERE X IS ONE-TENTH OR GREATER, THE ABSOLUTE VALUE OF THE ERROR IS AT MOST (.72/LN X/+8.6) TIMES 2 TO THE -35TH POWER. FOR X LESS THAN ONE-TENTH,

```
B     741111634006
B     044540300304
B     725207705376
B     063144151162
B     700000730075
B     125252547122
B     577777773345
B     777777777724
B     666264736730
B
B
B
```

```
IT IS LESS THAN 1 OVER X                37SL
TIMES 2 TO THE -35TH.                   38SL
                                        39SL
 RANGE OF INPUT. X MUST                 40SL
EXCEED ZERO AND BE LESS                 41SL
THAN 2 TO THE 35TH POWER                42SL
                                        43SL
    ERROR PROCEDURES                    44SL
 FOR INPUT OUT OF RANGE,                45SL
THE COMPUTER STOPS.                     46SL
                                        47SL
                                        48SL
```

1. IDENTIFICATION

STATED POINT ARCSINE
D. L. Richards
Identification Tag: SARCSN

2. DESCRIPTION

This routine computes the arcsine of the argument. The Rand polynomial $P(x) = \sum_{i=0}^{7} A_i/x/^i$ is evaluated for argument x. Also $R(x) = \sqrt{1-/x/}$ is evaluated by the Newton-Raphson Method where $S_n = \frac{1}{2}\left(\frac{1-/x/}{S_{n-1}}\right)$, iterating until $\frac{1-/x/}{S_{n-1}} - S_{n-1}$ is positive. Then if x is positive, arcsine $x = \pi/2 - P(x)R(x)$; if x is negative, arcsine $x = -\pi/2 + (P(x)R(x)$.

The output is an angle from quadrant I or quadrant IV expressed in radians.

3. CALLING SEQUENCE

```
TP      L(x)      A
CALL    SARCSN
```

4. SPACE REQUIRED

77 decimal or 115 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 33 in A.

Accuracy: $/ E / \leq 9x10^{-9}$

Range of input: $-1 \leq x \leq 1$

6. ERROR PROCEDURES

For input out of range, machine stops.

```
SARCSN  MJ                  L+3
        MS
        MJ
        TP      L+66        L+68
        TM      A           L+68
        TJ      L+50        L-4
        TJ      L+50        L+2
        MJ                  L-6
        TP      A           Q
        ZJ      L+1         L-7
        SJ      L+1         L+2
        TP      L+43        L+60
        TM      A           A
        EJ      L+44        L+34
        MP      L+58        L+44
        LT      1           A
        AT      L+43        L+57
        MP      L+55        L+56
        LT      1           A
        AT      L+41        L+54
        MP      L+52        L+53
        LT      3           A
        AT      L+39        L+51
        MP      L+49        L+50
        LT      2           A
        AT      L+37        L+48
        MP      L+46        L+47
        LT      2           A
        AT      L+35        L+45
        MP      L+43        L+44
        LT      2           A
        AT      L+33        L+42
        MP      L+40        L+41
        LT                  A
        AT      L+31        L+39
        TN      L+37        A
```

IDENTIFICATION

STATED POINT ARCSINE

IDENTIFICATION TAG

SARCSN

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCSINE OF X, WHERE X IS A NUMBER IN A-RIGHT THE RESULT IS LEFT IN A-RIGHT.

CALLING SEQUENCE

```
TP    L(X)    A
CALL  SARCSN
```

CODING INFORMATION

ROUTINE USES 76 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 33 IN A.

ACCURACY. ABSOLUTE

```
SA    L+21          2
TP    L+30          L+37
EJ    L+29          L+8
TP    A             L+36
SP    L+35          34
DV    L+33          L+29
LA    L+32          71
RS    Q             L+31
RA    L+30          L+26
QJ    L-5           L+1
MP    A             L+27
LT    1             A
ST    L+18          Q
IJ    L+22          L+2
TN    Q             Q
TP    Q             A
DV    L+16          A
MJ                  L-51
B     1
B     677777777777
B     100000000001
B     100000000000
B     532413520070
B     332441425535
B     564007151545
B     375041741233
B     462370666522
B     266165166073
B     444200330653
B     311037551633
B     311037552421
B     377777777777
B     2
B
RSRV  6             6
```

VALUE OF ERROR IS AT MOST 9 TIMES 10 TO THE MINUS 9TH POWER.

RANGE OF INPUT. ABSOLUTE VALUE OF X MUST BE LESS THAN OR EQUAL TO 1.

THE RESULT IS AN ANGLE FROM QUADRANT I (IF X IS POSITIVE) OR QUADRANT IV (IF X IS NEGATIVE, EXPRESSED IN RADIANS.

ERROR PROCEDURES

FOR INPUT OUT OF RANGE, THE COMPUTER STOPS.

1. IDENTIFICATION

STATED POINT ARCOSINE
D. L. Richards
Identification Tag: SARCOS

2. DESCRIPTION

This routine computes the arcosine of the argument. The Rand polynomial $P(x) = \sum_{i=0}^{7} A_i/x/^i$ is evaluated for argument x. Also $R(x) = \sqrt{1 - /x/}$ is evaluated by the Newton-Raphson method where $S_n = \frac{1}{2}\left(\frac{1 - /x/}{S_{n-1}} + S_{n-1}\right)$, iterating until $\frac{1 - /x/}{S_{n-1}} - S_{n-1}$ is positive. Then if x is positive, arcosine $x = P(x)R(x)$; if x is negative, arcosine $x = \pi - P(x)R(x)$.

The output is an angle from quadrant I or quadrant II expressed in radians.

3. CALLING SEQUENCE

TP	L(x)	A
CALL	SARCOS	

4. SPACE REQUIRED

79 decimal or 117 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 33 in A.

Accuracy: $/E/ \leq 9 \times 10^{-9}$

Range of input: $-1 \leq x \leq 1$

6. ERROR PROCEDURES

For input out of range, machine stops.

STATED POINT ARCOSINE

```
SARCOS  MJ                  L+3
        MS
        MJ
        TP    L+68          L+70
        TM    A             L+70
        TJ    L+52          L-4
        TJ    L+52          L+2
        MJ                  L-6
        TP    A             Q
        ZJ    L+1           L+42
        SJ    L+1           L+2
        TP    L+61          L+62
        TM    A             A
        EJ    L+46          L+42
        MP    L+60          L+46
        LT    1             A
        AT    L+45          L+59
        MP    L+57          L+58
        LT    1             A
        AT    L+43          L+56
        MP    L+54          L+55
        LT    3             A
        AT    L+41          L+53
        MP    L+51          L+52
        LT    2             A
        AT    L+39          L+50
        MP    L+48          L+49
        LT    2             A
        AT    L+37          L+47
        MP    L+45          L+46
        LT    2             A
        AT    L+35          L+44
        MP    L+42          L+43
        LT                  A
        AT    L+33          L+41
        TN    L+39          A
```

IDENTIFICATION

STATED POINT ARCOSINE

IDENTIFICATION TAG

SARCOS

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCOSINE OF X, WHERE X IS A NUMBER IN A-RIGHT THE RESULT IS LEFT IN A-RIGHT.

CALLING SEQUENCE

```
TP    L(X)    A
CALL  SARCOS
```

CODING INFORMATION

ROUTINE USES 79 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 33 IN A.

ACCURACY. ABSOLUTE

```
SA    L+23          2
TP    L+32          L+39
EJ    L+31          L+8
TP    A             L+38
SP    L+37          34
DV    L+35          L+37
LA    L+34          71
RS    Q             L+33
RA    L+32          L+34
QJ    L-5           L+1
MP    A             L+29
LT    1             A
ST    L+20          Q
IJ    L+24          L+2
TN    Q             Q
RS    Q             L+17
DV    L+18          A
TN    A             A
MJ                  L-52
TN    L+13          Q
MJ                  L-7
B     677777777777
B     100000000001
B     100000000000
B     532413520070
B     332441425535
B     564007151545
B     375041741233
B     462370666522
B     266165166073
B     444200330653
B     311037551633
B     311037552421
B     377777777777
B     2
B
B     1
RSRV  6             6
```

VALUE OF ERROR IS AT MOST 9 TIMES 10 TO THE MINUS 9TH POWER.

RANGE OF INPUT. ABSOLUTE VALUE OF X MUST BE LESS THAN OR EQUAL TO 1.

THE RESULT IS AN ANGLE FROM QUADRANT I (IF X IS POSITIVE) OR QUADRANT II (IF X IS NEGATIVE), EXPRESSED IN RADIANS.

ERROR PROCEDURES

FOR INPUT OUT OF RANGE, THE COMPUTER STOPS.

1. IDENTIFICATION

STATED POINT ARCTANGENT
D. L. Richards
Identification Tag: SARCTN

2. DESCRIPTION

This routine computes the arctangent of the argument. The Rand polynomial $\arctan x = \sum_{i=0}^{7} C_{2i+1} X^{2i+1}$ is evaluated for x if $/x/ < 1$, for 1/x otherwise. In the second case the identity $\arctan x = \pi/2 - \arctan (1/x)$ supplies the answer.

The output is an angle from quadrant I or quadrant IV expressed in radians.

3. CALLING SEQUENCE

```
SP      L(x_L)      36
SA      L(x_R)
CALL    SARCTN
```

4. SPACE REQUIRED

49 decimal or 61 octal cells

5. RESTRICTIONS

Scaling: Input and output are scaled 33 in A.

Accuracy: $/E/ < 8^{-8}$

Range of input: $/x/ < 2^{37}$

6. ERROR PROCEDURES

None. If input exceeds range, answer may be wrong.

```
SARCTN  MJ                      L+3
        MS
        MJ
        TP      L+41            L+42
        TP      L+40            L+42
        TP      A               Q
        LA      A               2
        EJ      A               L+10
        TP      L+33            L+37
        SJ      L+1             L+2
        TN      L+35            L+35
        SF      A               L+35
        TN      A               Q
        TN      L+33            A
        AT      L+18            L+1
        SP      L+28
        DV      Q               Q
        TP      Q               L+31
        MP      Q               Q
        LT      3               Q
        TP      L+13            L+27
        TU      L-1             L+5
        TP      L+20            L+24
        RA      L+3             L+20
        MP      Q               L+23
        LT      3               A
        AT                      L+21
        IJ      L+19            L-4
        MP      L+20            L+19
        LT      3               A
        AT      L+15            A
        MJ                      L-29
        SP      L+11            53
        B       777573120142
        B       1314262427
        B       774327743606
```

IDENTIFICATION

STATED POINT ARCTANGENT

IDENTIFICATION TAG

SARCTN

DESCRIPTION

THIS ROUTINE COMPUTES THE ARCTANGENT OF X, WHERE X IS A 72 BIT NUMBER IN A. THE RESULT IS LEFT IN A.

CALLING SEQUENCE

```
SP    L(XL)   36
SA    L(XR)
CALL  SARCTN
```

XL - LEFT 36 BITS OF X

XR - RIGHT 36 BITS OF X

CODING INFORMATION

ROUTINE USES 49 CELLS.

RESTRICTIONS

SCALING. INPUT AND OUTPUT ARE SCALED 33 IN A.

ACCURACY. ABSOLUTE VALUE OF ERROR IS LESS THAN 8 TO THE -8TH POWER

RANGE OF INPUT. ABSOLUTE VALUE OF X MUST BE LESS THAN 2 TO THE 37TH POWER.

```
B     6127402442                                                37IT
B     767062347224      THE RESULT IS AN ANGLE                  38IT
B     14610051333     FROM QUADRANT I (FOR                      39IT
B     752526362035    POSITIVE X) OR QUADRANT                   40IT
B     077777764636    IV (FOR NEGATIVE X), EX                   41IT
B     144417665211    PRESSED IN RADIANS.                       42IT
B     6                                                         43IT
B     100000                ERROR PROCEDURES                    44IT
B                         NONE. FOR INPUT OUT OF                45IT
RSRV  4           4     RANGE, RESULT IS WRONG.                 46IT
```

1. IDENTIFICATION

COMPLEX ARITHMETIC PACKAGE - D. N. Williams
Identification Tag: CMPLX

2. DESCRIPTION

This is an interpretive routine using machine floating point arithmetic to accomplish the elementary operations upon complex numbers.

3. CALLING SEQUENCE

Before execution of the first interpretive command, the following instruction must be executed to set the proper manual jump in F_2:

CALL CMPLX

The interpretive instruction format is

IP ARGUMENT OPERATION

ARGUMENT is the location of the first of two successive cells, the real and imaginary parts (or the modulus and argument in certain cases--see below) of the complex number to be operated upon.

OPERATION is a tag referring to the operation to be performed.

4. RESULTS OF EXECUTION

	OP	U	V
The result of executing	IP	ARGUMENT	OPERATION

is to transfer the contents of the two cells beginning with ARGUMENT to successive cells tagged UREAL and UIMAG, and then to jump to OPERATION. The results of operations appear in the successive cells FREAL and FIMAG. The real part of the result appears also in Q, except in the POLAR operation, where the modulus appears in Q. Control is returned to F_1, which is not disturbed by the sequence.

The available instructions are listed below. The contents of the two cells FREAL and FIMAG are referred to as F, and the contents of the cells ARG and ARG+1 are referred to as U. All complex numbers are assumed to be in rectangular form except in the operation POLAR, which gives the result F in polar form; and RECT, which assumes U to be in polar form. For numbers in polar form FREAL (ARG) contains the modulus and FIMAG (ARG+1) the argument.

IP	ARG	ADD	F + U → F
IP	ARG	SUBT	F - U → F
IP	ARG	MULT	F x U → F
IP	ARG	DIV	F ÷ U → F
IP	ARG	ROOT	$\sqrt{U}$ → F (FREAL≥0)
IP	ARG	ABSV	|U| → F
IP	ARG	ROTATE	iU → F
IP	ARG	CONJ	U* → F
IP	ARG	POLAR	U_{polar} → F ($-\pi \leq$ FIMAG $\leq \pi$)
IP	ARG	RECT	U_{rect} → F

5. CODING INFORMATION

The routine uses the following tags and cells:

TAG	CELLS
CMPLX	21
FREAL	1
FIMAG	1
UREAL	1
UIMAG	1
ADD	5
SUBT	5
MULT	10
DIV	17
ROOT	44
ABSV	6
ROTATE	4
CONJ	4
POLAR	30
RECT	10
	160 decimal

All subroutines named above are self-contained except for the addition of certain SLAP subroutines, which must be included if the following are used:

If USE:	Add SUBROUTINE:
ROOT	SQ ROOT
ABSV	SQ ROOT
POLAR	ARCTAN, SQ ROOT
RECT	SINE, COSINE

6. ERROR PROCEDURE

A stop, MSO with PAK = CMPLX+16, occurs if an attempt is made to divide by zero. Restarting sets F to zero and continues.

7. REMARKS

The execution time of the interpretation is 440 microseconds, not including the complex operation.

Loading into and storing from FREAL and FIMAG is accomplished by Transmit Positive commands.

The ROTATE and CONJ operations are included only for convenience. Machine time will be saved by using instead the appropriate transmit commands.

The programmer may add operations of his own by using the same instruction format. Such a subroutine must begin at the address specified by the V field, and the argument specified by the U field will be found in the two cells UREAL and UIMAG. Exit to F_1 will send control to the cell following the Interpret command.

```
CMPLX   MJ                  L+3             COMPLEX ARITHMETIC          1CA
        MS                  CMPLX+16        ALARM EXIT                  2CA
        MJ                  FILL            EXIT                        3CA
        TP      L+2         1               SET F2                      4CA
        MJ                  L-2                                         5CA
        MJ                  CMPLX+6         CONTENTS OF F2              6CA
        SP                  15              BEGIN INTERPRETATION        7CA
        AT      CMPLX+20    L+1             SET TO GET INSTRUCTION      8CA
        TP      FILL        A               GET INSTRUCTION             9CA
        TV      A           CMPLX+15        SET EXIT TO OPERATION      10CA
        TU      A           L+3             SET LOAD ARGUMENT          11CA
        SA      CMPLX+19                                                12CA
        TU      A           L+2                                         13CA
        TP      FILL        UREAL           LOAD ARGUMENT              14CA
        TP      FILL        UIMAG                                      15CA
        MJ                  FILL            EXIT TO OPERATION          16CA
        CC      FREAL       A               CLEAR F FOR ALARM EXIT     17CA
        TP      A           FIMAG                                      18CA
        MJ                                                             19CA
        S15     1                                                      20CA
        B       107777732000                                           21CA
FREAL                                       COMPLEX FLOATING           22CA
FIMAG                                        ACCUMULATOR               23CA
UREAL                                       COMPLEX ARGUMENT           24CA
UIMAG                                        BUFFER                    25CA
ADD     FA      FIMAG       UIMAG           COMPLEX ADDITION           26CA
        TP      Q           FIMAG                                      27CA
        FA      FREAL       UREAL            F+U TO F                  28CA
        TP      Q           FREAL            FRE (FINAL) TO Q          29CA
        MJ                                                             30CA
SUBT    FS      FIMAG       UIMAG           COMPLEX SUBTRACTION        31CA
        TP      Q           FIMAG                                      32CA
        FS      FREAL       UREAL            F-U TO F                  33CA
        TP      Q           FREAL            FRE (FINAL) TO Q          34CA
        MJ                                                             35CA
MULT    FM      FIMAG       UREAL           COMPLEX MULTIPLICATION     36CA
```

```
         FI    FREAL        UIMAG                                  37CA
         TP    Q            MULT+9       FXU TO F                  38CA
         FM    FIMAG        UIMAG        FRE (FINAL) TO Q          39CA
         TN    Q            Q                                      40CA
         FI    FREAL        UREAL                                  41CA
         TP    Q            FREAL                                  42CA
         TP    MULT+9       FIMAG                                  43CA
         MJ                                                        44CA
                                         BUFFER                    45CA
DIV      FM    UREAL        UREAL        COMPLEX DIVISION          46CA
         FI    UIMAG        UIMAG                                  47CA
         ZJ    L+1          CMPLX+1      ZERO DIVISOR ALARM EXIT   48CA
         TP    Q            DIV+15                                 49CA
         FM    FREAL        UIMAG         F/U TO F                 50CA
         TN    Q            Q             FRE (FINAL) TO Q         51CA
         FI    FIMAG        UREAL                                  52CA
         FD    Q            DIV+15                                 53CA
         TP    Q            DIV+16                                 54CA
         FM    FREAL        UREAL                                  55CA
         FI    FIMAG        UIMAG                                  56CA
         FD    Q            DIV+15                                 57CA
         TP    Q            FREAL                                  58CA
         TP    DIV+16       FIMAG                                  59CA
         MJ                                                        60CA
                                         BUFFER                    61CA
                                         BUFFER                    62CA
ROOT     TP    UIMAG        A            COMPLEX SQUARE ROOT       63CA
         ZJ    L+17         L+1                                    64CA
         TP    UREAL        A            UIM EQUAL TO ZERO         65CA
         TM    A            Q                                      66CA
         SJ    L+9          L+1                                    67CA
         ZJ    L+4          L+1                                    68CA
         TP    A            FREAL         IF URE IS ZERO, Q AND    69CA
         TP    A            FIMAG         F ARE ZERO.              70CA
         MJ                                                        71CA
         CALL  SQROOT                     IF URE IS PLUS, Q AND    72CA
```

```
        TP    Q           FREAL       FRE ARE ITS PLUS ROOT,     73CA
        TP    UIMAG       FIMAG       FIM IS ZERO.               74CA
        MJ                                                       75CA
        CALL  SQROOT                  IF URE IS MINUS, FIM IS    76CA
        TP    Q           FIMAG       PLUS ROOT OF ITS MAGNI-    77CA
        TP    UIMAG       FREAL       TUDE. Q AND FRE ARE        78CA
        TP    FREAL       Q           ZERO.                      79CA
        MJ                                                       80CA
        FM    A           UIMAG     UIM NOT EQUAL TO ZERO        81CA
        FI    UREAL       UREAL                                  82CA
        CALL  SQROOT                  LET PLUS SQUARE ROOT OF    83CA
        TM    UREAL       FREAL       (MAG U + MAG URE)/2        84CA
        FA    Q           FREAL       EQUAL D.                   85CA
        RS    Q           L+20                                   86CA
        SJ    L+1         L+3                                    87CA
        CC    Q           A           IF BIASED EXPONENT IS      88CA
        MJ                L-20        MINUS, CLEAR Q AND F.      89CA
        CALL  SQROOT                                             90CA
        TP    Q           FREAL                                  91CA
        RA    Q           L+14                                   92CA
        FD    UIMAG       Q                                      93CA
        TP    UREAL       A                                      94CA
        SJ    L+4         L+1                                    95CA
        TP    Q           FIMAG       IF URE IS PLUS, UIM/2D     96CA
        TP    FREAL       Q           TO FIM, D TO Q AND FRE.    97CA
        MJ                                                       98CA
        TP    UIMAG       A           IF URE IS MINUS,           99CA
        SJ    L+1         L+2         (SIGN UIM)D TO FIM.       100CA
        TN    FREAL       FREAL       MAG UIM/2D TO Q, FRE.     101CA
        TP    FREAL       FIMAG                                 102CA
        TM    Q           Q                                     103CA
        TP    Q           FREAL                                 104CA
        MJ                                                      105CA
              10000B)                                           106CA
ABSV    FM    UREAL       UREAL       ABSOLUTE VALUE OF U TO Q  107CA
        FI    UIMAG       UIMAG       AND FRE, ZERO TO FIM      108CA
```

```
          CALL  SQROOT                                                  109CA
          TP    Q             FREAL                                     110CA
          CC    FIMAG         A                                         111CA
          MJ                                                            112CA
ROTATE    TN    UIMAG         Q           ROTATION BY PI/2              113CA
          TP    Q             FREAL                                     114CA
          TP    UREAL         FIMAG        IXU TO F, FRE TO Q           115CA
          MJ                                                            116CA
CONJ      TP    UREAL         Q           COMPLEX CONJUGATE             117CA
          TP    Q             FREAL                                     118CA
          TN    UIMAG         FIMAG        U CONJ TO F, FRE TO Q        119CA
          MJ                                                            120CA
POLAR     TP    UREAL         A           RECT TO POLAR FORM, R,        121CA
          ZJ    L+12          L+1         THETA AT FREAL, FIMAG         122CA
          TP    UIMAG         A                                         123CA
          TM    A             FREAL       IF URE IS ZERO, MAG UIM       124CA
          TM    A             Q           TO R, Q AND IF UIM IS         125CA
          SJ    L+1           L+3                                       126CA
          TN    POLAR+28      FIMAG        MINUS, -PI/2 TO THETA.       127CA
          MJ                                                            128CA
          ZJ    L+3           L+1                                       129CA
          TP    A             FIMAG        ZERO, ZERO TO THETA.         130CA
          MJ                                                            131CA
          TP    POLAR+28      FIMAG        PLUS, PI/2 TO THETA.         132CA
          MJ                                                            133CA
          FD    UIMAG         UREAL       IF URE IS NOT ZERO,LET D      134CA
          CALL  ARCTAN                    BE PRINC ARCTAN UIM/URE.      135CA
          TP    UREAL         A                                         136CA
          SJ    L+1           L+6                                       137CA
          TP    UIMAG         A           IF URE IS NEG AND UIM IS      138CA
          SJ    L+3           L+1                                       139CA
          FA    Q             POLAR+29     PLUS, D+PI TO THETA.         140CA
          MJ                  L+2                                       141CA
          FS    Q             POLAR+29     MINUS, D-PI TO THETA.        142CA
          TP    Q             FIMAG                                     143CA
          FM    UREAL         UREAL       IF URE IS PLUS, D TO          144CA
```

```
        FI    UIMAG          UIMAG          THETA.                          145CA
        CALL  SQROOT                                                        146CA
        TP    Q              FREAL          MAG U TO R                      147CA
        MJ                                                                  148CA
        F     1.5707963268                  PI OVER 2                       149CA
        F     3.1415926536                  PI                              150CA
RECT    TP    UIMAG          Q              POLAR TO RECT FORM, R,          151CA
        CALL  COSINE                        THETA AT UREAL, UIMAG           152CA
        TP    Q              FREAL                                          153CA
        TP    UIMAG          Q               R SIN THETA TO FIM             154CA
        CALL  SINE                                                          155CA
        FM    Q              UREAL                                          156CA
        TP    Q              FIMAG                                          157CA
        FM    FREAL          UREAL           R COS THETA TO FRE, Q          158CA
        TP    Q              FREAL                                          159CA
        MJ                                                                  160CA
```

SECTION IV

INPUT - OUTPUT SUBROUTINES

1. IDENTIFICATION

PRINT EDIT
A. Podvin
Identification Tag: PREDIT

2. DESCRIPTION

The Print Edit Routine has been written to provide a flexible output capable of producing nearly any format desired by customers of Dept. 51-51. This routine should do away with the necessity of having a large library of standard output routines.

3. CODING INFORMATION

Cells required are 520, which includes subroutines and output buffer:

365 Instructions
15 Constants
140 Temps

4. FUNCTION

This routine will prepare a magnetic tape, in fixed block mode, on a designated Uniservo for listing a format or combination of formats on the high speed printer.

5. USAGE

Print Edit uses an argument and a set of parameter words to produce a matrix with m lines and n columns for output. A matrix entry (element, $a_{i,j}$) is a string of XS 3 characters. ($1 \leq i \leq m$ and $1 \leq j \leq n$).

1. Calling Sequence

The calling sequence consists of sending an argument word to the Q-register followed by a return jump:

```
TP      ARG      Q

CALL    PREDIT
```

This argument word controls the number of lines of output, the tape unit used and the location of the parameter set. Its format is:

LOC	OP	U	V
ARG	TT	PARAM	NNNNN

1. Calling Sequence (Cont.)

TT = Tape unit number, in octal.
PARAM = Location of the first parameter word of the set.
NNNNN = The number of lines, in octal, to be output.

2. Parameter Words

The set of parameter words consists of a first parameter word followed by pairs of parameter words. The first parameter word gives over-all editing information. The succeeding pairs of words control the editing of columns.

(a) First Parameter Word

The first parameter word has the following format:

LOC	OP	U	V
PARAM	FE	_____	QQQQQ

F specifies fast feed editing. F may be 1, 2, 3 or 4 in which cast fast feed symbols I, II, III or IV, respectively, will be inserted as the initial symbol of the first line. If F = 0 no insertion will take place. See Note #7.

Output always occurs in groups of 6 lines, except for the final set of 5 or less lines. E controls the output of the final set of lines. If E = 0 this set of lines is left in the buffer and will not be output until Print Edit is used again. If E = 1 the final set of lines is output with any unused lines being output as blanks.

QQQQQ equals the number, in octal, of parameter pairs following the first parameter word.

(b) Parameter Pairs

The format of a parameter pair, P_k, where $1 \leq k \leq QQQQQ$, is as follows:

LOC	OP	U	V
PARAM + 2k-1	ΔΔ	M	SSS WW
PARAM + 2k	RR	Y	C

The first parameter pair, P_1, controls the editing of the first RR+1 columns. If the parameter pair, P_k, controls the editing of a set of RR+1 consecutive columns, the first of which is column c_j, the next parameter pair, P_{k+1}, will control a set of consecutive columns starting with column c_{j+RR+1}. RR is an octal number which is one less than the number of columns controlled by P_k. SSS is the number, in octal, of blanks preceding an entry of each column controlled by P_k. WW is the number, in octal, of characters which comprise an entry of each column controlled by P_k.

(b) Parameter Pairs (Cont.)

The characters which comprise an entry are obtained by some conversion of the contents of a location in memory. The memory location corresponding to an entry, a_{ij}, of a column controlled by the above parameter pair is obtained as follows:

(1) Location M corresponds to the first entry of the first column controlled by this parameter pair.

(2) The location corresponding to an entry in a given column is $\Delta\Delta$ plus the location corresponding to the preceding entry of the column. The $\Delta\Delta$ occurring in a parametric pair is an octal number.

(3) The locations corresponding to the successive entried in any given line is one plus the location corresponding to the preceding entry of that line. See Note #1.

Y and C, which are explained below, are used to control the conversion that produces the entries in the columns controlled by the above parameter pair.

3. Conversions

The programmer may use any one of seven conversion routines embedded into Print Edit, or his own conversion routine. If the V-address of the second word of a parameter pair is less than 7, the conversion routine will be a routine in Print Edit according to the usage indicated below. Let BBB denote the binary scaling and II equal the number of digits to the left of the decimal, then:

C = 0, FLFIX. This routine will convert a packed single precision floating point number to its XS3 stated point equivalent.

FORMAT	Y	LIMITS
± X...X.X...X	11000	$0 \leq WW \leq 15_8$
		0 II 14_8

C = 1, FLFL. This routine will convert a packed single precision floating point number to its XS3 scientific decimal equivalent.

FORMAT	Y	LIMITS
± F .... F ± EE	00000	$0 \leq WW \leq 14_8$

C = 2, FIXFIX. This routine will convert a fixed point binary number occupying one storage location to its XS3 decimal equivalent.

FORMAT	Y	LIMITS
± X...X.X...X	IIBBB	$0 \leq WW \leq 15_8$ $0 \leq II \leq 14_8$ $0 \leq BBB \leq 107_8$

C = 3, FIXFL. This routine will convert a fixed point binary number occupying one storage location to its XS3 scientific decimal equivalent.

FORMAT	Y	LIMITS
± F ... F ± EE	OOBBB	$0 \leq WW \leq 15_8$ $0 \leq BBB \leq 107_8$

C = 4, OCTAL. This routine will convert a machine word to its XS3 octal equivalent.

FORMAT	Y	LIMITS
X....X	00000	0 WW 14_8

C = 5, XS3. This routine can be considered an identity conversion since the consecutive machine word arguments are already in XS3 and packed six characters to a word.

FORMAT	Y	LIMITS
X....X	00000	$0 \leq WW \leq 77_8$

C = 6, HEADING. This routine produces an entire line from twenty consecutively stored words in packed XS3 form. Hence, NNNNN lines of heading will be described by one and only one parameter pair.

If C is greater than seven, then it is considered to be the location of the first word of a conversion routine not embedded in Print Edit. Any such routine must conform to the following specifications:

(a) The first three lines of the routine must have the standard USE format:

LOC	OP	U	V
SUBR	MJ		SUBR + 3
SUBR + 1	MS		SUBR + 2
SUBR + 2	MJ		EXIT

(b) The routine must produce WW excess three characters, the first of which is located in a certain cell, say CHAR. The characters produced may be in packed or unpacked form. If packed, they occur six to a word in successive words beginning with CHAR. The last packed word, if it contains less than six characters must be justified to the left. If unpacked, characters occur one per word in successive cells beginning with CHAR and are justified to the right. (The remaining 30 bits in each word may contain an ything, since they are ignored.)

(c) Prior to exit, the subroutine must leave an indicator in the accumulator as follows: If the characters are packed, CHAR must appear in the U-address of the accumulator and the accumulator must be positive. If the characters are unpacked, the complement of CHAR must be in the U-address of the accumulator and the accumulator must be negative.

(d) The U-address of the second word of the parameter pair may contain any information necessary for usage by the subroutine. The subroutine will always find the parameter pair in the accumulator and Q-registers, respectively, except that the U-address of the accumulator (i.e., the location M) has been replaced by the location of the current word to be converted.

NOTES

1. If C_j is the first column controlled by the k^{th} parameter pair and if $0 \leq i \leq RR$, then

   (a) M is the location corresponding to $a_{1,j}$

   (b) $M + \Delta\Delta(k-1) + i$ is the location corresponding to $a_{k,j+i}$.

2. This routine does not provide for alarms.

3. If successive outputs involve different tape units, the partially filled block will be output on the old tape unit.

4. If the printing string width, WW, of a column exceeds the limit given for an internal conversion, asterisks appear instead of the converted word.

5. If the total number of characters in a line exceeds 120, the first 120 characters appear in the line. If the number is less than 120 characters, the unused symbols appear as blanks.

6. If QQQQQ = 0, NNNNN lines of blanks will be output.

7. If a fast feed symbol is desired, then SSS of the first parameter pair must be greater than zero.

REMARKS

Questions arising from the use of the Print Edit Routine should be referred to A. Podvin of the Numerical Methods Group.

```
PREDIT  MJ                  L+3
        RJ    L+124         L+119
        MJ                  FILL
        TP    L(0)          L+277
        TU    Q             L+10
        TV    Q             L+274
        SP    Q             6
        LT                  L+478
        TP    L+273         A
        EJ    L+476         L+3
        RJ    L+115         L+109
        TP    L+474         L+270
        IJ    L+267         L+2
        MJ                  L-11
        TP    FILL          L+471
        SP    L+470         3
        LT                  Q
        MP    Q             L(6)
        TV    A             L+1
        SP    L+242         FILL
        TV    L+74          L+2
        TP    L+239         Q
        QS    A             FILL
        TV    L+462         L+255
        IJ    L+254         L+2
        MJ                  L+83
        TU    L-12          L+3
        RA    L+2           L+235
        RP3   2             L+2
        TP    FILL          L+457
        SP    L+456         6
        LT                  Q
        MP    Q             L+248
        AT    L+453         L+453
        LT1   21            A
        LT    9             L+247
```

```
IDENTIFICATION                  1PE
                                2PE
 PRINT EDIT                     3PE
                                4PE
IDENTIFICATION TAG              5PE
                                6PE
  PREDIT                        7PE
                                8PE
                                9PE
DESCRIPTION                     10PE
                                11PE
 PRINT EDIT IS A FLEXI-         12PE
 BLE, GENERAL OUTPUT            13PE
 ROUTINE, CAPABLE OF            14PE
 PRODUCING NEARLY ANY           15PE
 FORMAT DESIRED. MOST           16PE
 CONVERSION ROUTINES ARE        17PE
 CONTAINED WITHIN PRINT         18PE
 EDIT, BUT ANY TYPE OF          19PE
 AUXILIARY CONVERSION           20PE
 ROUTINE CAN BE USED.           21PE
                                22PE
                                23PE
OUTPUT                          24PE
                                25PE
 OUTPUT IS IN XS3, FIXED        26PE
 BLOCK MODE, ON A DESIG         27PE
 NATED UNISERVO, READY-         28PE
 ING IT FOR LISTING ON          29PE
 THE HIGH SPEED PRINTER.        30PE
                                31PE
                                32PE
CALLING SEQUENCE AND            33PE
USAGE                           34PE
                                35PE
 A SEPARATE CALLING SE-         36PE
```

```
      SP    A           6
      LT                L+246
      SP    L+449       6
      LT                L+245
      LT1   15          L+448
      LQ    L+447       A+15
      TJ    L+221       L+85
      SA    L+225       15
      AT    Q           L+3
      TP    L+441       A
      TP    L+441       Q
      RJ    FILL        FILL
      SJ    L+1         L+16
      TM    A           A
      TU    A           L+5
      TV    L+24        L+8
      TP    L+231       L+119
      TP    L(77B)      Q
      RP3   6           L+2
      QT    FILL        L+231
      SS    A
      RP2   5           L+2
      SA    L+228       6
      AT    L+232       FILL
      RA    L-5         L+204
      RA    L-2         L(1)
      RS    L+109       L(6)
      SJ    L+39        L-9
      TU    A           L+2
      RP3   11          L+37
      TP    FILL        L+423
      RA    L+27        L(1)
      EJ    L+198       L+40
      MJ                L+2
      RA    L+215       L+212
      RS    L+214       L(6)
```

QUENCE IS REQUIRED FOR 37PE
EACH LINE OF PRINTING, 38PE
EXCEPT WHERE SUCCESSIVE 39PE
LINES HAVE THE SAME 40PE
FORMAT. 41PE
42PE

THE CALLING SEQUENCE 43PE
PARAMETER, WHICH STARTS 44PE
AT *PARAM*, IS DIVIDED 45PE
INTO SETS OF 2-WORD 46PE
PARAMETER PAIRS, EACH 47PE
PARAMETER PAIR DESCRIB 48PE
ING THE FORMAT OF A 49PE
SPECIFIC NUMBER OF COL 50PE
UMNS IN THE LINE TO BE 51PE
PRINTED. 52PE
53PE

AN ENTIRE CALLING SE- 54PE
QUENCE IS AS FOLLOWS. 55PE
56PE

```
LOC     OP     U        V
 L     TP    ARG      Q
L+1    CALL PREDIT
L+2    (NORMAL RETURN)

ARG    TT    PARAM   NNNNN

PARAM  FE              QQQQQ
 (+1)   1ST PARAMETER
 (+2)     PAIR
 (+3)   2ND PARAMETER
 (+4)     PAIR
   .    3RD
   .
   .    ETC.
```

57PE 58PE 59PE 60PE 61PE 62PE 63PE 64PE 65PE 66PE 67PE 68PE 69PE 70PE 71PE 72PE

```
      SJ    L+1         L-5                                        73PE
      LQ    L+210       A                                          74PE
      ZJ    L+7         L+30                                       75PE
      TP    L+192       L+414    TT=TAPE UNIT NUMBER,              76PE
      AT    L+209       L+209       IN OCTAL.                      77PE
      SJ    L+4         L+1                                        78PE
      RA    L+16        L(1)     NNNNN=NUMBER OF LINES             79PE
      EJ    L+187       L+29        TO BE PRINTED UNDER            80PE
      MJ                L+5         CONTROL OF THIS                81PE
      RA    L+204       L(6)        CALLING SEQUENCE.              82PE
      SP    L+12        15          EACH LINE MUST HAVE            83PE
      TU    A           L+1         THE SAME FORMAT.               84PE
      TP    FILL        L+202                                      85PE
      TP    L(0)        A        FE IS A 2-DIGIT, OCTAL            86PE
      RP0   6           L+2         NUMBER.                        87PE
      SA    L+198                                                  88PE
      TV    A           L+3       F=1,2,3, OR 4.                   89PE
      TN    A           A           A FAST FEED SYMBOL             90PE
      AT    L+175       L+3         I, II, III, OR IV              91PE
      SP    L+195       FILL        WILL BE INSERTED AS            92PE
      SS    A                       THE FIRST SYMBOL IN            93PE
      SA    FILL        FILL        THE FIRST LINE OF              94PE
      LT                L+271       PRINTING. THIS CAU-            95PE
      TP    A           L+191       SES THE HIGH SPEED             96PE
      RA    L-3         L+166       PRINTER TO SPACE A             97PE
      RS    Q           L(6)        REQUIRED NUMBER OF             98PE
      TJ    L(1)        L+5         TIMES BEFORE PRINT-            99PE
      RA    L-5         L(1)        ING.                          100PE
      EJ    L+166       L+8                                       101PE
      MJ                L-10      F=0.                            102PE
      RJ    L-4         L-32        NO FAST FEED INSER-           103PE
      RJ    L-5         L-28        TION WILL TAKE PLACE          104PE
      RA    L+382       L+158                                     105PE
      IJ    L+179       L-64      E=0.                            106PE
      RA    L-77        L+156       OUTPUT ALWAYS OCCURS          107PE
      IJ    L+171       L-80        IN GROUPS OF 6 LINES          108PE
```

```
      TP    L(0)          L+177
      RA    L+171         L+153
      TV    L+156         L-16
      RA    L+155         L(20)
      SS    L+157
      ZJ    L+2           L+1
      RJ    L+11          L+4
      IJ    L+164         L-92
      LQ    L+369         5
      QJ    L-116         L-115
      TP    L+163         A
      ZJ    L+1           L+4
      TP    L+146         A
      EJ    L+149         L+2
      RJ    L+172         L+170
      TP    L+147         L+143
      TV    L+2           L-30
      RP1   120           FILL
      TP    L+141         L+239
      TU    L+359         L+1
      TP    FILL          L+162
      TP    L+154         L+158
      LQ    L+357         A+12
      QT    L(77B)        L+158
      QT    L+139         A
      LT    9             L+155
      LQ    Q             21
      QJ    L+1           L+4
      QJ    L+1           L+2
      QJ    L+119         L+115
      QJ    L+4           L+7
      QJ    L+1           L+2
      QJ    L+103         L+13
      QJ    L+75          L+68
      TU    L+344         L+2
      RP3   11            L-41
      TP    FILL          L+345
```

```
  EXCEPT FOR THE FINAL      109PE
  SET OF 5 LINES OR         110PE
  LESS. IF E=0, THIS        111PE
  FINAL SET IS LEFT IN      112PE
  A BUFFER AND WILL         113PE
  NOT BE OUTPUT UNTIL       114PE
  PRINT EDIT IS USED        115PE
  AGAIN.                    116PE
                            117PE
E=1.                        118PE
  THE FINAL SET OF          119PE
  LINES IS OUTPUT,          120PE
  WITH ANY UNUSED           121PE
  LINES BEING OUT-          122PE
  PUT AS BLANKS.            123PE
                            124PE
QQQQQ=NUMBER OF PARA-       125PE
  METER PAIRS.              126PE
                            127PE
                            128PE
                            129PE
THE FORMAT DESCRIBED        130PE
BY THE 1ST PARAMETER        131PE
PAIR APPEARS AT THE         132PE
LEFT END OF THE LINE,       133PE
AND SUCCESSIVE PARA-        134PE
METER PAIR FORMATS ARE      135PE
PLACED ACROSS THE LINE      136PE
TO THE RIGHT.               137PE
                            138PE
EACH PARAMETER PAIR         139PE
IS AS FOLLOWS               140PE
                            141PE
  LOC      OP  U    V       142PE
                            143PE
(1ST WORD) DD  M  SSSWW     144PE
(2ND WORD) RR  Y    C       145PE
```

```
      SP    L+145
      RP1   12          L+2
      LT    3           L+342
      TP    L(7)        Q
      RP3   12          L+2
      QT    L+339       L+339
      RP2   12          L+107
      RA    L+337       L(3)
      IJ    L+134       L+2
      MJ                L-52
      TJ    L(13)       L+2
      MJ                L+100
      RS    L+130       L+132
      SJ    L+98        L+1
      TU    L+116       L+36
      TV    L+20        L+28
      RA    L+27        L+128
      AT    L(1)        A
      TV    A           L+34
      TV    A           L+40
      RS    L+123       L(36)
      SJ    L+7         L+1
      TJ    L(36)       L+2
      RS    L+122       A
      TN    A           A
      AT    L+106       L+1
      LA    FILL        FILL
      SP    L(1)
      TM    A           A
      SP    A           15
      AT    L+102       L+7
      TP    L+114       A
      TP    L(1)        L+312
      SJ    L+1         L+3
      TM    A           A
      TP    L(2)        L+309
      RJ    L           L+1
```

```
                                                  146PE
M=THE STORAGE TAG OF                              147PE
   THE LOCATION TO BE                             148PE
   PRINTED.                                       149PE
                                                  150PE
RR IS A 2-DIGIT OCTAL                             151PE
   NUMBER, INDICATING                             152PE
   THE NUMBER OF TIMES                            153PE
   A PARAMETER PAIR                               154PE
   FORMAT IS TO BE IM-                            155PE
   MEDIATELY REPEATED.                            156PE
   (RR=00 INDICATES                               157PE
   THAT THE FORMAT WILL                           158PE
   NOT BE REPEATED.)                              159PE
                                                  160PE
   EACH TIME A FORMAT                             161PE
   IS REPEATED, M IS                              162PE
   INCREMENTED BY 1 TO                            163PE
   OBTAIN THE PROPER                              164PE
   STORAGE LOCATION TO                            165PE
   BE OUTPUT. FOR EXAM                            166PE
   PLE, IF RR=02, THE                             167PE
   CONTENTS OF M, M+1,                            168PE
   AND M+2 WOULD                                  169PE
   BE PRINTED FROM LEFT                           170PE
   TO RIGHT ACROSS THE                            171PE
   LINE, EACH IN THE                              172PE
   FORMAT SPECIFIED BY                            173PE
   THIS ONE PARAMETER                             174PE
   PAIR.                                          175PE
                                                  176PE
SSSWW IS A 5-DIGIT OC-                            177PE
   TAL NUMBER.                                    178PE
                                                  179PE
 SSS=THE NUMBER OF                                180PE
   BLANK COLUMNS TO                               181PE
   PRECEDE THE PRINTED                            182PE
```

```
      LT1   FILL          FILL
      LT                  Q
      IJ    L+105         L+2
      MJ                  L+12
      SP    Q
      DV    L(10)         Q
      AT    L(3)          FILL
      EJ    L(3)          L+3
      TU    L+85          L+5
      MJ                  L+2
      RA    L+3           L+70
      RS    L-5           L(1)
      IJ    L+95          L-8
      RP    FILL          L+2
      TP    L(1)          L+294
      TP    L+77          FILL
      IJ    L+89          L+7
      MJ                  L+9
      SP    L+90          2
      SA    L+89          1
      LT1                 L+88
      LT                  A
      AT    L(3)          FILL
      RA    L-1           L(1)
      IJ    L+81          L-6
      RJ    L             L+1
      MJ                  L+50
      LA    L+81          9
      LQ    L+80          35
      LT                  A
      TM    A             A
      SN    A
      AT    L(243B)       L+74
      SJ    L+41          L-62
      RJ    L-35          L-40
      TP    A             L+147
      IJ    L+69          L+2
```

```
      FORMAT.                                    183PE
                                                 184PE
 WW=THE NUMBER OF COL-                           185PE
      UMS OVER WHICH THE                         186PE
      PRINTED FORMAT WILL                        187PE
      EXTEND.                                    188PE
                                                 189PE
C=THE CONVERSION ROU-                            190PE
      TINE TO BE USED.                           191PE
      SEVEN ARE AVAILABLE                        192PE
      WITHIN PRINT EDIT,                         193PE
      AND ARE DESCRIBED                          194PE
      BELOW.                                     195PE
                                                 196PE
Y IS USED TO INDICATE                            197PE
      BOTH INTERNAL AND                          198PE
      PRINTED SCALING OF                         199PE
      FIXED POINT NUMBERS.                       200PE
      IT IS OF THE FORM                          201PE
      IIBBB, A 5-DIGIT OC                        202PE
      TAL NUMBER, WHERE                          203PE
      BBB IS THE INTERNAL                        204PE
      BINARY SCALING, AND                        205PE
      II  IS THE NUMBER OF                       206PE
      DIGITS TO BE PRINTED                       207PE
      TO THE LEFT OF THE                         208PE
      DECIMAL.                                   209PE
                                                 210PE
DD IS A 2-DIGIT, OCTAL                           211PE
      NUMER, AND IS PER-                         212PE
      TINENT ONLY WHEN                           213PE
      MORE THAN 1 LINE IS                        214PE
      TO BE PRINTED.                             215PE
                                                 216PE
      DD IS THE INCREMENT                        217PE
      THAT IS GIVEN TO THE                       218PE
      M IN EACH PARAMETER                        219PE
```

```
          MJ                  L-117
          TJ    L(12)         L+2
          MJ                  L+35
          RS    L+65          L(3)
          TV    L-27          L-19
          RJ    L+79          L+77
          LT1   1             L+65
          RJ    L-19          L-20
          TV    L-23          L+10
          RA    L-24          L(1)
          TV    A             L+12
          SA    L(1)
          TV    A             L+8
          TP    L+131         A
          TP    L(1)          Q
          SJ    L+1           L+3
          TP    L(2)          Q
          TN    A             A
          TP    Q             FILL
          DV    L(10)         Q
          AT    L(3)          FILL
          SP    Q
          AT    L(3)          FILL
          MJ                  L+16
          RJ    L-62          L-67
          SP    A             35
          ZJ    L+1           L-28
          SF    A             L+45
          LT    28            L+43
          RA    L+43          L(200B)
          SS    L+39          27
          AT    L+40          L+40
          MJ                  L-34
          TU    L+234         L+3
          TV    L-159         L+2
          RP3   20            L-146
          TP    FILL          FILL
```

```
          PAIR TO OBTAIN THE      220PE
          PROPER STORAGE TO BE    221PE
          OUTPUT IN EACH LINE     222PE
          FOLLOWING THE FIRST     223PE
          LINE.                   224PE
                                  225PE
          FOR EXAMPLE, IF DD=     226PE
          5, IN A PARAMETER       227PE
          PAIR, AND NNNNN=3,      228PE
          THE PRINT-OUT WOULD     229PE
          SHOW THE CONTENTS OF    230PE
          M ON THE FIRST LINE,    231PE
          THE CONTENTS OF M+5     232PE
          DIRECTLY BELOW IT ON    233PE
          THE 2ND LINE, AND       234PE
          THE CONTENTS OF M+10    235PE
          DIRECTLY BELOW THEM     236PE
          BOTH ON THE 3RD         237PE
          LINE.                   238PE
                                  239PE
                                  240PE
                                  241PE
CONVERSIONS                       242PE
                                  243PE
 THE FOLLOWING CONVER-            244PE
 SION ROUTINES ARE CON-           245PE
 TAINED WITHIN PRINT ED-          246PE
 IT, AND ARE REFERENCED           247PE
 BY C IN THE PARAMETER            248PE
 PAIR.                            249PE
                                  250PE
                                  251PE
 C=0, FLOATING TO FIXED           252PE
                                  253PE
  CONVERTS A PACKED SIN-          254PE
 GLE PRECISION FLOATING           255PE
 POINT NUMBER TO ITS XS3          256PE
```

```
RP1   11              L-154
TP    L+16            L+232
TU    L+7             L-203
MJ                    L-208
B     770000000000
B     013742577600
B     000000100000
B     10
B     000000600Q00
SA    L+224           36
LT                    L+119
B     010101010101
B     3700002
LT                    L+236
LT                    L+115
B     777000000000
B     030303030303
B     565656565656
B     000000000022
B     001000000000
LA    L+14            71
LT1                   L+13
B
B
B
B
B
B
B
B
B
B
B
B
B
B
B
B
MJ                    L+3
```

```
STATED POINT EQUIVALENT  257PE
                         258PE
Y IS OF THE FORM II000   259PE
WW LIMITS ARE 0 TO 15    260PE
II LIMITS ARE 0 TO 14    261PE
    (LIMITS ARE OCTAL)   262PE
                         263PE
                         264PE
C=1, FLOATING TO FLOAT   265PE
      ING                266PE
                         267PE
 CONVERTS A PACKED SIN   268PE
GLE PRECISION FLOATING   269PE
POINT NUMBER TO ITS XS3  270PE
SCIENTIFIC DECIMAL       271PE
EQUIVALENT.*             272PE
                         273PE
Y IS ALWAYS ZERO.        274PE
WW LIMITS ARE 0 TO 14,   275PE
  OCTAL                  276PE
                         277PE
* SXXXXXXXSXX            278PE
                         279PE
                         280PE
C=2, FIXED TO FIXED      281PE
                         282PE
 CONVERTS A FIXED POINT  283PE
BINARY NUMBER TO ITS     284PE
XS3 DECIMAL EQUIVALENT.  285PE
                         286PE
Y IS OF THE FORM IIBBB   287PE
WW LIMITS ARE 0 TO 15    288PE
II LIMITS ARE 0 TO 14    289PE
BBB LIMITS ARE 0 TO 107  290PE
     (LIMITS ARE OCTAL)  291PE
                         292PE
                         293PE
```

```
B
MJ
SP    L-14            12
AT    L+4             L-3
EF                    L-4
RP1   120             L-4
EW1                   L+66
B     020064600000
MJ                    L+3
B
MJ
SP    L+60
LT    9               L+58
LQ    A               35
TM    Q               L+57
ZJ    L+1             L-5
RS    L+54            L(127)
MP    L+36            L+53
LT    1               L+52
LQ    A               35
SJ    L+1             L+4
RS    L+49            L(1)
SP    L+34            1
AT    Q               Q
MP    Q               L+30
LT    1               A
LT1   3               Q
LT                    A
AT    L+27            L+18
LQ    Q               35
SP    Q               4
LT                    A
AT    L+32            L+11
QT    L+32            Q
MP    Q               L+33
LT                    A
AT    L+30            L-39
```

```
C=3, FIXED TO FLOATING                    294PE
                                          295PE
 CONVERTS A FIXED POINT                   296PE
BINARY NUMBER TO ITS                      297PE
XS3 SCIENTIFIC DECIMAL                    298PE
EQUIVALENT.*                              299PE
                                          300PE
Y IS OF THE FORM 00BBB                    301PE
WW LIMITS ARE 0 TO 14                     302PE
BBB LIMITS ARE 0 TO 107                   303PE
     (LIMITS ARE OCTAL)                   304PE
                                          305PE
* SXXXXXXXXSXX                           306PE
                                          307PE
                                          308PE
C=4, OCTAL                                309PE
                                          310PE
 CONVERTS AN ENTIRE                       311PE
STORED WORD TO ITS XS3                    312PE
OCTAL EQUIVALENT. IF                      313PE
ONLY PART OF THE WORD                     314PE
IS TO BE CONVERTED,                       315PE
THAT PART MUST BE JUS-                    316PE
TIFIED TO THE LEFT IN                     317PE
STORAGE.                                  318PE
                                          319PE
Y IS ALWAYS ZERO                          320PE
WW LIMITS ARE 0 TO 14,                    321PE
  OCTAL                                   322PE
                                          323PE
                                          324PE
C=5, XS3                                  325PE
                                          326PE
 UP TO 63 PACKED XS3                      327PE
CHARACTERS, WHICH ARE                     328PE
STORED IN 11 (OR LESS)                    329PE
LOCATIONS, ARE PRINTED.                   330PE
```

```
MP    Q              L-40
LT                   A
AT    L+29           L-42
SP    Q              33
DV    L-44           A
AT    L+14           Q
      FILL           FILL
LT    2              A
MP    A              L+26
      FILL           FILL
SA    L+22
EJ    A              L+4
DV    L(10)          Q
RA    L+20           L(1)
RA    Q              L(1)
MJ                   L-42
B     115040465024
B     324464741135
SS    A              37
B     200000000000
B     213453407440
B     230157701214
B     245775532516
B     265011714640
B     305316250212
B     327211763126
B     352601433477
MP    Q              L-8
B     037777777777
B     600000171150
B     035440262675
B     270524354513
B     000000000254


RSRV  120            120
RSRV  20             20
```

```
                                      331PE
Y IS ALWAYS ZERO                      332PE
WW LIMITS ARE 0 TO 77,                333PE
  OCTAL                               334PE
                                      335PE
                                      336PE
C=6, 20 XS3 WORDS                     337PE
     (HEADING)                        338PE
                                      339PE
 PRODUCES AN ENTIRE                   340PE
LINE OF HEADING FROM                  341PE
20 CONSECUTIVELY STORED               342PE
XS3 WORDS.                            343PE
                                      344PE
Y IS ALWAYS ZERO, ALONG               345PE
 WITH ALL OTHER PARA-                 346PE
 METER PAIR QUANTITIES                347PE
 EXCEPT M.                            348PE
                                      349PE
                                      350PE
IF C IS GREATER THAN 7,               351PE
 IT IS ASSUMED TO BE THE              352PE
 FIRST LOCATION OF A                  353PE
 CONVERSION ROUTINE NOT               354PE
 CONTAINED IN PRINT                   355PE
 EDIT, AS EXPLAINED IN                356PE
 THE WRITE UP.                        357PE
                                      358PE
                                      359PE
NOTES                                 360PE
                                      361PE
 THIS ROUTINE DOES NOT                362PE
 PROVIDE FOR ALARMS.                  363PE
                                      364PE
 REFER TO ACCOMPANYING                365PE
 WRITE UP FOR ADDITIONAL              366PE
 INFORMATION.                         367PE
```

1. IDENTIFICATION

VARIABLE FIELD CARD READ
Identification Tag: VARAB.

2. DESCRIPTION

This routine reads n variable field cards and stores the converted numbers in specified locations. The conversion and storing of information is accomplished between card reads. See page 2 for description of card format. The format is the same as for VARCAR.

3. CALLING SEQUENCE

LOC	OP	U	V
L	TP	ARG	VARAB+3
L+1	CALL	VARAB	
L+2	Normal return		

The argument is of the form

00 bbbbb ccccc

bbbbb - The number of cards to be read,
ccccc - The initial loading location.

4. CODING INFORMATION

Space required: 393 cells (decimal)
611 cells (octal).

5. RESTRICTIONS

See page 2.

6. ERROR PROCEDURES

The argument word is left in Q and the following error codes in A when an error stop occurs:

660303050001 - core overflow while storing information.
660303050002 - power overflow during conversion.

7. VARIABLE FIELD CARD DESCRIPTION

The variable field card input uses only the first 72 columns. A number that would require punching beyond the first 72 columns may be continued in column 1 of the succeeding card if there are 72 non-blank columns in the first card.

The reading of a card is terminated by any of the following:

a. A blank column found anywhere in the first 72 columns.
b. When 72 non-blank columns have been read.
c. By the letter "C" found anywhere in the first 72 columns.

Loading of the input is terminated in one of two ways, whichever occurs first:

a. When the letter "C" appears on a card, or,
b. When "n" cards, as specified in the "u" addressof the parameter word, have been read.

Decimal storage addresses in the form of Lxxxxx, may appear anywhere on any card. The number immediately following such an address will be stored in the cell whose address is formed by adding to the Lxxxxx address the initial address in the "v" portion of the parameter word. The following numbers will be stored in consecutive cells until another Lxxxxx address appears.

A comma separates all fields of the variable field card input. Complete numbers may be duplicated into consecutive cells by successive commas.

Floating point numbers are written in the form F±xx. Plus signs need not be specified. No decimal point may be written in a floating point number; it is assumed that rhe decimal point precedes the left most written digit. The fractional part of a floating point number may be less than, but cannot exceed nine decimal digits.

Stated point numbers are specified by a sign followed by not more than eleven decimal digits. Plus signs need not be written. A decimal point may appear anywhere in a stated point number.

Scale factors are associated with each stated point number. The decimal scaling is in the form D±xx and the binary scaling is in the form Bxx. The binary scaling is actually the location of the binary point obtained by counting from the right, starting with the bit zero of the word as it appears in the machine. The plus sign need not be written in the decimal scaling factor, a minus sign is not allowed in the binary scaling factor.

The decimal scaling factor must not exceed ±11. A minus zero will be stored in place of the number if the scaling factor is too large.

After once being specified, the decimal and/or binary scaling of a number is duplicated in the following stated point numbers until new scale factors are encountered. Zero scalings are specified by writing only the alphabetical character.

```
VARAB   MJ                  L+4
        MS                  L+1
        RJ
        B
        RPV   30            L+2
        TP    L+283         L+349
        SP    L-3
        TV    A             L+352
        TV    A             L+201
        LT    21            L+349
        TP    L+278         L+350
        TP    L+277         L+350
        TP    L+277         L+350
        TP    L+369         L+368
        IJ    L+344         L+2
        MJ                  L-13
        EF                  L+332
        TP    L+292         L+337
        TP    L+286         L+337
        TU    L+291         L+18
        RPV   6             L+2
        TP    L+267         L+363
        RPV   6             L+2
        TP    L+265         L+367
        ER                  L+339
        ER1                 L+339
        ER1                 L+339
        TP    L+337         Q
        TU    L+283         L+2
        TP    L+271         L+327
        TU    L+282         L+9
        TP    L+269         L+326
        TP    L+256         L+331
        QJ    L+3           L+1
        LA    L+329         6
        MJ                  L+3
```

```
1. IDENTIFICATION                1VF
                                 2VF
VARIABLE FIELD CARD READ         3VF
                                 4VF
IDENTIFICATION TAG VARAB         5VF
                                 6VF
2. DESCRIPTION                   7VF
                                 8VF
THIS ROUTINE READS N             9VF
                                10VF
 VARIABLE FIELD CARDS            11VF
                                 12VF
 AND STORES THE CONVERT-         13VF
                                 14VF
 ED NUMBERS IN SPECIFIED         15VF
                                 16VF
 LOCATIONS. THE CONVERS-         17VF
                                 18VF
 ION AND STORING OF IN-          19VF
                                 20VF
 FORMATION IS ACCOMP-            21VF
                                 22VF
 LISHED BETWEEN CARD             23VF
                                 24VF
 READS. FOLLOWING IS             25VF
                                 26VF
 DESCRIPTION OF CARD             27VF
                                 28VF
 FORMAT. THE FORMAT IS           29VF
                                 30VF
 THE SAME AS FOR VARCAR.         31VF
                                 32VF
3. CALLING SEQUENCE              33VF
                                 34VF
                                 35VF
                                 36VF
```

```
SP    L+327          6
AT    L+270          L+326
IJ    L+319          L-5
RA    L+345          L+324
RA    L-1            L+251
IJ    L+315          L-10
TP    L+312          Q
QJ    L+1            L+5
TP    Q              L+310
TU    L+268          L-15
TP    L+319          Q
MJ                   L-18
RS    L-11           L+243
TP    Q              L+305
IJ    L+305          L-26
TP    L+238          L+304
TP    L+238          L+314
ER                   L+310
ER1                  L+310
ER1                  L+310
TP    L+308          L+311
TU    L+254          L+2
TP    L+242          L+298
SP    L+253
TV    A              L+13
TU    A              L+2
TP    L+238          L+295
TP    L+321          L+300
TP    L+303          Q
QJ    L+1            L+5
TP    Q              L+301
LQ    L+296          A+6
AT    L+298          L+295
MJ                   L+3
TP    Q              L+297
LQ    L+292          6
```

```
LOC    OP    U    V                    37VF
                                        38VF
L     TP    ARG    VARAB+3              39VF
                                        40VF
L+1    CALL    VARAB                    41VF
                                        42VF
L+2    NORMAL RETURN                    43VF
                                        44VF
THE ARGUMENT IS OF THE                  45VF
                                        46VF
 FORM                                   47VF
                                        48VF
00 BBBBB CCCCC                          49VF
                                        50VF
 BBBBB-THE NUMBER OF                    51VF
                                        52VF
 CARDS TO BE READ, CCCCC                53VF
                                        54VF
 THE INITIAL LOADING                    55VF
                                        56VF
 LOCATION.                              57VF
                                        58VF
                                        59VF
                                        60VF
4. CODING INFORMATION                   61VF
                                        62VF
                                        63VF
                                        64VF
SPACE REQUIRED 393 CELLS                65VF
                                        66VF
 (DECIMAL) 611 CELLS                    67VF
                                        68VF
 (OCTAL).                               69VF
                                        70VF
                                        71VF
                                        72VF
```

```
IJ    L+285        L-8
TP    L+290        L+311
RA    L-1          L+215
RA    L-12         L+216
IJ    L+280        L-14
TP    L+277        Q
QJ    L+1          L+5
TP    Q            L+275
TU    L+233        L-21
TP    L+284        L+286
MJ                 L-24
TP    Q            L+271
LQ    L+282        1
IJ    L+270        L-32
MJ                 L+1
TU    L+224        L+3
TP    L+201        L+267
TP    L+211        L+267
SP                 15
TU    A            L+2
TP    L+208        L+265
LQ                 6
QT    L+221        A
TP    L+286        L+287
TP    A            L+285
ZJ    L+1          L-84
EJ    L+251        L+11
EJ    L+217        L+12
TJ    L+218        L+13
EJ    L+195        L+18
EJ    L+193        L+20
EJ    L+191        L+28
EJ    L+189        L+31
EJ    L+203        L+40
EJ    L+186        L+47
EJ    L+190        L-105
```

```
5. ERROR PROCEDURES                    73VF
                                       74VF
                                       75VF
                                       76VF
THE ARGUMENT WORD IS                   77VF
                                       78VF
 LEFT IN Q AND THE FOL-                79VF
                                       80VF
 LOWING ERROR CODES IN A               81VF
                                       82VF
 WHEN AN ERROR STOP                    83VF
                                       84VF
 OCCURS                                85VF
                                       86VF
660303050001-CORE OVER-                87VF
                                       88VF
 FLOW WHILE STORING IN-                89VF
                                       90VF
 FORMATION.                            91VF
                                       92VF
660303050002-POWER OVER-               93VF
                                       94VF
 FLOW DURING CONVERSION.               95VF
                                       96VF
                                       97VF
                                       98VF
6. VARIABLE FIELD CARD                 99VF
                                      100VF
 DESCRIPTION.                         101VF
                                      102VF
                                      103VF
                                      104VF
THE VARIABLE FIELD CARD               105VF
                                      106VF
 INPUT USES ONLY THE                  107VF
                                      108VF
```

```
RJ          L-107
TP   L+179  L+259
MJ          L+37
TP   L+206  L+257
MJ          L+35
ST   L+185  Q
SP   L+247  2
SA   L+246  1
AT   Q      L+245
RA   L+243  L+245
MJ          L+29
TP   L+198  L+251
TP   L+168  L+241
MJ          L+26
TP   L+195  L+249
TP   L+238  L+251
TP   L+164  L+238
TP   L+163  L+251
TP   L+242  Q
QJ   L+1    L-7
TP   L+189  L+248
TP   L+159  L+239
MJ          L-10
TP   L+157  L+247
TP   L+185  L+240
TP   L+228  L+242
MJ          L-10
TP   L+182  L+238
TP   L+152  L+243
TP   L+235  Q
QJ   L+1    L-5
TP   L+222  L+239
TP   L+148  L+232
TP   L+227  Q
QJ   L+1    L-22
TN   L+235  L+235
```

```
FIRST 72 COLUMNS. A
NUMBER THAT WOULD RE-
QUIRE PUNCHING BEYOND
THE FIRST 72 COLUMNS
MAY BE CONTINUED IN
COLUMN 1 OF THE SUCCEED
ING CARD IF THERE ARE
72 NON-BLANK COLUMNS IN
THE FIRST CARD.


THE READING OF A CARD IS
 TERMINATED BY ANY OF
 THE FOLLOWING
 A. A BLANK COLUMN FOUND
 ANYWHERE IN THE FIRST
 72 COLUMNS.
 B. WHEN 72 NON-BLANK
 COLUMNS HAVE BEEN READ.
```

```
109VF
110VF
111VF
112VF
113VF
114VF
115VF
116VF
117VF
118VF
119VF
120VF
121VF
122VF
123VF
124VF
125VF
126VF
127VF
128VF
129VF
130VF
131VF
132VF
133VF
134VF
135VF
136VF
137VF
138VF
139VF
140VF
141VF
142VF
143VF
144VF
```

```
MJ                  L-15        C. BY THE LETTER C          145VF
TP    L+143         L+215                                   146VF
TP    L+171         L+223       FOUND ANYWHERE IN THE       147VF
IJ    L+210         L-54                                    148VF
RA    L-55          L+143       FIRST 72 COLUMNS.           149VF
IJ    L+207         L-57                                    150VF
TU    L+163         L-60                                    151VF
IJ    L+204         L-62                                    152VF
MJ                  L-138     LOADING OF THE INPUT IS       153VF
EJ    L+229         L+56                                    154VF
TP    L+216         Q           TERMINATED IN ONE OF        155VF
QJ    L+1           L+11                                    156VF
TP    L+205         A           TWO WAYS, WHICHEVER         157VF
AT    L+202         A                                       158VF
TV    A             L+51        OCCURS FIRST                159VF
TP    L+129         L+201                                   160VF
TP    L+128         L+216       A. WHEN THE LETTER C        161VF
TP    L+127         L+200                                   162VF
RPV   6             L+2         APPEARS ON A CARD, OR,      163VF
TP    L+125         L+205                                   164VF
TP    L+125         L+198       B. WHEN N CARDS, AS         165VF
MJ                  L-18                                    166VF
TP    L+205         Q           SPECIFIED IN THE U AD-      167VF
QJ    L+1           L+8                                     168VF
TP    L+193         L+209       DRESS OF THE PARAMETER      169VF
TP    L+119         L+202                                   170VF
TP    L+198         Q           WORD, HAVE BEEN READ.       171VF
QJ    L+1           L+76                                    172VF
TN    L+205         L+205                                   173VF
TP    L+115         L+195                                   174VF
MJ                  L+73      DECIMAL STORAGE ADDRESS-      175VF
TP    L+197         Q                                       176VF
QJ    L+1           L+9         ES IN THE FORM OF LXXXX     177VF
TP    L+111         L+195                                   178VF
TP    L+190         Q           X, MAY APPEAR ANYWHERE      179VF
QJ    L+1           L+4                                     180VF
```

```
    TN   L+181          L+198       ON ANY CARD. THE NUMBER   181VF
    TP   L+107          L+187                                 182VF
    MJ                  L+13        IMMEDIATELY FOLLOWING     183VF
    TP   L+178          L+195                                 184VF
    MJ                  L+11        SUCH AN ADDRESS WILL BE   185VF
    TP   L+188          Q                                     186VF
    QJ   L+1            L+4         STORED IN THE CELL        187VF
    TP   L+174          L+192                                 188VF
    TP   L+100          L+185       WHOSE ADDRESS IS FORMED   189VF
    MJ                  L+6                                   190VF
    TP   L+171          L+185       BY ADDING TO THE LXXXXX   191VF
    TP   L+177          Q                                     192VF
    QJ   L+1            L+3         ADDRESS THE INITIAL AD-   193VF
    TP   L+124          L+183                                 194VF
    TP   L+94           L+174       DRESS IN THE V PORTION    195VF
    TM   L+183          A                                     196VF
    SS   L+111                      OF THE PARAMETER WORD.    197VF
    SJ   L+1            L+3                                   198VF
    TP   L+180          A           THE FOLLOWING NUMBERS     199VF
    MJ                  L+3                                   200VF
    TP   L+150          L+180       WILL BE STORED IN CON-    201VF
    MJ                  L+8                                   202VF
    TP   L+167          Q           SECUTIVE CELLS UNTIL      203VF
    QJ   L+3            L+1                                   204VF
    TP   L+174          L+159       ANOTHER LXXXXX ADDRESS    205VF
    MJ                  L+11                                  206VF
    TP   L+82           L+163       APPEARS.                  207VF
    ST   L+153          L+156                                 208VF
    MJ                  L+8                                   209VF
    TP   L+171                                                210VF
    RA   L-1            L+79    A COMMA SEPARATES ALL         211VF
    EJ   L+142          L+2                                   212VF
    MJ                  L-53        FIELDS OF THE VARIABLE    213VF
    SP   L+138                                                214VF
    TP   L-211          Q           FIELD CARD INPUT. COM-    215VF
    MJ                  L-214                                 216VF
```

```
TP    L+147          A                                                    217VF
ZJ    L+1            L+15                                                 218VF
SJ    L+1            L+17                                                 219VF
SN    L+144          15                                                   220VF
SA    L+99                                                                221VF
TU    A              L+3                                                  222VF
TV    L+157          L+8                                                  223VF
SP    L+152                                                               224VF
DV                   L+143                                                225VF
SP    A              35                                                   226VF
TU    L-2            L+1                                                  227VF
DV                   L+156                                                228VF
SP    L+139          35                                                   229VF
SA    Q              37                                                   230VF
LA    A                                                                   231VF
MJ                   L+10                                                 232VF
TV    L+147          L+1                                                  233VF
SP    L+142                                                               234VF
MJ                   L+7                                                  235VF
TV    L+144          L+5                                                  236VF
SP    L+127          15                                                   237VF
SA    L+82                                                                238VF
TU    A              L+1                                                  239VF
MP                   L+136                                                240VF
LA    A                                                                   241VF
TP    L+135          Q                                                    242VF
QJ    L+1            L+3                                                  243VF
TN    A              L+137                                                244VF
MJ                   L-35                                                 245VF
TP    A              L+135                                                246VF
MJ                   L-37                                                 247VF
TP    L+130          A                                                    248VF
ST    L+112          Q                                                    249VF
MP    Q              L+82                                                 250VF
LT    3              L+114                                                251VF
LQ    A              35                                                   252VF
```

PLETE NUMBERS MAY BE
DUPLICATED INTO CONSEC-
UTIVE CELLS BY SUCCESS-
IVE COMMAS.

FLOATING POINT NUMBERS
ARE WRITTEN IN THE FORM
F+-XX. PLUS SIGNS NEED
NOT BE SPECIFIED. NO
DECIMAL POINT MAY BE
WRITTEN IN A FLOATING
POINT NUMBER, IT IS
ASSUMED THAT THE DEC-
IMAL POINT PRECEDES THE
LEFT MOST WRITTEN DIGIT
THE FRACTIONAL PART OF
A FLOATING POINT NUMBER
MAY BE LESS THAN, BUT

```
SJ    L+1          L+4
RS    L+111        L+36
SP    L+63
AT    Q            Q
SP    Q            4
LT                 A
AT    L+76         L+11
QT    L+74         Q
MP    Q            L+83
LT                 A
AT    L+82         L+103
MP    Q            L+102
LT                 A
AT    L+80         L+100
SP    Q            33
DV    L+98         A
AT    L+64         Q
MP    Q
LT    2            A
MP    A            L+103
ZJ    L+1          L-27
SF    A            L+93
TP    A            L+93
RA    L+89         L+71
AT    L+90         L+88
SJ    L+1          L+3
TP    L+10         A
MJ                 L+5
TJ    L+67         L+3
SP    L+71
MJ                 L-68
LQ    L+81         27
TP    L+83         A
LT    28           A
AT    Q            A
MJ                 L-46
```

```
CANNOT EXCEED NINE DEC-
IMAL DIGITS.

STATED POINT NUMBERS ARE
 SPECIFIED BY A SIGN FOL
-LOWED BY NOT MORE THAN
ELEVEN DECIMAL DITITS.
PLUS SIGNS NEED NOT BE
WRITTEN. A DECIMAL
POINT MAY APPEAR ANY-
WHERE IN A STATED POINT
NUMBER.

SCALE FACTORS ARE ASSOC-
 IATED WITH EACH STATED
POINT NUMBER. THE DECI-
MAL SCALING IS IN THE
FORM D+-XX AND THE BIN-
```

```
253VF
254VF
255VF
256VF
257VF
258VF
259VF
260VF
261VF
262VF
263VF
264VF
265VF
266VF
267VF
268VF
269VF
270VF
271VF
272VF
273VF
274VF
275VF
276VF
277VF
278VF
279VF
280VF
281VF
282VF
283VF
284VF
285VF
286VF
287VF
288VF
```

```
B
B     1
B     20
B15   1
B     24
B     45
B     47
B     51
B     26
B     46
B     3
B     4
B     5
B     6
B     7
B     10
B     11
B     12
B     13
B     14
B     61
B     525252525252
      L-3
      L+1
      L+72          L+72
      L+1
      L+76          L+76
B     77
B     20
B     400000000000
B     15
      L+1
B     1
B     12
B     144
B     1750
```

```
ARY SCALING IS IN THE                289VF
                                     290VF
FORM BXX. THE BINARY                 291VF
                                     292VF
SCALING IS ACTUALLY THE              293VF
                                     294VF
LOCATION OF THE BINARY               295VF
                                     296VF
POINT OBTAINED BY COUNT              297VF
                                     298VF
ING FROM THE RIGHT,                  299VF
                                     300VF
STARTING WITH THE BIT                301VF
                                     302VF
ZERO OF THE WORD AS IT               303VF
                                     304VF
APPEARS IN THE MACHINE.              305VF
                                     306VF
THE PLUS SIGN NEED NOT               307VF
                                     308VF
BE WRITTEN IN THE DECI-              309VF
                                     310VF
MAL SCALING FACTOR,                  311VF
                                     312VF
A MINUS SIGN IS NOT                  313VF
                                     314VF
ALLOWED IN THE BINARY                315VF
                                     316VF
SCALING FACTOR.                      317VF
                                     318VF
                                     319VF
                                     320VF
THE DECIMAL SCALING FAC-             321VF
                                     322VF
 TOR MUST NOT EXCEED                 323VF
                                     324VF
```

```
B     23420
B     303240
B     3641100
B     46113200
B     575360400
B     7346545000
B     112402762000
B     324464741134
B     200000000000
B     37777777777
MP    Q              L+1
B     200000000000
B     213453407440
B     230157701214
B     245775532516
B     265011714640
B     305316250212
B     327211763126
B     352601433477
B     035440262675
B     600000171150
B     270524354513
B     201
B     400
B     400000000005
B     40
B     777777777777
B     660303050001
B     660303050002
11    L+27           10000)B
RSRV  42             42
```

11. A MINUS ZERO WILL BE STORED IN PLACE OF THE NUMBER IF THE SCALING FACTOR IS TOO LARGE

AFTER ONCE BEING SPECIFIED, THE DECIMAL AND/OR BINARY SCALING OF A NUMBER IS DUPLICATED IN THE FOLLOWING STATED POINT NUMBERS UNTIL NEW SCALE FACTORS ARE ENCOUNTERED. ZERO SCALINGS ARE SPECIFIED BY WRITING ONLY THE ALPHABETICAL CHARACTER.

1. IDENTIFICATION

VARIABLE FIELD CARD READ - TAPE MODE
Identification Tag: VARCAR

2. DESCRIPTION

This routine reads n variable field cards from a tape prepared by the Card-to-Tape Converter. Each card is translated into one blockette and, hence, by the use of the variable block mode, reading can be accomplished in increments of one card. See page 2 for description of card format. The format is the same as for VARAB.

3. CALLING SEQUENCE

LOC	OP	U	V
L	CALL	VARCAR	
L+1	TT	bbbbb	vvvvv
L+2	Normal return		

TT - Uniservo

bbbbb - The number of cards to read

vvvvv - The initial storage address.

4. CODING INFORMATION

Space required: 377 cells (decimal)
571 cells (octal).

5. RESTRICTIONS

See page 2.

6. ERROR PROCEDURES:

Illegal character: MS
Core overflow: MS, $(A)_R$ = 454716031220
(Q) = ttbbbbbvvvvv
Power overflow: MS, $(A)_R$ = 450326110331
(Q) = ttbbbbbvvvvv

Depressing the start button at any error stop will send control to the normal exit of the subroutine.

7. VARIABLE FIELD CARD DESCRIPTION

The variable field card input uses only the first 72 columns. A number that would require punching beyond the first 72 columns may be continued in column 1 of the succeeding card if there are 72 non-blank columns in the first card.

The reading of a card is terminated by any of the following:

a. A blank column found anywhere in the first 72 columns.
b. When 72 non-blank columns have been read.
c. By the letter "C" found anywhere in the first 72 columns.

Loading of the input is terminated in one of two ways, whichever occurs first:

a. When the letter "C" appears on a card, or,
b. When "n" cards, as specified in the "u" address of the parameter word, have been read.

Decimal storage addresses in the form of Lxxxxx, may appear anywhere on any card. The number immediately following such an address will be stored in the cell whose address is formed by adding to the Lxxxxx address the initial address in the "v" portion of the parameter word. The following numbers will be stored in consecutive cells until another address appears.

A comma separates all fields of the variable field card input. Complete numbers may be duplicated into consecutive cells by successive commas.

Floating point numbers are written in the form F±xx. Plus signs need not be specified. No decimal point may be written in a floating point number; it is assumed that the decimal point precedes the left-most written digit. The fractional part of a floating point number may be less than, but cannot exceed nine decimal digits.

Stated point numbers are specified by a sign followed by not more than eleven decimal digits. Plus signs need not be written. A decimal point may appear anywhere in a stated point number.

Scale factors are associated with each stated point number. The decimal scaling is in the form D±xx and the binary scaling is in the form Bxx. The binary scaling is actually the location of the binary point obtained by counting from the right, starting with the bit zero of the word as it appears in the machine. The plus sign need not be written in the decimal scaling factor, a minus sign is not allowed in the binary scaling factor.

The decimal scaling factor must not exceed ± 11. A minus zero will be stored in place of the number if the scaling factor is too large.

7. VARIABLE FIELD CARD DESCRIPTION (Cont'd)

After once being specified, the decimal and/or binary scaling of a number is duplicated in the following stated point numbers until new scale factors are encountered. Zero scalings are specified by writing only the alphabetical character.

1. IDENTIFICATION

READ FLOATING DECIMAL TAPE (48 Words/Block)
Identification Tag: RDFLDC

2. DESCRIPTION

This program reads N blocks of floating decimal words (in XS3 code) from the designated uniservo. The routine translates these words into 1103A floating binary and stores them in sequential storages beginning with the storage address indicated in the parameter word. The routine stores only that number of words specified by the parameter word; this number need not be an exact multiple of 48.

3. CALLING SEQUENCE

LOC	OP	U	V
L	CALL	RDFLDC	
L+1	TT	WWWWW	DDDDD
L+2	Next instruction		

TT - Uniservo number.

WWWWW - Number of words to be read in and stored.

DDDDD - The address of the cell in which the first word is to be stored.

4. CODING INFORMATION

Space required for this routine:

284 cells (decimal)
434 cells (octal)

This routine is completely self-contained.

5. RESTRICTIONS

a. Accuracy. The exponential method used in conversion gives accuracy to within a binary one in the 27th bit of the mantissa in all cases. The conversion of all integers less than 107 is exact.

b. Range of Parameters. (See error procedures)

Largest floating decimal number (absolute value):

$$1.7014 \times 10^{38} \approx 377\ 77777777_8 .$$

Smallest (non-zero) floating point number (absolute value):

$1.4694 \times 10^{-39} \approx$ 000400000000

c. Machine Limitations. An attempt to store information in such a way as to overflow the last core address (17777) will cause an error MS.

6. ERROR PROCEDURES

The parameter word is left in Q when an error MS occurs.

a. When a parity error is detected four attempts are made to read the offending block 2 on normal bias and one each on high and low bias.

b. In case of a core overflow, the error exit is entered immediately and no attempt is made to space the tape forward to correspond to the number of blocks indicated by W.

c. In case of a power overflow, the largest floating binary number is substituted for the offending number and the error exit is not entered until the W words called for by the parameter word are read in and stored.

d. When a power underflow occurs, the offending number is set equal to zero and no error is indicated.

ERROR CODES

(A_R)	INDICATING
660303050001	Four attempts to read one block
660303050002	Core overflow while storing information
660303050003	Power overflow during floating conversion

7. REMARKS

The tape format required by this routine is as follows:

Fixed block length - 120 computer words per block.
Each block contains 48 floating decimal numbers in XS3 code.
A number is represented by 12 XS3 characters in the following order:

1. Sign of the number
2. 8 digit fraction
3. Sign of the power
4. 2 digit power

(e.g., the number -1.5 is represented by the 12 characters -15000000 + 01).

```
RDFLDC  MJ              L+4
        MS              L+1
        MJ              FILL

        SP    L-2       15
        TU    A         L+1
        TP    FILL      L-3
        RA    L-5       L+141
        TV    L-5       L+110
        TP    L+138     L+137
        LQ    L-7       Q+21
        QT    L+151     L+170
        LA    L-9       A+54
        TP    L+147     Q
        QS    A         L+129
        QS    A         L+127
        RS    L+165     L+139
        TP    L+138     L+165
        SJ    L+1       L+5
        SA    L+136
        SJ    L+118     L+1
        ZJ    L+1       L+117
        TP    A         L+160
        EF              L+140
        TP    L+126     L+159
        EF              L+118
        TV    L+1       L+4
        TP    L+127     L+157
        IJ    L+154     L+3
        RPB   4         L+2
        TP    L+250
        RPV   4         L+2
        ER1             L+248
        LA    L+249     18
        LA    L+249     18
        LTL             A
```

IDENTIFICATION

READ FLOATING DECIMAL TAPE (48 WORDS/BLOCK)

IDENTIFICATION TAG

RDFLDC

DESCRIPTION

THIS PROGRAM READS N BLOCKS OF FLOATING DECIMAL WORDS (IN EXCESS-3 CODE) FROM THE DESIGNATED UNISERVO. THE ROUTINE TRANSLATES THESE WORDS INTO 1103A FLOATING BINARY AND STORES THEM IN SEQUENTIAL STORAGES BEGINNING WITH THE STORAGE ADDRESS SPECIFIED IN THE PARAMETER WORD. THE ROUTINE STORES EXACTLY THAT NUMBER OF WORDS SPECIFIED BY THE PARAMETER WORD. THIS NUMBER NEED NOT BE A MULTIPLE OF 48.

CALLING SEQUENCE

```
LOC OP     U        V
L   CALL RDFLDC
```

```
AT    L+246        L+246
ER1                A
LTL   18           A
AT    L+244        L+244
RA    L-10         L+111
IJ    L+143        L-12
ER0                A
ZJ    L+1          L+11
IJ    L+139        L+4
SP    L+125
TP    L-43         Q
MJ                 L-46
SP    A            12
AT    L+114        L+136
EF                 L+135
EF                 L+91
RA    L+130        L+96
MJ                 L-28
TU    L+4          L+2
RPB   2            L+2
TP                 L+132
TV    L+39         L+77
SP    L+130        6
TP    A            Q
LT0   1            L+123
TP    L+90         L+123
RJ    L+73         L+62
TM    L+122        L+122
TP    L+85         L+120
TP    L+124        Q
RJ    L+69         L+59
SP    Q            6
LTL                L+115
TP    A            Q
RA    L+64         L+78
TP    L+77         L+113
```

```
                                                    37FT
L+1 TT   WWWWW  DDDDD                               38FT
                                                    39FT
L+2 NEXT INSTRUCTION                                40FT
                                                    41FT
                                                    42FT
     TT - UNISERVO NUMBER                           43FT
                                                    44FT
 WWWWW - NUMBER OF WORDS                            45FT
         TO BE READ IN                              46FT
         AND STORED.                                47FT
                                                    48FT
 DDDDD - THE ADDRESS OF                             49FT
         THE CELL IN                                50FT
         WHICH THE FIRST                            51FT
         WORD IS TO BE                              52FT
         STORED.                                    53FT
                                                    54FT
                                                    55FT
   CODING INFORMATION                               56FT
                                                    57FT
 COMPUTER STORAGE SPACE                             58FT
REQUIRED BY THIS ROU-                               59FT
TINE                                                60FT
      234 CELLS(DECIMAL)                            61FT
                                                    62FT
      434 CELLS(OCTAL)                              63FT
                                                    64FT
THIS ROUTINE IS COM-                                65FT
PLETELY SELF-CONTAINED.                             66FT
                                                    67FT
                                                    68FT
     RESTRICTIONS                                   69FT
                                                    70FT
 A. ACCURACY.                                       71FT
                                                    72FT
```

```
RJ    L+63          L+52
RS    L+114         L+80
MP    L+94          L+113
LTL   3             L+112
LQ    A             35
SJ    L+1           L+4
RS    L+109         L+70
SP    L+94          1
AT    Q             Q
SP    Q             4
LTL                 A
AT    L+61          L+11
QT    L+75          Q
MP    Q             L+80
LTL                 A
AT    L+79          L+97
MP    Q             L+96
LTL                 A
AT    L+77          L+94
SP    Q             33
DV    L+92          A
AT    L+80          Q
B
LTL   2             A
MP    A             L+90
ZJ    L+1           L+7
SF    A             L+47
TP    A             A
LTL   28            L+86
RA    L+86          L+55
AT    L+43          L+85
SJ    L+1           L+3
ST    A             Q
MJ                  L+13
TJ    L+51          L+8
TP    L+41          L+39
```

THE EXPONENTIAL METHOD USED IN CONVERSION GIVES ACCURACY TO WITHIN A BINARY ONE IN THE 27TH BIT OF THE MANTISSA IN ALL CASES. THE CONVERSION OF ALL INTEGERS LESS THAN 10 RAISED TO THE 7TH POWER IS EXACT.

B. RANGE OF PARAMETERS.

1.4694×10^{-39} (APPROX.) TO 1.7014×10^{38} (APPROX.)

C. MACHINE LIMITATIONS.

AN ATTEMPT TO STORE INFORMATION IN SUCH A WAY AS TO OVERFLOW THE LAST CORE ADDRESS (I.E.17777) WILL CAUSE AN ERROR MS.

ERROR PROCEDURES

ON AN ERROR MS, Q CONTAINS THE PARAMETER WORD AND A THE ERROR CODE.

A. PARITY ERROR. FOUR UNSUCCESSFUL ATTEMPTS TO READ A BLOCK.

```
TN    L+56            A
TP    L+77            Q
QJ    L+1             L+2
TN    A               A
TP    L+40            Q
MJ                    L+3
LTR   27              Q
TP    L+71            A
SJ    L+1             L+2
TN    Q               Q
AT    Q
RA    L-1             L+29
EJ    L+38            L+16
RA    L-65            L+48
IJ    L+60            L-67
MJ                    L-107
TP    L+23            L+61
LQ    Q               6
SP    L+59            2
SA    L+58            1
QA    L+33            A
ST    L+21            L+56
IJ    L+54            L-5
RS    L+52            L+18
ZJ    L+2             L+1
TN    L+52            L+52
TP    L+51
MJ
SP    L+35
MJ                    L-91
SP    L+8
ZJ    L+1             L-137
SP    L+32
MJ                    L-95
B     020061400001
B     020060200000
MP    Q               L+29
```

```
                CODE.660303050001
B. CORE OVERFLOW.

                CODE.660303050002

 C. POWER OVERFLOW. THE
LARGEST FLOATING BINARY
NUMBER IS SUBSTITUTED
FOR OFFENDING NUMBER AND
ERROR MS OCCURS ONLY
AFTER ALL THE NUMBERS
SPECIFIED BY W HAVE BEEN
READ IN AND STORED.

                CODE.660303050003

 D. POWER UNDERFLOW. THE
OFFENDING NUMBER IS SET
TO ZERO AND NO MS OCCURS

                CODE.NONE.


                REMARKS

 THE TAPE FORMAT RE-
QUIRED BY THIS ROUTINE
IS DESCRIBED BELOW.

 FIXED BLOCK LENGTH-120
WORDS PER BLOCK. EACH
BLOCK CONTAINS 48 FLOAT-
ING DECIMAL NUMBERS IN
EXCESS-3 CODE. A NUMBER
IS REPRESENTED BY 12
EXCESS-3 CHARACTERS IN
```

```
109FT
110FT
111FT
112FT
113FT
114FT
115FT
116FT
117FT
118FT
119FT
120FT
121FT
122FT
123FT
124FT
125FT
126FT
127FT
128FT
129FT
130FT
131FT
132FT
133FT
134FT
135FT
136FT
137FT
138FT
139FT
140FT
141FT
142FT
143FT
144FT
145FT
```

```
      B
      B
      B
      B     1
      B     2
      B     3
      B     4
      B     5
      B     10
      B     27
      B     60
      B     201
      B     400
      B     353100020000
      B     037777777777
      B     170000
      B     77
      B     77777
      B     020000150000
      B33   4
      B     035440262675
      B     600000171150
      B     270524354513
      B     324464741134
      B     200000
      B     660303050001
      B     660303050002
      B     660303050003
      B33   2
      B     213453407440
      B     230157701214
      B     245775532516
      B     265011714640
      B     305316250212
      B     327211763126
      B     352601433477
      RSRV  103          103
```

```
THE FOLLOWING ORDER.

 1. SIGN OF THE NUMBER

 2. 8 DIGIT FRACTION

 3. SIGN OF THE POWER

 4  2 DIGIT POWER

(E.G., THE NUMBER -1.5
IS REPRESENTED BY THE 12
CHARACTERS -15000000+01)
.

 THE FLOATING DECIMAL
TAPE READ SUBROUTINE
(RDFLDC) AND THE FLOAT-
ING DECIMAL TAPE WRITE
SUBROUTINE (WFLDEC) ARE
COMPLEMENTARY ROUTINES.
 THE RDFLDC ROUTINE WILL
READ TAPES PREPARED BY
THE WFLDEC ROUTINE AND
THE TAPES PREPARED BY
THE WFLDEC ROUTINE CAN
BE LISTED ON THE HIGH
SPEED PRINTER.
 A USEFUL CONSEQUENCE
OF THIS IS THAT TAPES
TO BE READ IN BY THE
RDFLDC ROUTINE CAN BE
LISTED ON THE HIGH SPEED
PRINTER FOR VERIFICATION
PURPOSES PRIOR TO READ-
ING THEM INTO THE 1103A.
```

1. IDENTIFICATION

WRITE FLOATING DECIMAL TAPE
Identification Tag: WFLDEC

2. DESCRIPTION

This subroutine writes n blocks of floating decimal information suitable for High Speed Printer listing. There are 48 words per block. Refer to the Read Floating Decimal Tape write-up (1103AF-SUBR-00020S) for description of the tape format.

3. CALLING SEQUENCE

LOC	OP	U	V
L	CALL	WFLDEC	
L+1	TT	NNNNN	vvvvv
L+2	Normal Return		

TT - Uniservo number.

NNNNN - Number of blocks to write.

VVVVV - Address of first word of output.

4. CODING INFORMATION

Space Required: 326 cells (decimal)
506 cells (octal).

5. ERROR PROCEDURE

In case of a power overflow during conversion, the routine types OV on the typewriter and goes to the error exit. Depressing the start button will cause a normal exit.

```
WFLDEC  MJ              L+4             IDENTIFICATION          1WF
        MS              L+1                                     2WF
        MJ                               WRITE FLOATING DECIMAL  3WF
        B                               TAPE (48 WORDS/BLOCK)   4WF
        SP    L-2       15                                      5WF
        TU    A         L+1                                     6WF
        TP              L-3             IDENTIFICATION TAG      7WF
        RA    L-5       L+169                                   8WF
        TV    L-5       L+194           WFLDEC                  9WF
        LQ    L+166     Q+9                                     10WF
        SP    L-7       18                                      11WF
        LT              A                   DESCRIPTION         12WF
        QS    A         L+178                                   13WF
        LQ    L-10      Q+21             THIS SUBROUTINE WRITES 14WF
        QT    L+175     L+185       N BLOCKS OF FLOATING        15WF
        IJ    L+184     L+2         DECIMAL INFORMATION ON      16WF
        MJ              L-14        THE DESIGNATED UNISERVO.    17WF
        TV    L+60      L+54        THE TAPE IS WRITTEN IN      18WF
        TP    L+159     L+182       EXCESS-3 CODE IN A FORM     19WF
        SP    L+183     15          SUITABLE FOR HIGH SPEED     20WF
        TU    A         L+2         PRINTER LISTING. THE        21WF
        TP    L+170     L+303       ROUTINE TRANSLATES PACK-    22WF
        TP              A           ED FLOATING BINARY NUM-     23WF
        SJ    L+1       L+3         BERS INTO THE FORM DES-     24WF
        TP    L+168     L+300       CRIBED UNDER REMARKS.       25WF
        TN    A         A           THESE NUMBERS ARE TAKEN     26WF
        RJ    L+78      L+52        FROM SEQUENTIAL STORAGES    27WF
        LT1   1         Q           BEGINNING WITH THE STOR-    28WF
        RA    L+296     L+164       AGE ADDRESS SPECIFIED IN    29WF
        TP    L+166     L+296       THE PARAMETER WORD. THE     30WF
        LA    L+294     6           ROUTINE TRANSLATES AND      31WF
        SP    Q         2           WRITES FLOATING DECIMAL     32WF
        SA    Q         1           NUMBERS IN INCREMENTS OF    33WF
        TP    A         Q           48 NUMBERS ONLY.            34WF
        LT              A                                       35WF
        SA    L+159                                             36WF
```

```
AT   L+288        L+288                                          37WF
IJ   L+288        L-7                                            38WF
TP   L+155        L+163          LOC   OP     U      V          39WF
SP   Q            2                                             40WF
SA   Q            1              L     CALL   WFLDEC            41WF
TP   A            Q                                             42WF
LT                A              L+1   TT     NNNNN  VVVVV     43WF
AT   L+282        A                                             44WF
SA   L+150        6              L+2   NEXT INSTRUCTION         45WF
TP   A            L+280                                         46WF
IJ   L+155        L-7                                           47WF
TP   L+157        A                TT - UNISERVO NUMBER.        48WF
SJ   L+1          L+3                                           49WF
RA   L+276        L+143        NNNNN - NUMBER OF BLOCKS         50WF
TN   L+154        A                    TO BE WRITTEN.           51WF
DV   L+147        Q                                             52WF
TP   A            L+152        VVVVV - ADDRESS OF THE           53WF
TP   L+139        A                    CELL IN WHICH            54WF
SA   L+271        6                    THE FIRST NUMBER         55WF
SA   Q                                 TO BE WRITTEN IS         56WF
SA   L+138        6                    STORED.                  57WF
SA   L+147                                                      58WF
AT   L+136        L+267                                         59WF
LQ   L+119        1                CODING INFORMATION           60WF
QJ   L+3          L+1                                           61WF
RPB  2            L+12          COMPUTER STORAGE RE-           62WF
TP   L+262        L+259        QUIRED BY THIS ROUTINE.          63WF
LA   L+261        18                                            64WF
LT                A                326 CELLS (DECIMAL)          65WF
AT   L+114        L+258                                         66WF
LA   L+259        18               506 CELLS (OCTAL)            67WF
LT                A                                             68WF
AT   L+256        L+256         THIS ROUTINE IS COM-           69WF
RA   L+256        L+111        PLETELY SELF-CONTAINED.          70WF
RPB  5            L+2                                           71WF
TP   L+250                                                      72WF
```

```
RA    L-1          L+124          RESTRICTIONS                    73WF
RA    L+129        L+119                                          74WF
IJ    L+126        L-55                                           75WF
EF                 L+115          A. ACCURACY.                    76WF
RP1   120          L-61                                           77WF
EW1                L+129          THE CONVERSION FROM             78WF
LT    9            L+126        FLOATING BINARY TO                79WF
LQ    A            35           FLOATING DECIMAL IS               80WF
TM    Q            L+125        ACCURATE TO WITHIN A ONE          81WF
ZJ    L+1          L+23         IN THE LEAST SIGNIFICANT          82WF
RS    L+122        L+99         DIGIT OF THE DECIMAL              83WF
MP    L+99         L+121        FRACTION.                         84WF
LT    1            L+120                                          85WF
LQ    A            35                                             86WF
SJ    L+1          L+4            B. RANGE OF PARAMETERS.         87WF
RS    L+117        L+105                                          88WF
SP    L+56         1              00040000000  MAGNITUDES         89WF
AT    Q            Q                           OF FLOAT-         90WF
MP    Q            L+93               TO       ING BINARY        91WF
LT    1            A                           NUMBERS IN        92WF
LT1   3            Q              37777777777  OCTAL CODE        93WF
LT                 A                                              94WF
AT    L+90         L+3            THE ABOVE CORRESPONDS           95WF
RJ    L+79         L+10         APPROXIMATELY TO THE              96WF
MP    A            L+109        FOLLOWING RANGE OF DEC-           97WF
B                                 MAL NUMBERS.                    98WF
SA    L+87                                    -39                 99WF
EJ    A            L+4            1.4694 X 10                    100WF
DV    L+98         Q                                             101WF
RA    L+103        L+91               TO                         102WF
RA    Q            L+90                        38                103WF
TP    A            L+102          1.7014 X 10                    104WF
MJ                                                               105WF
LQ    Q            35                                            106WF
MJ                 L+53           C. MACHINE LIMITATIONS.        107WF
RS    L+100        L+90                                          108WF
```

```
MP    L+34            L+99
LT    3               L+98
LQ    A               35
SJ    L+1             L+4
RS    L+95            L+80
SP    L+31            1
AT    Q               Q
RJ    L+59            L+44
MP    A               L+90
ZJ    L+1             L+7
SF    A               L+25
TP    A               A
LT    28              L+86
RA    L+86            L+65
AT    L+21            L+85
SJ    L+1             L+3
ST    A               Q
MJ                    L+15
TJ    L+61            L+10
PR                    L+67
PR                    L+11
MJ                    L-128
TN    L+58            A
TP    L+75            Q
QJ    L+1             L+2
TN    A               A
TP    L+62            Q
MJ                    L+3
LT1   27              Q
TP    L+69            A
SJ    L+1             L+2
TN    Q               31017)B
AT    Q
MJ
B     324464741134
B
```

NO ATTEMPT IS MADE TO CHECK FOR ILLEGAL STORAGE ADDRESSES BEING GENERATED FROM THE ADDRESS SPECIFIED IN THE PARAMETER WORD.

ERROR PROCEDURES

IN CASE OF A POWER OVERFLOW DURING CONVERSION, THE ROUTINE TYPES THE LETTERS O V ON THE FLEXIWRITER AND GOES TO THE ERROR EXIT. DEPRESSING THE START BUTTON WILL RESULT IN A NORMAL EXIT FROM THE ROUTINE. THE BLOCK OF 48 WORDS WHICH CONTAINS THE WORD THAT CAUSED THE OVERFLOW IS NOT RECORDED ON TAPE.

REMARKS

THE TAPE FORMAT EMPLOYED IN THE ROUTINE IS DESCRIBED BELOW.

FIXED BLOCK LENGTH-120 WORDS PER BLOCK. EACH BLOCK CONTAINS 48 FLOATING DECIMAL NUMBERS IN EXCESS-3 CODE. A NUMBER

```
B34  1                                  IS REPRESENTED BY 12        145WF
B    213453407440                       EXCESS-3 CHARACTERS IN      146WF
B    230157701214                       THE FOLLOWING ORDER.        147WF
B    245775532516                                                   148WF
B    265011714640                        1. SIGN OF THE NUMBER      149WF
B    305316250212                                                   150WF
B    327211763126                        2. 8 DIGIT FRACTION        151WF
B    352601433477                                                   152WF
B    270524354513                        3. SIGN OF THE POWER       153WF
B    600000171150                                                   154WF
B    035440262675                        4. 2 DIGIT POWER           155WF
B    177000000000                                                   156WF
B    201000000000                       (E.G. THE NUMBER -1.5678    157WF
MP   Q              L-13               IS DESIGNATED BY THE 12     158WF
B    037777777777                       CHARACTERS.                 159WF
SP   Q              4                                              160WF
LT                  A                        -15678000+01).        161WF
AT   L-4            L+11                                           162WF
QT   L-4            Q                                              163WF
MP   Q              L-9                 TAPES PREPARED BY THIS     164WF
LT                  A                  ROUTINE ARE LISTED BY       165WF
AT   L-12           L+38               THE HIGH SPEED PRINTER      166WF
MP   Q              L+37               AS FOLLOWS.                 167WF
LT                  A                                              168WF
AT   L-16           L+35                   8 FLOATING DECIMAL      169WF
SP   Q              33                       WORDS PER LINE OF     170WF
DV   L+33           A                        HIGH SPEED PRINTER    171WF
AT   L-27           Q                        OUTPUT.               172WF
B                                                                  173WF
LT   2              A                      6 LINES OF PRINTER      174WF
MJ                                     OUTPUT FOR EACH 48 WORD     175WF
                    170)B              BLOCK THAT IS WRITTEN       176WF
                    1                  ON THE TAPE.                177WF
                    57)B                                           178WF
                                                                   179WF
B    525252525252                        THE FLOATING DECIMAL       180WF
B    010101000000
```

```
     B     000000010101                TAPE READ SUBROUTINE       181WF
     B     177                         (RDFLDC) AND THE FLOAT-    182WF
     B     115040465024                ING DECIMAL TAPE WRITE     183WF
     B     324464741135                SUBROUTINE (WFLDEC) ARE    184WF
     SS    A             37            COMPLEMENTARY ROUTINES.    185WF
     B     254                          THE RDFLDC ROUTINE WILL   186WF
     B     201                         READ TAPES PREPARED BY     187WF
     B     400000000005                THE WFLDEC ROUTINE AND     188WF
     B     400000000000                THE TAPES PREPARED BY      189WF
     B     000000077777                THE WFLDEC ROUTINE CAN     190WF
     B     020064600000                BE LISTED ON THE HIGH      191WF
                                       SPEED PRINTER.             192WF
                         1              A USEFUL CONSEQUENCE      193WF
                         2             OF THIS IS THAT TAPES      194WF
                         3             TO BE READ IN BY THE       195WF
                         4             RDFLDC ROUTINE CAN BE      196WF
                         5             LISTED ON THE HIGH SPEED   197WF
                         8             PRINTER FOR VERIFICATION   198WF
                        10             PURPOSES PRIOR TO READ-    199WF
     RSRV  127          127           ING THEM INTO THE 1103A.   200WF
```

1. IDENTIFICATION

BINARY CARD READ
Identification Tag: RDBIN

2. DESCRIPTION

This routine reads full binary cards (22 computer words per card) as prepared by the PUNCH BINARY CARD subroutine. The transfer card (see Remarks) following the full binary cards terminates card reading.

3. CALLING SEQUENCE

LOC	OP	U	V
L	CALL	RDBIN	
L+1	Normal return		

4. CODING INFORMATION

Space required: 68 cells (decimal)
104 cells (octal).

Loading options:

a. Stop.

If MS1 switch is set, the routine will stop before transferring control to the address in the transfer card (see Remarks); if MS1 switch is OFF, the transfer of control is automatic.

b. Check sum.

If MJ1 switch is set, the routine will not perform a check sum comparison; if MJ1 switch is OFF, the card check sum is compared with the computed check sum.

5. RESTRICTIONS

An attempt to store information in an illegal address will result in an SCC fault.

No attempt should be made to store information in F1.

6. ERROR PROCEDURES

Check sum disagreement will result in an MS with (PAK)=0.

6. ERROR PROCEDURES (Cont'd)

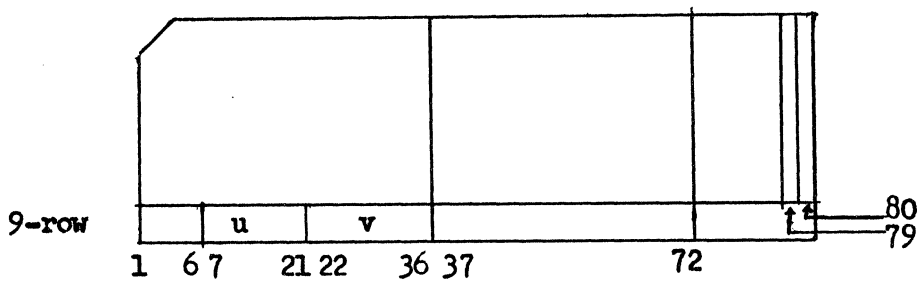
Restarting when a BULL failure occurs is accomplished as follows:

a. Clear the BULL.
b. Position the cards manually and transfer to RDBIN or to the calling sequence in the main program.

7. REMARKS

Card Format:

a. Full Binary Card:



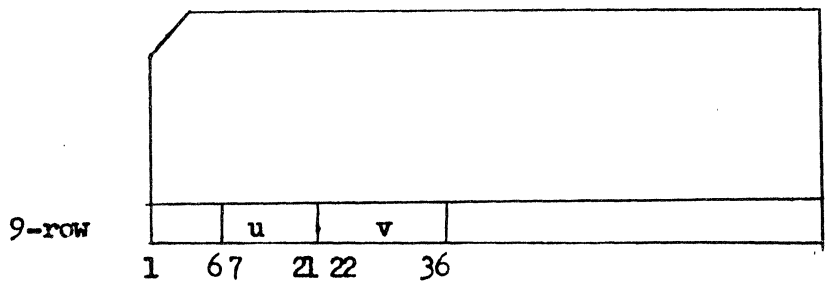
(1) Word Count. The u-address of 9L contains the number of words beginning with 8L to be read in from card.

(2) Card Origin. The v-address of 9L contains the origin or initial core or drum location into which the card is read.

(3) Check Sum. The 9R word is the 36-bit check sum.

(4) Complement Bits. A punch is column 79 and/or 80 indicates that the left and/or right half row has been complemented and will cause the read routines to recomplement the respective entry.

b. Transfer Card:



7. REMARKS (Cont'd)

(1) Identification. A punch in column 1 of 9L identifies the transfer card.

(2) Transfer Address. The v-address of 9L contains the transfer address, which is the location in core or drum to which control is transferred on completion of loading.

```
RDBIN   MJ                  L+3
        MS0
        MJ
        EF                  L+32
        TP      L+32        L+63
        TV      L+33        L+10
        ER                  L+34
        ER1                 L+34
        ER1                 L+34
        LQ      L+31        34
        QJ      L+1         L+2
        TN      L+30        L+30
        QJ      L+1         L+2
        TN      L+29        L+29
        RPB     2           L+2
        TP      L+26        L+28
        RA      L-1         L+21
        IJ      L+50        L-11
        TP      L+25        A
        SJ      L+1         L+3
        TV      A           L+1
        MS1
        TV      A           L+11
        RP2     22          L+2
        SA      L+21
        SP      A
        SS      L+18
        MJ1                 L+2
        ZJ      L-27        L+1
        TP      L+14        A
        AT      L+9         L+2
        TV      L+3         L+1
        B
        TP      L+12
                            L-31
        B       400000000005
```

```
RDBIN - BINARY CARD READ                1RB
                                        2RB
CALLING SEQUENCE                        3RB
                                        4RB
   L  CALL   RDBIN                      5RB
 L+1  (NORMAL RETURN)                   6RB
                                        7RB
 OCCUPIES 68 CELLS (DEC)                8RB
                                        9RB
ROUTINE LOADS FULL BINA-                10RB
 RY CARDS. LOADING IS                   11RB
 TERMINATED BY A TRANS-                 12RB
 FER CARD.                              13RB
                                        14RB
BINARY CARD FORMAT                      15RB
                                        16RB
  9L U-ADR. NO. OF WORDS                17RB
     V-ADR. CARD ORIGIN                 18RB
                                        19RB
  9R 36 BIT CHECK SUM                   20RB
                                        21RB
  WORDS ARE STORED IN                   22RB
   8L, 8R, 7L, 7R, ETC.                 23RB
                                        24RB
  A PUNCH IN COL. 79 OR                 25RB
   80 INDICATES THAT THE                26RB
   LEFT AND/OR RIGHT                    27RB
   HALF-ROW IS STORED IN                28RB
   COMPLEMENTED FORM.                   29RB
                                        30RB
TRANSFER CARD FORMAT                    31RB
                                        32RB
  9L U-ADR. TRANSFER ADR                33RB
                                        34RB
  PUNCH IN COL. 1, 9L                   35RB
                                        36RB
```

```
    B     13                                CHECK SUM COMPARISONS       37RB
    B     2                                  WILL NOT BE PERFORMED      38RB
                           L+5               IF MJ1 IS SET.             39RB
    B     753000000000                                                  40RB
    RSRV  28              28                                            41RB
```

1. IDENTIFICATION

PUNCH BINARY CARDS
Identification Tag: PCHBIN

2. DESCRIPTION

This routine punches the contents of the storages indicated in the parameter word into 80 column cards. Three partial cards are punched, which are combined by one 519 Reproducer step into one full binary card (22 computer words per card).

3. CALLING SEQUENCE

LOC	OP	u	v
L	CALL	PCHBIN	
L+1	00	AAAAA	BBBBB
L+2	Normal	return	

AAAAA = Location of first word to be punched.
BBBBB = Location of last word to be punched.

4. CODING INFORMATION

Space required: 215 cells (decimal)
327 cells (octal)

5. RESTRICTIONS

It is assumed that the addresses specified in the parameter word are both legal addresses and that they are both core addresses or both drum addresses.

6. ERROR PROCEDURES

None.

7. REMARKS

A. See BINARY CARD READ subroutine write up for details of card format.

B. Reproducer procedure:
   a. The order of the partial binary cards must be preserved.
   b. A special reproducer board will produce full binary cards from the partial cards.
   c. Place partial cards in the punch side and set PX1 to column 78.
   d. Sorting the deck on column 77 will select the full binary deck.

```
PCHBIN  MJ                  L+3
        B
        MJ                  FILL
        SP      L-1         15
        TU      A           L+1
        TP      FILL        L-4
        RA      L-4         L+102
        TP      L-5
        EF                  L+115
        SP      L-8         21
        LT                  L+118
        SP      A           15
        LT1     36          L+117
        TP      L+113       L+122
        SP      L+114
        SS      L+109
        SJ      L+1         L+2
        TP      L+108       L+118
        SP      L+111
        ST      L+109       L+111
        SJ      L-18        L+60
        SS      L+81
        SJ      L+2         L+1
        TP      L+79        L+107
        RA      L+106       L+84
        SP      L+105       15
        AT      L+102       L+110
        SP      L+101       15
        TU      A           L+7
        RP1     35          L+2
        TP      L+96        L+107
        SP      L+99        15
        AT      L+71        L+2
        RA      L+2         L+102
        RP3                 L+2
        TP                  L+103
```

IDENTIFICATION

PUNCH BINARY CARDS
IDENTIFICATION TAG- PCHBIN

DESCRIPTION

THIS ROUTINE PUNCHES THE CONTENTS OF THE STORAGES INDICATED IN THE PARAMETER WORD INTO 80 COLUMN CARDS. SINCE THE BULL CANNOT PUNCH A FULL BINARY CARD, 3 PARTIAL CARDS ARE PUNCHED, WHICH ARE COMBINED BY ONE 519 REPRODUCER STEP INTO ONE FULL BINARY CARD.

CALLING SEQUENCE

```
LOC   OP     U       V
 L   CALL  PCHBIN
L+1  00    AAAAA  BBBBB
L+2   (NORMAL RETURN)
```

AAAAA=LOC. OF FIRST WORD TO BE PUNCHED
BBBBB=LOC. OF LAST WORD TO BE PUNCHED

CODING INFORMATION

```
SP    L+100
RP2   22          L+2
SA    L+100
LT1               L+98
TP    L+64        L+91
TP    L+64        L+14
TU    L+63        L+6
TU    L+73        L+11
TP    L+64        L+90
TV    L+53        L+9
TP    L+61        L+86
TP    L+79        L+86
TP                Q
QJ    L+1         L+2
RA    L+83        L+58
IJ    L+81        L-2
RS    L+81        L+57
SJ    L+3         L+1
RA                L+54
TN    L+81        L+81
RA    L-8         L+54
RA    L-2         L+54
TV    L-34        L-4
IJ    L+75        L-13
RA    L-6         L+50
IJ    L+70        L-17
RP1   36          L+2
TP    L+63        L+109
TP    L+51        L+19
TP    L+51        L+20
RJ    L+22        L+16
RJ    L+34        L+23
RP1   36          L+2
TP    L+57        L+103
RJ    L+18        L+12
TV    L+35        L+135
```

```
 OCCUPIES 215 CELLS                37PB
          (327 OCTAL)              38PB
                                   39PB
RESTRICTIONS                       40PB
                                   41PB
 IT IS ASSUMED THAT THE            42PB
 ADDRESSES SPECIFIED IN            43PB
 THE PARAMETER WORD ARE            44PB
 BOTH LEGAL ADDRESSES,             45PB
 AND THAT THEY ARE BOTH            46PB
 CORE ADDRESSES OR BOTH            47PB
 DRUM ADDRESSES.                   48PB
                                   49PB
ERROR PROCEDURES                   50PB
                                   51PB
 NONE                              52PB
                                   53PB
REMARKS                            54PB
                                   55PB
 A. BINARY CARD FORMAT             56PB
                                   57PB
  9L U-ADR. NO. OF WORDS           58PB
     V-ADR. CARD ORIGIN            59PB
                                   60PB
  9R 36 BIT CHECK SUM              61PB
                                   62PB
  WORDS ARE STORED IN              63PB
   8L, 8R, 7L, 7R, ETC.            64PB
                                   65PB
  A PUNCH IN COL. 79 OR            66PB
   80 INDICATES THAT THE           67PB
   LEFT AND/OR RIGHT               68PB
   HALF-ROW IS STORED IN           69PB
   COMPLEMENTED FORM.              70PB
                                   71PB
 B. REPRODUCER PROCEDURE           72PB
```

```
RJ    L+29          L+17
RP1   36            L+2
TP    L+52          L+98
RJ    L+13          L+7
RA    L+130         L+46
RJ    L+24          L+12
RA    L+50          L+34
MJ                  L-66
EF                  L+33
MJ                  L-60
RP3   8             L+2
TP    L+53          L+89
RP3   4             L+2
TP    L+75          L+111
RA    L-3           L+32
RA    L-2           L+30
MJ
EF                  L+24
TP    L+14          L+40
TV    L+25          L+3
TV    L+23          L+3
TV    L+27          L+3
EW
EW1
EW1
RA    L-3           L+11
RA    L-3           L+23
RA    L-3           L+22
IJ    L+30          L-6
MJ
B     25
RP3                 L-67
B     13
TN    L+31          L+31
B     4
B     43
```

THE ORDER OF THE PARTIAL BINARY CARDS MUST BE PRESERVED.

PLACE PARTIAL CARDS IN THE PUNCH SIDE AND SET PX1 TO COLUMN 78.
(WIRING DIAGRAM FOR BOARD INCLUDED IN WRITE-UP)

SORTING THE DECK ON COLUMN 77 WILL SELECT THE FULL BINARY DECK.

```
73PB
74PB
75PB
76PB
77PB
78PB
79PB
80PB
81PB
82PB
83PB
84PB
85PB
86PB
87PB
88PB
89PB
90PB
91PB
92PB
93PB
94PB
95PB
96PB
97PB
98PB
99PB
100PB
101PB
102PB
103PB
104PB
105PB
106PB
107PB
108PB
```

```
B     1                                                    109PB
B     23                                                   110PB
B     100000                                               111PB
B     100001                                               112PB
B     26                                                   113PB
B     400000000012                                         114PB
B     3                                                    115PB
TP    L+21            L+57                                 116PB
TP    L+44            L+80                                 117PB
B     400004                                               118PB
B     1000010                                              119PB
B     13                                                   120PB
                      L+53                                 121PB
B     2                                                    122PB
B     14                                                   123PB
B     400000000010                                         124PB
B                                                          125PB
B                                                          126PB
B                                                          127PB
RSRV  91              91                                   128PB
```

IBM

Trade Mark

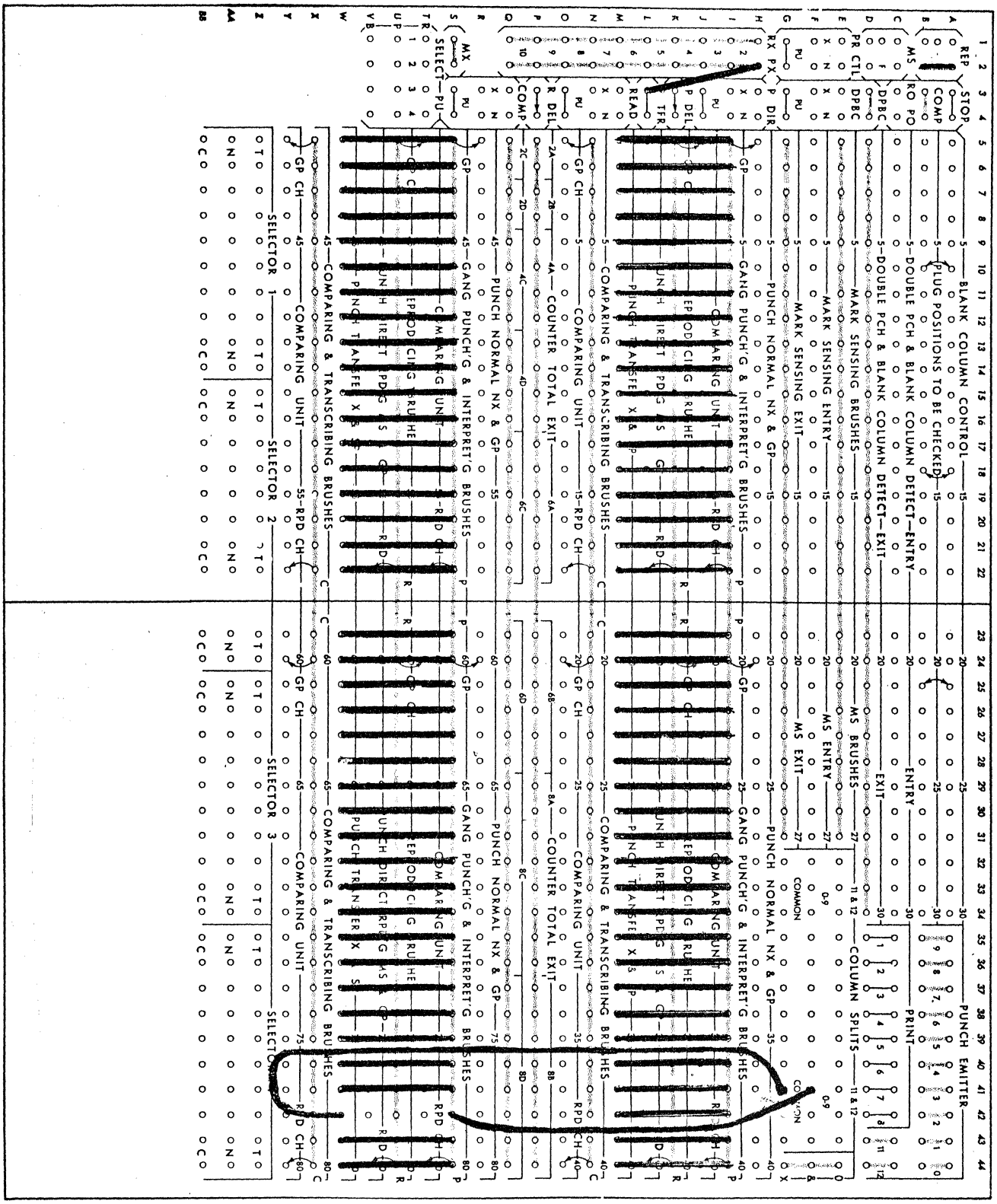
FORM 22-9317-1

INTERNATIONAL BUSINESS MACHINES CORPORATION

ELECTRIC DOCUMENT-ORIGINATING MACHINE

TYPE 519 CONTROL PANEL

PRINTED IN U.S.A.



ELECTRO NO.	CARD NAME OR FUNCTION	X OR D CODE	NOTES:
	PCHBIN		PX1 must be set to
	Punch Binary Cards		column 78.

NAME _____ DEPT. _____

USE _____ NO. _____