```
0001  * 0520-001-H002 (016-DPT9)   DRAWING NO. 41285751-001-01
0002  *
0003  *
0004  *
0005  * COMPUTER:  H316, DDP-516
0006  *
0007  *
0008  * PROGRAM CATEGORY:  VERIFICATION AND TEST
0009  *
0010  *
0011  * PROGRAM TITLE:  016-DPT9
0012  *                 TEST THE DIGITAL INCREMENTAL PLOTTER OPTION
0013  *                 316/516-211X
0014  *
0015  *
0016  *
0017  *
0018  *
0019  *
0020  *
0021  *
0022  *
0023  *
0024  *                                    APPROVAL          DATE
0025  *
0026  *
0027  *                                PROG Patricia Field   2-3-70
0028  *
0029  *
0030  *                                SUPR ____________     12-3-70
0031  *
0032  *
0033  *                                QUAL P.G. Wilson      16.MAR.70
0034  *
0035  *
0036  *                                NO. OF PAGES          67
0037  *
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0038                    *
0039                    *
0040                    * AUTHOR
0041                    *
0042                    *    HONEYWELL - COMPUTER CONTROL DIVISION (EUROPE)
0043                    *
0044                    *
0045                    * PURPOSE
0046                    *
0047                    *    TO TEST THE DIGITAL INCREMENTAL PLOTTER, OPTION 316/516-2111/2112/
0048                    *    2113/2114, IN I/O BUS MODE
0049                    *
0050                    *
0051                    * RESTRICTIONS
0052                    *
0053                    *    THE PROGRAM WILL OPERATE ON A CONFIGURATION WITH AN H316 OR
0054                    *    DDP-516 COMPUTER, WITH A DIGITAL INCREMENTAL PLOTTER, AND
0055                    *    WITH EITHER AN ASR-33 OR AN ASR-35
0056                    *
0057                    *
0058                    * STORAGE
0059                    *
0060                    *    3466  (OCTAL)
0061                    *    1846  (DECIMAL)
0062                    *
0063                    *
0064                    * USE
0065                    *
0066                    *    COMPUTER OPERATION
0067                    *
0068                    *          1     LOAD THE SELF-LOADING SYSTEM TAPE OF 016-DPT9
0069                    *
0070                    *          2     CHECK THAT P='7632
0071                    *
0072                    *          3     MASTER CLEAR, P = '1000, START, IF H316 BEING USED,
0073                    *                SET SENSE SWITCH 1
0074                    *
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0075                *          4      TYPE IN THE APPROPRIATE ANSWERS TO THE PARAMETER
0076                *                 QUESTIONS
0077                *
0078                *          AFTER THE LAST QUESTION IS ANSWERED THE PROGRAM GOES THROUGH
0079                *          THE INITIALISATION ROUTINE AND THEN THE QUESTION 'TEST NO?'
0080                *          IS ASKED
0081                *
0082                *          5      TYPE IN THE REQUIRED ANSWER (IF THE ANSWER IS NUMBER 2
0083                *                 OR LETTER A, SEE 6 BELOW)
0084                *
0085                *          WHEN THE REQUIRED TEST NUMBER IS TYPED IN, THE PROGRAM
0086                *          ATTEMPTS TO PLOT THE TEST PATTERN/PATTERNS AND THE
0087                *          APPROPRIATE CONDITIONS ARE TESTED EITHER SUCCESSFULLY OR AN
0088                *          ERROR CONDITION FOUND
0089                *
0090                *          6      IF THE ANSWER TO QUESTION 'TEST NO?' IS NUMBER 2 OR
0091                *                 LETTER A, SENSE SWITCH 4 MUST BE RESET BEFORE PATTERN
0092                *                 2 IS COMPLETED IF OPTIONAL SPEED PRINTOUT IS REQUIRED,
0093                *                 OR SET IF NOT REQUIRED
0094                *
0095                *          7      THE TEST PROCEDURE MAY BE REPEATED FOR THE SAME OR
0096                *                 ANOTHER PLOTTER AS REQUIRED
0097                *
0098                *          8      TYPE IN THE ANSWER E (TO THE QUESTION 'TEST NO?') WHEN
0099                *                 IT IS DESIRED TO END THE SERIES OF TESTS
0100                *
0101                *
0102                *     PARAMETER QUESTIONS
0103                *
0104                *          ANSWERS TO ALL THE QUESTIONS MUST BE TERMINATED BY A CARRIAGE
0105                *          RETURN CHARACTER.   IN CASE THE LAST OR THE MOST PROBABLE
0106                *          ANSWER (SHOWN ADJACENT TO THE QUESTION) SUFFICES, THE ANSWER
0107                *          SHOULD ONLY BE A CARRIAGE RETURN CHARACTER.   IF AN ILLEGAL
0108                *          ANSWER IS TYPED IN, THE QUESTION CONCERNED WILL BE REPEATED.
0109                *          A DOLLAR SIGN CHARACTER WITHIN ANY ANSWER WILL MAKE THE
0110                *          PARAMETER QUESTIONS REPEAT FROM THE VERY FIRST ONE.
0111                *
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0112                *          QUESTION 1          OPTION NO   1X/
0113                *          ANSWER              11, 12, 13 OR 14 (THE TWO LEAST SIGNIFICANT
0114                *                              DIGITS OF THE OPTION NUMBER 211X)
0115                *                              NO PROBABLE ANSWER
0116                *
0117                *          QUESTION 2          DEV ADDR  27/
0118                *          ANSWER              TWO-DIGIT OCTAL DEVICE CODE IN THE RANGE
0119                *                              00-77
0120                *                              THE PROBABLE ANSWER IS 27
0121                *
0122                *          QUESTION 3          STAND INTRPT  Y /
0123                *          ANSWER              Y (YES) OR N (NO)
0124                *                              THE PROBABLE ANSWER IS Y
0125                *
0126                *                              IF THE ANSWER TO Q3 IS Y, Q4 IS ASKED (Q5
0127                *                              IS NOT POSED;  BUT IF THE ANSWER IS N, Q5
0128                *                              IS ASKED (Q4 IS NOT POSED)
0129                *
0130                *          QUESTION 4          MASK BIT  13/
0131                *          ANSWER              TWO-DIGIT DECIMAL NUMBER (OTB BIT NUMBER
0132                *                              ASSIGNED TO THE PLOTTER) IN THE RANGE 01-16
0133                *                              THE PROBABLE ANSWER IS 13
0134                *
0135                *          QUESTION 5          PRTY INTRPT LINE  01/
0136                *          ANSWER              TWO-DIGIT DECIMAL INTERRUPT LINE NUMBER IN
0137                *                              THE RANGE 01-48
0138                *                              THE PROBABLE ANSWER IS 01
0139                *
0140                *          WHEN Q4/Q5 IS ANSWERED THE PROGRAM GOES THROUGH
0141                *          INITIALISATION ROUTINE AND THE FOLLOWING QUESTION IS ASKED:
0142                *
0143                *          QUESTION 6          TEST NO?
0144                *          ANSWER              I, 1, 2, 3, 4, A OR E;
0145                *                              NO PROBABLE ANSWER
0146                *
0147                *          IF THE ANSWER TO Q6 IS LETTER I, INITIALISATION IS REPEATED.
0148                *          IF THE ANSWER IS NUMBER 1, 2, 3 OR 4, THE APPROPRIATE TEST
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0149                *          ONLY IS PERFORMED.   IF THE ANSWER IS LETTER A, ALL FOUR
0150                *          TESTS ARE PERFORMED SEQUENTIALLY.   BUT IF THE ANSWER IS
0151                *          LETTER E, AN END MESSAGE IS TYPED OUT AND THE PROGRAM COMES
0152                *          TO A HALT.
0153                *
0154                *
0155                * ERRORS
0156                *
0157                *    DETECTION OF AN ERROR IS INDICATED BY A MESSAGE ON THE ASR.   THE
0158                *    TABLE BELOW EXPLAINS THE ERROR MESSAGES THAT MAY BE PRINTED OUT.
0159                *
0160                *    LMTL - LIMIT LATE - NOT OCCURED BEFORE FIVE PERCENT ABOVE
0161                *           SPECIFIED VALUE
0162                *    LMTE - LIMIT EARLY - OCCURED LESS THAN FIVE PERCENT BELOW
0163                *           SPECIFIED VALUE
0164                *    BSMC - PLOTTER BUSY AFTER MASTER CLEAR
0165                *    ITMC - PLOTTER INTERRUPTING AFTER MASTER CLEAR
0166                *    ITMR - PLOTTER INTERRUPTING WHEN MASK RESET
0167                *    NIMS - PLOTTER NOT INTERRUPTING WHEN MASK SET
0168                *    NBXX - PLOTTER NOT BUSY IMMEDIATELY AFTER MOVING XX
0169                *    BSXX - PLOTTER REMAINING BUSY 4(4.2 OPTION 2112)MILLI-SECONDS
0170                *           AFTER MOVING XX
0171                *           WHERE XX MAY BE
0172                *                 NT-NORTH - PAPER UP
0173                *                 ST-SOUTH - PAPER DOWN
0174                *                 ET-EAST - PEN RIGHT
0175                *                 WT-WEST - PEN LEFT
0176                *                 NE-NORTHEAST - PAPER UP, PEN RIGHT
0177                *                 NW-NORTHWEST - PAPER UP, PEN LEFT
0178                *                 SE-SOUTHEAST - PAPER DOWN, PEN RIGHT
0179                *                 SW-SOUTHWEST - PAPER DOWN, PEN LEFT
0180                *                 UP - PEN UP
0181                *                 DN - PEN DOWN
0182                *    NIND - NO INTERRUPT WITHIN 4(4.2 OPTION 2112)MILLI-SECONDS
0183                *           (DIRECTIONAL)
0184                *    INCD - INTERRUPT NOT CAUSED BY PLOTTER (DIRECTIONAL)
0185                *    BAID - PLOTTER REMAINING BUSY AFTER INTERRUPT (DIRECTIONAL)
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0186                *     NINZ - NO INTERRUPT WITHIN 25 MILLI-SECONDS (Z-AXIS)
0187                *     INCZ - INTERRUPT NOT CAUSED BY PLOTTER (Z-AXIS)
0188                *     BAIZ - PLOTTER REMAINING BUSY AFTER INTERRUPT (Z-AXIS)
0189                *            WHERE Z-AXIS IS VERTICAL LINE OF TRAVEL OF THE PEN
0190                *
0191                *            NB  ALL TIMINGS AND DELAYS ARE CALCULATED USING A MACHINE
0192                *                CYCLE TIME OF 0.86 MICRO-SECONDS FOR DDP-516
0193                *                AND 1.6 MICRO-SECONDS FOR H316
0194                *
0195                *     AFTER AN ERROR MESSAGE IS OUTPUT, THE PEN IS MOVED NORTH TWENTY
0196                *     UNIT LENGTHS AND Q6 (TEST NO?) IS ASKED
0197                *
0198                *
0199                * METHOD
0200                *
0201                *     BEFORE A TEST IS RUN ON A PLOTTER, THE RELEVANT PARAMETERS ARE SET
0202                *     UP BY TYPING IN APPROPRIATE ANSWERS TO THE PARAMETER QUESTIONS AS
0203                *     DESCRIBED ABOVE.   AFTER THE FIRST QUESTION IS ANSWERED UNIT, LMAX
0204                *     AND LMIN ARE SET UP AS DESCRIBED BELOW:
0205                *
0206                *     OPTN  UNIT  (NUMBER OF STEPS IN ONE UNIT LENGTH)
0207                *     ----  ----  ------------------------------------
0208                *     2111    20  = 20*0.005 IN = 0.1 IN
0209                *     2112    10  = 10*0.010 IN = 0.1 IN
0210                *     2113    20  = 20*0.100 MM = 2.0 MM
0211                *     2114    10  = 10*0.200 MM = 2.0 MM
0212                *
0213                *     OPTN  LMAX  (NUMBER OF STEPS IN MAXIMUM RANGE OF EAST-WEST LIMIT)
0214                *     ----  ----  ------------------------------------------------------
0215                *     2111  2730  = (13/0.005)*(21/20)
0216                *     2112  1365  = (13/0.010)*(21/20)
0217                *     2113  3465  = (1730/0.10)*(21/20)
0218                *     2114  1733  = (3330/0.20)*(21/20)
0219                *
0220                *     OPTN  LMIN  (NUMBER OF STEPS IN MINIMUM RANGE OF EAST-WEST LIMIT)
0221                *     ----  ----  ------------------------------------------------------
0222                *     2111  2470  = (13/0.005)*(19/20)
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0223    *     2112  1235  = (13/0.010)*(19/20)
0224    *     2113  3135  = (330/0.10)*(19/20)
0225    *     2114  1567  = (330/0.20)*(19/20)
0226    *
0227    *     WHEN THE LAST PARAMETER QUESTION IS ANSWERED, THE PROGRAM GOES
0228    *     THROUGH INITIALISATION ROUTINE, CHECKING BUSY AND INTERRUPT FLIP-
0229    *     FLOPS.   THE LIMIT IS ALSO CHECKED TO ENSURE THAT IT DOES NOT OCCUR
0230    *     IN LESS THAN FIVE PERCENT OF THE SPECIFIED VALUE AND DOES OCCUR
0231    *     WITHIN MORE THAN FIVE PERCENT OF THE SPECIFIED VALUE.   AFTER THAT
0232    *     THE QUESTION 'TEST NO?' IS ASKED. IF IT IS DESIRED TO REPEAT THE
0233    *     INITIALISATION THE ANSWER SHOULD BE LETTER I, OTHERWISE IT SHOULD
0234    *     BE 1, 2, 3, 4 OR A (ALL TESTS SEQUENTIALLY).THE APPROPRIATE
0235    *     TEST/TESTS WILL THEN BE PERFORMED. ANY OR ALL TESTS MAY NOW BE
0236    *     REPEATED BY RETYPING THE ANSWER.   WHEN IT IS DESIRED TO END THE
0237    *     SERIES OF TESTS, THE ANSWER SHOULD BE LETTER E.   IF AN ERROR
0238    *     CONDITION IS FOUND, THE PEN IS MOVED UP;  THE APPROPRIATE ERROR
0239    *     MESSAGE IS TYPED OUT;  THE PEN IS MOVED NORTH TWENTY UNIT LENGTHS
0240    *     AND CONTROL IS RETURNED TO THE ASR BY ASKING 'TEST NO?'.
0241    *
0242    *
0243    *     TEST PATTERNS
0244    *
0245    *           ALL PATTERNS ARE PLOTTED FROM THE LEFT HAND SIDE AND A GAP OF
0246    *           THIRTY UNIT LENGTHS IS KEPT IN BETWEEN THE PATTERNS
0247    *
0248    *           1     PEN MOVEMENT TEST - DOTTED LINE
0249    *                 ------------------------------
0250    *                 THIS TEST CONSISTS OF A DOTTED LINE DRAWN FROM WEST TO
0251    *                 EAST FOR A DISTANCE OF ONE HUNDRED AND TWENTY UNITS,
0252    *                 SUCH THAT THE DOTS AND SPACES ARE EACH ONE UNIT LENGTH.
0253    *                 THIS IS REPEATED IN ALTERNATE DIRECTIONS WITH
0254    *                 ALTERNATING DOTS AND SPACES ON EACH LINE.   THE LINE
0255    *                 SEPARATION IS ONE UNIT.
0256    *
0257    *                 EIGHT LINES ARE PLOTTED WITHOUT INTERRUPT CONTROL.
0258    *
0259    *           2     INCREMENT AND SPEED TEST - SQUARE SPIRAL
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0260                *
0261                *          ----------------------------------------
0262                *          THIS TEST CONSISTS OF A DIVERGENT SQUARE SPIRAL DRAWN
0263                *          IN AN ANTI-CLOCKWISE DIRECTION, COMMENCING AT ONE UNIT
0264                *          LENGTH NORTH TO SOUTH AND ENDING AT TWENTY UNIT LENGTHS
0265                *          EAST TO WEST, THE INCREMENT EMPLOYED BEING ONE UNIT.
0266                *          THE FIGURE IS TIMED AND THE SPEED (NUMBER OF MEMORY
0267                *          CYCLES PER INCREMENT) IS TYPED OUT FOR EACH FIGURE
0268                *          IF SENSE SWITCH 4 IS OFF.
0269                *
0270                *          FOUR FIGURES ARE PLOTTED IN A ROW SEPARATED BY TEN
0271                *          UNITS,   TWO ROWS ARE DRAWN (ROW SEPARATION BEING TEN
0272                *          UNITS), AND INTERRUPT CONTROL IS USED ONLY WHILE
0273                *          PLOTTING THE SPIRALS.
0274                *     3    FULL DIRECTIONAL TEST - SIXTEEN POINTED STAR
0275                *          ----------------------------------------------
0276                *          THIS TEST CONSISTS OF A SIXTEEN POINTED SYMMETRICAL
0277                *          STAR OCCUPYING A CIRCULAR AREA OF TWENTY UNIT DIAMETER.
0278                *          ALL EIGHT HARDWARE DIRECTIONS ARE EMPLOYED, AND EIGHT
0279                *          SOFTWARE-COMPUTED DIRECTIONS.   THE TEST CHECKS FOR
0280                *          EQUAL PRECISION IN THE MAJOR AND MINOR PLOTTING
0281                *          DIRECTIONS, AND A NON-COINCIDENCE OF THE CENTRE
0282                *          OF THE FIGURE
0283                *
0284                *          THREE FIGURES ARE PLOTTED IN A ROW SEPARATED BY TWENTY
0285                *          UNITS, THREE ROWS ARE DRAWN (ROW SEPARATION BEING TEN
0286                *          UNITS), AND INTERRUPT CONTROL IS USED THROUGHOUT.
0287                *
0288                *     4    ALIGNMENT TEST - DIAMOND MESH
0289                *          ----------------------------
0290                *          THIS TEST DRAWS A COMPLEX FIGURE CONSISTING OF SIX
0291                *          DIAMONDS DRAWN BETWEEN HORIZONTAL PARALLEL LINES.   THE
0292                *          DIAMOND DIAGONALS ARE ALSO DRAWN.   THE PATTERN IS
0293                *          CONTINUOUS AND THE HEIGHT AND WIDTH OF EACH DIAMOND IS
0294                *          TWENTY UNITS.   THE TEST DEMONSTRATES THE HORIZONTAL
0295                *          AND VERTICAL ALIGNMENT OF THE PLOTTER.   THE HORIZONTAL
0296                *          LINES SHOULD INTERSECT EACH DIAMOND APEX, AND THE
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0297                *                VERTICAL DIAGONALS OF THE ENTIRE FIGURE SHOULD
0298                *                INTERSECT THE DIAMOND APICES AND EACH SHOULD FORM A
0299                *                CONTINUOUS STRAIGHT LINE OVER THE WHOLE FIGURE.
0300                *
0301                *                SIX ROWS ARE DRAWN WITHOUT INTERRUPT CONTROL AND WITH
0302                *                NO INTERVENING SPACES, I.E. THE RESULTANT PATTERN IS
0303                *                CONTINUOUS.
0304                *
0305                *
0306                * ABBREVIATIONS
0307                *
0308                *    REGA   - REGISTER A
0309                *    REGB   - REGISTER B
0310                *    REGAB  - REGISTERS A AND B
0311                *    CR     - CARRIAGE RETURN
0312                *    LF     - LINE FEED
0313                *
0314                *
0315                ********************************************************************************
0316                *
0317                *
0318                     CF5                        H316, DDP-516
0319                     ABS                        ABSOLUTE
0320                     ORG    '1000               ORIGIN
0321                *
0322                *
0323                * ASR 33/35 DEVICE CODES
0324                *
0325                * OCP
0326  000004        ASRN EQU    4                  ENABLE ASR IN INPUT MODE
0327  000104        ASRT EQU    ASRN+'100          ENABLE ASR IN OUTPUT MODE
0328                *
0329                * SKS
0330  000104        ASRB EQU    ASRN+'100          SKIP IF ASR NOT BUSY
0331                *
0332                * INA
0333  000004        ASRI EQU    ASRN               INPUT A CHARACTER FROM ASR IF READY
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0334                        *
0335                        * OTA
0336          000004        ASRO EQU   ASRN              OUTPUT A CHARACTER FROM ASR IF READY
0337                        *
0338                        *
0339                        * DIGITAL INCREMENTAL PLOTTER DEVICE CODES
0340                        *
0341          000027        ADIP EQU   '27               DEVICE ADDR OF DIGITAL INCREMENTAL PLOTTER
0342                        *
0343                        * OCP
0344          000127        PLET EQU   ADIP+'0100        EAST - PEN RIGHT
0345          000227        PLWT EQU   ADIP+'0200        WEST - PEN LEFT
0346          000427        PLNT EQU   ADIP+'0400        NORTH - PAPER UP
0347          000527        PLNE EQU   ADIP+'0500        NORTHEAST - PAPER UP, PEN RIGHT
0348          000627        PLNW EQU   ADIP+'0600        NORTHWEST - PAPER UP, PEN LEFT
0349          001027        PLST EQU   ADIP+'1000        SOUTH - PAPER DOWN
0350          001127        PLSE EQU   ADIP+'1100        SOUTHEAST - PAPER DOWN, PEN RIGHT
0351          001227        PLSW EQU   ADIP+'1200        SOUTHWEST - PAPER DOWN, PEN LEFT
0352          001427        PEND EQU   ADIP+'1400        PEN DOWN
0353          001627        PENU EQU   ADIP+'1600        PEN UP
0354                        *
0355                        * SKS
0356          000127        PLNB EQU   ADIP+'0100        SKIP IF PLOTTER NOT BUSY
0357          000227        PLLR EQU   ADIP+'0200        SKIP UNLESS LIMIT REACHED
0358          000427        PLNI EQU   ADIP+'0400        SKIP IF PLOTTER NOT INTERRUPTING
0359                        *
0360                        *
0361                        * MAIN PROGRAM
0362                        *
0363                        * OUTPUT START HEADING MESSAGE TO ASR
0364 01000    0 02 04464 STRT LDA   =-34                NUMBER OF WORDS TO BE OUTPUT
0365 01001    0 10 04030      JST   OASR                OUTPUT TO ASR
0366 01002    106612          OCT   106612,105212       CR/LF/LF/LF
     01003    105212
0367 01004    151724          BCI   15,START 016-DPT9 41285751-001-01
     01005    140722
     01006    152240
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        01007   147661
        01010   133255
        01011   142320
        01012   152271
        01013   120264
        01014   130662
        01015   134265
        01016   133665
        01017   130655
        01020   130260
        01021   130655
        01022   130261
0368    01023   106612          OCT   106612            CARRIAGE RETURN/LINE FEED
0369    01024   106612          OCT   106612            CARRIAGE RETURN/LINE FEED
0370    01025   144706          BCI   15,IF H316 SET SENSE SWITCH 1 NOW
        01026   120310
        01027   131661
        01030   133240
        01031   151705
        01032   152240
        01033   151705
        01034   147323
        01035   142640
        01036   151727
        01037   144724
        01040   141710
        01041   120261
        01042   120316
        01043   147727
0371    01044   0 02 04463 CHNG LDA   =-1               NUMBER OF WORDS TO BE OUTPUT
0372    01045   0 10 04030      JST   OASR
0373    01046   106612          OCT   106612            CR/LF
0374                        *
0375                        *
0376                        * PARAMETER QUESTIONS
0377                        *
0378                        * QUESTION 1 - OPTION NUMBER (11, 12, 13 OR 14)
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0379 01047   0 02 04462 QST1 LDA   =-9              NUMBER OF WORDS TO BE OUTPUT
0380 01050   0 10 04030      JST   OASR             OUTPUT TO ASR
0381 01051   106612         OCT   106612           CR/LF
0382 01052   147720         BCI   6,OPTION NO
     01053   152311
     01054   147716
     01055   120316
     01056   147640
     01057   120240
0383 01060   130730   OPTN BCI   1,1X             LAST ANSWER
0384 01061   127640        BCI   1,/
0385                  *
0386 01062   0 02 04461      LDA   =-3              NUMBER OF CHARACTERS TO BE INPUT
0387 01063   0 10 04050      JST   IASR             INPUT FROM ASR
0388 01064   0 001060        DAC   OPTN             ADDRESS OF LAST ANSWER
0389 01065   0 01 01047      JMP   QST1             CR NOT TYPED, REPEAT THE QUESTION
0390                  *                            * NORMAL RETURN
0391 01066   0 02 04315      LDA   CHR1             FIRST INPUT CHARACTER
0392 01067   0 05 04460      ERA   ='261            '261 = CHARACTER ONE
0393 01070   100040         SZE                    TEST FOR CHARACTER ONE
0394 01071   0 01 01047      JMP   QST1             INVALID CHARACTER, REPEAT THE QUESTION
0395                  *                            * FIRST INPUT CHARACTER IS ONE
0396 01072   0 02 04316      LDA   CHR2             SECOND INPUT CHARACTER
0397 01073   0 11 04460      CAS   ='261            '261 = CHARACTER ONE
0398 01074   0 01 01122      JMP   Q102             INPUT CHARACTER OTHER THAN ONE
0399 01075   100000         SKP                    SECOND INPUT CHARACTER IS ONE
0400 01076   0 01 01047      JMP   QST1             INVALID CHARACTER, REPEAT THE QUESTION
0401                  *
0402                  * OPTION NUMBER 11
0403 01077   0 02 04457      LDA   =20              20*0.005 = 0.1 INCH
0404 01100   0 04 04346      STA   UNIT             NUMBER OF STEPS IN ONE UNIT LENGTH
0405 01101   0 02 04456      LDA   =2730            2730 = (13/0.005)*(21/20)
0406 01102   0 04 04333      STA   LMAX
0407 01103   0 02 04455      LDA   =2470            2470 = (13/0.005)*(19/20)
0408 01104   0 04 04334      STA   LMIN
0409 01105   101020         SS1                    TEST FOR SENSE SWITCH 1 SET
0410 01106   0 01 01111      JMP   D51              NOT SET, DDP-516 BEING USED
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 411                        *                          SET, H316 BEING USED
 412 01107   0 02 04454        LDA    =-417           417 = (4*1000)/(6*1.6)
0413 01110   100000           SKP
0414                        *
0415 01111   0 02 04453  D51   LDA    =-776           776 = (4*1000)/(6*0.86)
0416 01112   0 04 04327        STA    DRTR            DIRECTIONAL TIMER
0417 01113   101020           SS1                    TEST FOR SENSE SWITCH 1 SET
0418 01114   0 01 01117        JMP    D54             NOT SET, DDP-516 BEING USED
0419                        *                          SET, H316 BEING USED
0420 01115   0 02 04452        LDA    =-179           179 = (4*1000)/(14*1.6)
0421 01116   100000           SKP
0422                        *
0423 01117   0 02 04451  D54   LDA    =-333           333 = (4*1000)/(14*0.86)
0424 01120   0 04 04332        STA    INTR            INTERRUPT TIMER
0425 01121   0 01 01220        JMP    Q105            FORM MULTIPLES OF UNIT
0426                        *
0427 01122   0 11 04450  Q102  CAS    ='262           '262 = CHARACTER TWO
0428 01123   0 01 01147        JMP    Q103            INPUT CHARACTER OTHER THAN TWO
0429                        *
0430                        * OPTION NUMBER 12
0431 01124   0 02 04447        LDA    =10             10*0.01 = 0.1 INCH
0432 01125   0 04 04346        STA    UNIT            NUMBER OF STEPS IN ONE UNIT LENGTH
0433 01126   0 02 04446        LDA    =1365           1365 = (13/0.01)*(21/20)
0434 01127   0 04 04333        STA    LMAX
0435 01130   0 02 04445        LDA    =1235           1235 = (13/0.01)*(19/20)
0436 01131   0 04 04334        STA    LMIN
0437 01132   101020           SS1                    TEST FOR SENSE SWITCH 1 SET
0438 01133   0 01 01136        JMP    D57             NOT SET, DDP-516 BEING USED
0439                        *                          SET, H316 BEING USED
0440 01134   0 02 04444        LDA    =-438           438 = (4.2*1000)/(6*1.6)
0441 01135   100000           SKP
0442                        *
0443 01136   0 02 04443  D57   LDA    =-814           814 = (4.2*1000)/(6*0.86)
0444 01137   0 04 04327        STA    DRTR            DIRECTIONAL TIMER
0445 01140   101020           SS1                    TEST FOR SENSE SWITCH 1 SET
0446 01141   0 01 01144        JMP    D58             NOT SET, DDP-516 BEING USED
0447                        *                          SET, H316 BEING USED
```

```
0448 01142   0 02 04442       LDA   =-188          188 = (4.2*1000)/(14*1.6)
0449 01143   100000            SKP
0450                      *
0451 01144   0 02 04441 D58   LDA   =-349          349 = (4.2*1000)/(14*0.86)
0452 01145   0 04 04332       STA   INTR           INTERRUPT TIMER
0453 01146   0 01 01220       JMP   Q105           FORM MULTIPLES OF UNIT
0454                      *
0455 01147   0 11 04440 Q103  CAS   ='263          '263 = CHARACTER THREE
0456 01150   0 01 01174       JMP   Q104           INPUT CHARACTER OTHER THAN THREE
0457                      *
0458                      * OPTION NUMBER 13
0459 01151   0 02 04457       LDA   =20            20*0.1 = 2MM
0460 01152   0 04 04346       STA   UNIT           NUMBER OF STEPS IN ONE UNIT LENGTH
0461 01153   0 02 04437       LDA   =3465          3465 = (330/0.1)*(21/20)
0462 01154   0 04 04333       STA   LMAX
0463 01155   0 02 04436       LDA   =3135          3135 = (330/0.1)*(19/20)
0464 01156   0 04 04334       STA   LMIN
0465 01157   101020           SS1                  TEST FOR SENSE SWITCH 1 SET
0466 01160   0 01 01163       JMP   D52            NOT SET, DDP-516 BEING USED
0467                      *                        SET, H316 BEING USED
0468 01161   0 02 04454       LDA   =-417          417 = (4*1000)/(6*1.6)
0469 01162   100000           SKP
0470                      *
0471 01163   0 02 04453 D52   LDA   =-776          776 = (4*1000)/(6*0.86)
0472 01164   0 04 04327       STA   DRTR           DIRECTIONAL TIMER
0473 01165   101020           SS1                  TEST FOR SENSE SWITCH 1 SET
0474 01166   0 01 01171       JMP   D55            NOT SET, DDP-516 BEING USED
0475                      *                        SET, H316 BEING USED
0476 01167   0 02 04452       LDA   =-179          179 = (4*1000)/(14*1.6)
0477 01170   100000           SKP
0478                      *
0479 01171   0 02 04451 D55   LDA   =-333          333 = (4*1000)/(14*0.86)
0480 01172   0 04 04332       STA   INTR           INTERRUPT TIMER
0481 01173   0 01 01220       JMP   Q105           FORM MULTIPLES OF UNIT
0482                      *
0483 01174   0 11 04435 Q104  CAS   ='264          '264 = CHARACTER FOUR
0484 01175   0 01 01047       JMP   QST1           INVALID CHARACTER, REPEAT THE QUESTION
```

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 485                        *
 486                        * OPTION NUMBER 14
 487 01176   0 02 04447        LDA   =10              10*0.2 = 2MM
 488 01177   0 04 04346        STA   UNIT             NUMBER OF STEPS IN ONE UNIT LENGTH
 489 01200   0 02 04434        LDA   =1733            1733 = (330/0.2)*(21/20)
 490 01201   0 04 04333        STA   LMAX
 491 01202   0 02 04433        LDA   =1567            1567 = (330/0.2)*(19/20)
 492 01203   0 04 04334        STA   LMIN
 493 01204   101020           SS1                    TEST FOR SENSE SWITCH 1 SET
 494 01205   0 01 01210        JMP   D53              NOT SET, DDP-516 BEING USED
 495                        *                        SET, H316 BEING USED
 496 01206   0 02 04454        LDA   =-417            417 = (4*1000)/(6*1.6)
 497 01207   100000           SKP
 498                        *
 499 01210   0 02 04453  D53   LDA   =-776            776 = (4*1000)/(6*0.86)
 500 01211   0 04 04327        STA   DRTR             DIRECTIONAL TIMER
 501 01212   101020           SS1                    TEST FOR SENSE SWITCH 1 SET
 502 01213   0 01 01216        JMP   D56              NOT SET, DDP-516 BEING USED
 503                        *                        SET, H316 BEING USED
 504 01214   0 02 04452        LDA   =-179            179 = (4*1000)/(14*1.6)
 505 01215   100000           SKP
 506                        *
 507 01216   0 02 04451  D56   LDA   =-333            333 = (4*1000)/(14*0.86)
 508 01217   0 04 04332        STA   INTR             INTERRUPT TIMER
 509                        *
 510                        * FORM MULTIPLES OF UNIT
 511 01220   0 02 04346  0105  LDA   UNIT
 512 01221   140407           TCA                    NEGATE UNIT
 513 01222   0 04 04340        STA   NUNT
 514 01223   140407           TCA                    REGA = UNIT (U)
 515 01224   0414 76          LGL   2                REGA = 4U
 516 01225   0 06 04346       ADD   UNIT             REGA = 5U
 517 01226   0 04 04320       STA   CNTA             COUNT A = 5*UNIT
 518 01227   0414 77          LGL   1                REGA = 10U
 519 01230   0 04 04321       STA   CNTB             COUNT B = 10*UNIT
 520 01231   140407           TCA                    NEGATE 10U
 521 01232   0 04 04347       STA   10NU
```

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0522 01233   140407          TCA                    REGA = 10U
0523 01234   0414 77         LGL   1                REGA = 20U
0524 01235   140407          TCA                    NEGATE 20U
0525 01236   0 04 04350      STA   20NU
0526 01237   140407          TCA                    REGA = 20U
0527 01240   0 06 04321      ADD   CNTB             REGA = 30U
0528 01241   140407          TCA                    NEGATE 30U
0529 01242   0 04 04351      STA   30NU
0530 01243   140407          TCA                    REGA = 30U
0531 01244   0 06 04321      ADD   CNTB             REGA = 40U
0532 01245   140407          TCA                    NEGATE 40U
0533 01246   0 04 04352      STA   40NU
0534 01247   140407          TCA                    REGA = 40U
0535 01250   0 06 04320      ADD   CNTA             REGA = 45U
0536 01251   140407          TCA                    NEGATE 45U
0537 01252   0 04 04353      STA   45NU
0538 01253   140407          TCA                    REGA = 45U
0539 01254   0 06 04320      ADD   CNTA             REGA = 50U
0540 01255   140407          TCA                    NEGATE 50U
0541 01256   0 04 04354      STA   50NU
0542 01257   140407          TCA                    REGA = 50U
0543 01260   0 06 04321      ADD   CNTB             REGA = 60U
0544 01261   140407          TCA                    NEGATE 60U
0545 01262   0 04 04355      STA   60NU
0546 01263   140407          TCA                    REGA = 60U
0547 01264   0 06 04321      ADD   CNTB             REGA = 70U
0548 01265   140407          TCA                    NEGATE 70U
0549 01266   0 04 04356      STA   70NU
0550 01267   140407          TCA                    REGA = 70U
0551 01270   0 06 04321      ADD   CNTB             REGA = 80U
0552 01271   140407          TCA                    NEGATE 80U
0553 01272   0 04 04357      STA   80NU
0554                        *
0555                        * QUESTION 2 - DEVICE ADDRESS (2 DIGIT OCTAL NUMBER)
0556 01273   0 02 04432 QST2 LDA   =-8               NUMBER OF WORDS TO BE OUTPUT
0557 01274   0 10 04030      JST   0ASR             OUTPUT TO ASR
0558 01275   106612         OCT   106612           CR/LF
```

```
0559 01276   142305          BCI   5,DEV ADDR
     01277   153240
     01300   140704
     01301   142322
     01302   120240
0560 01303   131267     DADD BCI   1,27          LAST ANSWER (PROBABLE ANSWER IS 27)
0561 01304   127640          BCI   1,/
0562                    *
0563 01305   0 02 04461      LDA   =-3           NUMBER OF CHARACTERS TO BE INPUT
0564 01306   0 10 04050      JST   IASR          INPUT FROM ASR
0565 01307   0 001303       DAC   DADD          ADDRESS OF LAST ANSWER
0566 01310   0 01 01273     JMP   QST2          CR NOT TYPED, REPEAT THE QUESTION
0567                    *                       * NORMAL RETURN
0568 01311   0 02 04431      LDA   =-2           NUMBER OF CHARACTERS TO BE TESTED
0569 01312   0 04 04324      STA   CNTR          CHARACTER COUNTER
0570 01313   0 02 04313      LDA   CHRL          CHARACTER LOCATION
0571 01314   0 04 04345      STA   TMPB
0572 01315  -0 02 04345 TNC1 LDA*  TMPB          CHARACTER
0573 01316   0 12 04345      IRS   TMPB          NEXT CHARACTER
0574 01317   0 05 04430      ERA   ='260         '260 = CHARACTER ZERO
0575 01320   100400          SPL                 TEST FOR VALIDITY OF CHARACTER
0576 01321   0 01 01273     JMP   QST2          INVALID CHARACTER, REPEAT THE QUESTION
0577 01322   0 07 04427      SJB   ='10
0578 01323   101400          SMI                 TEST FOR VALIDITY OF CHARACTER
0579 01324   0 01 01273     JMP   QST2          INVALID CHARACTER, REPEAT THE QUESTION
0580 01325   0 12 04324      IRS   CNTR          INCREMENT CHARACTER COUNTER
0581 01326   0 01 01315     JMP   TNC1          TEST NEXT CHARACTER
0582 01327   0 02 04315      LDA   CHR1          MS DIGIT OF PLOTTER DEVICE ADDRESS
0583 01330   0 03 04426      ANA   ='007         REMOVE '260
0584 01331   0414 75         LGL   3
0585 01332   0 06 04316      ADD   CHR2          LS DIGIT OF PLOTTER DEVICE ADDRESS
0586 01333   0 07 04430      SUB   ='260         REMOVE '260
0587 01334   0 04 04326      STA   DPDA
0588                    *
0589                    * INSERT DEVICE ADDRESS IN PLOTTER INSTRUCTIONS
0590 01335   0 02 04314      LDA   IATB          INDIRECT ADDRESS OF TABLE
0591 01336   0 04 04345      STA   TMPB
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0592 01337  -0 02 04345 IDAI LDA*  TMPB            PLOTTER INSTRUCTION
0593 01340   101040           SNZ                  TEST FOR COMPLETION OF DEV ADDR INSERTION
0594 01341   0 01 01347        JMP   DAII           DEV ADDR INSERTED IN ALL PLOTTER INSTRCTNS
0595 01342   0 03 04425        ANA   ='177700      CLEAR LS 6 BITS
0596 01343   0 05 04326        ERA   DPDA
0597 01344  -0 04 04345        STA*  TMPB           PLOTTER INSTRUCTION
0598 01345   0 12 04345        IRS   TMPB           ADDRESS OF NEXT INSTRUCTION
0599 01346   0 01 01337        JMP   IDAI           INSERT DEV ADDR IN NEXT PLOTTER INSTRUCTION
0600                      *
0601 01347   0 02 04315 DAII LDA   CHR1             FIRST INPUT CHARACTER
0602 01350   0414 70           LGL   8
0603 01351   0 05 04316        ERA   CHR2           REGA = INPUT NUMBER (DEV ADDR)
0604 01352   0 04 01303        STA   DADD           REPLACE LAST ANSWER BY THE PRESENT ONE
0605                      *
0606                      * QUESTION 3 - STANDARD INTERRUPT (Y OR N)
0607 01353   0 02 04424 QST3 LDA   =-10            NUMBER OF WORDS TO BE OUTPUT
0608 01354   0 10 04030        JST   OASR           OUTPUT TO ASR
0609 01355   106612           OCT   106612         CR/LF
0610 01356   151724           BCI   7,STAND INTRPT
     01357   140716
     01360   142240
     01361   144716
     01362   152322
     01363   150324
     01364   120240
0611 01365   154640      SINT BCI   1,Y            LAST ANSWER (PROBABLE ANSWER IS Y)
0612 01366   127640           BCI   1,/
0613                      *
0614 01367   0 02 04431        LDA   =-2            NUMBER OF CHARACTERS TO BE INPUT
0615 01370   0 10 04050        JST   IASR           INPUT FROM ASR
0616 01371   0 001365         DAC   SINT           ADDRESS OF LAST ANSWER
0617 01372   0 01 01353       JMP   QST3           CR NOT TYPED, REPEAT THE QUESTION
0618                      *                       * NORMAL RETURN
0619 01373   0 02 04315       LDA   CHR1           FIRST INPUT CHARACTER
0620 01374   0 11 04423       CAS   ='331          '331 = CHARACTER Y
0621 01375   0 01 01353       JMP   QST3           INVALID CHARACTER, REPEAT THE QUESTION
0622 01376   0 01 01403       JMP   YES3           FIRST INPUT CHARACTER IS Y
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0623 01377   0 05 04422       ERA   ='316            '316 = CHARACTER N
0624 01400   100040           SZE                    TEST FOR CHARACTER N
0625 01401   0 01 01353       JMP   QST3             INVALID CHARACTER, REPEAT THE QUESTION
0626 01402   0 01 01410       JMP   N003             FIRST INPUT CHARACTER IS N
0627                          *
0628 01403   0 02 04315 YES3  LDA   CHR1             FIRST INPUT CHARACTER
0629 01404   0414 70          LGL   8                CHARACTER IN MS HALF OF REGA
0630 01405   0 05 04421       ERA   ='240            INSERT SPACE IN LS HALF
0631 01406   0 04 01365       STA   SINT             REPLACE LAST ANSWER BY THE PRESENT ONE
0632 01407   0 01 01415       JMP   QST4             ASK QUESTION 4 (Q5 IS NOT POSED)
0633                          *
0634 01410   0 02 04315 N003  LDA   CHR1             FIRST INPUT CHARACTER
0635 01411   0414 70          LGL   8                CHARACTER IN MS HALF OF REGA
0636 01412   0 05 04421       ERA   ='240            INSERT SPACE IN LS HALF
0637 01413   0 04 01365       STA   SINT             REPLACE LAST ANSWER BY THE PRESENT ONE
0638 01414   0 01 01460       JMP   QST5             ASK QUESTION 5 (Q4 IS NOT POSED)
0639                          *
0640                          * QUESTION 4 - MASK BIT (2 DIGIT DECIMAL NUMBER)
0641 01415   0 02 04432 QST4  LDA   =-8              NUMBER OF WORDS TO BE OUTPUT
0642 01416   0 10 04030       JST   OASR             OUTPUT TO ASR
0643 01417   106612           OCT   106612           CR/LF
0644 01420   146701           BCI   5,MASK BIT
     01421   151713
     01422   120302
     01423   144724
     01424   120240
0645 01425   130663     MBIT  BCI   1,13             LAST ANSWER (PROBABLE ANSWER IS 13)
0646 01426   127640           BCI   1,/
0647                          *
0648 01427   0 02 04461       LDA   =-3              NUMBER OF CHARACTERS TO BE INPUT
0649 01430   0 10 04050       JST   IASR             INPUT FROM ASR
0650 01431   0 001425         DAC   MBIT             ADDRESS OF LAST ANSWER
0651 01432   0 01 01415       JMP   QST4             CR NOT TYPED, REPEAT THE QUESTION
0652                          *                      * NORMAL RETURN
0653 01433   0 10 04117       JST   DCML             TEST INPUT DECIMAL 00-99
0654 01434   0 01 01415       JMP   QST4             INVALID CHARACTER, REPEAT THE QUESTION
0655                          *                      * NORMAL RETURN
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0656 01435   101040          SNZ                     TEST FOR ZERO
0657 01436   0 01 01415      JMP   QST4              INPUT NUMBER = 0, REPEAT THE QUESTION
0658 01437   0 07 04420      SUB   =17
0659 01440   101400          SMI                     TEST FOR NUMBER MORE THAN SIXTEEN
0660 01441   0 01 01415      JMP   QST4              INPUT NUMBER > 16, REPEAT THE QUESTION
0661 01442   0 04 04324      STA   CNTR              BIT COUNTER
0662 01443   0 02 04417      LDA   =1                SET BIT 16
0663 01444   100000          SKP
0664 01445   0414 77         LGL   1
0665 01446   0 12 04324      IRS   CNTR              INCREMENT BIT COUNTER
0666 01447   0 01 01445      JMP   *-2               PROPER BIT YET TO BE SET
0667 01450   0 04 04337      STA   MSKB              MASK BIT FOR INTERRUPT
0668 01451   0 02 04416      LDA   ='63              '63 = STANDARD INTERRUPT LOCATION
0669 01452   0 04 04331      STA   INTL              INTERRUPT LOCATION
0670 01453   0 02 04315      LDA   CHR1              FIRST INPUT CHARACTER
0671 01454   0414 70         LGL   8
0672 01455   0 05 04316      ERA   CHR2              REGA = INPUT NUMBER (MASK BIT)
0673 01456   0 04 01425      STA   MBIT              REPLACE LAST ANSWER BY THE PRESENT ONE
0674 01457   0 01 01537      JMP   DPT0              START INITIALISATION (Q5 NOT POSED)
0675                    *
0676                    * QUESTION 5 - PRIORITY INTERRUPT LINE (2 DIGIT DECIMAL NUMBER)
0677 01460   0 02 04415 QST5 LDA   =-12             NUMBER OF WORDS TO BE OUTPUT
0678 01461   0 10 04030      JST   OASR              OUTPUT TO ASR
0679 01462   106612          OCT   106612            CR/LF
0680 01463   150322          BCI   9,PRTY INTRPT LINE
     01464   152331
     01465   120311
     01466   147324
     01467   151320
     01470   152240
     01471   146311
     01472   147305
     01473   120240
0681 01474   130261      PINT BCI   1,01              LAST ANSWER (PROBABLE ANSWER IS 01)
0682 01475   127640          BCI   1,/
0683                    *
0684 01476   0 02 04461      LDA   =-3               NUMBER OF CHARACTERS TO BE INPUT
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0685 01477   0 10 04050       JST   IASR          INPUT FROM ASR
0686 01500   0 001474         DAC   PINT          ADDRESS OF LAST ANSWER
0687 01501   0 01 01460       JMP   QST5          CR NOT TYPED, REPEAT THE QUESTION
0688                     *                       * NORMAL RETURN
0689 01502   0 10 04117       JST   DCML          TEST INPUT DECIMAL 00-99
0690 01503   0 01 01460       JMP   QST5          INVALID CHARACTER, REPEAT THE QUESTION
0691                     *                       * NORMAL RETURN
0692 01504   101040          SNZ                 TEST FOR ZERO
0693 01505   0 01 01460       JMP   QST5          INPUT NUMBER = 0, REPEAT THE QUESTION
0694 01506   0 07 04414       SUB   =49
0695 01507   101400          SMI                 TEST FOR NUMBER MORE THAN FORTY EIGHT
0696 01510   0 01 01460       JMP   QST5          INPUT NUMBER > 48, REPEAT THE QUESTION
0697 01511   0 06 04414       ADD   =49           RESTORE INPUT NUMBER
0698 01512   0 06 04416       ADD   ='63          '63 = STANDARD INTERRUPT LOCATION
0699 01513   0 04 04331       STA   INTL          INTERRUPT LOCATION
0700 01514   0 07 04416       SUB   ='63          REGA = PRIORITY INTERRUPT LINE
0701 01515   0 07 04420       SUB   =17
0702 01516   100400          SPL                 DETERMINE PRIORITY INT MASK ASSIGNMENTS
0703 01517   0 01 01524       JMP   Q501          PI LINE 01-16
0704 01520   0 07 04413       SUB   =16
0705 01521   100400          SPL
0706 01522   100000          SKP                 PI LINE 17-32
0707 01523   0 07 04413       SUB   =16          PI LINE 33-48
0708 01524   0 04 04324 Q501  STA   CNTR          BIT COUNTER
0709 01525   0 02 04417       LDA   =1            SET BIT 16
0710 01526   100000          SKP
0711 01527   0414 77         LGL   1
0712 01530   0 12 04324       IRS   CNTR          INCREMENT BIT COUNTER
0713 01531   0 01 01527       JMP   *-2           PROPER BIT YET TO BE SET
0714 01532   0 04 04337       STA   MSKB          MASK BIT FOR INTERRUPT
0715 01533   0 02 04315       LDA   CHR1          FIRST INPUT CHARACTER
0716 01534   0414 70         LGL   8
0717 01535   0 05 04316       ERA   CHR2          REGA = INPUT NUMBER (PRTY INTRPT LINE)
0718 01536   0 04 01474       STA   PINT          REPLACE LAST ANSWER BY THE PRESENT ONE
0719                     *
0720                     *
0721                     * INITIALISATION
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0722                        *
0723 01537   140040     DPT0 CRA
0724 01540   0 04 04345       STA   TMPB
0725 01541   0 02 04331       LDA   INTL
0726 01542   0 07 04416       SUB   ='63              REGA = INTERRUPT LINE
0727 01543   100040          SZE
0728 01544   0 12 04345       IRS   TMPB              PI LINE 01-16
0729 01545   0 07 04420       SUB   =17
0730 01546   101400          SMI
0731 01547   0 12 04345       IRS   TMPB              PI LINE 17-32
0732 01550   0 07 04413       SUB   =16
0733 01551   101400          SMI
0734 01552   0 12 04345       IRS   TMPB              PI LINE 33-48
0735 01553   0 02 04345       LDA   TMPB
0736 01554   0414 72          LGL   6
0737 01555   0 05 04412       ERA   ='170020          '170020 = SMK '0020 INSTRUCTION
0738 01556   0 04 01560       STA   SMKI              SMK '0X20 INSTRUCTION
0739 01557   140040          CRA
0740 01560   0 00 00000 SMKI  ***   **                PERFORM  SMK '0X20
0741                        *
0742                        * TEST PLOTTER BUSY AND INTERRUPT FLIP-FLOPS
0743 01561   34 0127     DP01 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
0744 01562   0 10 04150       JST   ERRR
0745 01563   0 01 01566       JMP   *+3               PLOTTER NOT BUSY, OK
0746 01564   141323          BCI   2,BSMC            PLOTTER BUSY AFTER MASTER CLEAR
     01565   146703
0747 01566   34 0427     DP02 SKS   PLNI              SKIP IF PLOTTER NOT INTERRUPTING
0748 01567   0 10 04150       JST   ERRR
0749 01570   0 01 01573       JMP   *+3               PLOTTER NOT INTERRUPTING, OK
0750 01571   144724          BCI   2,ITMR            PLOTTER INTERRUPTING WHEN MASK RESET
     01572   146722
0751 01573   0 02 01560       LDA   SMKI              SMK '0X20 INSTRUCTION
0752 01574   0 04 01576       STA   *+2
0753 01575   0 02 04337       LDA   MSKB
0754 01576   0 00 00000       ***   **                PERFORM  SMK '0X20
0755 01577   34 0427     DP03 SKS   PLNI
0756 01600   0 01 01605       JMP   DPT9              PLOTTER INTERRUPTING OK
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0757 01601   0 10 04150       JST   ERRR
0758 01602   101000           NOP
0759 01603   147311           BCI   2,NIMS            PLOTTER NOT INTERRUPTING WHEN MASK SET
     01604   146723
0760                        *
0761                        * TEST EAST LIMIT LATE
0762 01605   0 10 03507 DPT9 JST   MPUP
0763 01606   0 02 04333       LDA   LMAX
0764 01607   140407           TCA
0765 01610   0 04 00000       STA   0                 STEP COUNTER
0766 01611   0 10 03241 DPT1 JST   MPET
0767 01612   34 0227    DP04 SKS   PLLR              SKIP UNLESS LIMIT REACHED
0768 01613   0 01 01622       JMP   DPT2              EAST LIMIT REACHED WITHIN MAX RANGE, OK
0769 01614   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0770 01615   0 01 01611       JMP   DPT1              MOVE PLOTTER NEXT STEP
0771 01616   0 10 04150       JST   ERRR
0772 01617   101000           NOP
0773 01620   146315           BCI   2,LMTL            LIMIT LATE - NOT OCCURED WITHIN MAX RANGE
     01621   152314
0774                        *
0775                        * TEST WEST LIMIT EARLY AND LATE
0776 01622   0 35 04347 DPT2 LDX   10NU              STEP COUNTER
0777 01623   0 10 03263       JST   MPWT
0778 01624   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0779 01625   0 01 01623       JMP   *-2               MOVE PLOTTER NEXT STEP
0780 01626   0 02 04334       LDA   LMIN
0781 01627   0 06 04347       ADD   10NU
0782 01630   140407           TCA
0783 01631   0 04 00000       STA   0                 STEP COUNTER
0784 01632   0 10 03263 DPT3 JST   MPWT
0785 01633   34 0227    DP05 SKS   PLLR
0786 01634   0 10 04150       JST   ERRR
0787 01635   0 01 01640       JMP   *+3               LIMIT NOT YET REACHED, OK
0788 01636   146315           BCI   2,LMTE            LIMIT EARLY - OCCURED BEFORE MIN RANGE
     01637   152305
0789 01640   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0790 01641   0 01 01632       JMP   DPT3              MOVE PLOTTER NEXT STEP
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```
0791 01642   0 02 04334       LDA   LMIN
0792 01643   0 07 04333       SUB   LMAX
0793 01644   0 04 00000       STA   0                  STEP COUNTER
0794 01645   0 10 03263 DPT4  JST   MPWT
0795 01646   34 0227    DP06  SKS   PLLR
0796 01647   0 01 01656       JMP   DPT5               WEST LIMIT REACHED WITHIN MAX RANGE, OK
0797 01650   0 12 00000       IRS   0                  INCREMENT STEP COUNTER
0798 01651   0 01 01645       JMP   DPT4               MOVE PLOTTER NEXT STEP
0799 01652   0 10 04150       JST   ERRR
0800 01653   101000           NOP
0801 01654   146315          BCI   2,LMTL             LIMIT LATE - NOT OCCURED WITHIN MAX RANGE
     01655   152314
0802                         *
0803                         * TEST EAST LIMIT EARLY AND LATE
0804 01656   0 35 04347 DPT5  LDX   10NU               STEP COUNTER
0805 01657   0 10 03241       JST   MPET
0806 01660   0 12 00000       IRS   0                  INCREMENT STEP COUNTER
0807 01661   0 01 01657       JMP   *-2                MOVE PLOTTER NEXT STEP
0808 01662   0 02 04334       LDA   LMIN
0809 01663   0 06 04347       ADD   10NU
0810 01664   140407           TCA
0811 01665   0 04 00000       STA   0                  STEP COUNTER
0812 01666   0 10 03241 DPT6  JST   MPET
0813 01667   34 0227    DP07  SKS   PLLR
0814 01670   0 10 04150       JST   ERRR
0815 01671   0 01 01674       JMP   *+3                LIMIT NOT YET REACHED, OK
0816 01672   146315          BCI   2,LMTE             LIMIT EARLY - OCCURED BEFORE MIN RANGE
     01673   152305
0817 01674   0 12 00000       IRS   0                  INCREMENT STEP COUNTER
0818 01675   0 01 01666       JMP   DPT6               MOVE PLOTTER NEXT STEP
0819 01676   0 02 04334       LDA   LMIN
0820 01677   0 07 04333       SUB   LMAX
0821 01700   0 04 00000       STA   0                  STEP COUNTER
0822 01701   0 10 03241 DPT7  JST   MPET
0823 01702   34 0227    DP08  SKS   PLLR
0824 01703   0 01 01712       JMP   DPT8               EAST LIMIT REACHED WITHIN MAX RANGE, OK
0825 01704   0 12 00000       IRS   0                  INCREMENT STEP COUNTER
```

```
0826 01705   0 01 01701       JMP   DPT7              MOVE PLOTTER NEXT STEP
0827 01706   0 10 04150       JST   ERRR
0828 01707   101000          NOP
0829 01710   146315          BCI   2,LMTL            LIMIT LATE - NOT OCCURED WITHIN MAX RANGE
     01711   152314
0830                     *
0831                     * FORM MEASURED LIMIT
0832 01712   0 02 00000 DPT8 LDA   0                 REMAINING NUMBER OF STEPS IN X-REGISTER
0833 01713   141206          AOA
0834 01714   0 06 04333       ADD   LMAX
0835 01715   0 04 04335       STA   LMIT
0836                     *
0837                     * MOVE PEN TWENTY UNITS NORTH
0838 01716   0 35 04350       LDX   20NU              STEP COUNTER (NO OF STEPS IN 20 UNITS)
0839 01717   0 10 03305       JST   MPNT
0840 01720   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0841 01721   0 01 01717       JMP   *-2               MOVE PLOTTER NEXT STEP
0842                     *
0843 01722   0 02 04463 AQTN LDA   =-1                NUMBER OF WORDS TO BE OUTPUT
0844 01723   0 10 04030       JST   OASR              OUTPUT TO ASR
0845 01724   106612          OCT   106612            CR/LF
0846                     *
0847                     * QUESTION 6 - TEST NO? (I, 1, 2, 3, 4, A OR E)
0848 01725   0 02 04411 QST6 LDA   =-6                NUMBER OF WORDS TO BE OUTPUT
0849 01726   0 10 04030       JST   OASR
0850 01727   106612          OCT   106612            CR/LF
0851 01730   152305          BCI   5,TEST NO?
     01731   151724
     01732   120316
     01733   147677
     01734   120240
0852                     *
0853 01735   0 02 04431       LDA   =-2              NUMBER OF CHARACTERS TO BE INPUT
0854 01736   0 10 04050       JST   IASR
0855 01737   0 004364        DAC   =0
0856 01740   0 01 01725       JMP   QST6             CR NOT TYPED, REPEAT THE QUESTION
0857                     *                          * NORMAL RETURN
```

```
0858 01741   0 02 04315       LDA   CHR1              FIRST INPUT CHARACTER
0859 01742   0 11 04407       CAS   ='311             '311 = CHARACTER I
0860 01743   100000          SKP                     INPUT CHARACTER OTHER THAN I
0861 01744   0 01 01537       JMP   DPT0              REPEAT INITIALISATION (INPUT CHAR = I)
0862 01745   0 05 04406       ERA   ='301             '301 = CHARACTER A
0863 01746   0 04 04341       STA   PALL              PALL IS ZERO IF ALL PATTERNS TO BE PLOTTED
0864 01747   101040          SNZ                     TEST FOR REQUIREMENT OF PLOTTING ALL PATRNS
0865 01750   0 01 01756       JMP   PAT1              PLOT PATTERN ONE
0866 01751   0 02 04315       LDA   CHR1              FIRST INPUT CHARACTER
0867 01752   0 11 04460       CAS   ='261             '261 = CHARACTER ONE
0868 01753   0 01 02041       JMP   P002              INPUT CHARACTER OTHER THAN ONE
0869 01754   100000          SKP                     PLOT PATTERN ONE (INPUT CHAR = 1)
0870 01755   0 01 01725       JMP   QST6              INVALID CHAR, REPEAT THE QUESTION
0871                        *
0872                        *
0873                        * PATTERN ONE (PEN MOVEMENT TEST - DOTTED LINE)
0874                        *
0875 01756   0 35 04347 PAT1  LDX   10NU              STEP COUNTER (NO OF STEPS IN 10 UNITS)
0876 01757   0 10 03305       JST   MPNT
0877 01760   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0878 01761   0 01 01757       JMP   *-2               MOVE PLOTTER NEXT STEP
0879 01762   0 10 03224       JST   MPCT
0880 01763   0 35 04355       LDX   60NU              STEP COUNTER (NO OF STEPS IN 60 UNITS)
0881 01764   0 10 03263       JST   MPWT
0882 01765   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
0883 01766   0 01 01764       JMP   *-2               MOVE PLOTTER NEXT STEP
0884 01767   0 02 04432       LDA   =-8               NUMBER OF ROWS IN THE PATTERN
0885 01770   0 04 04344       STA   ROWC
0886 01771   0 02 04405 P1NR  LDA   =-60              NUMBER OF PAIRS OF UNITS TO BE MOVED
0887 01772   0 04 04324       STA   CNTR              UNIT-PAIR COUNTER
0888                        *
0889 01773   0 10 03461 P101  JST   MPDN
0890 01774   0 35 04340       LDX   NUNT              STEP COUNTER (NO OF STEPS IN 1 UNIT)
0891 01775   0 02 04344 P102  LDA   ROWC
0892 01776   100100          SLZ                     SKIP IF BIT 16 RESET (TEST FOR ODD/EVEN ROW)
0893 01777   0 01 02002       JMP   *+3               BIT 16 SET (EVEN NUMBERED ROW)
0894 02000   0 10 03241       JST   MPET
```

```
0895 02001   100000           SKP
0896 02002   0 10 03263       JST   MPWT
0897 02003   0 12 00000       IRS   0          INCREMENT STEP COUNTER
0898 02004   0 01 01775       JMP   P102       PLOT NEXT STEP
0899 02005   0 10 03507       JST   MPUP
0900 02006   0 35 04340       LDX   NUNT       STEP COUNTER (NO OF STEPS IN 1 UNIT)
0901 02007   0 02 04344 P103  LDA   ROWC
0902 02010   100100           SLZ              SKIP IF BIT 16 RESET (TEST FOR ODD/EVEN ROW)
0903 02011   0 01 02014       JMP   *+3        BIT 16 SET (EVEN NUMBERED ROW)
0904 02012   0 10 03241       JST   MPET
0905 02013   100000           SKP
0906 02014   0 10 03263       JST   MPWT
0907 02015   0 12 00000       IRS   0          INCREMENT STEP COUNTER
0908 02016   0 01 02007       JMP   P103       MOVE PLOTTER NEXT STEP
0909 02017   0 12 04324       IRS   CNTR       INCREMENT UNIT-PAIR COUNTER
0910 02020   0 01 01773       JMP   P101       MOVE PLOTTER NEXT PAIR OF UNITS LENGTH
0911                  *
0912 02021   0 12 04344       IRS   ROWC       INCREMENT ROW COUNTER
0913 02022   100000           SKP              MOVE PLOTTER NORTH TO PLOT NEXT ROW
0914 02023   0 01 02031       JMP   P104       ALL ROWS PLOTTED IN THE PATTERN
0915 02024   0 35 04340       LDX   NUNT       STEP COUNTER (NO OF STEPS IN 1 UNIT)
0916 02025   0 10 03305       JST   MPNT
0917 02026   0 12 00000       IRS   0          INCREMENT STEP COUNTER
0918 02027   0 01 02025       JMP   *-2        MOVE PLOTTER NEXT STEP
0919 02030   0 01 01771       JMP   P1NR       PLOT NEXT ROW
0920                  *
0921 02031   0 35 04350 P104  LDX   20NU       STEP COUNTER (NO OF STEPS IN 20 UNITS)
0922 02032   0 10 03305       JST   MPNT
0923 02033   0 12 00000       IRS   0          INCREMENT STEP COUNTER
0924 02034   0 01 02032       JMP   *-2        MOVE PLOTTER NEXT STEP
0925                  *
0926 02035   0 02 04341       LDA   PALL
0927 02036   101040           SNZ              TEST FOR REQUIREMENT OF PLOTTING ALL PATRNS
0928 02037   0 01 02043       JMP   PAT2       PLOT PATTERN TWO
0929 02040   0 01 01722       JMP   AQTN       ASK QUESTION: TEST NO?
0930                  *
0931 02041   0 11 04450 P002  CAS   ='262       '262 = CHARACTER TWO
```

```
0932 02042   0 01 02341      JMP   P003            INPUT CHARACTER OTHER THAN TWO
0933                       *                       * PLOT PATTERN TWO (INPUT CHAR = 2)
0934                       *
0935                       * PATTERN TWO (INCREMENT AND SPEED TEST - SQUARE SPIRAL)
0936                       *
0937 02043   0 35 04350 PAT2 LDX   20NU            STEP COUNTER (NO OF STEPS IN 20 UNITS)
0938 02044   0 10 03305      JST   MPNT
0939 02045   0 12 00000      IRS   0               INCREMENT STEP COUNTER
0940 02046   0 01 02044      JMP   *-2             MOVE PLOTTER NEXT STEP
0941 02047   0 10 03224      JST   MPCT
0942 02050   0 35 04353      LDX   45NU            STEP COUNTER (NO OF STEPS IN 45 UNITS)
0943 02051   0 10 03263      JST   MPWT
0944 02052   0 12 00000      IRS   0               INCREMENT STEP COUNTER
0945 02053   0 01 02051      JMP   *-2             MOVE PLOTTER NEXT STEP
0946                       *
0947 02054   0 02 04431      LDA   =-2             NUMBER OF ROWS IN THE PATTERN
0948 02055   0 04 04344      STA   ROWC
0949 02056   0 02 04404 P2NR LDA   =-4             NUMBER OF FIGURES IN A ROW
0950 02057   0 04 04330      STA   FGRC
0951 02060   0 02 04312      LDA   AMSG            START ADDRESS OF MESSAGE
0952 02061   0 06 04403      ADD   =6
0953 02062   0 04 04342      STA   PNTR            POINTER (ADDRESS FOR INSERTION OF SPEED)
0954 02063   140040    P2NF CRA
0955 02064   0 04 04336      STA   MRKR            MARKER
0956 02065   0 04 04320      STA   CNTA            COUNTER A
0957 02066   0 04 04321      STA   CNTB            COUNTER B
0958 02067   0 04 04322      STA   CNTC            COUNTER C
0959 02070   0 10 03461      JST   MPDN            MOVE PEN DOWN
0960                       *
0961 02071   0 02 04336 P201 LDA   MRKR            MARKER
0962 02072   0 07 04346      SJB   UNIT            UNIT
0963 02073   0 04 04336      STA   MRKR            MRKR = MRKR - UNIT
0964 02074   0 35 04336      LDX   MRKR            STEP COUNTER
0965 02075   0 10 03605      JST   MIST
0966 02076   0 12 00000      IRS   0               INCREMENT STEP COUNTER
0967 02077   0 01 02075      JMP   *-2             PLOT NEXT STEP
0968 02100   0 35 04336      LDX   MRKR            STEP COUNTER
```

```
0969 02101   0 10 03535      JST   MIET
0970 02102   0 12 00000      IRS   0              INCREMENT STEP COUNTER
0971 02103   0 01 02101      JMP   *-2            PLOT NEXT STEP
0972 02104   0 02 04336      LDA   MRKR
0973 02105   0 07 04346      SJB   UNIT
0974 02106   0 04 04336      STA   MRKR           MRKR = MRKR - UNIT
0975 02107   0 35 04336      LDX   MRKR           STEP COUNTER
0976 02110   0 10 03555      JST   MINT
0977 02111   0 12 00000      IRS   0              INCREMENT STEP COUNTER
0978 02112   0 01 02110      JMP   *-2            PLOT NEXT STEP
0979 02113   0 35 04336      LDX   MRKR           STEP COUNTER
0980 02114   0 10 03545      JST   MIWT
0981 02115   0 12 00000      IRS   0              INCREMENT STEP COUNTER
0982 02116   0 01 02114      JMP   *-2            PLOT NEXT STEP
0983 02117   0 02 04336      LDA   MRKR           LENGTH OF PRESENT ARM
0984 02120   0 11 04350      CAS   20NU           20NU = LENGTH OF OUTERMOST ARM
0985 02121   0 01 02071      JMP   P201           PLOT NEXT SQUARE OF SPIRAL
0986                    *                        * SQUARE SPIRAL HAS BEEN PLOTTED
0987 02122   0 10 03507      JST   MPUP
0988 02123   0 02 04320      LDA   CNTA           COUNT A
0989 02124   000201          IAB
0990 02125   0 02 04321      LDA   CNTB           COUNT B
0991 02126   0410 77         LLL   1              REGA = 2B+MSB A
0992 02127   0 04 04321      STA   CNTB           COUNT B
0993 02130   000201          IAB
0994 02131   0404 77         LGR   1              REGA = A-MSB A
0995 02132   0 04 04320      STA   CNTA           COUNT A
0996 02133   000201          IAB                  REGA,REGB = COUNT
0997 02134   0401 77         LRS   1              TEMPORARY COUNT TC = 0.5 COUNT
0998 02135   0 10 03772      JST   HADD           HALF ADD COUNT, TC = 1.25 COUNT
0999 02136   0 10 03772      JST   HADD           TC = 1.625 COUNT
1000 02137   0 10 03772      JST   HADD           TC = 1.8125 COUNT
1001 02140   0401 76         LRS   2              TC = 0.4531 COUNT
1002 02141   0 10 03772      JST   HADD           TC = 1.2266 COUNT
1003 02142   0401 77         LRS   1              TC = 0.6133 COUNT
1004 02143   0 10 03772      JST   HADD           TC = 1.3067 COUNT
1005 02144   0 10 03772      JST   HADD           TC = 1.6534 COUNT
```

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1006 02145   0401 77          LRS   1              TC = 0.8267 COUNT
1007 02146   0 10 03772       JST   HADD           TC = 1.4134 COUNT
1008 02147   0 10 03772       JST   HADD           TC = 1.7067 COUNT
1009 02150   0411 71          LLS   7              REGA = (1.7067 COUNT) * (2**-8)
1010 02151   0 04 04345       STA   TMPB           TEMPORARY BUFFER
1011                    *
1012 02152   0 02 04346       LDA   UNIT
1013 02153   0 05 04457       ERA   =20
1014 02154   100040           SZE                  TEST FOR EOM OPTION 2111/2113
1015 02155   0 01 02161       JMP   *+4            EOM OPTION 2112/2114 (10 STEPS/UNIT)
1016 02156   0 02 04345       LDA   TMPB           TEMPORARY BUFFER
1017 02157   0404 77          LGR   1              REGA =(1.7067 COUNT) * (2**-9)
1018 02160   100000           SKP
1019 02161   0 02 04345       LDA   TMPB           TEMPORARY BUFFER
1020 02162   141206           AOA                  ADD ONE TO A FOR ROUNDING UP VALUE
1021 02163   0404 77          LGR   1              REGA = NO OF MEMORY CYCLES/INCREMENT
1022 02164   0 04 04345       STA   TMPB
1023                    *
1024 02165   0 02 04430       LDA   ='260          '260 = CHARACTER ZERO
1025 02166   0 04 04320       STA   CNTA
1026 02167   0 04 04321       STA   CNTB
1027 02170   0 04 04322       STA   CNTC
1028 02171   0 04 04323       STA   CNTD
1029 02172   0 02 04345       LDA   TMPB           NO OF MEMORY CYCLES/INCREMENT
1030 02173   0 07 04402 P202  SUB   =1000
1031 02174   100400           SPL                  TEST FOR THOUSANDS DIGIT
1032 02175   0 01 02200       JMP   *+3            NO MORE THOUSANDS DIGIT
1033 02176   0 12 04320       IRS   CNTA           CNTA = THOUSANDS DIGIT (ISO-CODE CHAR)
1034 02177   0 01 02173       JMP   P202
1035 02200   0 06 04402       ADD   =1000          RESTORE HUNDREDS+TENS+UNITS DIGITS
1036 02201   0 07 04401 P203  SUB   =100
1037 02202   100400           SPL                  TEST FOR HUNDREDS DIGIT
1038 02203   0 01 02206       JMP   *+3            NO MORE HUNDREDS DIGIT
1039 02204   0 12 04321       IRS   CNTB           CNTB = HUNDREDS DIGIT (ISO-CODE CHAR)
1040 02205   0 01 02201       JMP   P203
1041 02206   0 06 04401       ADD   =100           RESTORE TENS + UNITS DIGITS
1042 02207   0 07 04447 P204  SUB   =10
```

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1043 02210   100400          SPL                    TEST FOR TENS DIGIT
1044 02211   0 01 02214      JMP   *+3              NO MORE TENS DIGIT
1045 02212   0 12 04322      IRS   CNTC             CNTC = TENS DIGIT (ISO-CODE CHAR)
1046 02213   0 01 02207      JMP   P204
1047 02214   0 06 04447      ADD   =10              RESTORE UNITS DIGIT
1048 02215   0 06 04322      ADD   CNTC
1049 02216   0 04 04323      STA   CNTD             CNTD = UNITS DIGIT (ISO-CODE CHAR)
1050                        *
1051 02217   0 02 04320      LDA   CNTA             THOUSANDS DIGIT
1052 02220   0414 70         LGL   8                THOUSANDS DIGIT IN MS HALF OF REGA
1053 02221   0 05 04321      ERA   CNTB             REGA = THOUSANDS DIGIT, HUNDREDS DIGIT
1054 02222  -0 04 04342      STA*  PNTR             STORE IN MESSAGE (REPLACE WX)
1055 02223   0 12 04342      IRS   PNTR             INCREMENT ADDRESS OF MESSAGE
1056 02224   0 02 04322      LDA   CNTC             TENS DIGIT
1057 02225   0414 70         LGL   8                TENS DIGIT IN MS HALF OF REGA
1058 02226   0 05 04323      ERA   CNTD             REGA = TENS DIGIT, UNITS DIGIT
1059 02227  -0 04 04342      STA*  PNTR             STORE IN MESSAGE (REPLACE YZ)
1060 02230   0 02 04342      LDA   PNTR
1061 02231   0 06 04427      ADD   =8
1062 02232   0 04 04342      STA   PNTR
1063 02233   0 12 04330      IRS   FGRC             INCREMENT FIGURE COUNTER
1064 02234   100000          SKP                    MOVE PLOTTER IN POSITION TO PLOT NEXT FIGURE
1065 02235   0 01 02247      JMP   P207             ALL FIGURES PLOTTED IN THE ROW
1066                        *
1067 02236   0 35 04347      LDX   10NU             STEP COUNTER (NO OF STEPS IN 10 UNITS)
1068 02237   0 10 03373      JST   MPST
1069 02240   0 12 00000      IRS   0                INCREMENT STEP COUNTER
1070 02241   0 01 02237      JMP   *-2              MOVE PLOTTER NEXT STEP
1071 02242   0 35 04352      LDX   40NU             STEP COUNTER (NO OF STEPS IN 40 UNITS)
1072 02243   0 10 03241      JST   MPET
1073 02244   0 12 00000      IRS   0                INCREMENT STEP COUNTER
1074 02245   0 01 02243      JMP   *-2              MOVE PLOTTER NEXT STEP
1075 02246   0 01 02063      JMP   P2NF             PLOT NEXT FIGURE
1076                        *
1077                        * TEST FOR REQUIREMENT OF SPEED OUTPUT
1078 02247   100002        P207 SR4                TEST FOR REQUIREMENT OF SPEED OUTPUT
1079 02250   0 01 02321      JMP   P208             SPEED MESSAGE NOT REQUIRED
```

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1080                        *
1081                        * OUTPUT SPEED MESSAGE
1082 02251   0 02 04400        LDA   =-38              NUMBER OF WORDS TO BE OUTPUT
1083 02252   0 10 04030        JST   OASR              OUTPUT SPEED MESSAGE
1084 02253   106612           OCT   106612,105212     CR/LF/LF/LF
     02254   105212
1085 02255   143307       MSSG BCI   9,FGR1  MC/IN WXYZ
     02256   151261
     02257   120240
     02260   146703
     02261   127711
     02262   147240
     02263   153730
     02264   154732
     02265   120240
1086 02266   143307           BCI   9,FGR2  MC/IN WXYZ
     02267   151262
     02270   120240
     02271   146703
     02272   127711
     02273   147240
     02274   153730
     02275   154732
     02276   120240
1087 02277   143307           BCI   9,FGR3  MC/IN WXYZ
     02300   151263
     02301   120240
     02302   146703
     02303   127711
     02304   147240
     02305   153730
     02306   154732
     02307   120240
1088 02310   143307           BCI   9,FGR4  MC/IN WXYZ
     02311   151264
     02312   120240
     02313   146703
```

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      02314   127711
      02315   147240
      02316   153730
      02317   154732
      02320   120240
1089  02321   0 35 04350 P208 LDX   20NU              STEP COUNTER (NO OF STEPS IN 20 UNITS)
1090  02322   0 10 03305      JST   MPNT
1091  02323   0 12 00000      IRS   0                 INCREMENT STEP COUNTER
1092  02324   0 01 02322      JMP   *-2               MOVE PLOTTER NEXT STEP
1093  02325   0 12 04344      IRS   ROWC              INCREMENT ROW COUNTER
1094  02326   100000          SKP                     MOVE PLOTTER WEST TO PLOT NEXT ROW
1095  02327   0 01 02335      JMP   P210              ALL ROWS PLOTTED, END OF PATTERN 2
1096                        *
1097  02330   0 35 04357      LDX   80NU              STEP COUNTER (NO OF STEPS IN 80 UNITS)
1098  02331   0 10 03263      JST   MPWT
1099  02332   0 12 00000      IRS   0                 INCREMENT STEP COUNTER
1100  02333   0 01 02331      JMP   *-2               MOVE PLOTTER NEXT STEP
1101  02334   0 01 02056      JMP   P2NR              PLOT NEXT ROW OF FIGURES
1102                        *
1103  02335   0 02 04341 P210 LDA   PALL
1104  02336   101040          SNZ                     TEST FOR REQUIREMENT OF PLOTTING ALL PATRNS
1105  02337   0 01 02343      JMP   PAT3              PLOT PATTERN THREE
1106  02340   0 01 01722      JMP   AQTN              ASK QUESTION: TEST NO?
1107                        *
1108  02341   0 11 04440 P003 CAS   ='263            '263 = CHARACTER THREE
1109  02342   0 01 03030      JMP   P004              INPUT CHARACTER OTHER THAN THREE
1110                        *                       * PLOT PATTERN THREE (INPUT CHAR = 3)
1111                        *
1112                        * PATTERN THREE (FULL DIRECTIONAL TEST - SIXTEEN POINTED STAR)
1113                        *
1114  02343   0 02 04346 PAT3 LDA   UNIT              NUMBER OF STEPS IN ONE UNIT LENGTH (U)
1115  02344   0414 76         LGL   2                 REGA = 4U
1116  02345   0 06 04346      ADD   UNIT              REGA = 5U
1117  02346   0414 77         LGL   1                 REGA = 10U
1118  02347   0 04 04343      STA   RDUS
1119  02350   0414 77         LGL   1                 REGA = 20U
1120  02351   0 04 04325      STA   DMTR
```

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1121                        *
1122 02352   0414 77          LGL   1              REGA = 4R
1123 02353   0 06 04343       ADD   RDUS           REGA = 5R
1124 02354   0414 77          LGL   1              REGA = 10R
1125 02355   0 06 04343       ADD   RDUS           REGA = 11R
1126 02356   0414 76          LGL   2              REGA = 44R
1127 02357   0 06 04343       ADD   RDUS           REGA = 45R
1128 02360   0414 76          LGL   2              REGA = 180R
1129 02361   0 06 04343       ADD   RDUS           REGA = 181R
1130 02362   0404 70          LGR   8              REGA = 181R/256 = 0.707R
1131 02363   0 04 04361       STA   707R
1132 02364   0414 77          LGL   1              REGA = 2*(0.707R) = 0.707D
1133 02365   0 04 04360       STA   707D
1134                        *
1135 02366   0 02 04343       LDA   RDUS
1136 02367   0414 77          LGL   1              REGA = 2R
1137 02370   0 06 04343       ADD   RDUS           REGA = 3R
1138 02371   0414 77          LGL   1              REGA = 6R
1139 02372   0 06 04343       ADD   RDUS           REGA = 7R
1140 02373   0414 76          LGL   2              REGA = 28R
1141 02374   0 06 04343       ADD   RDUS           REGA = 29R
1142 02375   0414 77          LGL   1              REGA = 58R
1143 02376   0 06 04343       ADD   RDUS           REGA = 59R
1144 02377   0404 72          LGR   6              REGA = 59R/64 = 0.92R
1145 02400   0 04 04363       STA   92RD
1146 02401   0414 77          LGL   1              REGA = 2*(0.92R) = 0.92D
1147 02402   0 04 04362       STA   92DM
1148                        *
1149 02403   0 35 04350       LDX   20NU           STEP COUNTER (NO OF STEPS IN 20 UNITS)
1150 02404   0 10 03555       JST   MINT
1151 02405   0 12 00000       IRS   0              INCREMENT STEP COUNTER
1152 02406   0 01 02404       JMP   *-2            MOVE PLOTTER NEXT STEP
1153                        *
1154 02407   0 10 03535       JST   MIET
1155 02410   34 0227      DP09 SKS   PLLR
1156 02411   100000           SKP                  EAST LIMIT REACHED
1157 02412   0 01 02407       JMP   *-3            LIMIT NOT YET REACHED, MOVE EAST
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1158 02413   0 02 04335       LDA   LMIT
1159 02414   0404 77          LGR   1
1160 02415   140407           TCA
1161 02416   0 04 00000       STA   0                 STEP COUNTER
1162 02417   0 10 03545       JST   MIWT
1163 02420   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1164 02421   0 01 02417       JMP   *-2               MOVE PLOTTER NEXT STEP
1165                    *
1166 02422   0 35 04351       LDX   30NU              STEP COUNTER (NO OF STEPS IN 30 UNITS)
1167 02423   0 10 03545       JST   MIWT
1168 02424   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1169 02425   0 01 02423       JMP   *-2               MOVE PLOTTER NEXT STEP
1170                    *
1171 02426   0 02 04461       LDA   =-3               NUMBER OF ROWS IN THE PATTERN
1172 02427   0 04 04344       STA   ROWC
1173 02430   0 02 04461 P3NR  LDA   =-3               NUMBER OF FIGURES IN A ROW
1174 02431   0 04 04330       STA   FGRC
1175 02432   140040           CRA
1176 02433   0 04 04320       STA   CNTA
1177 02434   0 04 04321       STA   CNTB
1178 02435   0 04 04322       STA   CNTC
1179                    *
1180 02436   0 10 03635 P3NF  JST   MIDN
1181 02437   0 02 04325       LDA   DMTR
1182 02440   140407           TCA
1183 02441   0 04 00000       STA   0                 STEP COUNTER
1184 02442   0 10 03545       JST   MIWT
1185 02443   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1186 02444   0 01 02442       JMP   *-2               PLOT NEXT STEP
1187                    *
1188 02445   0 10 03645       JST   MIUP
1189 02446   0 02 04417       LDA   =1
1190 02447   0 04 04336       STA   MRKR
1191 02450   0 10 04012 P302  JST   CALC
1192 02451   0 11 04377       CAS   ='10000           '10000 = 0.5*(2**13)
1193 02452   0 10 03575       JST   MINW
1194 02453   0 01 02455       JMP   *+2
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1195 02454   0 10 03545       JST   MIWT
1196 02455   0 12 04336       IRS   MRKR          INCREMENT MARKER
1197 02456   0 02 04363       LDA   92RD
1198 02457   0 11 04336       CAS   MRKR          TEST FOR COMPLETION OF W-NW MOVEMENT
1199 02460   0 01 02450       JMP   P302          MOVE PLOTTER NEXT STEP
1200 02461   101000           NOP                 W-NW MOVEMENT OF RADIUS LENGTH COMPLETE
1201                  *
1202 02462   0 02 04343       LDA   RDUS
1203 02463   140407           TCA
1204 02464   0 04 00000       STA   0             STEP COUNTER
1205 02465   0 10 03535       JST   MIET
1206 02466   0 12 00000       IRS   0             INCREMENT STEP COUNTER
1207 02467   0 01 02465       JMP   *-2           MOVE PLOTTER NEXT STEP
1208                  *
1209 02470   0 10 03635       JST   MIDN
1210 02471   0 02 04417       LDA   =1
1211 02472   0 04 04336       STA   MRKR
1212 02473   0 10 04012 P304  JST   CALC
1213 02474   0 11 04377       CAS   ='10000       '10000 = 0.5*(2**13)
1214 02475   0 10 03615       JST   MISE
1215 02476   0 01 02500       JMP   *+2
1216 02477   0 10 03535       JST   MIET
1217 02500   0 12 04336       IRS   MRKR          INCREMENT MARKER
1218 02501   0 02 04362       LDA   92DM
1219 02502   0 11 04336       CAS   MRKR          TEST FOR COMPLETION OF E-SE MOVEMENT
1220 02503   0 01 02473       JMP   P304          PLOT NEXT STEP
1221 02504   101000           NOP                 E-SE MOVEMENT OF DIAMETER LENGTH COMPLETE
1222                  *
1223 02505   0 10 03645       JST   MIUP
1224 02506   0 02 04361       LDA   707R
1225 02507   140407           TCA
1226 02510   0 04 00000       STA   0             STEP COUNTER
1227 02511   0 10 03615       JST   MISE
1228 02512   0 12 00000       IRS   0             INCREMENT STEP COUNTER
1229 02513   0 01 02511       JMP   *-2           MOVE PLOTTER NEXT STEP
1230                  *
1231 02514   0 02 04417       LDA   =1
```

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   52 02515   0 04 04336       STA   MRKR
   53 02516   0 10 04012 P306  JST   CALC
1234 02517   0 11 04377       CAS   ='10000          '10000 = 0.5*(2**13)
1235 02520   0 10 03575       JST   MINW
1236 02521   0 01 02523       JMP   *+2
1237 02522   0 10 03545       JST   MIWT
1238 02523   0 12 04336       IRS   MRKR             INCREMENT MARKER
1239 02524   0 02 04363       LDA   92RD
1240 02525   0 11 04336       CAS   MRKR             TEST FOR COMPLETION OF W-NW MOVEMENT
1241 02526   0 01 02516       JMP   P306             MOVE PLOTTER NEXT STEP
1242 02527   101000           NOP                    W-NW MOVEMENT OF RADIUS LENGTH COMPLETE
1243                    *
1244 02530   0 10 03635       JST   MIDN
1245 02531   0 02 04360       LDA   707D
1246 02532   140407           TCA
1247 02533   0 04 00000       STA   0                STEP COUNTER
1248 02534   0 10 03575       JST   MINW
1249 02535   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1250 02536   0 01 02534       JMP   *-2              PLOT NEXT STEP
1251                    *
1252 02537   0 10 03645       JST   MIUP
1253 02540   0 02 04417       LDA   =1
1254 02541   0 04 04336       STA   MRKR
1255 02542   0 10 04012 P308  JST   CALC
1256 02543   0 11 04377       CAS   ='10000          '10000 = 0.5*(2**13)
1257 02544   0 10 03575       JST   MINW
1258 02545   0 01 02547       JMP   *+2
1259 02546   0 10 03555       JST   MINT
1260 02547   0 12 04336       IRS   MRKR             INCREMENT MARKER
1261 02550   0 02 04363       LDA   92RD
1262 02551   0 11 04336       CAS   MRKR             TEST FOR COMPLETION OF N-NW MOVEMENT
1263 02552   0 01 02542       JMP   P308             MOVE PLOTTER NEXT STEP
1264 02553   101000           NOP                    N-NW MOVEMENT OF RADIUS LENGTH COMPLETE
1265                    *
1266 02554   0 02 04361       LDA   707R
1267 02555   140407           TCA
1268 02556   0 04 00000       STA   0                STEP COUNTER
```

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1269 02557   0 10 03615       JST   MISE
1270 02560   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1271 02561   0 01 02557       JMP   *-2               MOVE PLOTTER NEXT STEP
1272                    *
1273 02562   0 10 03635       JST   MIDN
1274 02563   0 02 04417       LDA   =1
1275 02564   0 04 04336       STA   MRKR
1276 02565   0 10 04012 P310  JST   CALC
1277 02566   0 11 04377       CAS   ='10000           '10000 = 0.5*(2**13)
1278 02567   0 10 03615       JST   MISE
1279 02570   0 01 02572       JMP   *+2
1280 02571   0 10 03605       JST   MIST
1281 02572   0 12 04336       IRS   MRKR              INCREMENT MARKER
1282 02573   0 02 04362       LDA   92DM
1283 02574   0 11 04336       CAS   MRKR              TEST FOR COMPLETION OF S-SE MOVEMENT
1284 02575   0 01 02565       JMP   P310              PLOT NEXT STEP
1285 02576   101000           NOP                     S-SE MOVEMENT OF DIAMETER LENGTH COMPLETE
1286                    *
1287 02577   0 10 03645       JST   MIUP
1288 02600   0 02 04343       LDA   RDUS
1289 02601   140407           TCA
1290 02602   0 04 00000       STA   0                 STEP COUNTER
1291 02603   0 10 03605       JST   MIST
1292 02604   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1293 02605   0 01 02603       JMP   *-2               MOVE PLOTTER NEXT STEP
1294                    *
1295 02606   0 02 04417       LDA   =1
1296 02607   0 04 04336       STA   MRKR
1297 02610   0 10 04012 P312  JST   CALC
1298 02611   0 11 04377       CAS   ='10000           '10000 = 0.5*(2**13)
1299 02612   0 10 03575       JST   MINW
1300 02613   0 01 02615       JMP   *+2
1301 02614   0 10 03555       JST   MINT
1302 02615   0 12 04336       IRS   MRKR              INCREMENT MARKER
1303 02616   0 02 04363       LDA   92RD
1304 02617   0 11 04336       CAS   MRKR              TEST FOR COMPLETION OF N-NW MOVEMENT
1305 02620   0 01 02610       JMP   P312              MOVE PLOTTER NEXT STEP
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1306 02621   101000          NOP                    N-NW MOVEMENT OF DIAMETER LENGTH COMPLETE
1307                    *
1308 02622   0 10 03635      JST   MIDN
1309 02623   0 02 04325      LDA   DMTR
1310 02624   140407          TCA
1311 02625   0 04 00000      STA   0                STEP COUNTER
1312 02626   0 10 03555      JST   MINT
1313 02627   0 12 00000      IRS   0                INCREMENT STEP COUNTER
1314 02630   0 01 02626      JMP   *-2              PLOT NEXT STEP
1315                    *
1316 02631   0 10 03645      JST   MIUP
1317 02632   0 02 04417      LDA   =1
1318 02633   0 04 04336      STA   MRKR
1319 02634   0 10 04012 P314 JST   CALC
1320 02635   0 11 04377      CAS   ='10000          '10000 = 0.5*(2**13)
1321 02636   0 10 03565      JST   MINE
1322 02637   0 01 02641      JMP   *+2
1323 02640   0 10 03555      JST   MINT
1324 02641   0 12 04336      IRS   MRKR             INCREMENT MARKER
1325 02642   0 02 04363      LDA   92RD
1326 02643   0 11 04336      CAS   MRKR             TEST FOR COMPLETION OF N-NE MOVEMENT
1327 02644   0 01 02634      JMP   P314             MOVE PLOTTER NEXT STEP
1328 02645   101000          NOP                    N-NE MOVEMENT OF RADIUS LENGTH COMPLETE
1329                    *
1330 02646   0 02 04343      LDA   RDUS
1331 02647   140407          TCA
1332 02650   0 04 00000      STA   0                STEP COUNTER
1333 02651   0 10 03605      JST   MIST
1334 02652   0 12 00000      IRS   0                INCREMENT STEP COUNTER
1335 02653   0 01 02651      JMP   *-2              MOVE PLOTTER NEXT STEP
1336                    *
1337 02654   0 10 03635      JST   MIDN
1338 02655   0 02 04417      LDA   =1
1339 02656   0 04 04336      STA   MRKR
1340 02657   0 10 04012 P316 JST   CALC
1341 02660   0 11 04377      CAS   ='10000          '10000 = 0.5*(2**13)
1342 02661   0 10 03625      JST   MISW
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1343 02662   0 01 02664       JMP   *+2
1344 02663   0 10 03605       JST   MIST
1345 02664   0 12 04336       IRS   MRKR              INCREMENT MARKER
1346 02665   0 02 04362       LDA   92DM
1347 02666   0 11 04336       CAS   MRKR              TEST FOR COMPLETION OF S-SW MOVEMENT
1348 02667   0 01 02657       JMP   P316              PLOT NEXT STEP
1349 02670   101000           NOP                     S-SW MOVEMENT OF DIAMETER LENGTH COMPLETE
1350                    *
1351 02671   0 10 03645       JST   MIUP
1352 02672   0 02 04361       LDA   707R
1353 02673   140407           TCA
1354 02674   0 04 00000       STA   0                 STEP COUNTER
1355 02675   0 10 03625       JST   MISW
1356 02676   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1357 02677   0 01 02675       JMP   *-2               MOVE PLOTTER NEXT STEP
1358                    *
1359 02700   0 02 04417       LDA   =1
1360 02701   0 04 04336       STA   MRKR
1361 02702   0 10 04012 P318  JST   CALC
1362 02703   0 11 04377       CAS   ='10000           '10000 = 0.5*(2**13)
1363 02704   0 10 03565       JST   MINE
1364 02705   0 01 02707       JMP   *+2
1365 02706   0 10 03555       JST   MINT
1366 02707   0 12 04336       IRS   MRKR              INCREMENT MARKER
1367 02710   0 02 04363       LDA   92RD
1368 02711   0 11 04336       CAS   MRKR              TEST FOR COMPLETION OF N-NE MOVEMENT
1369 02712   0 01 02702       JMP   P318              MOVE PLOTTER NEXT STEP
1370 02713   101000           NOP                     N-NE MOVEMENT OF RADIUS LENGTH COMPLETE
1371                    *
1372 02714   0 10 03635       JST   MIDN
1373 02715   0 02 04360       LDA   707D
1374 02716   140407           TCA
1375 02717   0 04 00000       STA   0                 STEP COUNTER
1376 02720   0 10 03565       JST   MINE
1377 02721   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1378 02722   0 01 02720       JMP   *-2               MOVE PLOTTER NEXT STEP
1379                    *
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1380 02723   0 10 03645       JST   MIUP
1381 02724   0 02 04417       LDA   =1
1382 02725   0 04 04336       STA   MRKR
1383 02726   0 10 04012 P320  JST   CALC
1384 02727   0 11 04377       CAS   ='10000          '10000 = 0.5*(2**13)
1385 02730   0 10 03565       JST   MINE
1386 02731   0 01 02733       JMP   *+2
1387 02732   0 10 03535       JST   MIET
1388 02733   0 12 04336       IRS   MRKR             INCREMENT MARKER
1389 02734   0 02 04363       LDA   92RD
1390 02735   0 11 04336       CAS   MRKR             TEST FOR COMPLETION OF E-NE MOVEMENT
1391 02736   0 01 02726       JMP   P320             MOVE PLOTTER NEXT STEP
1392 02737   101000           NOP                    E-NE MOVEMENT OF RADIUS LENGTH COMPLETE
1393                    *
1394 02740   0 02 04361       LDA   707R
1395 02741   140407           TCA
1396 02742   0 04 00000       STA   0                STEP COUNTER
1397 02743   0 10 03625       JST   MISW
1398 02744   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1399 02745   0 01 02743       JMP   *-2              MOVE PLOTTER NEXT STEP
1400                    *
1401 02746   0 10 03635       JST   MIDN
1402 02747   0 02 04417       LDA   =1
1403 02750   0 04 04336       STA   MRKR
1404 02751   0 10 04012 P322  JST   CALC
1405 02752   0 11 04377       CAS   ='10000          '10000 = 0.5*(2**13)
1406 02753   0 10 03625       JST   MISW
1407 02754   0 01 02756       JMP   *+2
1408 02755   0 10 03545       JST   MIWT
1409 02756   0 12 04336       IRS   MRKR             INCREMENT MARKER
1410 02757   0 02 04362       LDA   92DM
1411 02760   0 11 04336       CAS   MRKR             TEST FOR COMPLETION OF W-SW MOVEMENT
1412 02761   0 01 02751       JMP   P322             PLOT NEXT STEP
1413 02762   101000           NOP                    W-SW MOVEMENT OF DIAMETER LENGTH COMPLETE
1414                    *
1415 02763   0 10 03645       JST   MIUP
1416 02764   0 02 04417       LDA   =1
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1417 02765   0 04 04336       STA   MRKR
1418 02766   0 10 04012 P330  JST   CALC
1419 02767   0 11 04377       CAS   ='10000          '10000 = 0.5*(2**13)
1420 02770   0 10 03565       JST   MINE
1421 02771   0 01 02773       JMP   *+2
1422 02772   0 10 03535       JST   MIET
1423 02773   0 12 04336       IRS   MRKR             INCREMENT MARKER
1424 02774   0 02 04363       LDA   92RD
1425 02775   0 11 04336       CAS   MRKR             TEST FOR COMPLETION OF E-NE MOVEMENT
1426 02776   0 01 02766       JMP   P330             MOVE PLOTTER NEXT STEP
1427 02777   101000           NOP                    E-NE MOVEMENT OF RADIUS LENGTH COMPLETE
1428                    *
1429 03000   0 12 04330       IRS   FGRC             INCREMENT FIGURE COUNTER
1430 03001   100000           SKP                    MOVE PLOTTER EAST TO PLOT NEXT FIGURE
1431 03002   0 01 03010       JMP   P350             ALL FIGURES PLOTTED IN THE ROW
1432 03003   0 35 04354       LDX   50NU             STEP COUNTER (NO OF STEPS IN 50 UNITS)
1433 03004   0 10 03535       JST   MIET
1434 03005   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1435 03006   0 01 03004       JMP   *-2              MOVE PLOTTER NEXT STEP
1436 03007   0 01 02436       JMP   P3NF             PLOT NEXT FIGURE
1437                    *
1438 03010   0 35 04351 P350  LDX   30NU             STEP COUNTER (NO OF STEPS IN 30 UNITS)
1439 03011   0 10 03555       JST   MINT
1440 03012   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1441 03013   0 01 03011       JMP   *-2              MOVE PLOTTER NEXT STEP
1442                    *
1443 03014   0 12 04344       IRS   ROWC             INCREMENT ROW COUNTER
1444 03015   100000           SKP                    MOVE PLOTTER WEST TO PLOT NEXT ROW
1445 03016   0 01 03024       JMP   P370             ALL ROWS PLOTTED, END OF PATTERN 3
1446                    *
1447 03017   0 35 04356       LDX   70NU             STEP COUNTER (NO OF STEPS IN 70 UNITS)
1448 03020   0 10 03545       JST   MIWT
1449 03021   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1450 03022   0 01 03020       JMP   *-2              MOVE PLOTTER NEXT STEP
1451 03023   0 01 02430       JMP   P3NR             PLOT NEXT ROW OF FIGURES
1452                    *
1453 03024   0 02 04341 P370  LDA   PALL
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1454 03025   101040          SNZ                    TEST FOR REQUIREMENT OF PLOTTING ALL PATRNS
1455 03026   0 01 03032       JMP   PAT4             PLOT PATTERN FOUR
1456 03027   0 01 01722       JMP   AQTN             ASK QUESTION: TEST NO?
1457                  *
1458 03030   0 11 04435 P004  CAS   '=264            '264 = CHARACTER FOUR
1459 03031   0 01 03205       JMP   P00E             INPUT CHARACTER OTHER THAN FOUR
1460                  *                             * PLOT PATTERN FOUR (INPUT CHAR = 4)
1461                  *
1462                  * PATTERN FOUR (ALIGNMENT TEST - DIAMOND MESH)
1463                  *
1464 03032   0 35 04347 PAT4  LDX   10NU             STEP COUNTER (NO OF STEPS IN 10 UNITS)
1465 03033   0 10 03305       JST   MPNT
1466 03034   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1467 03035   0 01 03033       JMP   *-2              MOVE PLOTTER NEXT STEP
1468 03036   0 10 03224       JST   MPCT
1469 03037   0 35 04355       LDX   60NU             STEP COUNTER (NO OF STEPS IN 60 UNITS)
1470 03040   0 10 03263       JST   MPWT
1471 03041   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1472 03042   0 01 03040       JMP   *-2              MOVE PLOTTER NEXT STEP
1473                  *
1474 03043   0 02 04411       LDA   =-6              NUMBER OF ROWS IN THE PATTERN
1475 03044   0 04 04344       STA   ROWC
1476 03045   0 02 04411 P4NR  LDA   =-6              NUMBER OF FIGURES IN A ROW
1477 03046   0 04 04330       STA   FGRC
1478 03047   0 10 03461       JST   MPDN
1479                  *
1480 03050   0 35 04347 P4NF  LDX   10NU             STEP COUNTER (NO OF STEPS IN 10 UNITS)
1481 03051   0 10 03241       JST   MPET
1482 03052   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1483 03053   0 01 03051       JMP   *-2              PLOT NEXT STEP
1484 03054   0 35 04347       LDX   10NU             STEP COUNTER (NO OF STEPS IN 10 UNITS)
1485 03055   0 10 03327       JST   MPNE
1486 03056   0 12 00000       IRS   0                INCREMENT STEP COUNTER
1487 03057   0 01 03055       JMP   *-2              PLOT NEXT STEP
1488 03060   0 35 04347       LDX   10NU             STEP COUNTER (NO OF STEPS IN 10 UNITS)
1489 03061   0 10 03351       JST   MPNW
1490 03062   0 12 00000       IRS   0                INCREMENT STEP COUNTER
```

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1491 03063   0 01 03061        JMP   *-2        PLOT NEXT STEP
1492 03064   0 35 04347        LDX   10NU       STEP COUNTER (NO OF STEPS IN 10 UNITS)
1493 03065   0 10 03437        JST   MPSW
1494 03066   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1495 03067   0 01 03065        JMP   *-2        PLOT NEXT STEP
1496 03070   0 35 04347        LDX   10NU       STEP COUNTER (NO OF STEPS IN 10 UNITS)
1497 03071   0 10 03415        JST   MPSE
1498 03072   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1499 03073   0 01 03071        JMP   *-2        PLOT NEXT STEP
1500 03074   0 35 04347        LDX   10NU       STEP COUNTER (NO OF STEPS IN 10 UNITS)
1501 03075   0 10 03241        JST   MPET
1502 03076   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1503 03077   0 01 03075        JMP   *-2        PLOT NEXT STEP
1504 03100   0 12 04330        IRS   FGRC       INCREMENT FIGURE COUNTER
1505 03101   0 01 03050        JMP   P4NF       PLOT NEXT FIGURE
1506                      *
1507 03102   0 10 03507        JST   MPUP
1508 03103   0 02 04461        LDA   =-3        NUMBER OF PAIRS OF LINES TO BE DRAWN
1509 03104   0 04 04324        STA   CNTR       LINE-PAIR COUNTER
1510 03105   0 35 04347 P401   LDX   10NU       STEP COUNTER (NO OF STEPS IN 10 UNITS)
1511 03106   0 10 03263        JST   MPWT
1512 03107   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1513 03110   0 01 03106        JMP   *-2        MOVE PLOTTER NEXT STEP
1514 03111   0 10 03461        JST   MPDN
1515 03112   0 35 04350        LDX   20NU       STEP COUNTER (NO OF STEPS IN 20 UNITS)
1516 03113   0 10 03305        JST   MPNT
1517 03114   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1518 03115   0 01 03113        JMP   *-2        PLOT NEXT STEP
1519 03116   0 10 03507        JST   MPUP
1520 03117   0 35 04350        LDX   20NU       STEP COUNTER (NO OF STEPS IN 20 UNITS)
1521 03120   0 10 03263        JST   MPWT
1522 03121   0 12 00000        IRS   0          INCREMENT STEP COUNTER
1523 03122   0 01 03120        JMP   *-2        MOVE PLOTTER NEXT STEP
1524 03123   0 10 03461        JST   MPDN
1525 03124   0 35 04350        LDX   20NU       STEP COUNTER (NO OF STEPS IN 20 UNITS)
1526 03125   0 10 03373        JST   MPST
1527 03126   0 12 00000        IRS   0          INCREMENT STEP COUNTER
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1528 03127   0 01 03125       JMP   *-2          PLOT NEXT STEP
1529 03130   0 10 03507       JST   MPUP
1530 03131   0 35 04347       LDX   10NU         STEP COUNTER (NO OF STEPS IN 10 UNITS)
1531 03132   0 10 03263       JST   MPWT
1532 03133   0 12 00000       IRS   0            INCREMENT STEP COUNTER
1533 03134   0 01 03132       JMP   *-2          MOVE PLOTTER NEXT STEP
1534 03135   0 12 04324       IRS   CNTR         INCREMENT LINE-PAIR COUNTER
1535 03136   0 01 03105       JMP   P401         PLOT NEXT PAIR OF LINES
1536                     *
1537 03137   0 35 04347       LDX   10NU         STEP COUNTER (NO OF STEPS IN 10 UNITS)
1538 03140   0 10 03305       JST   MPNT
1539 03141   0 12 00000       IRS   0            INCREMENT STEP COUNTER
1540 03142   0 01 03140       JMP   *-2          MOVE PLOTTER NEXT STEP
1541 03143   0 10 03461       JST   MPDN
1542 03144   0 02 04376       LDA   =-120        NO OF UNIT LENGTHS TO BE PLOTTED
1543 03145   0 04 04324       STA   CNTR         UNIT COUNTER
1544 03146   0 35 04340 P402  LDX   NUNT         STEP COUNTER (NO OF STEPS IN 1 UNIT)
1545 03147   0 10 03241       JST   MPET
1546 03150   0 12 00000       IRS   0            INCREMENT STEP COUNTER
1547 03151   0 01 03147       JMP   *-2          PLOT NEXT STEP
1548 03152   0 12 04324       IRS   CNTR         INCREMENT UNIT COUNTER
1549 03153   0 01 03146       JMP   P402         PLOT NEXT UNIT LENGTH
1550 03154   0 10 03507       JST   MPUP
1551 03155   0 35 04347       LDX   10NU         STEP COUNTER (NO OF STEPS IN 10 UNITS)
1552 03156   0 10 03305       JST   MPNT
1553 03157   0 12 00000       IRS   0            INCREMENT STEP COUNTER
1554 03160   0 01 03156       JMP   *-2          MOVE PLOTTER NEXT STEP
1555 03161   0 02 04344       LDA   ROWC
1556 03162   0 05 04463       ERA   =-1
1557 03163   101040           SNZ                TEST FOR LAST ROW
1558 03164   0 10 03461       JST   MPDN
1559 03165   0 02 04376       LDA   =-120        NO OF UNIT LENGTHS TO BE MOVED
1560 03166   0 04 04324       STA   CNTR         UNIT COUNTER
1561 03167   0 35 04340 P403  LDX   NUNT         STEP COUNTER (NO OF STEPS IN ONE UNIT)
1562 03170   0 10 03263       JST   MPWT
1563 03171   0 12 00000       IRS   0            INCREMENT STEP COUNTER
1564 03172   0 01 03170       JMP   *-2          MOVE PLOTTER NEXT STEP
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1565 03173   0 12 04324       IRS   CNTR              INCREMENT UNIT COUNTER
1566 03174   0 01 03167       JMP   P403              MOVE PLOTTER NEXT UNIT LENGTH
1567 03175   0 12 04344       IRS   ROWC              INCREMENT ROW COUNTER
1568 03176   0 01 03045       JMP   P4NR              PLOT NEXT ROW OF FIGURES
1569 03177   0 10 03507       JST   MPUP
1570 03200   0 35 04350       LDX   20NU              STEP COUNTER (NO OF STEPS IN 20 UNITS)
1571 03201   0 10 03305       JST   MPNT
1572 03202   0 12 00000       IRS   0                 INCREMENT STEP COUNTER
1573 03203   0 01 03201       JMP   *-2               MOVE PLOTTER NEXT STEP
1574                      *
1575 03204   0 01 01722       JMP   AQTN              ASK QUESTION: TEST NO?
1576                      *
1577 03205   0 05 04375 P00E  ERA   ='305             '305 = CHARACTER E
1578 03206   100040           SZE                     TEST FOR CHARACTER E
1579 03207   0 01 01725       JMP   QST6              INVALID CHARACTER, REPEAT THE QUESTION
1580                      *                           * CHAR E (END OF TEST)
1581                      *
1582                      * OUTPUT END HEADING MESSAGE TO ASR
1583                      *
1584 03210   0 02 04432       LDA   =-8               NUMBER OF WORDS TO BE OUTPUT
1585 03211   0 10 04030       JST   0ASR
1586 03212   105212           OCT   105212            LF/LF
1587 03213   142716           BCI   6,END 016-DPT9
     03214   142240
     03215   147661
     03216   133255
     03217   142320
     03220   152271
1588 03221   105212           OCT   105212            LF/LF
1589                      *
1590 03222   000000           HLT
1591 03223   0 01 01000       JMP   STRT              RESTART
1592                      *
1593                      *
1594                      * SUBROUTINES
1595                      *
1596                      * MOVE PLOTTER TO CENTRE (WITHOUT INTERRUPT)
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```
1597 03224    0 000000    MPCT DAC    **                  MOVE PLOTTER TO CENTRE (WITHOUT INT)
1598 03225    0 10 03241        JST    MPET
1599 03226    34 0227     DP10 SKS    PLLR
1600 03227    100000            SKP                       EAST LIMIT REACHED
1601 03230    0 01 03225        JMP    *-3                LIMIT NOT YET REACHED, MOVE EAST
1602 03231    0 02 04335        LDA    LMIT
1603 03232    0404 77           LGR    1
1604 03233    140407            TCA
1605 03234    0 04 00000        STA    0                  STEP COUNTER
1606 03235    0 10 03263        JST    MPWT
1607 03236    0 12 00000        IRS    0                  INCREMENT STEP COUNTER
1608 03237    0 01 03235        JMP    *-2                MOVE PLOTTER NEXT STEP
1609 03240   -0 01 03224        JMP*   MPCT               EXIT FROM SUBROUTINE
1610                        *
1611                        * MOVE PLOTTER EAST ONE STEP (WITHOUT INTERRUPT)
1612 03241    0 000000    MPET DAC    **                  MOVE PLOTTER EAST (WITHOUT INT)
1613 03242    14 0127     DP11 OCP    PLET                EAST - CARRIAGE RIGHT
1614 03243    34 0127     DP12 SKS    PLNB                SKIP IF PLOTTER NOT BUSY
1615 03244    0 01 03251        JMP    PET1               PLOTTER BUSY, OK
1616 03245    0 10 04150        JST    ERRR               ERROR ROUTINE
1617 03246    101000            NOP
1618 03247    147302            BCI    2,NBET             P NOT BUSY IMMEDIATELY AFTER MOVING EAST
     03250    142724
1619 03251    0 02 04327 PET1 LDA    DRTR                DIRECTIONAL TIMER 4(4.2) MS
1620 03252    34 0127    PET0 SKS    PLNB                SKIP IF PLOTTER NOT BUSY
1621 03253    100000            SKP                       PLOTTER BUSY, DELAY LOOP
1622 03254   -0 01 03241        JMP*   MPET               EXIT FROM SUBROUTINE
1623 03255    141206            ~~ACA~~ A<0 ONE'S A
1624 03256    101040            SNZ                       TEST FOR COMPLETION OF 4(4.2) MS
1625 03257    0 10 04150        JST    ERRR               ERROR ROUTINE
1626 03260    0 01 03252        JMP    PET0               DELAY LOOP OF 4(4.2) MILLI-SECONDS
1627 03261    141323            BCI    2,BSET             PLOTTER BUSY 4(4.2) MS AFTER MOVING EAST
     03262    142724
1628                        *
1629                        * MOVE PLOTTER WEST ONE STEP (WITHOUT INTERRUPT)
1630 03263    0 000000    MPWT DAC    **                  MOVE PLOTTER WEST (WITHOUT INT)
1631 03264    14 0227     DP14 OCP    PLWT                WEST-CARRIAGE LEFT
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1632 03265   34 0127     DP15 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1633 03266   0 01 03273       JMP   PWT1              PLOTTER BUSY, OK
1634 03267   0 10 04150       JST   ERRR              ERROR ROUTINE
1635 03270   101000          NOP
1636 03271   147302          BCI   2,NBWT            P NOT BUSY IMMEDIATELY AFTER MOVING WEST
     03272   153724
1637 03273   0 02 04327 PWT1 LDA   DRTR              DIRECTIONAL TIMER 4(4.2) MS
1638 03274   34 0127    PWT0 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1639 03275   100000          SKP                     PLOTTER BUSY, DELAY LOOP
1640 03276  -0 01 03263      JMP*  MPWT              EXIT FROM SUBROUTINE
1641 03277   141206          AOA
1642 03300   101040          SNZ                     TEST FOR COMPLETION OF 4(4.2) MS
1643 03301   0 10 04150      JST   ERRR              ERROR ROUTINE
1644 03302   0 01 03274      JMP   PWT0              DELAY LOOP OF 4(4.2) MILLI-SECONDS
1645 03303   141323          BCI   2,BSWT            PLOTTER BUSY 4(4.2) MS AFTER MOVING WEST
     03304   153724
1646                 *
1647                 * MOVE PLOTTER NORTH ONE STEP (WITHOUT INTERRUPT)
1648 03305   0 000000   MPNT DAC   **                MOVE PLOTTER NORTH (WITHOUT INT)
1649 03306   14 0427    DP17 OCP   PLNT              NORTH - DRUM UP
1650 03307   34 0127    DP18 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1651 03310   0 01 03315      JMP   PNT1              PLOTTER BUSY, OK
1652 03311   0 10 04150      JST   ERRR              ERROR ROUTINE
1653 03312   101000          NOP
1654 03313   147302          BCI   2,NBNT            P NOT BUSY IMMEDIATELY AFTER MOVING NORTH
     03314   147324
1655 03315   0 02 04327 PNT1 LDA   DRTR              DIRECTIONAL TIMER 4(4.2) MS
1656 03316   34 0127    PNT0 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1657 03317   100000          SKP                     PLOTTER BUSY, DELAY LOOP
1658 03320  -0 01 03305      JMP*  MPNT              EXIT FROM SUBROUTINE
1659 03321   141206          AOA
1660 03322   101040          SNZ                     TEST FOR COMPLETION OF 4(4.2) MS
1661 03323   0 10 04150      JST   ERRR              ERROR ROUTINE
1662 03324   0 01 03316      JMP   PNT0              DELAY LOOP OF 4(4.2) MILLI-SECONDS
1663 03325   141323          BCI   2,BSNT            PLOTTER BUSY 4(4.2) MS AFTER MOVING NORTH
     03326   147324
1664                 *
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1665                        * MOVE PLOTTER NORTH-EAST ONE STEP (WITHOUT INTERRUPT)
1666 03327   0 000000   MPNE DAC   **                 MOVE PLOTTER NORTH-EAST (WITHOUT INT)
1667 03330   14 0527     DP20 OCP   PLNE               NORTH EAST-DRUM UP, CARRIAGE RIGHT
1668 03331   34 0127     DP21 SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1669 03332   0 01 03337       JMP   PNE1               PLOTTER BUSY, OK
1670 03333   0 10 04150       JST   ERRR               ERROR ROUTINE
1671 03334   101000           NOP
1672 03335   147302           BCI   2,NBNE            P NOT BUSY IMMEDIATELY AFTER MOVING N-EAST
     03336   147305
1673 03337   0 02 04327 PNE1  LDA   DRTR               DIRECTIONAL TIMER 4(4.2) MS
1674 03340   34 0127    PNE0  SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1675 03341   100000           SKP                      PLOTTER BUSY, DELAY LOOP
1676 03342  -0 01 03327       JMP*  MPNE               EXIT FROM SUBROUTINE
1677 03343   141206           ADA
1678 03344   101040           SNZ                      TEST FOR COMPLETION OF 4(4.2) MS
1679 03345   0 10 04150       JST   ERRR               ERROR ROUTINE
1680 03346   0 01 03340       JMP   PNE0               DELAY LOOP OF 4(4.2) MILLI-SECONDS
1681 03347   141323           BCI   2,BSNE            PLOTTER BUSY 4(4.2) MS AFTER MOVING N-EAST
     03350   147305
1682                        *
1683                        * MOVE PLOTTER NORTH-WEST ONE STEP (WITHOUT INTERRUPT)
1684 03351   0 000000   MPNW DAC   **                 MOVE PLOTTER NORTH-WEST (WITHOUT INT)
1685 03352   14 0627    DP23 OCP   PLNW               NORTH WEST - DRUM UP, CARRIAGE LEFT
1686 03353   34 0127    DP24 SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1687 03354   0 01 03361       JMP   PNW1               PLOTTER BUSY, OK
1688 03355   0 10 04150       JST   ERRR               ERROR ROUTINE
1689 03356   101000           NOP
1690 03357   147302           BCI   2,NBNW            P NOT BUSY IMMEDIATELY AFTER MOVING N-WEST
     03360   147327
1691 03361   0 02 04327 PNW1  LDA   DRTR               DIRECTIONAL TIMER 4(4.2) MS
1692 03362   34 0127    PNW0  SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1693 03363   100000           SKP                      PLOTTER BUSY, DELAY LOOP
1694 03364  -0 01 03351       JMP*  MPNW               EXIT FROM SUBROUTINE
1695 03365   141206           ADA
1696 03366   101040           SNZ                      TEST FOR COMPLETION OF 4(4.2) MS
1697 03367   0 10 04150       JST   ERRR               ERROR ROUTINE
1698 03370   0 01 03362       JMP   PNW0               DELAY LOOP OF 4(4.2) MILLI-SECONDS
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1699 03371   141323          BCI   2,BSNW            PLOTTER BUSY 4(4.2) MS AFTER MOVING N-WEST
     03372   147327
1700                       *
1701                       * MOVE PLOTTER SOUTH ONE STEP (WITHOUT INTERRUPT)
1702 03373   0 000000    MPST DAC   **                MOVE PLOTTER SOUTH (WITHOUT INT)
1703 03374   14 1027     DP26 OCP   PLST              SOUTH - DRUM DOWN
1704 03375   34 0127     DP27 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1705 03376   0 01 03403       JMP   PST1              PLOTTER BUSY, OK
1706 03377   0 10 04150       JST   ERRR              ERROR ROUTINE
1707 03400   101000           NOP
1708 03401   147302           BCI   2,NBST           P NOT BUSY IMMEDIATELY AFTER MOVING SOUTH
     03402   151724
1709 03403   0 02 04327 PST1  LDA   DRTR              DIRECTIONAL TIMER 4(4.2) MS
1710 03404   34 0127    PST0  SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1711 03405   100000           SKP                     PLOTTER BUSY, DELAY LOOP
1712 03406  -0 01 03373       JMP*  MPST              EXIT FROM SUBROUTINE
1713 03407   141206           AOA
1714 03410   101040           SNZ                     TEST FOR COMPLETION OF 4(4.2) MS
1715 03411   0 10 04150       JST   ERRR              ERROR ROUTINE
1716 03412   0 01 03404       JMP   PST0              DELAY LOOP OF 4(4.2) MILLI-SECONDS
1717 03413   141323           BCI   2,BSST           PLOTTER BUSY 4(4.2) MS AFTER MOVING SOUTH
     03414   151724
1718                       *
1719                       * MOVE PLOTTER SOUTH-EAST ONE STEP (WITHOUT INTERRUPT)
1720 03415   0 000000    MPSE DAC   **                MOVE PLOTTER SOUTH-EAST (WITHOUT INT)
1721 03416   14 1127     DP29 OCP   PLSE              SOUTH EAST - DRUM DOWN, CARRIAGE RIGHT
1722 03417   34 0127     DP30 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1723 03420   0 01 03425       JMP   PSE1              PLOTTER BUSY, OK
1724 03421   0 10 04150       JST   ERRR              ERROR ROUTINE
1725 03422   101000           NOP
1726 03423   147302           BCI   2,NBSE           P NOT BUSY IMMEDIATELY AFTER MOVING S-EAST
     03424   151705
1727 03425   0 02 04327 PSE1  LDA   DRTR              DIRECTIONAL TIMER 4(4.2) MS
1728 03426   34 0127    PSE0  SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1729 03427   100000           SKP                     PLOTTER BUSY, DELAY LOOP
1730 03430  -0 01 03415       JMP*  MPSE              EXIT FROM SUBROUTINE
1731 03431   141206           AOA
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1732 03432   101040           SNZ                      TEST FOR COMPLETION OF 4(4.2) MS
1733 03433   0 10 04150        JST   ERRR               ERROR ROUTINE
1734 03434   0 01 03426        JMP   PSE0               DELAY LOOP OF 4(4.2) MILLI-SECONDS
1735 03435   141323           BCI   2,BSSE             PLOTTER BUSY 4(4.2) MS AFTER MOVING S-EAST
     03436   151705
1736                          *
1737                          * MOVE PLOTTER SOUTH-WEST ONE STEP (WITHOUT INTERRUPT)
1738 03437   0 000000   MPSW DAC   **                   MOVE PLOTTER SOUTH-WEST (WITHOUT INT)
1739 03440   14 1227    DP32 OCP   PLSW                 SOUTH WEST - DRUM DOWN, CARRIAGE LEFT
1740 03441   34 0127    DP33 SKS   PLNB
1741 03442   0 01 03447       JMP   PSW1               PLOTTER BUSY, OK
1742 03443   0 10 04150       JST   ERRR               ERROR ROUTINE
1743 03444   101000           NOP
1744 03445   147302           BCI   2,NBSW             P NOT BUSY IMMEDIATELY AFTER MOVING S-WEST
     03446   151727
1745 03447   0 02 04327 PSW1  LDA   DRTR               DIRECTIONAL TIMER 4(4.2) MS
1746 03450   34 0127    PSW0  SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1747 03451   100000           SKP                      PLOTTER BUSY, DELAY LOOP
1748 03452  -0 01 03437       JMP*  MPSW               EXIT FROM SUBROUTINE
1749 03453   141206           AOA
1750 03454   101040           SNZ                      TEST FOR COMPLETION OF 4(4.2) MS
1751 03455   0 10 04150       JST   ERRR               ERROR ROUTINE
1752 03456   0 01 03450       JMP   PSW0               DELAY LOOP OF 4(4.2) MILLI-SECONDS
1753 03457   141323           BCI   2,BSSW             PLOTTER BUSY 4(4.2) MS AFTER MOVING S-WEST
     03460   151727
1754                          *
1755                          * MOVE PEN DOWN (WITHOUT INTERRUPT)
1756 03461   0 000000   MPDN DAC   **                   MOVE PEN DOWN (WITHOUT INT)
1757 03462   14 1427    DP35 OCP   PEND                 PEN DOWN
1758 03463   34 0127    DP36 SKS   PLNB                 SKIP IF PLOTTER NOT BUSY
1759 03464   0 01 03471       JMP   PDN1               PLOTTER BUSY, OK
1760 03465   0 10 04150       JST   ERRR               ERROR ROUTINE
     03466   101000           NOP
     03467   147302           BCI   2,NBDN             PEN NOT BUSY IMMEDIATELY AFTER MOVING DOWN
     03470   142316
     03471   101020     PDN1  SS1                      TEST FOR SENSE SWITCH 1 SET
1764 03472   0 01 03475       JMP   D59                NOT SET, DDP-516 BEING USED
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1765                        *                                   SET, H316 BEING USED
1766 03473   0 02 04374       LDA    =-2604                    2604 = (25*1000)/(6*1.6)
1767 03474   100000           SKP
1768                        *
1769 03475   0 02 04373 D59  LDA    =-4845                    4845 = (25*1000)/(6*0.86)
1770 03476   34 0127    PDN0 SKS    PLNB                      SKIP IF PLOTTER NOT BUSY
1771 03477   100000           SKP                             PLOTTER BUSY, DELAY LOOP
1772 03500  -0 01 03461       JMP*   MPDN                      EXIT FROM SUBROUTINE
1773 03501   141206           AOA
1774 03502   101040           SNZ                             TEST FOR COMPLETION OF 25 MS DELAY LOOP
1775 03503   0 10 04150       JST    ERRR                      ERROR ROUTINE
1776 03504   0 01 03476       JMP    PDN0                      DELAY LOOP OF 25 MILLI-SECONDS
1777 03505   141323           BCI    2,BSDN                    PEN BUSY 25 MS AFTER MOVING DOWN
     03506   142316
1778                        *
1779                        * MOVE PEN UP (WITHOUT INTERRUPT)
1780 03507   0 000000   MPUP DAC    **                        MOVE PEN UP (WITHOUT INT)
1781 03510   14 1627    DP38 OCP    PENU                      PEN UP
1782 03511   34 0127    DP39 SKS    PLNB                      SKIP IF PLOTTER NOT BUSY
1783 03512   0 01 03517       JMP    PUP1                      PLOTTER BUSY, OK
1784 03513   0 10 04150       JST    ERRR                      ERROR ROUTINE
1785 03514   101000           NOP
1786 03515   147302           BCI    2,NBUP                    PEN NOT BUSY IMMEDIATELY AFTER MOVING UP
     03516   152720
1787 03517   101020     PUP1 SS1                               TEST FOR SENSE SWITCH 1 SET
1788 03520   0 01 03523       JMP    D510                      NOT SET, DDP-516 BEING USED
1789                        *                                   SET, H316 BEING USED
1790 03521   0 02 04374       LDA    =-2604                    2604 = (25*1000)/(6*1.6)
1791 03522   100000           SKP
1792                        *
1793 03523   0 02 04373 D510 LDA    =-4845                    4845 = (25*1000)/(6*0.86)
1794 03524   34 0127    PUP0 SKS    PLNB                      SKIP IF PLOTTER NOT BUSY
1795 03525   100000           SKP                             PLOTTER BUSY, DELAY LOOP
1796 03526  -0 01 03507       JMP*   MPUP                      EXIT FROM SUBROUTINE
1797 03527   141206           AOA
1798 03530   101040           SNZ                             TEST FOR COMPLETION OF 25 MS DELAY LOOP
1799 03531   0 10 04150       JST    ERRR                      ERROR ROUTINE
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1800 03532   0 01 03524       JMP   PUP0              DELAY LOOP OF 25 MILLI-SECONDS
1801 03533   141323           BCI   2,BSUP            PEN BUSY 25 MS AFTER MOVING UP
     03534   152720
1802                         *
1803                         * MOVE PLOTTER EAST ONE STEP (WITH INTERRUPT)
1804 03535   0 000000    MIET DAC   **                MOVE PLOTTER EAST (WITH INT)
1805 03536   14 0127     DP41 OCP   PLET              EAST - CARRIAGE RIGHT
1806 03537   34 0127     DP42 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1807 03540   0 10 03655       JST   INTD
1808 03541   0 10 04150       JST   ERRR              ERROR ROUTINE
1809 03542  -0 01 03535       JMP*  MIET              EXIT FROM SUBROUTINE
1810 03543   147302          BCI   2,NBET            P NOT BUSY IMMEDIATELY AFTER MOVING EAST
     03544   142724
1811                         *
1812                         * MOVE PLOTTER WEST ONE STEP (WITH INTERRUPT)
1813 03545   0 000000    MIWT DAC   **                MOVE PLOTTER WEST (WITH INT)
1814 03546   14 0227     DP43 OCP   PLWT              WEST - CARRIAGE LEFT
1815 03547   34 0127     DP44 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1816 03550   0 10 03655       JST   INTD
1817 03551   0 10 04150       JST   ERRR              ERROR ROUTINE
1818 03552  -0 01 03545       JMP*  MIWT              EXIT FROM SUBROUTINE
1819 03553   147302          BCI   2,NBWT            P NOT BUSY IMMEDIATELY AFTER MOVING WEST
     03554   153724
1820                         *
1821                         * MOVE PLOTTER NORTH ONE STEP (WITH INTERRUPT)
1822 03555   0 000000    MINT DAC   **                MOVE PLOTTER NORTH (WITH INT)
1823 03556   14 0427     DP45 OCP   PLNT              NORTH - DRUM UP
1824 03557   34 0127     DP46 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1825 03560   0 10 03655       JST   INTD
1826 03561   0 10 04150       JST   ERRR              ERROR ROUTINE
1827 03562  -0 01 03555       JMP*  MINT              EXIT FROM SUBROUTINE
1828 03563   147302          BCI   2,NBNT            P NOT BUSY IMMEDIATELY AFTER MOVING NORTH
     03564   147324
1829                         *
1830                         * MOVE PLOTTER NORTH-EAST ONE STEP (WITH INTERRUPT)
1831 03565   0 000000    MINE DAC   **                MOVE PLOTTER NORTH-EAST (WITH INT)
1832 03566   14 0527     DP47 OCP   PLNE              NORTH EAST - DRUM UP, CARRIAGE RIGHT
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1833 03567   34 0127     DP48 SKS   PLNB              SKIP IF PLOTTER NOT BUSY
1834 03570   0 10 03655       JST   INTD
1835 03571   0 10 04150       JST   ERRR              ERROR ROUTINE
1836 03572  -0 01 03565       JMP*  MINE              EXIT FROM SUBROUTINE
1837 03573   147302            BCI   2,NBNE            P NOT BUSY IMMEDIATELY AFTER MOVING N-EAST
     03574   147305
1838                        *
1839                        * MOVE PLOTTER NORTH-WEST ONE STEP (WITH INTERRUPT)
1840 03575   0 000000   MINW DAC   **                  MOVE PLOTTER NORTH-WEST (WITH INT)
1841 03576   14 0627    DP49 OCP   PLNW                NORTH WEST - DRUM UP, CARRIAGE LEFT
1842 03577   34 0127    DP50 SKS   PLNB                SKIP IF PLOTTER NOT BUSY
1843 03600   0 10 03655       JST   INTD
1844 03601   0 10 04150       JST   ERRR              ERROR ROUTINE
1845 03602  -0 01 03575       JMP*  MINW              EXIT FROM SUBROUTINE
1846 03603   147302            BCI   2,NBNW            P NOT BUSY IMMEDIATELY AFTER MOVING N-WEST
     03604   147327
1847                        *
1848                        * MOVE PLOTTER SOUTH ONE STEP (WITH INTERRUPT)
1849 03605   0 000000   MIST DAC   **                  MOVE PLOTTER SOUTH (WITH INT)
1850 03606   14 1027    DP51 OCP   PLST                SOUTH - DRUM DOWN
1851 03607   34 0127    DP52 SKS   PLNB                SKIP IF PLOTTER NOT BUSY
1852 03610   0 10 03655       JST   INTD
1853 03611   0 10 04150       JST   ERRR              ERROR ROUTINE
1854 03612  -0 01 03605       JMP*  MIST              EXIT FROM SUBROUTINE
1855 03613   147302            BCI   2,NBST            P NOT BUSY IMMEDIATELY AFTER MOVING SOUTH
     03614   151724
1856                        *
1857                        * MOVE PLOTTER SOUTH-EAST ONE STEP (WITH INTERRUPT)
1858 03615   0 000000   MISE DAC   **                  MOVE PLOTTER SOUTH-EAST (WITH INT)
1859 03616   14 1127    DP53 OCP   PLSE                SOUTH EAST - DRUM DOWN, CARRIAGE RIGHT
1860 03617   34 0127    DP54 SKS   PLNB                SKIP IF PLOTTER NOT BUSY
1861 03620   0 10 03655       JST   INTD
1862 03621   0 10 04150       JST   ERRR              ERROR ROUTINE
1863 03622  -0 01 03615       JMP*  MISE              EXIT FROM SUBROUTINE
1864 03623   147302            BCI   2,NBSE            P NOT BUSY IMMEDIATELY AFTER MOVING S-EAST
     03624   151705
1865                        *
```

```
1866                        * MOVE PLOTTER SOUTH-WEST ONE STEP (WITH INTERRUPT)
1867 03625   0 000000    MISW DAC   **                 MOVE PLOTTER SOUTH-WEST (WITH INT)
1868 03626   14 1227     DP55 OCP   PLSW               SOUTH WEST - DRUM DOWN, CARRIAGE LEFT
1869 03627   34 0127     DP56 SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1870 03630   0 10 03655       JST   INTD
1871 03631   0 10 04150       JST   ERRR               ERROR ROUTINE
1872 03632  -0 01 03625       JMP*  MISW               EXIT FROM SUBROUTINE
1873 03633   147302          BCI   2,NBSW             P NOT BUSY IMMEDIATELY AFTER MOVING S-WEST
     03634   151727
1874                        *
1875                        * MOVE PEN DOWN (WITH INTERRUPT)
1876 03635   0 000000    MIDN DAC   **                 MOVE PEN DOWN (WITH INT)
1877 03636   14 1427     DP57 OCP   PEND               PEN DOWN
1878 03637   34 0127     DP58 SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1879 03640   0 10 03730       JST   INTZ
1880 03641   0 10 04150       JST   ERRR               ERROR ROUTINE
1881 03642  -0 01 03635       JMP*  MIDN               EXIT FROM SUBROUTINE
1882 03643   147302          BCI   2,NBDN             PEN NOT BUSY IMMEDIATELY AFTER MOVING DOWN
     03644   142316
1883                        *
1884                        * MOVE PEN UP (WITH INTERRUPT)
1885 03645   0 000000    MIUP DAC   **                 MOVE PEN UP (WITH INT)
1886 03646   14 1627     DP59 OCP   PENU               PEN UP
1887 03647   34 0127     DP60 SKS   PLNB               SKIP IF PLOTTER NOT BUSY
1888 03650   0 10 03730       JST   INTZ
1889 03651   0 10 04150       JST   ERRR               ERROR ROUTINE
1890 03652  -0 01 03645       JMP*  MIUP               EXIT FROM SUBROUTINE
1891 03653   147302          BCI   2,NBUP             PEN NOT BUSY IMMEDIATELY AFTER MOVING UP
     03654   152720
1892                        *
1893                        * WAIT FOR INTERRUPT (DIRECTIONAL)
1894 03655   0 000000    INTD DAC   **                 WAIT FOR INTERRUPT (DIRECTIONAL)
1895 03656   0 02 04310       LDA   AIED               ADDRESS OF INTERRUPT ENTRY POINT
1896 03657  -0 04 04331       STA*  INTL               INTERRUPT LOCATION
1897 03660   0 02 01560       LDA   SMKI               SMK '0X20 INSTRUCTION
1898 03661   0 04 03663       STA   *+2
1899 03662   0 02 04337       LDA   MSKB               MASK BIT FOR INTERRUPT
```

```
1900 03663   0 00 00000        ***   **          PERFORM  SMK '0X20 INSTRUCTION
1901 03664   000401            ENB               ENABLE INTERRUPT
1902 03665   0 02 04332        LDA   INTR        INTERRUPT TIMER 4(4.2) MILLI-SECONDS
1903 03666   0 12 04320 DIN1   IRS   CNTA        INCREMENT COUNT A
1904 03667   0 01 03674        JMP   DIN2
1905 03670   0 12 04321        IRS   CNTB        INCREMENT COUNT B [CNTB = CNTA*(2**16)]
1906 03671   0 01 03677        JMP   DIN3
1907 03672   0 12 04322        IRS   CNTC        INCREMENT COUNT C [CNTC = CNTB*(2**16)]
1908 03673   0 01 03702        JMP   DIN4
1909 03674   101000      DIN2  NOP               OBEYS WHEN CNTA IS NON-ZERO
1910 03675   101000            NOP
1911 03676   101000            NOP
1912 03677   101000      DIN3  NOP               OBEYS WHEN CNTB IS NON-ZERO, BUT CNTA ZERO
1913 03700   101000            NOP
1914 03701   101000            NOP
1915 03702   101000      DIN4  NOP               OBEYS WHEN BOTH CNTA AND CNTB ARE ZERO
1916 03703   141206            ADA               ADD ONE TO A-REGISTER
1917 03704   100040            SZE               TEST FOR COMPLETION OF 4(4.2) MS
1918 03705   0 01 03666        JMP   DIN1        DELAY LOOP OF 4(4.2) MS
1919 03706   001001            INH               INHIBIT INTERRUPT
1920 03707   0 10 04150        JST   ERRR        ERROR ROUTINE
1921 03710   101000            NOP
1922 03711   147311            BCI   2,NIND      NO INTERRUPT WITHIN 4(4.2) MS
     03712   147304
1923                     *
1924 03713   0 000000    IEPD  DAC   **          INTERRUPT ENTRY POINT (DIRECTIONAL)
1925 03714   34 0427     DP61  SKS   PLNI        SKIP IF PLOTTER NOT INTERRUPTING
1926 03715   0 01 03722        JMP   DIN5        PLOTTER INTERRUPTING, OK
1927 03716   0 10 04150        JST   ERRR        ERROR ROUTINE
1928 03717   101000            NOP
1929 03720   144716            BCI   2,INCD      INTERRUPT NOT CAUSED BY PLOTTER (DIRECTIONAL)
     03721   141704
1930 03722   0 12 03655 DIN5   IRS   INTD        UPDATE RETURN ADDRESS
1931 03723   34 0127    DP62   SKS   PLNB        SKIP IF PLOTTER NOT BUSY
1932 03724   0 10 04150        JST   ERRR        ERROR ROUTINE
1933 03725  -0 01 03655        JMP*  INTD        EXIT FROM SUBROUTINE
1934 03726   141301            BCI   2,BAID      P REMAINING BUSY AFTER INT (DIRECTIONAL)
```

```
     03727   144704
1935                        *
1936                        * WAIT FOR INTERRUPT (Z-AXIS)
1937 03730    0 000000     INTZ DAC    **                  WAIT FOR INTERRUPT (Z-AXIS)
1938 03731    0 02 04311        LDA    AIEZ                ADDRESS OF INTERRUPT ENTRY POINT
1939 03732   -0 04 04331        STA*   INTL                INTERRUPT LOCATION
1940 03733    0 02 01560        LDA    SMKI                SMK '0X20 INSTRUCTION
1941 03734    0 04 03736        STA    *+2
1942 03735    0 02 04337        LDA    MSKB                MASK BIT FOR INTERRUPT
1943 03736    0 00 00000        ***    **                  PERFORM  SMK '0X20
1944 03737    000401            ENB                        ENABLE INTERRUPT
1945 03740    101020            SS1                        TEST FOR SENSE SWITCH 1 SET
1946 03741    0 01 03744        JMP    D511                NOT SET, DDP-516 BEING USED
1947                        *                              SET, H316 BEING USED
1948 03742    0 02 04372        LDA    =-5208              5208 = (25*1000)/(3*1.6)
1949 03743    100000            SKP
1950                        *
1951 03744    0 02 04371 D511   LDA    =-9690              9690 = (25*1000)/(3*0.86)
1952 03745    141206            AOA
1953 03746    100040            SZE                        TEST FOR COMPLETION OF 25 MS DELAY LOOP
1954 03747    0 01 03745        JMP    *-2                 DELAY LOOP OF 25 MILLI-SECONDS
1955 03750    001001            INH                        INHIBIT INTERRUPT
1956 03751    0 10 04150        JST    ERRR                ERROR ROUTINE
1957 03752    101000            NOP
1958 03753    147311            BCI    2,NINZ              NO INTERRUPT WITHIN 25 MILLI-SECONDS
     03754    147332
1959                        *
1960 03755    0 000000     IEPZ DAC    **                  INTERRUPT ENTRY POINT (Z-AXIS)
1961 03756    34 0427      DP63 SKS    PLNI                SKIP IF PLOTTER NOT INTERRUPTING
1962 03757    0 01 03764        JMP    ZIN0                PLOTTER INTERRUPTING, OK
1963 03760    0 10 04150        JST    ERRR                ERROR ROUTINE
1964 03761    101000            NOP
1965 03762    144716            BCI    2,INCZ              INTERRUPT NOT CAUSED BY PLOTTER (Z-AXIS)
     03763    141732
1966 03764    0 12 03730 ZIN0   IRS    INTZ                UPDATE RETURN ADDRESS
1967 03765    34 0127      DP64 SKS    PLNR                SKIP IF PLOTTER NOT BUSY
1968 03766    0 10 04150        JST    ERRR                ERROR ROUTINE
```

```
1969 03767  -0 01 03730      JMP*  INTZ              EXIT FROM SUBROUTINE
1970 03770   141301         BCI   2,BAIZ            P REMAINING BUSY AFTER INT (Z-AXIS)
     03771   144732
1971                      *
1972                      * HALF REGAB AND ADD DOUBLE LENGTH COUNTER
1973 03772   0 000000     HADD DAC   **
1974 03773   000201            IAB                   INTERCHANGE REGS A AND B
1975 03774   140200            RCB                   ZERO C BIT
1976 03775   141206            ADA                   ADD ONE
1977 03776   140100            SSP                   ZERO MS BIT OF REG A
1978 03777   000201            IAB                   INTERCHANGE REGS A AND B
1979 04000   141216            ACA                   ADD CARRY BIT
1980 04001   0401 77           LRS   1               REGAB = ROUNDED VALUE
1981 04002   0 06 04321        ADD   CNTB            ADD MS HALF OF COUNTER
1982 04003   000201            IAB                   INTERCHANGE REGS A AND B
1983 04004   140200            RCB                   ZERO C BIT
1984 04005   0 06 04320        ADD   CNTA            ADD LS HALF OF COUNTER
1985 04006   140100            SSP                   ZERO MS BIT OF REGA
1986 04007   000201            IAB                   INTERCHANGE REGS A AND B
1987 04010   141216            ACA                   ADD CARRY BIT
1988 04011  -0 01 03772        JMP*  HADD            EXIT FROM SUBROUTINE
1989                      *
1990                      * CALCULATE [(0.4142*M) - INTEGER]*(2**13)
1991 04012   0 000000     CALC DAC   **              CALCULATE [(0.4142*M) - INTEGER]*(2**13)
1992 04013   0 02 04336        LDA   MRKR            MARKER (M)
1993 04014   0414 77           LGL   1               REGA = 2M
1994 04015   0 06 04336        ADD   MRKR            REGA = 3M
1995 04016   0414 76           LGL   2               REGA = 12M
1996 04017   0 06 04336        ADD   MRKR            REGA = 13M
1997 04020   0414 76           LGL   2               REGA = 52M
1998 04021   0 06 04336        ADD   MRKR            REGA = 53M
1999 04022   000201            IAB                   REGA = JUNK + REGB = 53M
2000 04023   0410 72           LLL   6               REGAB = 3392M (MS BITS OF REGA = JUNK)
2001 04024   000201            IAB                   REGA = LS HALF OF 3392M
2002 04025   0 06 04336        ADD   MRKR            REGA = LS HALF OF 3393M
2003 04026   0 03 04370        ANA   ='17777         REGA = [(0.4142*M) - INTEGER]*(2**13)
2004 04027  -0 01 04012        JMP*  CALC            EXIT FROM SUBROUTINE
```

```
2005                        *
2006                        * OUTPUT TO AUTOMATIC SEND-RECEIVE SET
2007 04030   0 000000    OASR DAC   **                  OUTPUT TO ASR
2008 04031   0 04 04324       STA   CNTR                WORD COUNTER
2009 04032   14 0104          OCP   ASRT                ENABLE ASR IN OUTPUT MODE
2010 04033  -0 02 04030 0001 LDA*  OASR                FETCH NEXT WORD TO OUTPUT
2011 04034   141340           ICA
2012 04035   74 0004          OTA   ASRO                OUTPUT MS CHARACTER TO ASR
2013 04036   0 01 04035       JMP   *-1                 DELAY IF ASR NOT READY
2014 04037   141140           ICL
2015 04040   74 0004          OTA   ASRO                OUTPUT LS CHARACTER TO ASR
2016 04041   0 01 04040       JMP   *-1                 DELAY IF ASR NOT READY
2017 04042   0 12 04030       IRS   OASR                UPDATE RETURN ADDRESS
2018 04043   0 12 04324       IRS   CNTR                INCREMENT WORD COUNTER
2019 04044   0 01 04033       JMP   0001                OUTPUT NEXT WORD TO ASR
2020 04045   34 0104          SKS   ASRB                SKIP IF ASR NOT BUSY
2021 04046   0 01 04045       JMP   *-1                 DELAY UNTIL NOT BUSY
2022 04047  -0 01 04030       JMP*  OASR                EXIT FROM SUBROUTINE
2023                        *
2024                        * INPUT FROM AUTOMATIC SEND-RECEIVE SET
2025 04050   0 000000    IASR DAC   **                  INPUT FROM ASR
2026 04051   0 04 04324       STA   CNTR                CHARACTER COUNTER
2027 04052   0 02 04313       LDA   CHRL
2028 04053   0 04 04345       STA   TMPB                START ADDRESS FOR INPUT
2029 04054   140040           CRA
2030 04055   0 04 04315       STA   CHR1
2031 04056   0 04 04316       STA   CHR2
2032 04057   14 0004          OCP   ASRN
2033 04060   0 02 04367 I001 LDA   ='200               ENSURE BIT 8 OF CHARACTER IS SET
2034 04061   54 0004          INA   ASRI
2035 04062   0 01 04061       JMP   *-1                 DELAY IF ASR NOT READY
2036 04063  -0 04 04345       STA*  TMPB                STORE INPUT CHARACTER
2037 04064   0 12 04345       IRS   TMPB                UPDATE TO ADDR OF NEXT CHARACTER
2038 04065   0 11 04366       CAS   ='215               '215 = CARRIAGE RETURN CHARACTER
2039 04066   100000           SKP                       INPUT CHAR OTHER THAN CR
2040 04067   0 01 04077       JMP   I002                INPUT CHARACTER IS CARRIAGE RETURN
2041 04070   0 11 04365       CAS   ='244               '244 = DOLLAR SIGN CHARACTER
```

```
2042 04071   100000          SKP
2043 04072   0 01 01044      JMP    CHNG
2044 04073   0 12 04324      IRS    CNTR
2045 04074   0 01 04060      JMP    I001
2046 04075   0 12 04050      IRS    IASR
2047 04076  -0 01 04050      JMP*   IASR
2048                        *
2049 04077   0 02 04315 I002 LDA    CHR1
2050 04100   0 11 04366      CAS    ='215
2051 04101   0 01 04114      JMP    I003
2052 04102   100000          SKP
2053 04103   0 01 04114      JMP    I003
2054 04104  -0 02 04050      LDA*   IASR
2055 04105   0 04 04345      STA    TMPB
2056 04106  -0 02 04345      LDA*   TMPB
2057 04107   141140          ICL
2058 04110   0 04 04315      STA    CHR1
2059 04111  -0 02 04345      LDA*   TMPB
2060 04112   141050          CAL
2061 04113   0 04 04316      STA    CHR2
2062 04114   0 12 04050 I003 IRS    IASR
2063 04115   0 12 04050      IRS    IASR
2064 04116  -0 01 04050      JMP*   IASR
2065                        *
2066                        * TEST INPUT DECIMAL 00-99
2067 04117   0 000000   DCML DAC    **
2068 04120   0 02 04431      LDA    =-2
2069 04121   0 04 04324      STA    CNTR
2070 04122   0 02 04313      LDA    CHRL
2071 04123   0 04 04345      STA    TMPB
2072 04124  -0 02 04345 TNC2 LDA*   TMPB
2073 04125   0 12 04345      IRS    TMPB
2074 04126   0 07 04430      SUB    ='260
2075 04127   100400          SPL
2076 04130  -0 01 04117      JMP*   DCML
2077 04131   0 07 04447      SUB    =10
2078 04132   101400          SMI
```

```
INPUT CHAR OTHER THAN $
INPUT CHAR IS $, REPEAT FROM THE FIRST QSTN
INCREMENT CHARACTER COUNTER
INPUT NEXT CHARACTER FROM ASR
UPDATE RETURN ADDRESS
EXIT 1 - CR NOT TYPED, REPEAT THE QUESTION

FIRST INPUT CHARACTER
'215 = CR CHARACTER
FIRST INPUT CHAR OTHER THAN CR
FIRST INPUT CHARACTER IS CARRIAGE RETURN
FIRST INPUT CHAR OTHER THAN CR
ADDRESS OF LAST ANSWER

LAST ANSWER
MS HALF OF LAST ANSWER

LAST ANSWER
LS HALF OF LAST ANSWER

UPDATE RETURN ADDRESS
UPDATE RETURN ADDRESS
EXIT FROM SUBROUTINE


TEST INPUT DECIMAL 00-99
NUMBER OF CHARACTERS TO BE TESTED
CHARACTER COUNTER


CHARACTER
NEXT CHARACTER
'260 = CHARACTER ZERO
TEST FOR VALIDITY OF CHARACTER
EXIT 1 - INVALID CHAR, REPEAT THE QUESTION

TEST FOR VALIDITY OF CHARACTER
```

```
2079 04133  -0 01 04117      JMP*  DCML      EXIT 1 - INVALID CHAR, REPEAT THE QUESTION
2080 04134   0 12 04324      IRS   CNTR      INCREMENT CHARACTER COUNTER
2081 04135   0 01 04124      JMP   TNC2      TEST NEXT CHARACTER
2082 04136   0 02 04315      LDA   CHR1      FIRST INPUT CHARACTER (TENS DIGIT)
2083 04137   0 05 04430      ERA   ='260
2084 04140   0414 76         LGL   2         REGA = 4*(TENS DIGIT)
2085 04141   0 06 04315      ADD   CHR1      REGA = 5*(TENS DIGIT)
2086 04142   0 07 04430      SUB   ='260
2087 04143   0414 77         LGL   1         REGA = 10*(TENS DIGIT)
2088 04144   0 06 04316      ADD   CHR2      REGA = 10*(TENS DIGIT) + UNITS DIGIT
2089 04145   0 07 04430      SUB   ='260
2090 04146   0 12 04117      IRS   DCML      UPDATE RETURN ADDRESS
2091 04147  -0 01 04117      JMP*  DCML      EXIT 2 - CHARACTERS OK
2092                        *
2093                        * ERROR ROUTINE
2094 04150   0 000000   ERRR DAC   **        ERROR ROUTINE
2095 04151   34 0127    DP65 SKS   PLNB
2096 04152   0 01 04151      JMP   *-1       DELAY UNTIL NOT BUSY
2097 04153   14 1627    DP68 OCP   PENU
2098 04154   0 12 04150      IRS   ERRR      UPDATE TO ADDRESS OF ERROR MESSAGE
2099 04155  -0 02 04150      LDA*  ERRR      MS HALF OF ERROR MESSAGE
2100 04156   0 04 04170      STA   EMSG
2101 04157   0 12 04150      IRS   ERRR      UPDATE TO ADDRESS OF ERROR MESSAGE + 1
2102 04160  -0 02 04150      LDA*  ERRR      LS HALF OF ERROR MESSAGE
2103 04161   0 04 04171      STA   EMSG+1
2104 04162   0 02 04432      LDA   =-8       NUMBER OF WORDS TO BE OUTPUT
2105 04163   0 10 04030      JST   OASR
2106 04164   105212         OCT   105212    LF/LF
2107 04165   142722         BCI   3,ERROR
     04166   151317
     04167   151240
2108 04170              EMSG BSS   2         ERROR MESSAGE
2109 04172   103607         OCT   103607,103607   BELL/BELL/BELL/BELL
     04173   103607
2110 04174   0 35 04350      LDX   20NU      STEP COUNTER (NO OF STEPS IN 20 UNITS)
2111 04175   34 0127    DP66 SKS   PLNB
2112 04176   0 01 04175      JMP   *-1       DELAY UNTIL NOT BUSY
```

```
2113 04177   14 0427     DP67 OCP   PLNT
2114 04200   0 12 00000       IRS   0                INCREMENT STEP COUNTER
2115 04201   0 01 04175       JMP   *-4              MOVE PLOTTER NEXT STEP
2116 04202   0 01 01722       JMP   AQTN             ASK QUESTION: TEST NO?
2117                        *
2118                        *
2119                        * CONSTANTS
2120                        *
2121                        * TABLE FOR DIGITAL INCREMENTAL PLOTTER INSTRUCTION ADDRESSES
2122 04203   0 001561     TBLE DAC   DP01
2123 04204   0 001566          DAC   DP02
2124 04205   0 001577          DAC   DP03
2125 04206   0 001612          DAC   DP04
2126 04207   0 001633          DAC   DP05
2127 04210   0 001646          DAC   DP06
2128 04211   0 001667          DAC   DP07
2129 04212   0 001702          DAC   DP08
2130 04213   0 002410          DAC   DP09
2131 04214   0 003226          DAC   DP10
2132 04215   0 003242          DAC   DP11
2133 04216   0 003243          DAC   DP12
2134 04217   0 003252          DAC   PET0
2135 04220   0 003264          DAC   DP14
2136 04221   0 003265          DAC   DP15
2137 04222   0 003274          DAC   PWT0
2138 04223   0 003306          DAC   DP17
2139 04224   0 003307          DAC   DP18
2140 04225   0 003316          DAC   PNT0
2141 04226   0 003330          DAC   DP20
2142 04227   0 003331          DAC   DP21
2143 04230   0 003340          DAC   PNE0
2144 04231   0 003352          DAC   DP23
2145 04232   0 003353          DAC   DP24
2146 04233   0 003362          DAC   PNW0
2147 04234   0 003374          DAC   DP26
2148 04235   0 003375          DAC   DP27
2149 04236   0 003404          DAC   PST0
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2150 04237    0 003416        DAC    DP29
2151 04240    0 003417        DAC    DP30
2152 04241    0 003426        DAC    PSE0
2153 04242    0 003440        DAC    DP32
2154 04243    0 003441        DAC    DP33
2155 04244    0 003450        DAC    PSW0
2156 04245    0 003462        DAC    DP35
2157 04246    0 003463        DAC    DP36
2158 04247    0 003476        DAC    PDN0
2159 04250    0 003510        DAC    DP38
2160 04251    0 003511        DAC    DP39
2161 04252    0 003524        DAC    PUP0
2162 04253    0 003536        DAC    DP41
2163 04254    0 003537        DAC    DP42
2164 04255    0 003546        DAC    DP43
2165 04256    0 003547        DAC    DP44
2166 04257    0 003556        DAC    DP45
2167 04260    0 003557        DAC    DP46
2168 04261    0 003566        DAC    DP47
2169 04262    0 003567        DAC    DP48
2170 04263    0 003576        DAC    DP49
2171 04264    0 003577        DAC    DP50
2172 04265    0 003606        DAC    DP51
2173 04266    0 003607        DAC    DP52
2174 04267    0 003616        DAC    DP53
2175 04270    0 003617        DAC    DP54
2176 04271    0 003626        DAC    DP55
2177 04272    0 003627        DAC    DP56
2178 04273    0 003636        DAC    DP57
2179 04274    0 003637        DAC    DP58
2180 04275    0 003646        DAC    DP59
2181 04276    0 003647        DAC    DP60
2182 04277    0 003714        DAC    DP61
2183 04300    0 003723        DAC    DP62
2184 04301    0 003756        DAC    DP63
2185 04302    0 003765        DAC    DP64
2186 04303    0 004151        DAC    DP65
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2187 04304    0 004175          DAC   DP66
2188 04305    0 004177          DAC   DP67
2189 04306    0 004153          DAC   DP68
2190 04307    0 004364          DAC   =0
2191                    *
2192 04310    0 003713    AIED  DAC   IEPD          ADDR OF INTERRUPT ENTRY POINT (DIRECTIONAL)
2193 04311    0 003755    AIEZ  DAC   IEPZ          ADDR OF INTERRUPT ENTRY POINT (Z-AXIS)
2194 04312    0 002255    AMSG  DAC   MSSG          START ADDRESS OF SPEED MESSAGE
2195 04313    0 004315    CHRL  DAC   CHR1          CHARACTER LOCATION
2196                    *
2197 04314   -0 004203    IATB  DAC*  TBLE          INDIRECT ADDRESS OF TABLE
2198                    *
2199                    *
2200                    * VARIABLES
2201                    *
2202 04315    000000      CHR1  BSZ   1             CHARACTER - ONE
2203 04316    000000      CHR2  BSZ   1             CHARACTER - TWO
2204 04317    000000            BSZ   1             CHARACTER - THREE
2205 04320    000000      CNTA  BSZ   1             COUNT A
2206 04321    000000      CNTB  BSZ   1             COUNT B
2207 04322    000000      CNTC  BSZ   1             COUNT C
2208 04323    000000      CNTD  BSZ   1             COUNT D
2209 04324    000000      CNTR  BSZ   1             COUNTER
2210 04325    000000      DMTR  BSZ   1             DIAMETER OF THE CIRCULAR FIGURE
2211 04326    000000      DPDA  BSZ   1             DIGITAL PLOTTER DEVICE ADDR (2 DIGIT OCT)
2212 04327    000000      DRTR  BSZ   1             DIRECTIONAL TIMER
2213 04330    000000      FGRC  BSZ   1             FIGURE COUNTER
2214 04331    000000      INTL  BSZ   1             INTERRUPT LOCATION
2215 04332    000000      INTR  BSZ   1             INTERRUPT TIMER
2216 04333    000000      LMAX  BSZ   1             MAXIMUM RANGE OF EAST-WEST LIMIT
2217 04334    000000      LMIN  BSZ   1             MINIMUM RANGE OF EAST-WEST LIMIT
2218 04335    000000      LMIT  BSZ   1             NUMBER OF STEPS IN EAST-WEST LIMIT
2219 04336    000000      MRKR  BSZ   1             MARKER (M)
2220 04337    000000      MSKB  BSZ   1             MASK BIT FOR INTERRUPT (2 DIGIT DEC)
2221 04340    000000      NUNT  BSZ   1             TWO'S COMPLEMENT OF NO OF STEPS IN ONE UNIT
2222 04341    000000      PALL  BSZ   1             MARKER FOR PLOTTING ALL PATTERNS
2223 04342    000000      PNTR  BSZ   1             POINTER (ADDRESS FOR INSERTION OF SPEED)
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2224 04343   000000     RDUS BSZ   1              RADIUS OF THE CIRCULAR FIGURE
2225 04344   000000     ROWC BSZ   1              ROW COUNTER
2226 04345   000000     TMPB BSZ   1              TEMPORARY BUFFER
2227 04346   000000     UNIT BSZ   1              NUMBER OF STEPS IN ONE UNIT LENGTH
2228 04347   000000     10NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 10 UNITS
2229 04350   000000     20NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 20 UNITS
2230 04351   000000     30NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 30 UNITS
2231 04352   000000     40NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 40 UNITS
2232 04353   000000     45NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 45 UNITS
2233 04354   000000     50NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 50 UNITS
2234 04355   000000     60NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 60 UNITS
2235 04356   000000     70NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 70 UNITS
2236 04357   000000     80NU BSZ   1              TWO'S COMPLEMENT OF NO OF STEPS IN 80 UNITS
2237 04360   000000     707D BSZ   1              0.707*(DIAMETER OF SIXTEEN POINTED STAR)
2238 04361   000000     707R BSZ   1              0.707*(RADIUS OF SIXTEEN POINTED STAR)
2239 04362   000000     92DM BSZ   1              0.92*(DIAMETER OF SIXTEEN POINTED STAR)
2240 04363   000000     92RD BSZ   1              0.92*(RADIUS OF SIXTEEN POINTED STAR)
2241                    *
2242                    *
2243                    * LITERALS
2244 04364   000000          FIN                 LITERALS
     04365   000244
     04366   000215
     04367   000200
     04370   017777
     04371   155046
     04372   165650
     04373   166423
     04374   172724
     04375   000305
     04376   177610
     04377   010000
     04400   177732
     04401   000144
     04402   001750
     04403   000006
     04404   177774
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04405   177704
04406   000301
04407   000311
04410   000000
04411   177772
04412   170020
04413   000020
04414   000061
04415   177764
04416   000063
04417   000001
04420   000021
04421   000240
04422   000316
04423   000331
04424   177766
04425   177700
04426   000007
04427   000010
04430   000260
04431   177776
04432   177770
04433   003037
04434   003305
04435   000264
04436   006077
04437   006611
04440   000263
04441   177243
04442   177504
04443   176322
04444   177112
04445   002323
04446   002525
04447   000012
04450   000262
04451   177263
```

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     04452   177515
     04453   176370
     04454   177137
     04455   004646
     04456   005252
     04457   000024
     04460   000261
     04461   177775
     04462   177767
     04463   177777
     04464   177736

2245                 *
2246                 *
2247                      END   STRT              END OF 016-DPT9  2.3.70  P.J.F
NO ERRORS IN ABOVE ASSEMBLY.
$DA 41285326-002-02
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