APPROVED BY
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IDENTIFICATION

Integer Cathode Ray Tube Display, MU SCP1

M. R. Storm - May 7, 1957

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PURPOSE

To display one decimal integer, I, on the 740 Output Recorder with dim spot intensity. A minus sign is prefixed on negative integers.

RESTRICTIONS

The size of each decimal character is determined by the number appearing in the prefix field of the first word following the TSX entry to this routine. The range, of course, is zero to seven. A prefix of 1 is recommended for this program. Zero, in most instances, is too small and numbers much greater than 1 usually result in distorted characters. The origin of the coordinate system is assumed to be in the lower left hand corner.

METHOD

Accuracy: Integers, I, are converted exactly.

Range: $0 \leq |I| \leq 2^{35} - 1$

USAGE

Calling Sequence: Entry to this routine is made with the integer in the accumulator. The binary point is assumed to be to the right of the 35th bit position.

UA SAP

Loc.	Instruction
α	TSX SCP1, 4
$\alpha + 1$	(prefix) Y, 0, X
$\alpha + 2$	normal return

MURASS

Loc.	Instruction
α	B TSX A 4
$\alpha + 1$	C N Y 0 X
$\alpha + 2$	normal return

where

Prefix = N = numbered size of character $0 \leq N \leq 7$
X = the x-coordinate $0 \leq X \leq (1023)$
Y = the y-coordinate $0 \leq Y \leq (1023)$

The integer will be displayed horizontally with the coordinates specified as the center of the last character.

This routine does not plot the coordinate axes nor advance the film frame.

Prior to exit the accumulator overflow indicator is turned off and the original contents of all three index registers are restored.

Space Required:

	UA SAP	MURASS
86 words program at	SCP1	A
9 words temporary at	COMMON	T

CODING INFORMATION

Timing: The maximum time between entry and exit is 105 ms. If it is assumed that nearly all of the integers are between 1 and 5 characters then the average time is about 28 ms.

Character Raster Size: The standard raster used is a 5 x 7 array of active spots with 0 to 7 dead spots available between each active spot. The number of dead spots is determined from the number in the prefix fields of the (α + 1) word. A table of key words for each decimal character and the minus sign is found at the end of this routine. The bit positions (1 - 35) of each word are made to correspond to the 35 active spots of the raster. A raster is displayed from top to bottom and from left to right.

```
        REM  SCP1  MURA INTEGER CRT DISPLAY                          MU   SCP1
SCP1    SXD COMMON+1,1        SAVE X1                              SCP1  0001
        SXD COMMON+2,2        SAVE XI                              SCP1  0002
        SXD COMMON+4,4        SAVE X4                              SCP1  0003
        STO COMMON            STORE INTEGER I                      SCP1  0004
        WTV                   SELECT CRT                           SCP1  0005
        CLA SCP1+73           MASK FOR X AND Y                     SCP1  0006
        STO COMMON+3                                               SCP1  0007
        CAL 1,4               PARAMETER WORD TO AC                 SCP1  0008
        ANS COMMON+3          X AND Y TO STORAGE                   SCP1  0009
        ARS 32                2S                                   SCP1  0010
        ACL SCP1+72           DEFINE 2S*=2(S+1)                    SCP1  0011
        STO COMMON+5                                               SCP1  0012
        ALS 1                 4S*                                  SCP1  0013
        ADD COMMON+5          6S*                                  SCP1  0014
        ARS 1                 3S*                                  SCP1  0015
        ADD COMMON+3          Y+3S*=Y*                             SCP1  0016
        STA COMMON+3          STORE FIRST Y COORDINATE             SCP1  0017
        CLS COMMON+5          -2S*                                 SCP1  0018
        ARS 1                 -S*                                  SCP1  0019
        STA COMMON+5          S* TO STORAGE                        SCP1  0020
        ALS 19                -2S* POSITIONED                      SCP1  0021
        ADD COMMON+3          X*=X-2S*                             SCP1  0022
        STD COMMON+3          FIRST X COORDINATE                   SCP1  0023
        CLA COMMON+3                                               SCP1  0024
        STO COMMON+6          RUNNING COORDINATES                  SCP1  0025
        LDQ COMMON            I TO MQ                              SCP1  0026
        TOV SCP1+27           OVERFLOW OFF                         SCP1  0027
        LXA SCP1+28,2         SET X2 TO 5                          SCP1  0028
        PXD 5                 CLEAR AC                             SCP1  0029
        DVH SCP1+74           DIVIDE BY TEN                        SCP1  0030
        PAX 7,4               PLACE DECIMAL DIGIT IN X4            SCP1  0031
        STQ COMMON+7          I*=UNCONVERTED PORTION               SCP1  0032
        CLA SCP1+84,4         KEY WORD                             SCP1  0033
        LXA SCP1+30,1         SET X1 TO 7                          SCP1  0034
        ALS 1                 POSITION BIT OF KEY WORD             SCP1  0035
        STO COMMON+8          STORE SHIFTED KEY WORD               SCP1  0036
        TNO SCP1+38           TRANSFER IF BIT IS ZERO              SCP1  0037
        CPY COMMON+6          PLOT POINT                           SCP1  0038
        TNX SCP1+44,1,1       DECREASE Y COUNT                     SCP1  0039
        CLS COMMON+5          -S*                                  SCP1  0040
        ADM COMMON+6          Y-S*                                 SCP1  0041
        STA COMMON+6          NEXT Y COORDINATE                    SCP1  0042
        CLA COMMON+8          KEY WORD BACK TO AC                  SCP1  0043
        TRA SCP1+34                                                SCP1  0044
        CLA COMMON+3                                               SCP1  0045
        STA COMMON+6          RESET Y*                             SCP1  0046
        TIX SCP1+62,2,1       DECREASE X COUNT                     SCP1  0047
        CLS COMMON+5          -S*                                  SCP1  0048
        ALS 3                 -8S*                                 SCP1  0049
        ADD COMMON+5          -7S*                                 SCP1  0050
        ALS 18                POSITION                             SCP1  0051
        ADM COMMON+3          X*-7S*                               SCP1  0052
        STD COMMON+3          NEW X*                               SCP1  0053
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```
STD COMMON+6                                                    SCP1  0054
LDQ COMMON+7          I* TO MQ                                  SCP1  0055
CLA COMMON+7          I* TO AC                                  SCP1  0056
TNZ SCP1+26           TRANSFER IF I* NOT ZERO                   SCP1  0057
CLA COMMON            I TO AC                                   SCP1  0058
TPL SCP1+68           TEST FOR SIGN                             SCP1  0059
TXH SCP1+68,4,10      OUT AFTER PLOTTING MINUS                  SCP1  0060
LXA SCP1+28,6         X4 AND X2 TO 5                            SCP1  0061
TXI SCP1+32,4,-6      SET X4 TO -1                              SCP1  0062
CLA COMMON+5          S*                                        SCP1  0063
ALS 18                POSITION                                  SCP1  0064
ADM COMMON+6          X*+S**                                    SCP1  0065
STD COMMON+6          STORE NEXT X*                             SCP1  0066
CLA COMMON+8          RETURN KEY WORD TO AC                     SCP1  0067
TRA SCP1+33                                                     SCP1  0068
LXD COMMON+1,1        RESTORE INDEX REGISTERS                   SCP1  0069
LXD COMMON+2,2                                                  SCP1  0070
LXD COMMON+4,4                                                  SCP1  0071
TRA 2,4               EXIT                                      SCP1  0072
HTR 2                                                           SCP1  0073
OCT 007777007777                                                SCP1  0074
HTR 10                                                          SCP1  0075
OCT 141104462474                                                SCP1  0076
OCT 155114462266                                                SCP1  0077
OCT 207044424140                                                SCP1  0078
OCT 074514442206                                                SCP1  0079
OCT 005714462306                                                SCP1  0080
OCT 030242236604                                                SCP1  0081
OCT 105014462266                                                SCP1  0082
OCT 107054462261                                                SCP1  0083
OCT 000417740200                                                SCP1  0084
OCT 175014060276                                                SCP1  0085
OCT 020100402010                                                SCP1  0086
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