TB188 (Rev-2) - Automatic Sequential Part Numbering for Engraving

Purpose:

This document describes how to set up Automatic Sequential Part Numbering for Engraving. Each time the operator presses cycle start to machine the next part, the serial number being machined into the part will automatically increment numerically.

Requirements:

Operator's Manual
MillWrite Manual

Overview:

Macro & sub program file names can be changed to match a family of parts so you can have different family names to do serial numbers for different parts.

The example program is written to machine numbers that are .125" high and spaced .125" apart. We are using three macro programs and ten individual sub-program G-code files. The 10 individual sub programs define the shape to be machined for each number (0,1,2,3,4,5,6,7,8,9). The first macro program sets the variables, calls the second macro program to assign variable #151 with the next serial number to engrave, and then calls the third macro program which will set the spacing for the number and which number to engrave. The first macro program also increments the serial number for each run by the amount you set and saves it to the second macro program after running the third macro program. The third macro program calls the sub-program for each of the numbers to be engraved.

We created our sub programs (G code files) for each number 0 through 9 (10 files). We used MillWrite software to create the sub programs for the individual numbers.

(**Note**: MillWrite is an optional conversational engraving program, which quickly creates G code programs for letters, numbers, and symbols. In this case, the base number G code program that is being used could be created by many different CAD/CAM programs or even by hand. MillWrite was chosen because of its ease of use and simplicity.)

*****For additional information on variables, sub-programs, macros, and parameter settings, see Chapter 11 CNC Program Codes, Chapter 12 G-codes, Chapter 13 M functions, and Chapter 15 - Configuration of the operator's manual. Also, see the MillWrite manual for creating and editing MillWrite programs.

Procedure:

Program 1: The main program that will define all of the variables.

Before you run example program #1 for the very first time, you need to edit the second macro program "Serial-Num-Record.DAT" with the starting serial number. After that, you will not have to do this unless you want a
different starting serial number.

Once variable #151 is correct in "Serial-Num-Record.DAT", look at example program #1 to see what the program should look like by graphing it.

Example Program #1:

```
; Program name: SER-Num-SN.CNC
; Macro program that calls engraving numbers.
; Purpose: Draw an integer value that will index automatically.
; Parameters:
; #A - Number to draw.
; #B - Total character width of numeric field.
; #C - 0 = Pad with leading zeros, 1 = pad with spaces.
; #D - X Spacing between numbers.
; #E - Y Spacing between numbers.
; #145 = 59  ; (ASCII ';')
; Notes: This routine will always draw the full value.
M25
T1 M6
S6000 M3
M8
G4 P2
G43 H1
G0 X0 Y0 Z.05
;
; Getting the next serial number to be used and assigning it to #151
M98 "Serial-Num-Record.DAT"
;
; Calling next level down in the macro to engrave numbers G65 "SERIAL-Num.CNC" A#151 B5 C0 D.125 E0
; If graphing, the program goes to N1999 and skips indexing the number and storing it in a file.
IF [#4201 == 1] THEN GOTO 1999;
; Index Number, Save to Parameter, and adds this Serial # to the File for a history.
#151 = #151 + 1 ; See chapter 11 for more info. about other variable that can be used.
M121"SER-Num-SN.CNC"; See Chapter 13 M functions about saving to a file.
M123 P[#151]
;
;This section is used to write the next serial number in file "Serial-Num-Record.DAT" that is read
;at the beginning of this program to assign #151 with the next number to engrave.
;
IF [#25018 == 10] then if #6001      ; CNC10 HOLD JOB PROCESSING UNTIL NOW
IF [#25018 != 10] then if #50001     ; CNC11 HOLD JOB PROCESSING UNTIL NOW

#145 = 59                            ; Assigning #145 to (ASCII ';')

M120"Serial-Num-Record.DAT"; See Chapter 13  M functions about saving to a file.
;See Chapter 13 M functions about writing to a file.
M123 ;;File Name "Serial-Num-Record.DAT"
M223 "#151 = %.0f          %c - Next Serial Number\n" #151 #145
; End of writing next serial number to the file.
;
N1999 ; Line to GOTO if graphing
M5
M9
M25
;END OF PROGRAM
```

Note: The G-code line with the G65 in file Ser-Num-SN.CNC could be added to an Intercon file. The G-code lines from the IF statement to the N1999 line should be added to the very end of the Intercon file. This would be done so the numbering could be combined with other operations.

Program 2: The file that the next serial number is saved to and when the G98 reads it, it will set #151 with the next serial when the program is run.

Example Program #2:

```
 ;File Name "Serial-Num-Record.DAT"
#151 = 1          ; - Next Serial Number
```

Note: This file needs to be created before running Example 1 program for the first time with the starting serial number. After that, Example #1 program will update this file automatically each time it is run with the next serial number.

Program 3: The file that extracts the integer to be engraved.

The following is a macro program to extract the integer from the number to engrave. The parameters that are used are explained in the program. All of the parameters are not used in this example, but are there so that it can be used as a master program and can be easily changed for other numbers.

Example Program #3:

```
; SERIAL-Num.CNC
; Purpose:    Draw an integer value using a G-code file for each integer.
; Parameters:
;        #A - Number to draw.
;        #B - Total character width of numeric field. (Maximum 9)
;        #C - 0 = pad with leading zeros, 1 = pad with spaces.
;        #D - X Spacing between numbers.
;        #E - 4TH Axis (rotary) Spacing between numbers.
;        #G - Holds digit to write.
;        #I - Loop index.
;        #J - Position of number being cut.
;        #N - Used to extract number.
;        #P - Used to hold value if padded with zeros or spaces.
;        #T - Holds transformed integer (reversed order of number).
;        #X - Machine position for "X" set from parameter #5041.
;        #Y - Machine position for "Y" set from parameter #5042.
;        #Z - Machine position for "Z" set from parameter #5043.
;        #W - Machine position for "4th" axis (Rotary) set from parameter #5044.
; Notes:      This routine will always draw the full value.


#[N] = #A ; Used to extract digits.
#[T] = 0  ; Holds transformed integer (reversed digits),
          ; setting to zero to start.
#[P] = #C ; setting #P equal to parameter #C.
#[I] = 0  ; Loop index, setting to zero to start.

; Transform the integer by reversing the order of its digits.

N1
  #[T] = [#T * 10] + [#N % 10]       ;Shift transformed integer left
                                     ; and adds Least Significant Digit
                                     ; (LSD)
  #[N] = [#N / 10] OR 0              ;Shift number right and truncate
  #[I] = #I + 1                      ;Add 1 to Loop index
  IF [[#I < #B] || [#N != 0]] GOTO 1 ; Loops back to finish reversing
                                     ; the order of the number.

; Write each digit.
```

```
#[I] = 0   ; Setting Index loop to zero

N2
  #[G] = #T % 10   ;Setting #G equal to LSD

 ; Make leading zero a space, if requested.
  IF [#G != 0] || [#I + 1 >= #B] THEN #[P] = 0
  IF [#P && [#G == 0] && #C] THEN #[G] = 32

     #[X] = #5041     ; Saving machine position for X
     #[Y] = #5042     ; Saving machine position for Y
     #[Z] = #5043     ; Saving machine position for Z
     #[W] = #5044     ; Saving machine position for 4th axis

:M00 ;READY TO CALL NEXT NUMBER
: Goes to the "N" block for each number (integer X 10)

 GOTO [#G * 10]

 N0 ; Number Zero (0)

     G65 "Ser-Num-0.CNC" ; Calls file to engrave Zero (0)

     GOTO 100

 N10 ; Number One (1)
     G65 "Ser-Num-1.CNC" ; Calls file to engrave One (1)

     GOTO 100

 N20 ; Number Two (2)
     G65 "Ser-Num-2.CNC" ; Calls file to engrave Two (2)

     GOTO 100

 N30 ; Number Three (3)
     G65 "Ser-Num-3.CNC" ; Calls file to engrave Three (3)

     GOTO 100

 N40 ; Number Four (4)
     G65 "Ser-Num-4.CNC" ; Calls file to engrave Four (4)

     GOTO 100

 N50 ; Number Five (5)
     G65 "Ser-Num-5.CNC" ; Calls file to engrave Five (5)

     GOTO 100

 N60 ; Number Six (6)
     G65 "Ser-Num-6.CNC" ; Calls file to engrave Six (6)

     GOTO 100

 N70 ; Number Seven (7)
     G65 "Ser-Num-7.CNC" ; Calls file to engrave Seven (7)

     GOTO 100

 N80 ; Number Eight (8)
     G65 "Ser-Num-8.CNC" ; Calls file to engrave Eight (8)
     GOTO 100

 N90 ; Number Nine (9)
     G65 "Ser-Num-9.CNC" ; Calls file to engrave Nine (9)

     GOTO 100

N320  ; Used for padding with spaces
    GOTO 100

N100 ; Shifts number to the right and deletes integer that was just cut.
  #[T] = [#T / 10] OR 0    ; Shift number right and truncate
  #[I] = #I + 1            ; Add 1 to Index loop

  IF [#I >= #B] GOTO 200  ; Goes to N200 if no more integers.

; Moving X and Y to start of next number.

  G90 ; Changes back to absolute positioning.
  IF [[#I < #B] || [#T !=0]] THEN #[X] = #X + #D ;Sets #X to Start of next number.
  IF [[#I < #B] || [#T !=0]] THEN #[W] = #W + #E ;Sets #W "4TH AXIS" to Start of next number.

  G0 X[#X]A[#W]  ; Moves to start of next number

 GOTO 2  ; Returns to N2 if there are more integers to cut.

N200     ; Used so machine does not position for another integer.


M99 ;  End of sub-program
```

Setting up the programs to do each number

Use MillWrite to create the files for each number.

1. Set up the numbers so the lower left corner is 0,0 and the G-Code is incremental. The reason the lower left corner is set to zero is so that you can position the tool at any X,Y position.
2. Change the G90 so that the lower left corner of the number starts with a G91. Now the program will move to where it needs to start cutting each number.
3. While in MillWrite, once the G-Code is created you need to delete lines 2 through 8, change G90 to G91 on line 13, and delete lines 10 through 13. At the end of the program before the M25, add line G00 Z0.60 (This may be different for your program. Z depth of cut plus clearance height). Change the M25 to M99.
4. For the example below the number zero is shown and the G-Code file is "Ser-Num-0.CNC". For each other number change the number before the decimal to the number that will be cut. You need to create 10 files for 0 through 9.

Example program 4 before editing:

```
N1 ; MillWrite program start
N2 M25 G49 - DELETE THIS LINE
N3 ; 90 DEG ENGR - DELETE THIS LINE
N4 G17 G40 - DELETE THIS LINE
N5 G20 - DELETE THIS LINE
N6 G80 - DELETE THIS LINE
```

```
N7 G90 - DELETE THIS LINE
N8 G49 H0 M25 - DELETE THIS LINE
N9 G90 G00 X0.0135 Y0.0258 - CHANGE G90 TO G91
N10 T30 M6 - DELETE THIS LINE
N11 M03 S5000 F15.0 - DELETE THIS LINE
N12 G43 G0 Z0.05 H30 - DELETE THIS LINE
N13 G91 - DELETE THIS LINE
N14 G01 Z-0.06 F10.5
N15 ; 0

N16 G03 X0.0122 Y-0.0122 I0.0123 J0. F15.0
N17 G01 X0.0343
N18 G03 X0.0122 Y0.0122 I0. J0.0122


N19 G01 Y0.0735
N20 G03 X-0.0122 Y0.0122 I-0.0122 J0.
N21 G01 X-0.0343
N22 G03 X-0.0122 Y-0.0122 I0. J-0.0123
N23 G01 Y-0.0735
N24 M25 - INSERT G00 Z0.060 AND CHANGE M25 TO M99
N25 ; MillWrite program finish
```

Example program 4 after editing:

```
; MillWrite program start
G91 G00 X0.0135 Y0.0258
G01 Z-0.06 F10.5
; 0
G03 X0.0122 Y-0.0122 I0.0123 J0. F15.0
G01 X0.0343
G03 X0.0122 Y0.0122 I0. J0.0122
G01 Y0.0735
G03 X-0.0122 Y0.0122 I-0.0122 J0.
G01 X-0.0343
G03 X-0.0122 Y-0.0122 I0. J-0.0123
G01 Y-0.0735
G00 Z0.060
M99 ;RETURNS TO SERIAL-Num.CNC
; MillWrite program finish
```

Document History

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