

TB292 (Rev2) – Installing Linear Scale for DRO Display on a CNC11 System

Using a linear scale to display DRO position with a CNC11 based Centroid CNC control.

Connecting a linear scale for DRO display on an MPU11 based system running CNC11 v3.14 + (this document applies to OAK, MPU11, and AllIN11DC)

Scale Output Type: Differential encoder output is **REQUIRED**. Many scales are available on the market that are not differential output. Wire scale as per DB9 encoder wiring diagram in any of the MPU11 based installation manuals. In our example, we used scales from <http://www.zsinstruments.com/> specifically the GT05-450 (18" for knee) and the GT05-150S (slime line unit for quill). ZS Instruments will configure the DB9 scale cable to match the Centroid encoder pin out so the scale is plug and play. Just be sure to specify "Centroid ready cable" when ordering.

For this example, we will be installing two scales on a 2-axis CNC knee mill equipped with a Centroid MPU11 based CNC control system. One scale will be installed on the knee. The second scale will be installed on the quill.

Configure CNC11

1.) Encoder Assignment: Parameters 308 thru 315 are used to tell the CNC11 software which scale is plugged into what encoder input on the MPU11 board. These parameters control which encoder the axis should look for feedback. Parameter 308 assigns the encoder to axis 1, parameter 309 assigns the encoder to axis 2, and so on. The values of these parameters can be set to any integer value from 1 thru 15 based on the table in the operator's manual. These parameters must be set before attempting to move motors. Note that if you change any of these values, the machine must be powered down and restarted for the changes to take effect. In our example, the encoder for the X axis is plugged into the #1 encoder input port on the MPU11 board so the value of P308 is set to 1, the encoder for the Y axis is plugged into the #2 encoder input port on the MPU11 board so P309 is set to 2, the scale for the knee (Z axis) is plugged into the #3 encoder input port on the MPU11 board so P310 is set to 3, and the scale for the quill (W axis) is plugged into the #4 encoder input port so P311 is set to 4.

2.) Drive Assignment: Parameters 300 thru 307 tell the control which drive number is actually connected for that axis. We want to make sure that the axes we use for the scale are set to 0. In our example, since it's a 2-axis CNC, parameter 300 is for Axis 1 (X axis) and 301 is for Axis 2 (Y axis). They are set to 1 and 2 respectively since the X axis is installed on Axis 1 output and the Y axis is installed on Axis 2 output. Since we are using Axis 3 for the knee scale and Axis 4 for the quill scale, we set parameter 302 (Axis 3) to 0 and parameter 303 (Axis 4) to 0.

3.) Manual Axis Assignment: Parameter 259 tells the control which axis is a manual axis by the value that it is set to which each bit corresponds to each of the eight axes as described in the table below.

Bit	0	1	2	3	4	5	6	7
Axis that is a manual axis	1	2	3	4	5	6	7	8
Value to Add together	1	2	4	8	16	32	64	128

A value of 1 tells the control that only the first axis is a manual axis. A value of 2 tells the control that only the second axis is a manual axis. A value of 3 tells the control that the first and the second axes are manual axes. In our example, Axis 3 is the knee scale and Axis 4 is the quill scale. Therefore, P259 = 12 (4+8) which tells CNC11 that both axes 3 and 4 are manual axes. (**NOTE:** If the system was a 3-axis x, y, z mill CNC system with a scale on the knee as W axis DRO, P259 would be set to 8) For our example, as described in step 5, we are going to label the 3rd axis with the "@" symbol instead of using "Z" which by default makes Z a manual axis. So in our example, set P259 to 8 to tell CNC11 that just the 4th axis, W, is a manual axis and if there wasn't a scale on the knee parameter 259 would be set to 0.

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4.) Axis Letter Assignment: Go to the Motor Configuration menu by pressing (F1 Setup, F3 Config, (pass=137), F2 Mach, F2 Motor) from the main screen.

Label the axes that the scales are connected to: In our example, Axis 3 is Z and Axis 4 is W.

Axis	Label	Motor mm/rev	Encoder counts/rev
1	X	5.000000	8000
2	Y	5.000000	8000
3	Z	1.000000	5000
4	W	1.000000	5000
5	S	1.000000	8192

Set Motor revs/inch(mm/rev) to 1.

Set Encoder counts/rev according to the scale resolution.

In our example, we used a 0.0002" scale so the counts per inch = $1"/.0002" = 5000$.

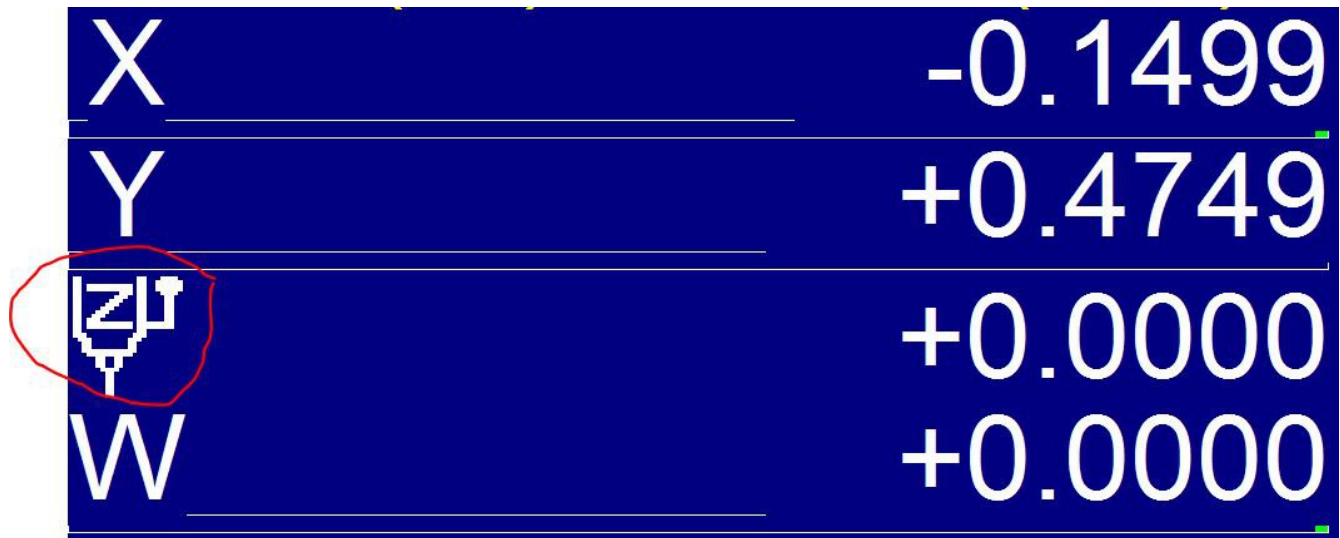
(NOTE: Some scales are metric. A common metric resolution is 0.05mm which relates to 5080 counts per inch.)

5.) 2-axis Operation Setup: In our example, the machine is a 2-axis knee mill with a manual quill. The operator is required to move the quill to the proper Z location when running a G code program. CNC11 will prompt the operator at each Z move and wait for the operator to press Cycle Start to confirm that the quill is at the proper location before continuing with the rest of the part program. Using Intercon to program 2 axis parts is the best and easiest way. Intercon will automatically generate 2-axis G-code. In order for Intercon to recognize that it's a 2-axis system the label in the Motor Configuration menu for the 3rd axis which by default is "Z" will now be an "@" symbol as shown below. (NOTE: Be sure to re-post any Intercon programs that were created before changing the axis label to "@")

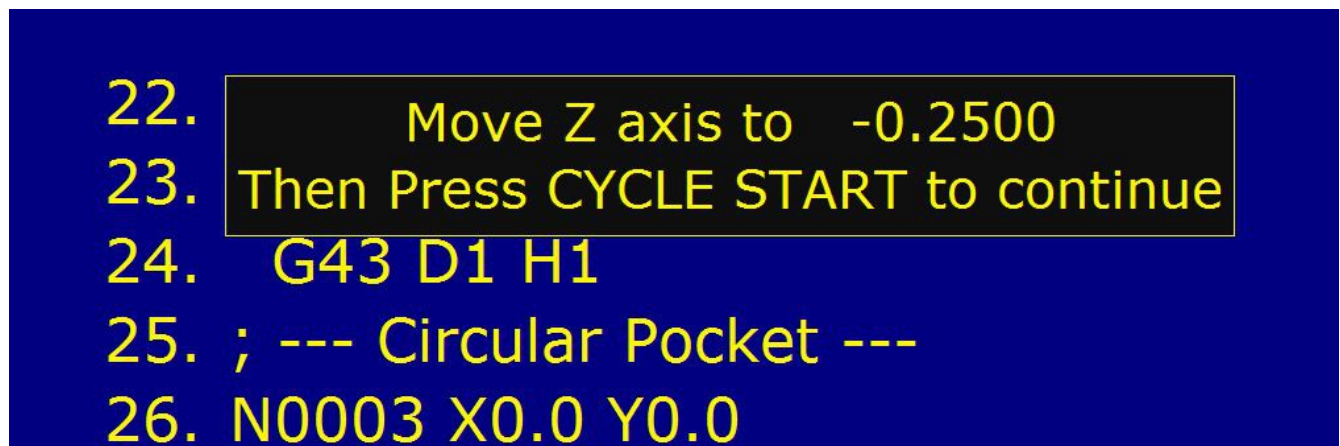
Axis	Label	Motor revs/in	Encoder counts/rev
1	X	5.0000000000	8000
2	Y	5.0000000000	8000
3	@	1.0000000000	5000
4	W	1.0000000000	5000

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Notice the display on the DRO on the main screen changes from “Z” to the Manual Quill Icon as shown below.



Now CNC11 will prompt the operator to move the quill to the proper location during a part program.



6.) Edit Home File: Edit the home program, cncm.hom, to set the scale home position where ever it currently is during homing by adding M26/@/W as shown below.

M26/@/W (this sets home position where ever the scales are located when the homing sequence is run)

M92/X

M26/X

M92/Y

M26/Y

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EXTRAS

A.) A quick and easy way to set the Scale DRO position to 0.0000” is by mapping a spare auxiliary key on the operator panel to run a custom M code.

Parameters 188 thru 199 are used to control the behavior of the auxiliary keys on the operator panel.

In our example, the AUX7 key is going to call custom macro M72 which will set the DRO position of the knee scale to 0 when it's pressed and the AUX6 key is going to call custom macro M73 which will set the DRO position of the quill scale to 0 when it's pressed.

Create a custom macro called mfunc72.mac that contains G92 @0 and one called mfunc73.mac that contains G92 W0. Make sure to save those custom macros in the <c:\cncm> directory.

Set parameter 194 to 7211 and parameter 193 to 7311.


B.) Customize the Part Setup menu graphics to match the scale.

The default graphics used in the Centroid Part Setup menu may not match the actual machine axis configuration. In our example, the Z axis is the knee scale so the default Part Setup menu graphics is fine. The quill scale we have installed is setup as a W axis. The default W axis graphic in the Part Setup menu shows a rotary table which does not match our application and is confusing to the user. It is simple to create a new graphic for the W axis and install it in the bmps directory.

The Part Setup menu graphics are located in a folder named “bmps”. The W axis rotary table graphics are called mstrtneg.bmp, mstrtpos.bmp and mstrtzro.bmp. Open the bmps folder and you will see them there. We are going to replace those three images with a single image showing the quill scale. There are three rotary table images since there are three ways to zero out a rotary table axis. In our example, we want the same quill scale graphic to be displayed in each case so simply create a .bmp (bitmap image) using your favorite bitmap editor (we used Photoshop) that is around 600x600 pixels wide (CNC11 will then scale it to the display size). Name the new .bmp files: mstrtneg.bmp, mstrtpos.bmp and mstrtzro.bmp and copy them into the bmps directory overwriting the originals (**NOTE:** Making a backup of the entire bmps directory before overwriting the files is a good idea!) For our example, the finished part setup graphic for the W axis looks like this.

NOTE: Be advised that every time you update the CNC11 software, the update will overwrite your custom images. Would highly recommend making a folder outside of cncm with the custom images and after updating the software, simply copy the custom images from that folder back into the updated BMPS directory.

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WCS #1 (G54) Current Position (mm)		Job Name: extrakmotorcover.cnc				
X	+0.370	Tool: T16 H16		Program		
Y	+0.402	Feedrate: 100% 0.0 mm/m			Cnt:	
Z	-0.125	Spindle: 0 M		Part # :		
W	+0.000	Coolant		Time: 0		
		Tool change: T13 center drill				
		302 Moving...				
		Tool change: T16 .230" diameter				
		302 Moving...				
		307 Operator abort: job cancelled				
Set Part 0/Position						
						
<ol style="list-style-type: none"> 1) Select Axis with F1 2) Jog to Touch Off on Part 3) Edit the Value if Necessary 4) Press F10 to Set Position 						
		Axis	Part	Standoff		
			Position	Distance		
		W	0.000	0.000		
WCS #1 (G54)						
Next Axis F1	Auto F4	Probe F5	Prev WCS F6	Next WCS F7	CSR F8	WCS Table F9

Document History

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