 <b>PRISMATIK DENTALCRAFT, INC.</b>	<b>PROCEDURE</b>	<b>Release ECO No.: 6996</b>
		<b>Document No.: 6438</b>
		<b>Release Date: MAY 01 2017</b>
		<b>Revision: 1.0</b>
<b>Calibration of the TS150e</b>		

**1.0 PURPOSE**

1.1 To describe the steps necessary to manually calibrate the TS150e.

**2.0 SCOPE**

2.1 This protocol is relevant to the calibration of the TS150e.

**3.0 APPLICABILITY**

3.1 This protocol is applicable to any department calibrating the TS150e.

**4.0 SUMMARY OF CHANGES / JUSTIFICATIONS OF CHANGES SINCE LAST REVISION**

REVISION STATUS		
Rev.	Effective Date	Description & Justifications of Change(s)
1.0	MAY 01 2017	Initial Release / The new TS150e requires documentation to calibrate the CNC.

**5.0 DEFINITIONS**

- 5.1 BRadius (R) – Radius between B-axis center of rotation and material
- 5.2 Center Offset (D) – distance between center of rotation between A-axis and B-axis
- 5.3 M1\_Home\_Offset (AHO) – A axis home offset
- 5.4 M2\_Home\_Offset (BHO) – B axis home offset
- 5.5 G54\_OffsetX - offset between machine X-axis zero and G54 X-axis zero
- 5.6 G54\_OffsetY - offset between machine Y-axis zero and G54 Y-axis zero
- 5.7 G54\_OffsetZ - offset between machine Z-axis zero and G54 Z-axis zero
- 5.8 CtsPerDegA – Counts per degree of A-axis
- 5.9 CtsPerDegB – Counts per degree of B-axis
- 5.10 OringOffsetX – Machine offset in X-axis
- 5.11 OringOffsetY – Machine offset in Y-axis
- 5.12 XAxisScaleCorrection – set to 1
- 5.13 XAxisCorrectionAng – set to 0

**6.0 REFERENCES**

6.1 None.

**7.0 RESPONSIBILITIES**

7.1 N/A

**8.0 MATERIAL/EQUIPMENT**

- 8.1 Digital Caliper
- 8.2 TS150 Calibration Software



## Calibration of the TS150e

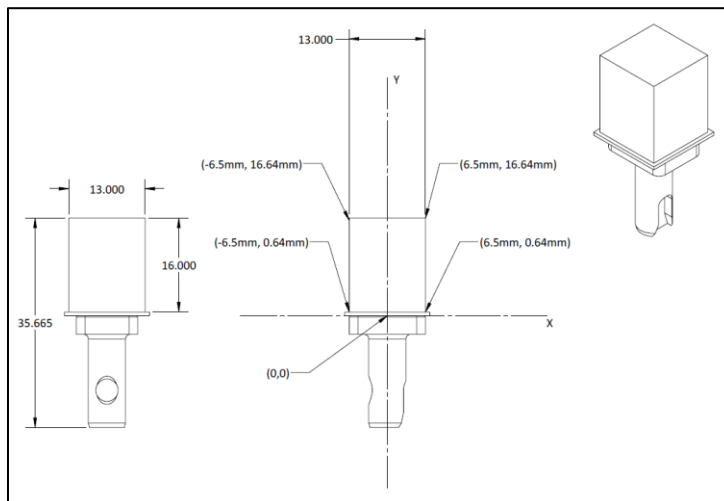
- 8.3 PMMA Calibration Blocks -- IOS P/N 40820-01
- 8.4 4mm Carbide Cutting Tool
- 8.5 11mm torque wrench set at 3.95 Nm (for tightening collet/tool)
- 8.6 2.5mm screwdriver hex
- 8.7 Distilled water
- 8.8 3.00mm collet
- 8.9 Micrometer


### 9.0 PROCESS MAP/FLOW CHARTS

- 9.1 N/A

### 10.0 PROCEDURE

**Overview:** Calibration is achieved by adjusting the calibration parameters of the mill. An initial calibration cube is milled to check the status of the machine. When the mill is not calibrated, the cube will appear distorted and may have a step or twist. When the mill is calibrated, the cube has no distortions and nominally has the dimensions shown below. During the calibration process, measurements of the cube are entered into the calibration software to create new calibration parameters. Iterating this process 3-6 times will calibrate a machine.



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<h2 style="color: blue;">Calibration of the TS150e</h2>		

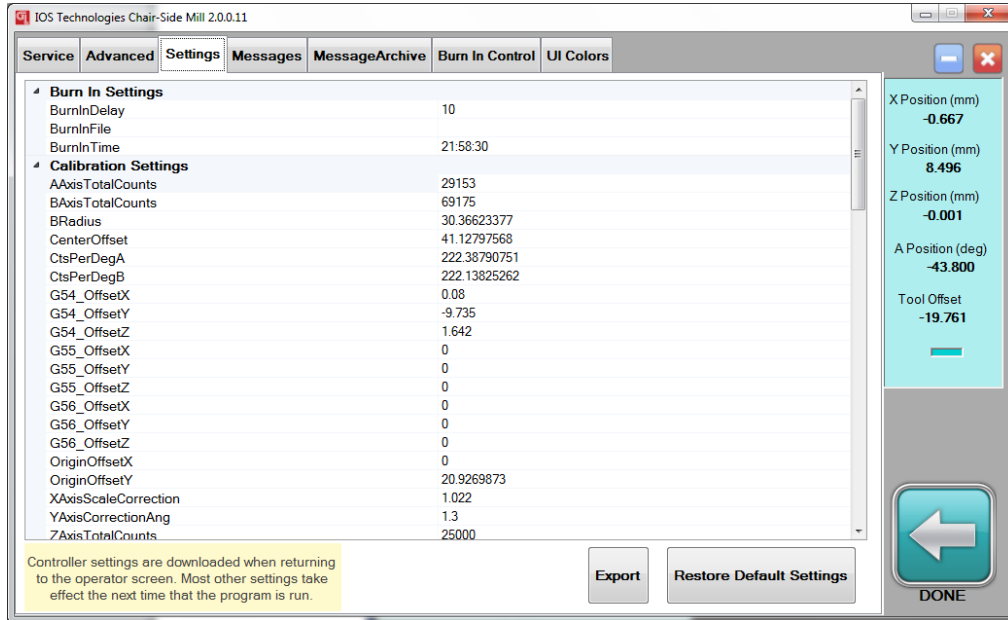
- 10.1 Remove the coolant and fill reservoir with plain, distilled water. The distilled water is less viscous than the coolant and will help prevent clogging of the coolant pumps with PMMA.
- 10.2 Remove the top filter from the trough to prevent clogging.



- 10.3 Open the mill program and click on the **service button**. The password is: 1234.



10.4 Click the **settings tab** to view the initial calibration parameters. If prompted, enter the password IOSTECH.



10.5 Enter the starting calibration parameters below.

**Table 1**

B Radius	Center Offset	M1 Home Offset	M2 Home Offset	G54X	G54Y	G54Z	Origin Offset X	Origin Offset Y	CtsPerDegA	CtsPerDegB
29.8	40	15100	-42000	0	-10.0	1.300	0	21	222.2222	222.2222

10.6 **Important:** On all machines, set the following parameters. These values won't change during calibration:

**Table 2**

XAxisScaleCorrection	YAxisCorrectionAng	CtsPerDegA	CtsPerDegB
1	0	222.2222	222.2222



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## PROCEDURE

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## Calibration of the TS150e

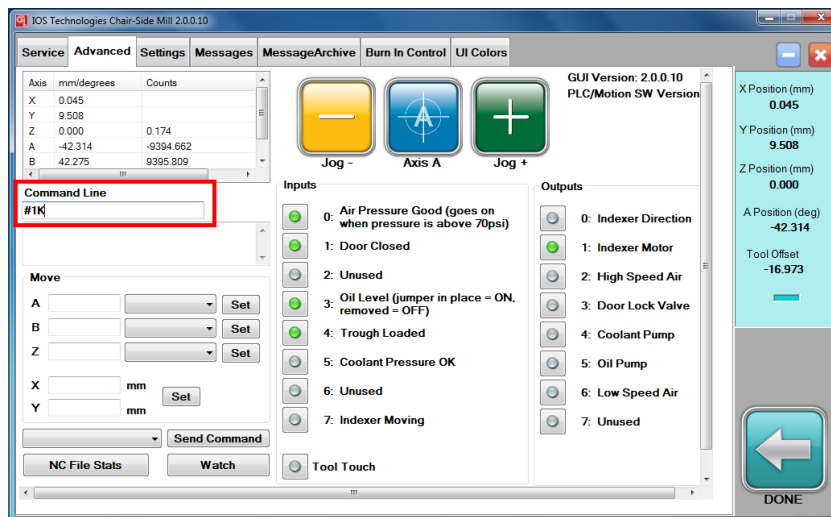
- 10.7 Click **done**.
- 10.8 Click the **Advanced Tab** to gain access to the **Command Line**. In the **Command Line** enter these four separate commands.

**#1K**

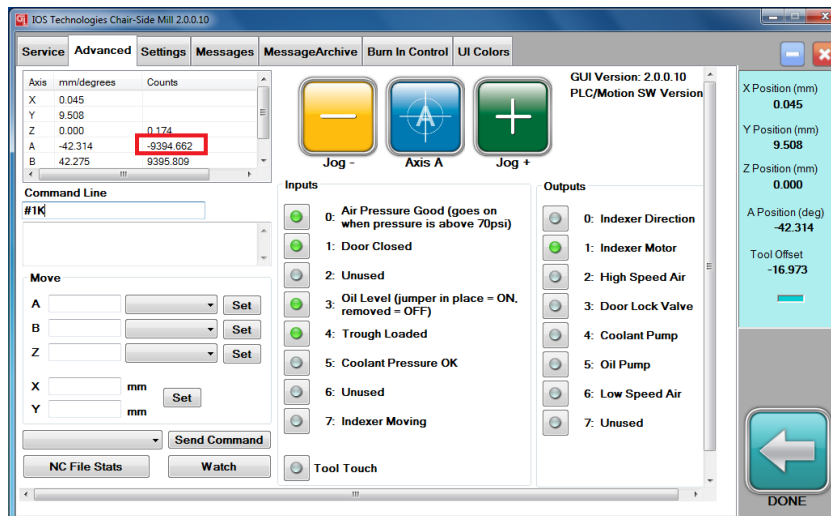
**#2K**


**I7010=3**

**I7020=3**



- 10.9 Rotate the A Axis all the way to one of its hard stops. Record the **Counts Value**.



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<h2 style="color: blue;">Calibration of the TS150e</h2>		

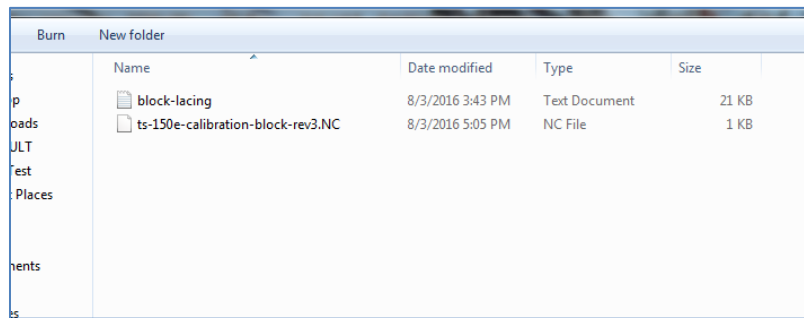
- 10.10 Rotate the A Axis to its other stop. Record the **Counts Value** again.
- 10.11 Calculate the difference by taking the larger number and subtracting the smaller value.  
Example:

$$\begin{array}{r}
 10000 \\
 - -15000 \\
 \hline
 25000
 \end{array}$$

- 10.12 Enter this number as **AAxis TotalCounts** in the **Settings Tab**. Click **Done**.
- 10.13 Repeat steps 10.10 through 10.13 for the B Axis, updating the **BAxis TotalCounts** setting.
- 10.14 Close the GUI and cycle the power with the **Rear Rocker Switch**.
- 10.15 Run the calibration program. Click **Load Program** to find the NC file.



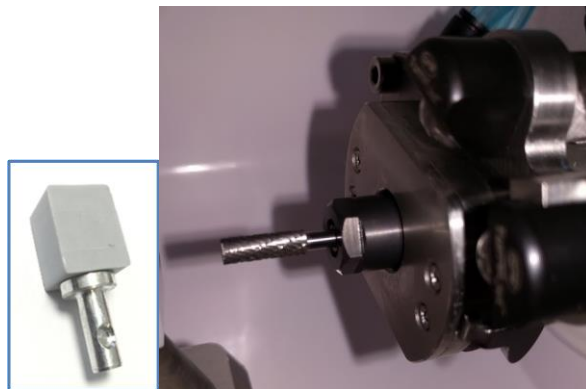
- 10.16 Choose TS150e Calibration Block 4mm.NC for the TS150e. Take care to ensure the correct file is chosen for the mill.





## Calibration of the TS150e

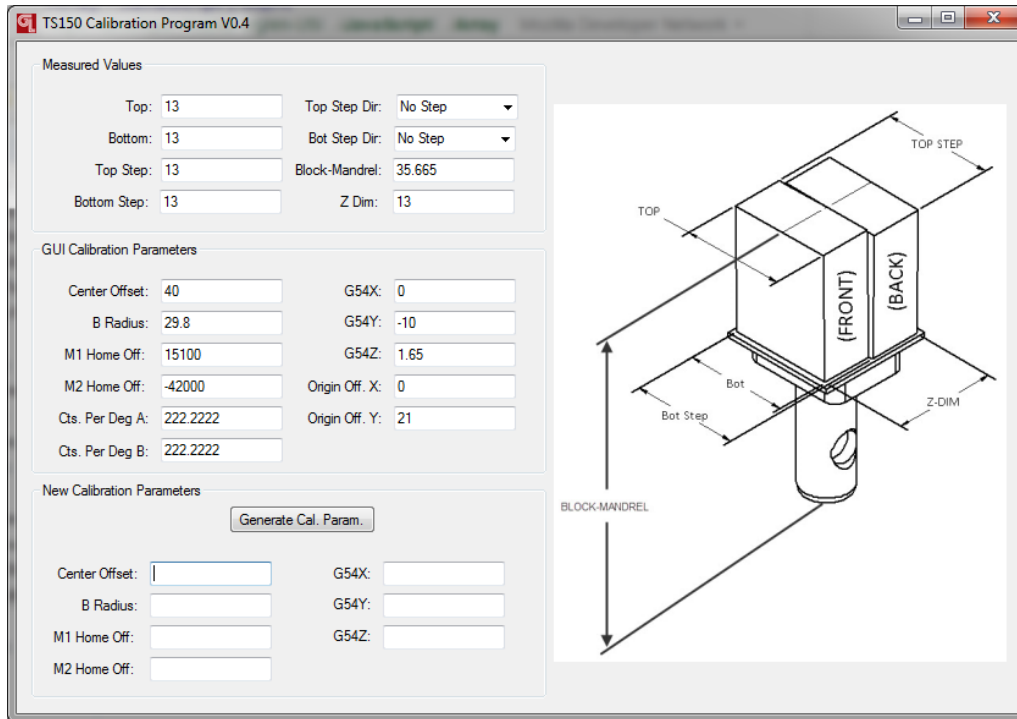
- 10.17 Load a PMMA calibration block and a 4mm carbide cutting tool using the precalibrated torque wrench.





## Calibration of the TS150e

10.18 When milling is complete, open the TS150 calibration program.



10.19 Using a digital caliper, measure the following dimensions on the finished block:

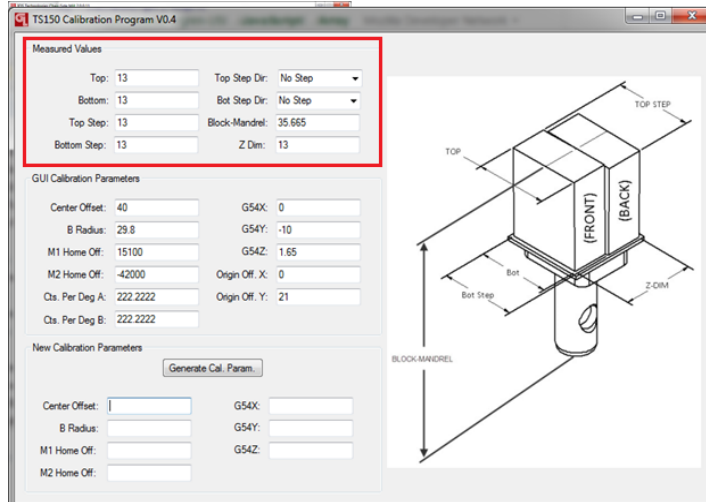
Measurements	(mm)
Top	
Bottom	
Top Step	
Bottom Step	
Z-Dimension	
Block-Mandrel Dimension	





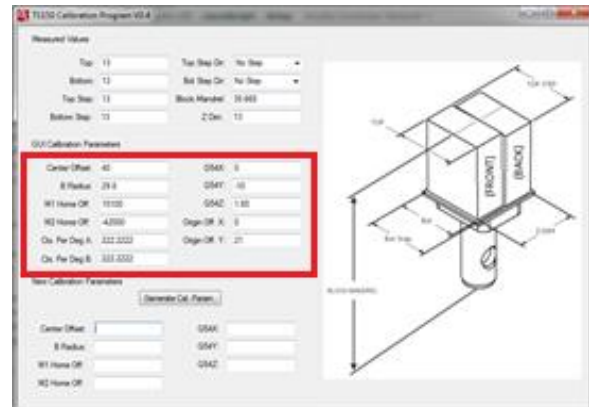
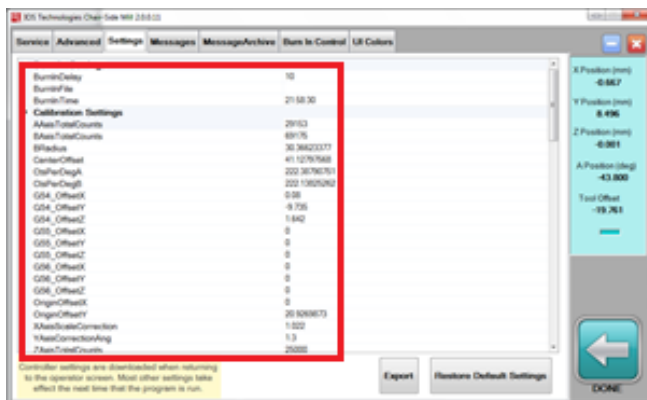
## Calibration of the TS150e

10.20 Enter the new measurements into the calibration program.



10.21 For Top Step Direction, when facing the set screw hole, enter whether the front or back face protrudes higher at the top side of the block; towards you is higher. For Bottom Step Direction enter whether the front or back face protrudes higher for the bottom side of the block. Example: image above shows the top step direction is back higher, and the bottom step direction is also back higher.

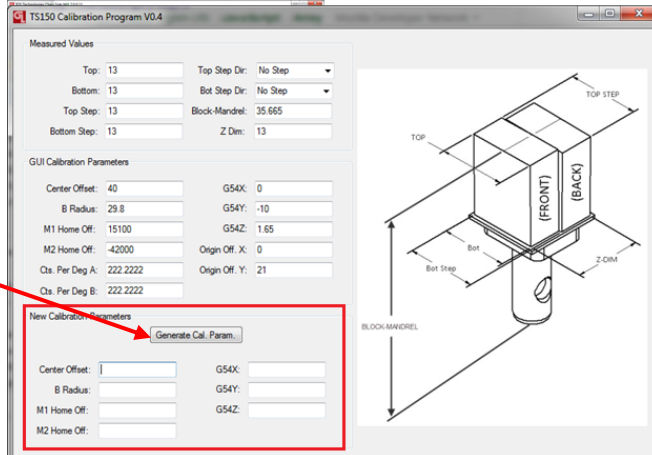
10.22 Enter the GUI parameters used for milling the calibration block into the calibration program.





## Calibration of the TS150e

### 10.23 Click **Generate Calibration Parameters**.



10.24 Click the **settings tab** to view the previous calibration parameters. Enter the new calibration parameters into the mill settings. Keep settings the same from Table 2 Click **done**. Click **reset controller button**, then click **yes**. This will make the changes effective.

10.25 Run a new calibration block on the machine with the new parameters. (Section 10.16 – 10.26). With each iteration, the mill will get closer to being calibrated. It may take 3 to 6 blocks to fully calibrate a machine.

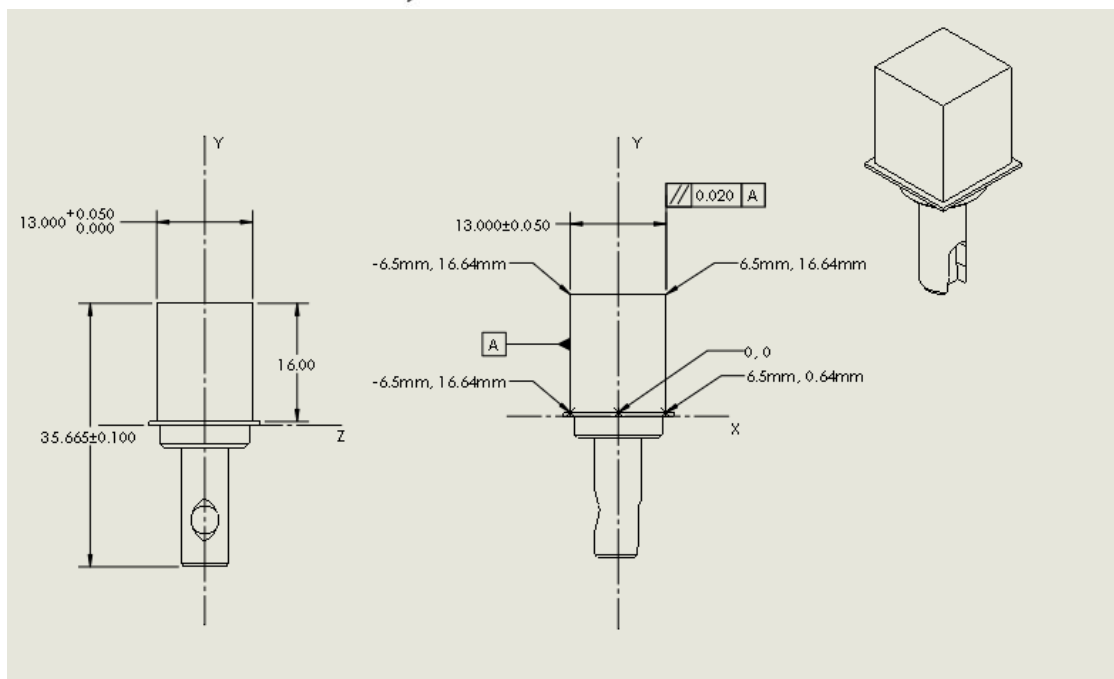
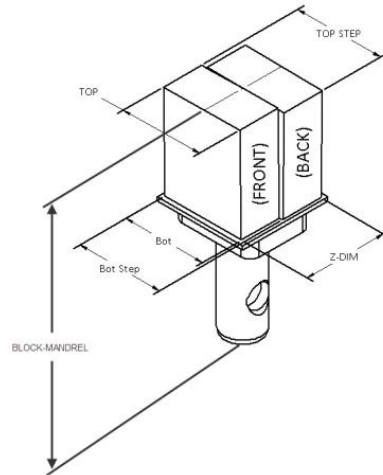
10.26 When the step has been eliminated and the top and bottom measurements are in spec, input 13.00 for top, top step, bottom and bottom step and continue calibration.

10.27 Repeat the process until a block with no distortions and all the correct dimensions (see below) is produced. The mill is calibrated. Please note that we should get as close to nominal measurements as possible since over time the machine may lose calibration. This calibration process can get within 20 microns of the nominal measurements but the machine is considered calibrated if the machine is within the tolerances in the figure below. Note there is a parallelism tolerance of 20 microns between surfaces along the x axis. The parallelism tolerance is the difference in measurement in the x dimension between top and bottom of the block.

Measurements	(mm)
Top	13±0.05
Bottom	13±0.05
Top Step	13±0.05
Bottom Step	13±0.05
Z-Dimension	13-13.05
Block-Mandrel Dimension	35.665±0.10
X-Dimension Planar Tolerance	0.020



## Calibration of the TS150e



### 11.0 REQUIRED PROPERTIES

11.1 See section 10.22.

### 12.0 DOCUMENTATION

12.1 None.

END OF DOCUMENT